

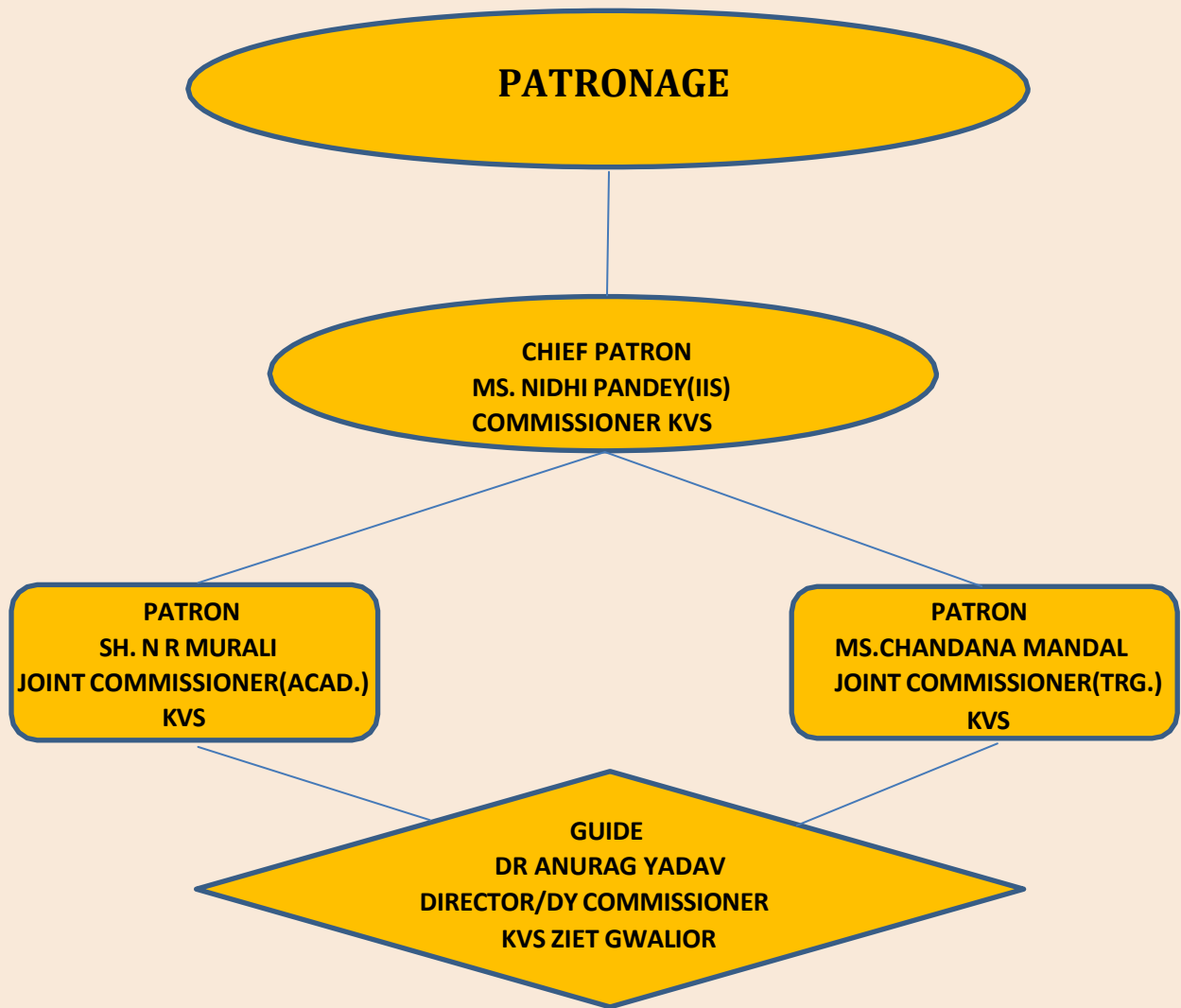


INTERACTIVE STUDY MATERIAL

CLASS XII

ACADEMIC YEAR • 2022-23

KVS ZIET GWALIOR



COMPILED BY: TEAM OF TRAINING ASSOCIATES, KVS ZIET GWALIOR

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ENGLISH

CHEMISTRY

BIOLOGY

ECONOMICS

HINDI

Kendriya Vidyalaya Sangathan
Zonal Institute of Education & Training, Gwalior (M.P.)



Interactive Resource Material for Class XII English

T. Uma Maheswari
Training Associate (English)

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1. The Last Lesson

- *Alphonse Daudet*



Alphonse Daudet (1840 – 1897)

Alphonse Daudet (born May 13, 1840, Nimes, France – died Dec. 16, 1897, Paris) French short-story writer and novelist. Now he is remembered chiefly as the author of sentimental tales of provincial life in the south of France. He wrote his first poems and his first novel at the age of 14. Unable to finish his schooling after his parents lost all their money, he took a position in a duke's household.

The Last Lesson is set in the days of the Franco-Prussian War (1870-1871) in which France was defeated by Prussia led by Bismarck. Prussia then consisted of what now are the nations of Germany, Poland and parts of Austria. The synopsis of the lesson follows to have a quick review.

TEXT BOOK LESSON LINK

<https://ncert.nic.in/textbook.php?lefl1=1-14>

AUDIO LESSON LINK

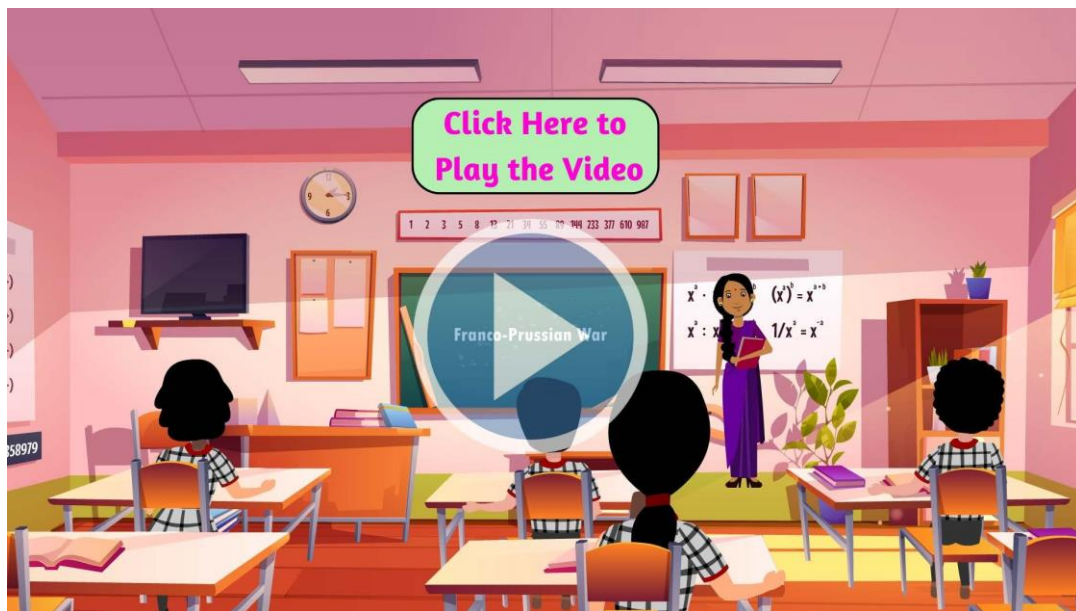


Chapter 1- The Last Lesson.mp3

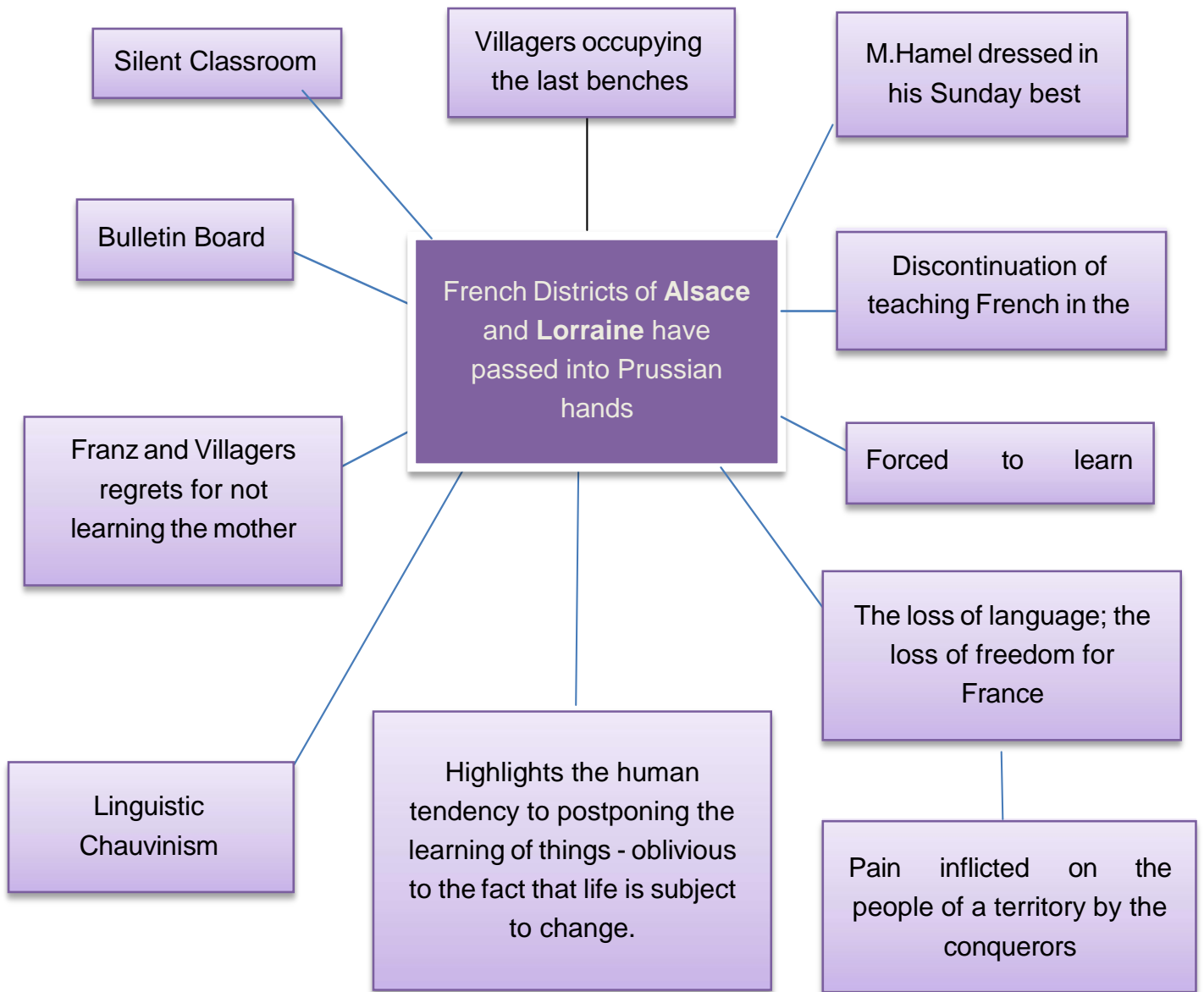
Districts of Alsace and Lorraine



France 1870 – 1871



Mind Map



LINGUISTIC CHAUVINISM - AUDIO LINK

PLAY AUDIO

Synopsis of the lesson

The Story is narrated by Franz, a French boy. French districts of Alsace and Lorraine have passed into the hands of Prussian. So Berlin has ordered that only German language should be taught instead of French in the schools of these districts.

That day was the last day of their French lesson by M.Hamel, French teacher who has been there for forty years. He was filled with grief, nostalgia and Patriotism. As a mark of respect to his hard work, the village elders also attended his „last lesson“. All felt sad as they did not learn their mother tongue properly when they were young.

Franz was shocked to know that that was his last lesson in French and regrets for not showing interest in learning it. Suddenly he gets interest in learning it and understands everything was taught on that day. He develops an instant liking for the teacher, M.Hamel and respects him for his sincerity and hard work. He feels sad that M.Hamel will teach French no more.

Franz feels bad and ashamed for not being able to recite the lesson of participles. M.Hamel also tells them that they all are at fault for not being eager enough to learn, and putting it off to the next day. He blames himself for not teaching them sincerely.

M.Hamel, praised the French language as being the most beautiful and most logical language in the world. He tells the class to guard their language „because when a people are enslaved, as long as they hold fast to their language it is as if they had the key to their prison.“ He made them realise the importance of learning their mother tongue.

Franz feels that it is impossible to take away one's language from a person as it is natural to each being, may it be the „coo“ to the pigeons or „French“ to the Frenchmen.

The lesson focuses on the pain that is inflicted on the people of a territory by its conquerors by taking away the right to study or speak their own language and student-teacher attitudes to learning and teaching.

2. Lost Spring

Stories of Stolen Childhood
- Anees Jung



Anees Jung (born 1944)

Anees Jung (1944) was born in Rourkela and spent her childhood and adolescence in Hyderabad. She received her education in Hyderabad and in the United States of America. Her parents were both writers. Anees Jung began her career as a writer in India. She has been an editor and columnist for major newspapers in India and abroad and has authored several books. This lesson is an excerpt from her book titled *Lost Spring, Stories of Stolen Childhood*. Here she analyses the grinding poverty and traditions which condemn these children to a life of exploitation.

TEXT BOOK LESSON LINK

<https://ncert.nic.in/textbook.php?lefl1=2-14>

AUDIO LESSON LINK



Chapter 2- Lost Spring.mp3

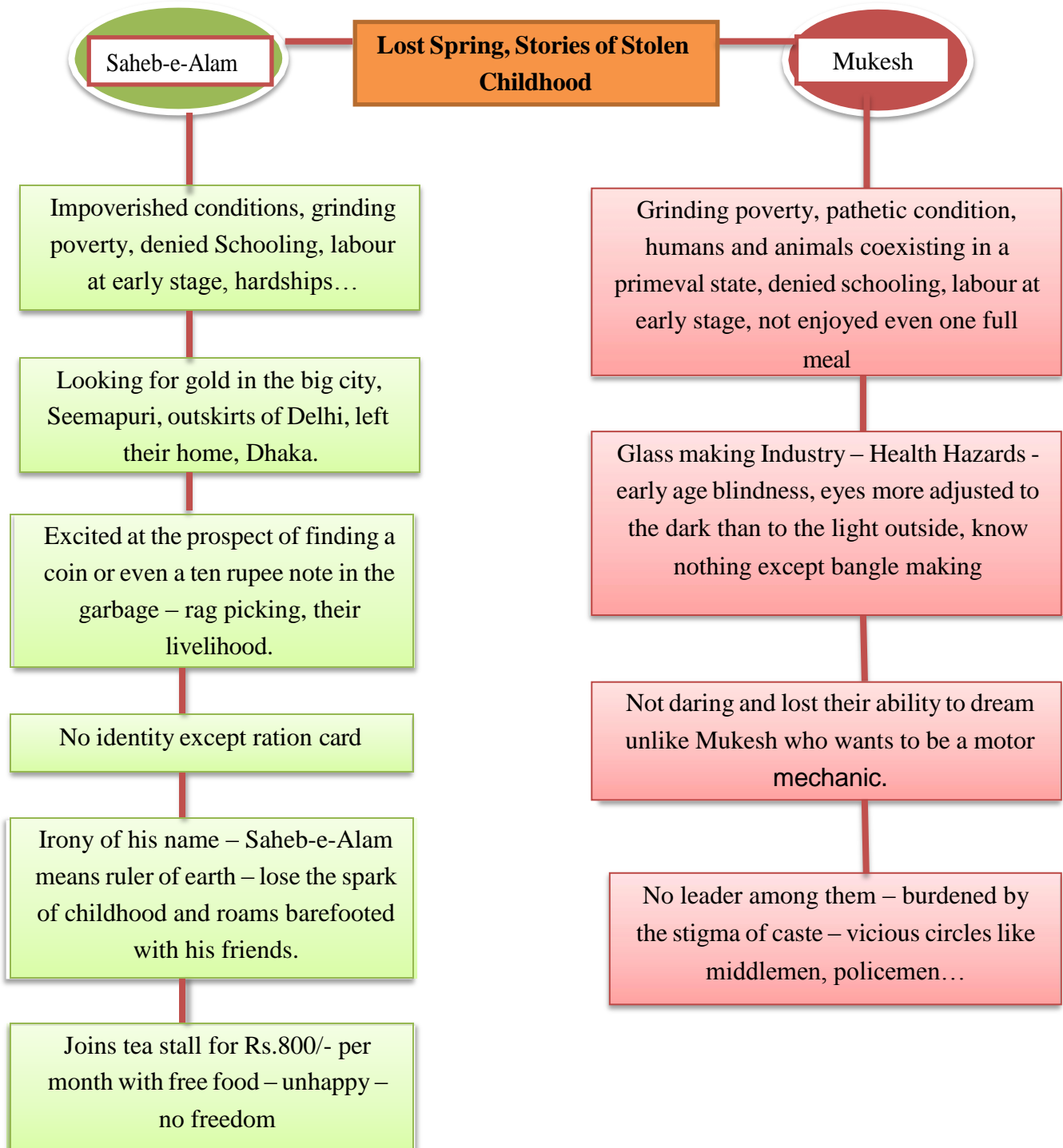
Rag Pickers & Glass Bangle Makers



POVERTY - AUDIO LINK

PLAY AUDIO

Mind Map



Synopsis of the lesson

The author *Anees Jung* analyses the grinding poverty and traditions which condemn the poor children to a life of exploitation through *Lost Spring, Stories of Stolen Childhood*. She narrates the stories of her interaction with children from two different deprived backgrounds and their plight. She highlights the plight of street children who are forced into labour early in life and are denied the opportunity of schooling. The author raises voice to eliminate child labour and strict law enforcement against it by creating awareness regarding child education. The call is to put an end to the exploitation of children and allow them to have fun and enjoy spring.

The first part tells the author's impressions about the life of poor rag pickers who have come from Dhaka and settled at Seemapuri, the outskirts of Delhi. Their fields and homes had been swept away by storms and they had come to the big city in the hope of finding their living. The narrator watches every morning Saheb-e-Alam as he scrounges for „gold“ in neighbourhood. Garbage is a means of survival for the elders and for the children it is something wrapped in wonder. Certain things are unreachable to them like shoes, tennis etc. They do have ambitions and desires but do not know to achieve them. Later Saheb joins tea stall for 800 rupees and free meals. He was unhappy as he is not the master of his own.

The second part of the story is about the life of Mukesh who belongs to the family of Bangle-makers. Firozabad is best known for its glass-blowing industry. The living and the working condition is miserable. Nearly 20,000 children are engaged in this business oblivious about the law. They are caught in two distinct worlds – one of the families, caught in a web of poverty, burdened by the stigma of caste in which they are born, the other a vicious circle of the *sahukars*, the middlemen, the policemen, the keepers of law, the bureaucrats and the politicians. They do have dreams but to do anything else would mean to dare. And daring is not part of his growing up. Mukesh is content to dream of cars and the writer feels that he would achieve it.

3. Deep Water

- *William O. Douglas*



William Orville Douglas (1898 –1980)

William Douglas (born October 16, 1898 Maine, Minnesota – died January 19, 1980 Bethesda, Maryland, USA) after graduating with a Bachelors of Arts in English and Economics, spent two years teaching high school in Yakima. However, he got tired of this and decided to pursue a legal career. He met Franklin D. Roosevelt at Yale and became an adviser and friend to the President. Douglas was a leading advocate of individual rights. He retired I 1975 with a term lasting thirty-six years and remains the longest-serving Justice in the history of the court.

This excerpt is taken from *Of Men and Mountains* by William O. Douglas. It reveals how as a young boy William Douglas nearly drowned in a swimming pool. In this essay he talks about his fear of water and thereafter, how he finally overcame it. We can notice the autobiographical part of the selection is used to support his discussion of fear.

TEXT BOOK LESSON LINK

<https://ncert.nic.in/textbook.php?lefl1=3-14>

AUDIO LESSON LINK



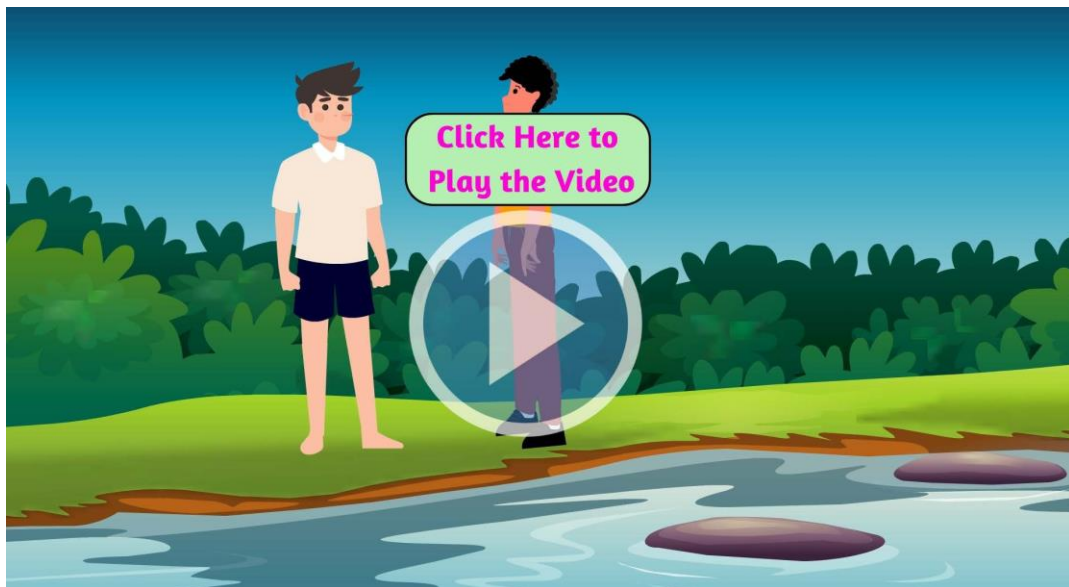
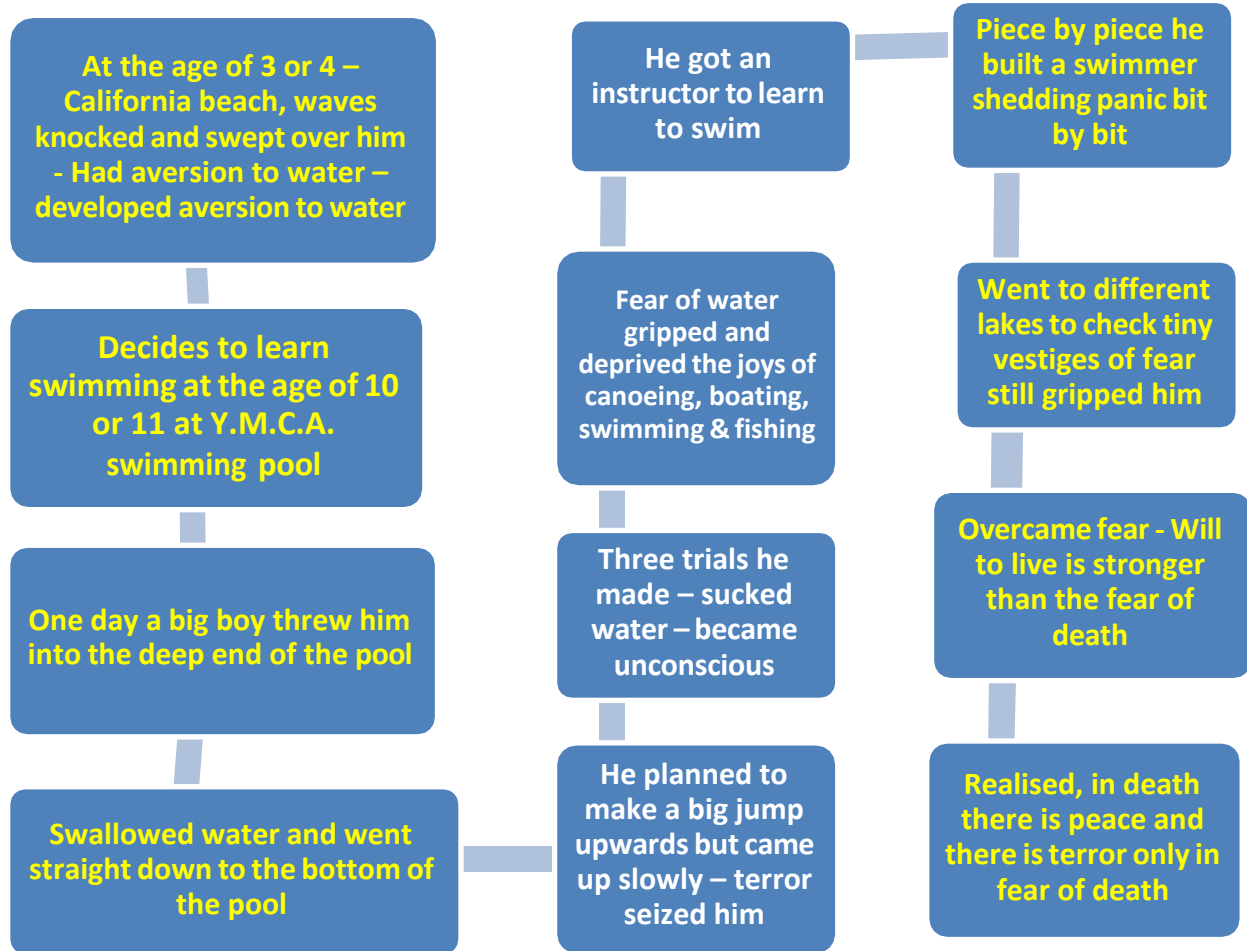
Chapter 3- Deep Water.mp3

The Yakima River



Y.M.C.A. Swimming Pool

Mind Map



Synopsis of the lesson

Deep Water is about the writer's journey of overcoming the fear of water, which is deeply rooted in him since childhood. The author started fearing water since the age of four. It starts when he was visiting California with his father. He visits a beach where a wave knocks him down and sweeps over him. This terrifies the author, although the father laughs at this knowing it was no danger. However, this experience terrifies him and develops a fear of water. After that, when the author is 11 years old, he experiences another incident which escalates his fear.

He is at a swimming pool in Yakima, trying to learn swimming. On one fine day, a bully decides to pull a dangerous prank. He pushes him in the deep end of the pool which frightens the author. He reaches nine feet into the water and starts struggling desperately to hold on to something. Moreover, he yells for help but he starts feeling paralyzed. Thus, he gives up and readies himself to die but wakes up at the side of the pool. However, the terror he experiences continues to haunt him for many years and even spoiled enjoying canoeing, swimming, fishing etc.

He even visits Marine Lakes, Columbia, New Hampshire and more but is not able to enjoy it. He decides to overcome this fear, so he takes the instructor to learn swimming. The instructor teaches him many tips and tricks for swimming. He begins with the inhaling and exhaling and practices it for many weeks bit by bit building a swimmer piece by piece. Finally, he combines all this with the final move of swimming.

Thus, in order to get rid of the fear, he decides to confront it. He plunges in to the water and to his surprise, his fear goes away. He faced it in many places and at last, manages to conquer it. There is terror only in the fear of death, so „All we have to fear is fear itself“.

4. The Rattrap

- *Selma Lagerlof*



Selma Lagerlof (1858 – 1940)

Selma Lagerlof (1858 – 1940) was a Swedish writer whose stories have been translated into many languages. A universal theme runs through all of them – a belief that the essential goodness in a human being can be awakened through understanding and love. This story is set amidst the mines of Sweden, rich in iron ore, which figure large in the history and legends of that country. The story is told somewhat in the manner of a fairy tale.

TEXT BOOK LESSON LINK

<https://ncert.nic.in/textbook.php?lefl1=4-14>

AUDIO LESSON LINK



Chapter 4- The Rattrap.mp3

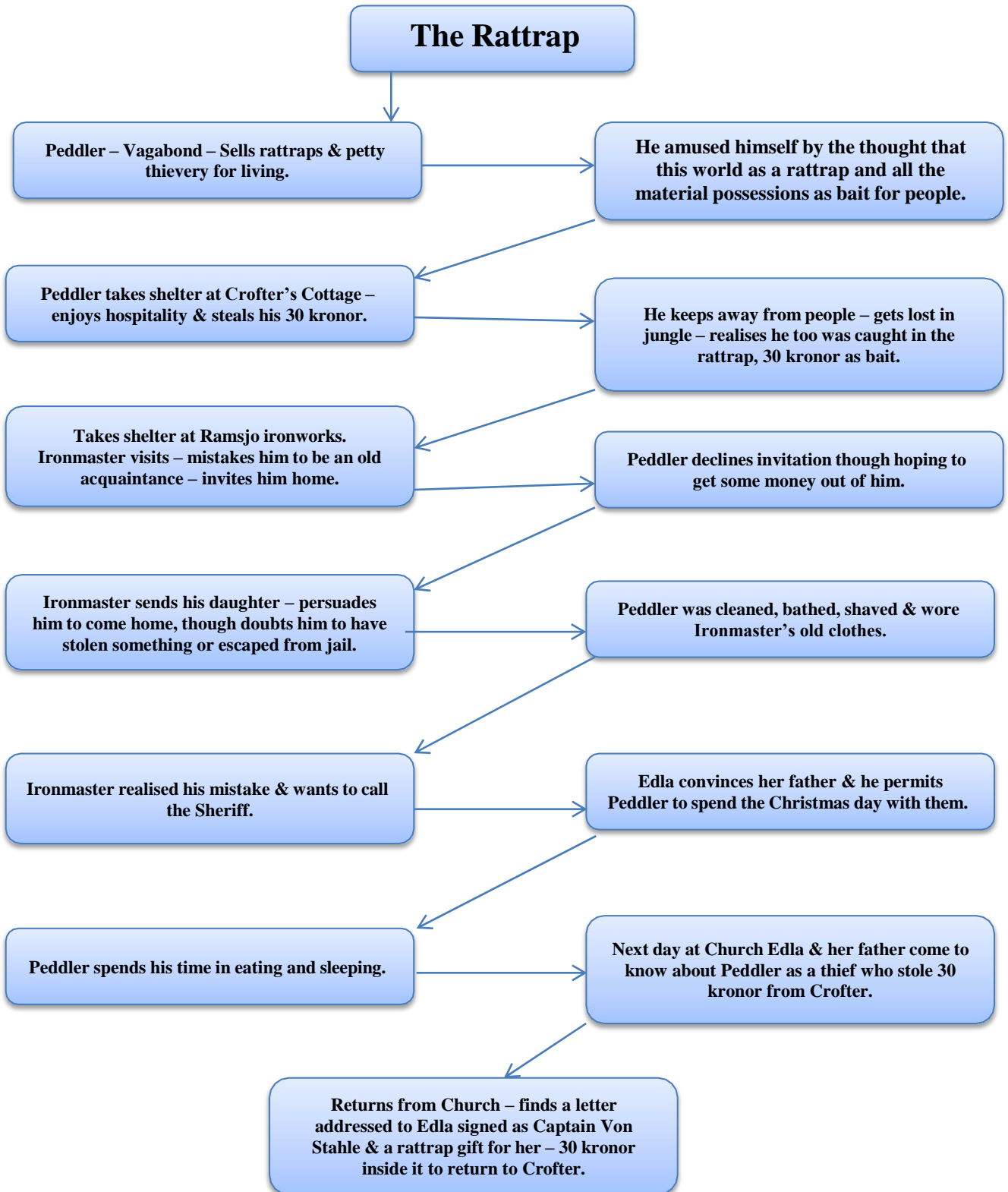
The Rattrap



The whole world was nothing but a big rattrap, set baits for people. It offered riches and joys, shelter and food, heat and clothing, exactly as the rattrap offered cheese and pork, and as soon as anyone let himself be tempted to touch the bait, it closed in on him, and then everything came to an end.



Mind Map



Synopsis of the lesson

The Rattrap begins with a peddler, a homeless wanderer with frail body and starved look, resorts to selling rattraps, begging and even stealing to survive dressed in rags. He leads a lonely life with no one to care about him. One fine day, it strikes to him that this whole world is a rattrap itself. If we touch it, it will trap us and never let us go. He goes on to think that there are people out there who are already in this rattrap and reaching for the bait. On one cold evening, he reaches at a cottage to ask for shelter. An old crofter lived in that cottage who took in the peddler.

The crofter needed company so he welcomes the peddler. He gives him hot food and even tobacco to smoke. They play cards and start talking. The peddler learns that the crofter got thirty kronor by selling his cow's milk for a month which he keeps in a pouch on the window frame. The peddler leaves the next day but after seeing the crofter leave his cottage, he comes back to steal the pouch of money.

After stealing it, he takes the woods to remain unsuspected. In the wood, the peddler meets an ironmaster who mistakes him to be his old comrade. He invites him over for Christmas but he refuses. After that, the ironmaster's daughter, Edla visits him and insists him to stay with them. In between, he feels sorry for stealing the crofter's money. They help the peddler get a makeover and dress him in nice clothes and shave his beard off. After this, the ironmaster realizes he has made a mistake; the peddler was not his comrade.

So, the ironmaster thinks he is a fraud and decides to turn him in. However, Edla insists on letting him stay and celebrate Christmas with them. Her father agrees, and they celebrate Christmas together. Next day, the ironmaster and Edla learn that the peddler was a thief through the church about the incident at the old crofter's. They head home in a hurry thinking he must have stolen all the silver. However, to their surprise, the peddler did not steal a thing. He left a note for Edla and the money in the tiny rattrap. There was also a note thanking her for her kindness which saved him from the trap and asked her to return the crofter's money.

The Rattrap brings out the inner goodness of the poor Peddler through Edla's compassion and kindness and also only love and respect does bring inner joy, not the materialistic things. The trap of material benefit that most human beings are prone to fall into and the human tendency to redeem oneself from dishonest ways are the theme and sub-theme of this lesson.

5. Indigo

- Louis Fischer



Louis Fischer (1896 – 1970)

Louis Fischer (1896 – 1970) was born in Philadelphia. He served as a volunteer in the British Army between 1918 and 1920. Fischer made a career as a journalist and wrote for *The New York Times*, *The Saturday Review* and for European and Asian publications. He was also a member of the faculty at Princeton University. The following is an excerpt from his book *The Life of Mahatma Gandhi*. The book has been reviewed as one of the best books ever written on Gandhi by *Times Educational Supplement*.

TEXT BOOK LESSON LINK

<https://ncert.nic.in/textbook.php?lef11=5-14>

AUDIO LESSON LINK



Chapter 5 Indigo.mp3

Champaran Episode

Resolute Rajkumar Shukla with Gandhi to take him to resolve Sharecroppers Issue



Legacy of Champaran Satyagraha in the Farmer Movement



Spontaneous Demonstration in Thousands around the Courthouse



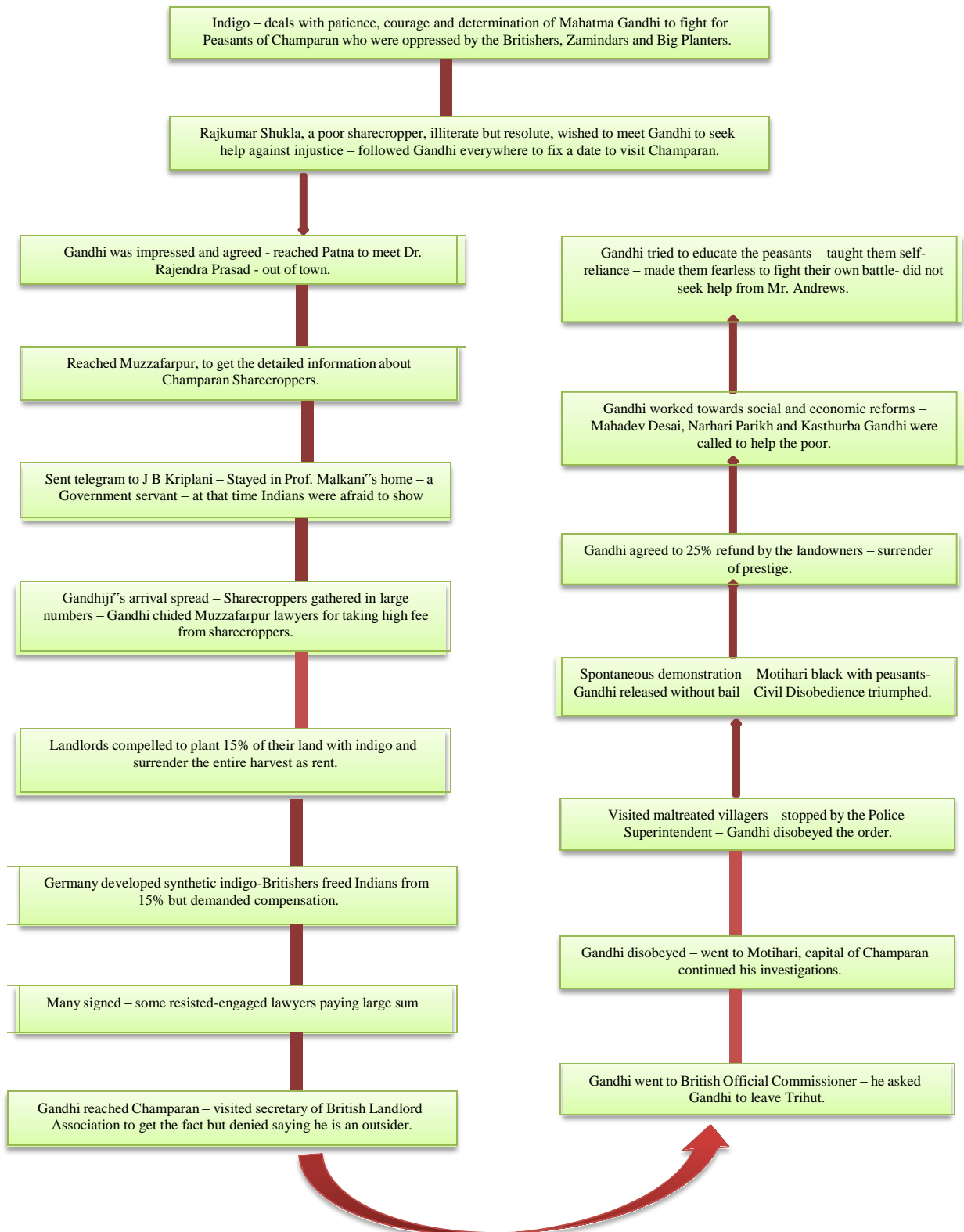
Police Superintendent ordered Gandhi to return to Town



[Click Here to Play the Video](#)



Mind Map



Synopsis of the lesson

Indigo is about how Mahatma Gandhi struggled for the underprivileged peasants of Champaran who were sharecroppers with the British planters at 1916. It gives an account of how he struggled to bring them justice and equality. The owners of the estates were Englishmen and these landlords compelled all the tenants to plant indigo, 15% of their land and submit the whole harvest in the form of rent. The tenants were under long-term agreement for this condition of planting indigo.

In the meanwhile, Germany developed synthetic indigo which is cheaper than this, the British do not require the indigo crop any more. So, in order to release these sharecroppers from the agreement of 15% they started demanding compensation. Few of the peasants who are illiterate agreed and others did not. Rajkumar Shukla, one of the sharecroppers waits resolutely to take Gandhi to resolve this longstanding injustice at Champaran. Raj Kumar Shukla helps Gandhi visit the house of Rajendra Prasad, a lawyer who was handling the case once for these peasants, to update to Gandhi.

When Gandhi arrived to resolve the Champaran Sharecroppers problem, the news of his arrival and mission spread across the town like wildfire. This resulted in a lot of lawyers and peasant groups pouring in large numbers in his support. When Gandhi asked the lawyers about the thug of fees they charged these poor peasants, the lawyers did accept that the charges are quite high and too unreasonable for poor peasants. He was emphasizing on counselling as this will provide the peasants with confidence to fight their fear.

Gandhi decided to fight against injustice. He waged a war which lasted for a year to tackle the discrimination and got justice for the peasants. It helped the peasants to become courageous and aware of their fundamental rights. Moreover, Gandhiji did not just work to tackle political or economic issues, but he also took up social issues. He worked to provide them with education, health, hygiene and taught them a lesson of self-sufficiency and self-confidence.

6. Poets and Pancakes

- *Asokamitran*



Asokamitran (1931 - 2017)

Asokamitran (1931 - 2017), a Tamil writer, recounts his years at Gemini Studios in his book *My Years with Boss* which talks of the influence of movies on every aspect of life in India. The Gemini Studios, located in Chennai, was set up in 1940. It was one of the most influential film-producing organisations of India in the early days of Indian film-making. Its founder was S. S. Vasan. The duty of Asokamitran in Gemini Studios was to cut out newspaper clippings on a wide variety of subjects and store them in files. Many of these had to be written out by hand. Although he performed an insignificant function he was the most well-informed of all the members of the Gemini family. This text is an excerpt from his book *My Years with Boss*.

TEXT BOOK LESSON LINK

<https://ncert.nic.in/textbook.php?lefl1=6-14>

AUDIO LESSON LINK



Chapter 6- Poets and Pancakes.mp3

Gemini Studio



Logo of Gemini Studios



Iconic Film Studio



The Entrance of Gemini Studio



**S. S. Vasan
Founder Gemini
Studio**



**Kothamangalam
Subbu**

WORLD OF CINEMA - AUDIO LINK

PLAY AUDIO

Mind Map



Synopsis of the lesson

The story *Poets and Pancakes* is an excerpt from Asokamitran's book *My Years with Boss*. Asokamitran talks about his days at the Gemini Studio. The Gemini Studio produced many films, which impacted the aspect of Indian life. Here, he talks about a trendy make-up brand named Pancake which was used in the Gemini studios excessively by ordering in truckloads. He also mentions few actresses who used this brand. He talks about the office boy whose task was to slap paint onto the faces of the players at the time of crowd-shooting. He states that the office boy once yearned to be a director, actor, screenwriter, or lyricist. However, he blamed his disgrace on Subbu.

In those days, the author worked inside a cubicle and had to cut newspaper clippings concerning different topics and maintaining a file of the same which was considered unimportant job by others. The office boy would come to bother him with his complaints, probably jealous of Subbu's growth. Subbu was very close to his boss because whenever the boss had any problem in doing a scene in a film, Subbu will be there ready with several practical solutions. Though Subbu was always beside his boss, he was also a member of the story department. Besides poets and writers in the story department, there existed a lawyer who was known as a legal adviser but people called him the opposite of it. This legal adviser once, due to his behaviour destroyed the career of a talented actress.

The narrator talks about another guest who visited Gemini Studio, an Englishman, a poet or an editor. The Boss, Mr. Vasam, greeted the Englishman and read out a long speech expressing freedom and democracy. Then the Englishman conversed. His accent baffled everyone. They could not understand the purpose of his visit, and it remained a mystery.

Years later, when the writer left the Gemini studios, he did not have much money but had much free time and got discounted books on sale. The writer came across a book that had six essays written by six famous men who wrote about communalism. The authors of the book were Richard Wright, Louis Fischer, and Stephen Spender. As the writer read Stephen's name, it reminded him of the days when Spenders visited Gemini Studios.

7. The Interview

- Christopher Silvester



Christopher Silvester (1959)

Christopher Silvester (1959) was a student of history at Peterhouse, Cambridge. He was a reporter for *Private Eye* for ten years and has written features for *Vanity Fair*. Following is an excerpt taken from his introduction to the *Penguin Book of Interviews, An Anthology from 1859 to the Present Day*.

TEXT BOOK LESSON LINK

<https://ncert.nic.in/textbook.php?lefl1=7-14>

AUDIO LESSON LINK



Chapter 7- The Interview.mp3

Christopher Silvester and Umberto Eco

**Mukund Padmanabhan Interviewed
Umberto Eco**



***'I am a Professor who writes novels on
Sundays'* - Umberto Eco**



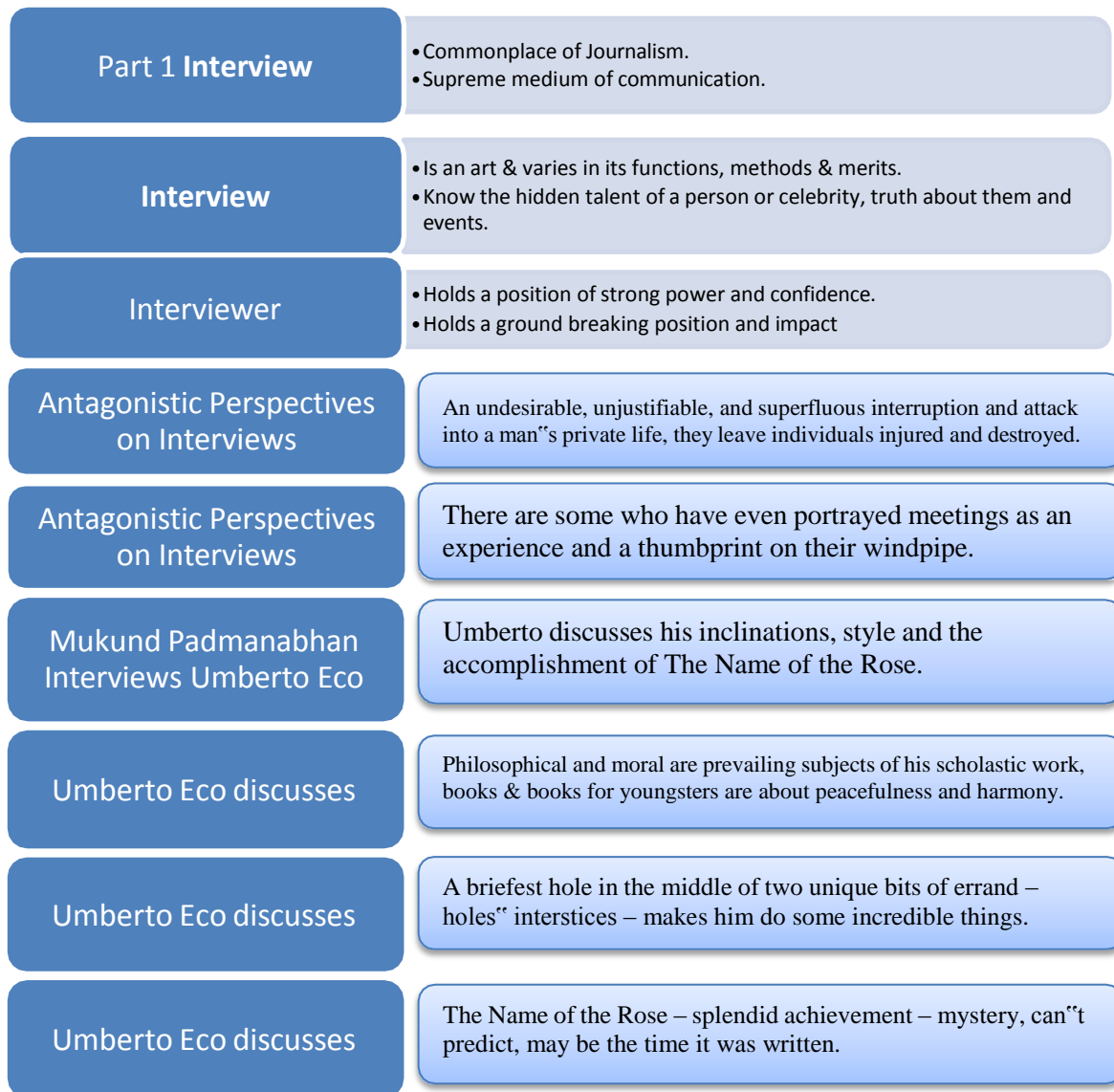
**Christopher Silvester, a Reporter for
*Private Eye***



**Umberto Eco, author of
*The Name of the Rose***



Mind Map



THE INTERVIEW - AUDIO LINK

PLAY AUDIO

Synopsis of the lesson

Part - 1

The author talks about the new invention in journalism that is Interview. It broadly discusses how different people or celebrities have multiple views about the interview and what it does to their personality. According to Christopher, Interview had different functions and advantages. Some people find it a source of truth and a medium through which the questions of a general public are answered whereas some people claim it as an unwarranted intrusion into their lives. The author has enlisted the writers who despise interviews like V S Naipaul who feels that „some people are wounded by interviews and lose a part of themselves“, for Lewis Carroll, it is „just horror of the interviewer“ and therefore refrained from it. Rudyard Kipling says that it’s immoral, crime, an assault that merits punishment, cowardly and vile. H G Wells referred to „the interviewing ordeal“ and Saul Bellow described it as „thumbprints on his windpipe“. Despite the drawbacks, interview is a supremely serviceable medium of communication and „the interviewer holds a position of unprecedented power and influence“ writes Denis Brian.

Part – 2

The second part is an extract from an interview of Umberto Eco, a Professor at the University of Bologna in Italy, by Mukund Padmanabhan from *The Hindu*. He had formidable reputation as a scholar for his ideas on Semiotics, literary fiction, academic texts, essays, children’s books, newspaper articles and had acquired superstardom with the publication of *The Name of the Rose*, which sold more than ten million copies.

Umberto replies that though people might think that he creates a different literary piece every time but in reality, he simply does the same thing again and again where he pursues his philosophical interests through his writings. He also replies in the interview that he tries to fill the empty spaces which he calls interstices to his advantage and make use of them.

When Mukund Padmanabhan asks the reason behind the huge success of the novel, he honestly replies that it is a mystery even to him. He also replies that it is difficult to trace the success of a novel because it may have different responses in different times and era, as he himself admits, had the novel come ten years later or earlier, the novel would not have got such success. This extract does not make us think that interview is a crime or an offence. He interacts very frankly and modestly which explains the interview as a communication genre.

8. Going Places

- A. R. Barton



A R Barton

A R. Barton is a modern writer, who lives in Zurich and writes in English. In the story Going Places, Barton explores the theme of adolescent fantasising and hero worship.

TEXT BOOK LESSON LINK

<https://ncert.nic.in/textbook.php?lefl1=8-14>

AUDIO LESSON LINK



Chapter 8-Going Places.mp3

Adolescent Fantasizing and Hero Worship

Sophie's Day Dreaming



'I'm going to have a boutique', Sophie.



Danney Casey, an Irish Football Player.



'I'll be like Mary Quant', Sophie.



Mind Map

Revolves around fantasies and daydreams

- Sophie, a school going teenager, fantasises always, impractical & dreamy, poor financial background
- Jansie, Sophie's friend and classmate, more practical & realistic.

Adolescent hero-worship and fantasising

- Sophie dreams to own a boutique, be an actress or fashion designer
- Jansie tries to pull Sophie to reality but in vain.

Relationships-family, friends

- Family members don't believe her, more mature & know the harsh realities of life.
- Sophie has fascination for her elder brother Geoff

Revolves around fantasies and daydreams

- She envies his silence and wonders about his thoughts and areas of his life that she doesn't know
- Sophie fantasises about Danney Casey & makes up a story that she met him - nobody believes at home.

Adolescent hero-worship and fantasising

- Sophie gets so pulled and starts believing her dream as true
- She waits for him but never showed up



- Still she fantasises about her hero and believes that he would definitely come to meet her.

Synopsis of the lesson

Sophie being a teenager belongs to a very poor family. She has her whims and fancies and wants to open a boutique, be a fashion designer or an actress. Her friend Jansie pulls her back to the reality by expressing the need for money to open a boutique and more over the place where Sophie wants to open a boutique is earmarked for biscuit factory. But Sophie pays no attention to Jansie and continues her daydreaming.

Sophie lives in a small house with her parents, one elder brother, Geoff and one younger brother, Derek. She finds a sort of fascination for her elder brother Geoff, who is tall, strong, handsome and reserved. She envies his silence and often wonders about his thoughts and areas of his life that she doesn't know about. Sophie fantasizes about Danney Casey, an Irish football player whom she had seen playing in innumerable matches. She makes up a story about how she met him in the streets and tells this to Geoff. Geoff who is more sensible than Sophie, does not really believe her, even if she wants to. It seems unlikely incident for Sophie to meet the prodigy in their street, but when Sophie describes the meeting in all her details, he begins to hope that it could be true. She tells him that Danney has promised to meet her somewhere again.

Sophie gets so pulled into the story she made that she herself begins to believe that it's true. She waits for the Irish player but obviously he never arrives. Then she makes her way home, wondering how her brother would be disappointed on knowing that Danney Casey never showed up. However, Sophie still fantasizes about her hero, Danney Casey and believes he would definitely come to meet her.



1. My Mother at Sixty-six

- Kamala Das



Kamala Das (1934)

Kamala Das (1934) was born in Malabar, Kerala. She is recognised as one of India's foremost poets. Her works are known for their originality, versatility and the indigenous flavour of the soil. Kamala Das has published many novels and short stories in English and Malayalam under the name „Madhavikutty“. Some of her works in English include the novel *Alphabet of Lust* (1977), a collection of short stories *Padmavati the Harlot and Other Stories* (1992), in addition to five books of poetry. She is a sensitive writer who captures the complex subtleties of human relationships in lyrical idiom; *My Mother at Sixty-six* is an example. The whole poem is in a single sentence, punctuated by commas, and indicates a single thread of thought interspersed with observations of the real world around and the way these are connected to the main idea.

POEM TEXT LINK

<https://ncert.nic.in/textbook.php?lef1=11-14>

Cochin Airport on Friday Morning



AUDIO POEM LINK



Chapter 10- My Mother at Sixty Six - Poem.mp3

Critical Appreciation

My Mother at Sixty-six is an emotional, a confessional and a representational work of Kamala Das. This poem confesses a daughter's fear of losing her mother. Firstly, the daughter, that is the poet, is surprised to realize that her mother is aging. Secondly, she notices how the rest of the world appears young and energetic. This is in contrast to her mother who continues to age. Thirdly, the poet expresses her apprehension over losing her mother. Finally, the poet says how she hides her true feelings and smiles outwardly. She wishes to show her love for her mother.

The poem, *My Mother at Sixty-six*, brings out this ordinary but profound human nature through personal thoughts that death is inevitable but people are afraid of losing their dear ones. As the poet expresses, the bond between a mother and her child is special, and therefore the anxiety in losing the relationship is also strong. As its thematic concern, the poem brings out the inner thoughts of a daughter for her mother. The whole poem is in a single sentence, punctuated by commas, which indicates a single thread of thought interspersed with observations of the real world and the way these are connected to the main idea.

The poem, *My Mother at Sixty-six*, is confessional, such as a first-person monologue. The arrangement of the lines is free and fluid. The poem is rich in imagery. The poet first compares her mother's appearance to that of a corpse and then describes her mother as the winter's moon. Both the comparisons are in the form of simile and indicate to the imminent death of her mother. Next there are expressions like „trees sprinting“ and „merry children spilling out“, shows the use of metaphor. The phrase, „Young Trees“ suggests the use of personification. The last lines of the poem repeat the word, „smile“, indicating that people display such positive gestures to express their true feelings for their loved ones. It could also mean, the poet wants to reassure her mother that she is happy and they are going to meet again soon.

The title, *My Mother at Sixty-six* is very appropriate as the subject of the poem is, poet's aged mother. The poem explains the beautiful relationship between a daughter and her mother, where the daughter is worried about her mother's health, old age and perhaps, the imminent death. The title prepares us for the context of the poem.

2. Keeping Quiet

- *Pablo Neruda*



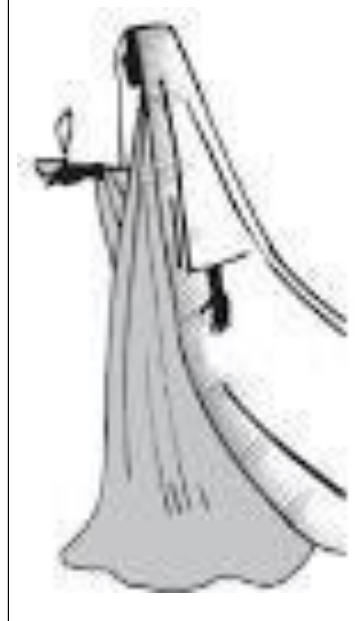
Pablo Neruda (1904 – 1973)

Pablo Neruda (1904 – 1973) is the pen name of Neftali Ricardo Reyes Basoalto who was born in the town of Parral in Chile. Neruda's poems are full of easily understood images which make them no less beautiful. He won the Nobel Prize for Literature in the year 1971. In this poem Neruda talks about the necessity of quiet introspection and creating a feeling of mutual understanding among human beings. Notice the differing line lengths of the stanzas and the shift in thought from stanza to stanza.

POEM TEXT LINK

<https://ncert.nic.in/textbook.php?lef1=13-14>

Keeping Quiet



AUDIO POEM LINK



Chapter-12 Keeping Quiet.mp3

Critical Appreciation

The poem *Keeping Quiet* is written by Pablo Neruda is written in free verse and simple. The poet has paused on the points where he wants the reader to ponder over, and understand the meaning. There are no rhyming words, or sentences, that are seen in almost all the poems of Neruda, and here as well. The themes that are present in the poem are about introspect, retrospect, and brotherhood among the people of the world. The significance of counting till twelve could be that it divides a day in two parts of twelve hours each. Another interesting fact about the poem is that even the title has twelve letters in it.

The values that are seen in the poem are about introspection, where everyone stops and thinks about the purpose of their actions, and how it is benefitting them in the end, retrospection, where we have a look back at our own actions in the history, where we have created wars, and have taken many lives, brotherhood, where the differences due to boundaries of cultures and countries are neglected, and we leave together in peace and harmony.

Neruda asks everyone to count till twelve and then keep still. In these twelve seconds, he wants everyone to calm down, relax, and get ready to begin introspection and retrospection. He wants that people speak no languages at all for few minutes and just think. By this action, he wants people to slow down and not think of their busy schedule and lives for some time, and thinks about the things that happens and had happened across them, and the purpose of all of them. He says that these moments of silence would be “exotic” and exciting, where people let their thoughts run about the purpose of the lives they are leading in the world.

He tries to bring about violence, which is not only against humans, but also the violence that it has posed towards nature. By this, he tries to put light on the selfish motif of human beings of their survival, and exploit everything for that. The third stanza about fishermen killing whales in the cold sea is a dual metaphor here, where the poet tries to point towards the cruel nature towards other species, and the wide class division of the society. In the third stanza, the poet tries to say that the fishermen are the oppressors of the society, and the men gathering salt are the oppressed ones. He appeals to the oppressor to forget about hunting or suppressing the weak for their benefit, and the men gathering salt to forget their struggle and pain, and think about each other as brothers.

3. A Thing of Beauty

- *John Keats*



John Keats (1795 – 1821)

John Keats (1795 – 1821) was a British Romantic poet. Although trained to be a surgeon, Keats decided to devote himself wholly to poetry. Keats' secret, his power to sway and delight the readers, lies primarily in his gift for perceiving the world and living his moods and aspirations in terms of language. This poem is an excerpt from his poem „Endymion: A Poetic Romance“. The poem is based on a Greek legend, in which Endymion, a beautiful young shepherd and poet who lived on Mount Latmos, had a vision of Cynthia, the Moon Goddess. The enchanted youth resolved to seek her out and so wandered away through the forest and down under the sea. Notice the consistency in rhyme scheme and line length. Also notice the balance in each sentence of the poem, as in „Of noble natures, of the gloomy days, Of all the unhealthy and o'er-darkened ways, Made for our searching: yes in spite of all,“

POEM TEXT LINK

<https://ncert.nic.in/textbook.php?lefl1=14-14>

A Thing of Beauty



AUDIO POEM LINK



Chapter 13- A Thing Of Beauty.mp3

Critical Appreciation

The poem *A Thing of Beauty* by John Keats is an excerpt from his poem *Endymion: A Poetic Romance*. He romanticizes beauty as something that has the ability to transform lives. The beauty and loveliness in anything is everlasting and they enhance every moment but never cease to be. One can relish its sweetness at all moments irrespective of the limits of time and space. The best thing about the beautiful things help a person relaxes and gives a sense of satisfaction even during toughest times. They are like endless gifts that pour down like nectar from heaven and make the beholder happy. The poet had followed „aa bb cc“ rhyme scheme throughout the poem.

The poem is fully sprinkled with sensory images and other poetic devices. The poet has used plenty of metaphors in the poem. The „fountain in heaven“, „flowery band“, „grandeur of the dooms“, „mighty dead“ are metaphors used to express the beauty of the nature which comforts humans in the time of need and low in spirit. The imagery, „are we wreathing a flowery band to bind us to the earth“, beautifully creates the picture of universal beauty. The imagery „shady boon“, „clear rills“, „a cooling covert“ creates a sense of comfort. The „sprinkling of fair musk rose blooms“ in the midst of forest is a feast to our eyes. The „flowery band“ is a paradox where the poet implicitly creates a sense of being bound. The grave of great people whose life was a tale of struggle is an inspiration. He creates such lovely images to bring out the idea about the universal beauty that transcends time itself.

4. A Roadside Stand

- *Robert Frost*



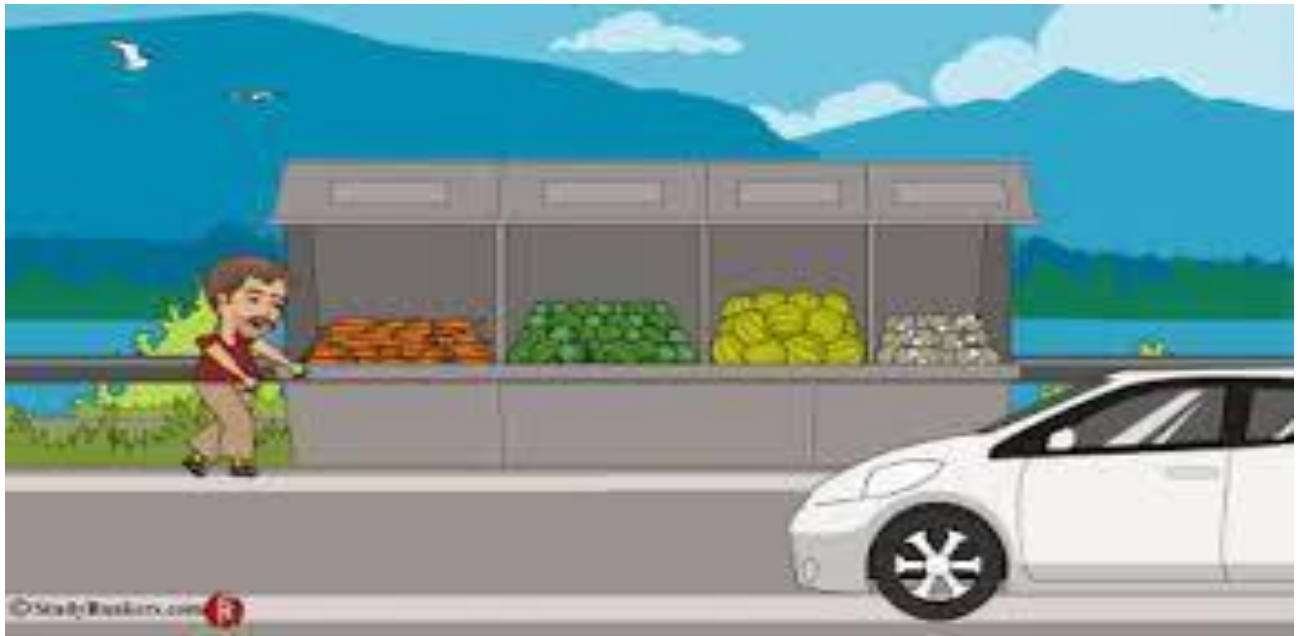
Robert Frost (1874 – 1963)

Robert Frost (1874 – 1963) is a highly acclaimed American poet of the twentieth century. Robert Frost wrote about characters, people and landscapes. His poems are concerned with human tragedies and fears, his reaction to the complexities of life and his ultimate acceptance of his burdens. Stopping by the Woods on a Snowy Evening, Birches, Mending Walls are a few of his well-known poems. In the poem A Roadside Stand, Frost presents the lives of poor deprived people with pitiless clarity and with the deepest sympathy and humanity. Notice the rhyme scheme. Is it consistent or is there an occasional variance? Does it indicate thought predominating over sound pattern? Notice the stanza divisions. Do you find a shift to a new idea in successive stanzas?

POEM TEXT LINK

<https://ncert.nic.in/textbook.php?lefl1=15-14>

A Roadside Stand



AUDIO POEM LINK



Chapter 14 - A Roadside Stand.mp3

Critical Appreciation

The poet, Robert Frost contrasts the lives of the poor with that of the rich in this poem A Roadside Stand. The poor people had constructed a roadside stand to sell their farm, local produce and earn their living but the rich do not even bother to take a look at it. The poem begins with the description of the stand where the farmer has put up outside his house along a highway, hoping the passing cars would stop to buy things, thereby to earn some money. Unfortunately, no passer by stop their cars and even if someone does, they look at the stand only to criticize the badly painted North – South signs without even noticing the „wild berries offered for sale“. The farmer tells the travellers, city people, to keep their money if they want to be mean. He is hurt the way he is treated and ignored, not for noticing or buying from the stand. He wishes for some city life and money which the „moving-pictures promise“ but „the party in power“ is keeping it away.

The poet expands his idea by saying that „good-doers“ who wants to re-locate the country people to cities to experience the cinemas and stores for their selfish advantage. These benefactors want to make these farmers completely dependent on them thus robbing them of their ability to think for themselves. These „greedy good-doers“, manipulate these innocent farmers who used to work day and night, now troubled and unable to sleep at night, „by teaching them how to sleep ... all day“.

The poem continues with the poet's personal feelings of his despair at the battered hopes of the farmers. The windows of the farmer's house just ache for a car to stop to make some purchase. However, they are always disappointed as the cars „did stop“ to enquire „only to plow up grass in using the yard to back and turn around“. Robert Frost feels that these farmers should be put out of pain, hardships and misery of existence as they have made no progress which is evidently visible through their lifestyle. He „wonders how I should like you to come to me“, „And offer to put me gently out of my pain“. The poet wonders for some solution to free the farmers from such painful existence.

The poem is not written in free verse but inconsistent throughout and in certain places the abab rhyme scheme is used. The use of transferred epithet „polished traffic“ and „selfish cars“ emphasizes the hypocrisy and selfishness of the city people. The poet has personified the stand by using the words plead for, „A roadside stand that too pathetically pled“ and „The sadness that lurks near the open window...“, and “voice of the country“. The alliteration and oxymoron, „greedy good-doers“ and „beneficent beasts of prey“ adds beauty to the poem.

5. Aunt Jennifer's Tigers

- *Adrienne Rich*



Adrienne Rich (1929 - 2012)

Adrienne Rich (1929 - 2012) was born in Baltimore, Maryland, USA. She is widely known for her involvement to contemporary women's movement as a poet and theorist. She has published nineteen volumes of poetry, three collections of essays and other writings. A strong resistance to racism and militarism echoes through her work. The poem Aunt Jennifer's Tigers addresses the constraints of married life a woman experiences. Notice the colour suggested in the poem and the repetitive use of certain sounds.

POEM TEXT LINK

<https://ncert.nic.in/textbook.php?lefl1=16-14>

*The tigers in the panel that she made
Will go on prancing, proud and unafraid.*



AUDIO POEM LINK



Chapter 15- Aunt Jenifer's Tigers.mp3

Critical Appreciation

Aunt Jennifer's Tigers is written by Adrienne Rich an American poet, essayist and feminist, addresses the constraints of married life a woman experiences. The poem expresses the struggle a woman faces due to the responsibilities of marital life in a patriarchal society. She engages herself in the art of creating the world she wishes to be in. She wanted to breathe fresh air of freedom from the stifling existence with Uncle, her husband. The poem opens up brilliantly with the description of tigers Aunt had created on the screen. They are fearless and confident which is her innermost desire to be. The second stanza expresses the ordeals of Aunt Jennifer's married life. The final stanza says even when her endurance comes to an end (she dies), her creation (tigers), will remain forever on the screen unafraid of men.

The poem, *Aunt Jennifer's Tigers* is written in a formal, conventional rhyme scheme of *aa bb* in three regular stanzas, having four lines each. Adrienne Rich has beautifully chosen third person point of view to convey the conventional married life of Aunt Jennifer exactly as she leads. Aunt cannot reveal her inner feelings or thoughts due to the fear of Uncle. The choice of diction brings out the objective, unbiased perspective of the poet and Aunt. She uses strong verbs, *prance, bright, denizens, pace, sleek, chivalric, proud, unafraid* and active voice to depict the vigour, energy and dominance of the tigers. At the same time she uses negative words and passive voice to describe the life of Aunt, *massive weight, sits heavily, terrified hand, ringed and ordeals*. The choice of words and sentences are short and simple but profound. The punctuation, full stop and commas, are very controlled like the life of Aunt. She uses metaphor, *bright topaz* to describe yellow colour of the tigers and contrast visual imagery of *bright topaz denizens* with the *world of green*.

The poem, *Aunt Jennifer's Tigers* uses symbols to bring out not only Aunt Jennifer's married life but all the sufferings a married woman endures during that period. Aunt Jennifer does not have any identity of her own. Brave, free and confident tigers symbolise the inner desires of Aunt, the creator who lives in constant fear. *Wedding band* and *ringed with ordeals* symbolise the unhappy and suppressed life of Aunt. The animal imagery presents the power and energy which Aunt aspires to acquire. The tigers are *certain* in their action which was created by *fluttering fingers* and *terrified hands* of Aunt, a paradox. The poet uses hyperbole and alliteration to emphasise Aunt's

suffering *massive weight...wedding ring, fingers fluttering, and prancing proud.*

The title, *Aunt Jennifer's Tigers*, is very apt as the subject of the poem is Aunt Jennifer's possession of her creation, the tigers on the screen. Even though *Uncle's wedding band's massive weight* is suffocating, *terrifying* and *fluttering*, it could not *ring* her mind. It is powerful and free. Aunt may not be free even after her death but her tigers (art) in the panel will be fearlessly moving around. The title prepares us for the context of the poem.



1. The Third Level

- Jack Finney



Jack Finney (1911 – 1995)

Jack Finney (October 2, 1911 – November 14, 1995) was born in Milwaukee, Wisconsin, and given the name John Finney. After his father died when Finney was three years old, he was renamed Walter Braden Finney in honour of his father, but continued to be known as “Jack”. He was graduated from Knox College in Galesburg, Illinois, in 1934. He was an American writer. His best-known works are *Science Fiction* and *Thrillers*. Finney’s first article, “Someone Who Knows Told Me...” published in the December 1943 issue of *Cosmopolitan*. The Third Level, Knox College’s Science Fiction and fantasy publication, is named for Finney’s short story “The Third Level”, published in *The Magazine of Fantasy & Science Fiction* in October 1952.

TEXT BOOK LESSON LINK
<https://ncert.nic.in/textbook.php?levt1=1-8>

Gist of the Lesson

The Third Level is set in 1950's New York. The three main characters of the story are – Charlie, a 31 year old man; Louisa, Charlie's wife and Sam, Charlie's friend and psychiatrist by profession. The story opens with our narrator (Charlie) addressing the readers that there are only two levels at the Grand Central Station of New York. Though there are only two levels, Charlie has visited the third level of Grand Central. He narrates that one night while he was in a hurry to get back home, he decided to take the subway from the Grand Central as it was faster means. He entered the Grand Central and went down the steps to the first level. Then he walked down another flight to the second level and got lost. The corridor he was in, turned sharp left and was slanting downwards. He went down a short flight of stairs and came out on the third level at Grand Central Station. (Delhi Metro Station too is multilevel and there are many corridors and steps. An example of this is Central Secretariat Metro Station.)

It looked different, "the room was smaller, there were fewer ticket windows and train gates, and the information booth in the centre was of wood and old looking. The man in the booth wore a green eyeshade and long black sleeve protectors. The lights were dim and sort of flickering" because "they were open-flame gaslights". There were brass spittoons on the floor. A man wearing a derby hat, a black four-button suit with tiny lapels, and a big, black, handlebar moustache was pulling a gold watch from his vest pocket. Women wearing dress with leg-of mutton sleeves and skirts to the top of their high-buttoned shoes. He even "caught a glimpse of a locomotive, a very small Currier & Ives locomotive with a funnel-shaped stack". Everybody on the station was dressed like 1890s. He realised that he has travelled to the past. "To make sure, he walked over to a newsboy and glanced at the stack of papers at his feet. It was *The World* and *The World* hasn't been published for years. The lead story said something about President Cleveland and it was printed June 11, 1894."

Understanding the entire situation, Charlie immediately moved to the ticket window. He wanted to buy two tickets for Louisa and himself to go to Galesburg, Illinois of 1894 with the First World War still twenty years off, and World War II over forty years in the future. Charlie had enough money to buy two one-way tickets. But, when he counted the money and looked up, the clerk nodded at the bills, "That ain't money, mister and if you're trying to skin me, you won't get very far". Charlie

glanced at the cash drawer beside him. The money was old-style bills and different looking. Charlie turned away and got out fast. Next day, during lunch hour, Charlie drew three hundred dollars out of the bank, paid a premium and bought old-style currency. Charlie's three hundred dollars bought him less than two hundred in old-style bills, but he didn't care because things were cheaper in 1894. But to his dismay, he never again found the corridor that leads to the third level at Grand Central Station.

His friends brushed his claim aside by suggesting it was a waking dream wish fulfilment (he was hallucinating). His psychiatrist friend said, "Charlie is unhappy as the modern world where he lives is full of insecurity, fear, war, worry and all the rest of it, and that he just wants to escape". His friends further argued that Charlie's habit of collecting the stamps was a „temporary refuge from reality". Charlie wonders about their claim as his grandfather too was a stamp collector though things were nice and peaceful in his days. Even President Roosevelt collected stamps. But his fruitless wandering made his wife Louisa worried and she didn't want him to look for the third level anymore, and after a while he stopped and went back to stamp collection. Suddenly, Charlie informs the readers that now both, he and his wife are looking for the third level, every weekend.

AUDIO BOOK LINK

<https://ciet.nic.in/pages.php?id=vistasxii&ln=en>

2. The Tiger King

- *Kalki*



Kalki (1899 – 1954)

Ramaswamy Krishnamurthy (September 9, 1899 – December 5, 1954), better known by his pen name **Kalki** was an Indian writer, journalist, poet, critic and Indian Independence activist. He started writing fiction stories in *Navasakthi* in 1923 where he worked as a sub editor. He was working under the tutelage of Thiru Vi Ka when he published his first book in 1927. He started writing with C Rajagopalachari in Thiruchengode in Gandhi Ashram. He joined *Ananda Vikatan*, a popular Tamil Magazine along with editor S S Vasan. He became very popular as a critic, witty author, political commentator and short story writer. He wrote under various pen names like “Kalki”, “Ra Ki”. “Tamil Theni” and “Karnatkam”. He left *Ananda Vikatan* and joined freedom struggle. On his release, he and Sadasivam started a weekly named *Kalki*. He was the editor in the journal till his death on December 5, 1954. His writings include over 120 short stories, 10 novellas, 5 novels, 3 historical romances, editorial and political writings and hundreds of film and music reviews.

TEXT BOOK LESSON LINK

<https://ncert.nic.in/textbook.php?levt1=2-8>

AUDIO BOOK LINK

<https://ciet.nic.in/pages.php?id=vistasxii&ln=en>

Gist of the Lesson

The Maharaja Sir Jilani Jung Bahadur was called the „Tiger King“. When he was just ten days old he asked intelligent questions to the astrologers and was told that he would be killed by a tiger. He uttered „Let tigers beware!“ No other miracle took place, the child grew like any other Royal child drinking white cow’s milk, taught by an English tutor, looked after by an English nanny and watched English films.

When he was twenty, he was crowned as king. It was then the prediction of his death by the tiger reached the Maharaja’s ear. He to safeguard himself killed a tiger and being thrilled he told the astrologer. The astrologer replied that he can kill ninety nine tigers but should be careful with the hundredth. From then on he started killing tigers and none was allowed to hunt tigers. A high ranking British officer visited the state that was fond of hunting tiger and his wish was declined. The officer requested for getting a photograph with a tiger killed by Maharaja and this request was rejected. So to please the officer’s wife he sent fifty diamond rings expecting that she would take one or two instead she kept all the rings costing three lakh rupees and sent thanks to the Maharaja. But his state was secured.

In ten years he killed seventy tigers and did not find any in Pratibandapuram. So he decided to marry a girl from royal state which had more tigers to complete his target whenever he visited his in-laws he killed five to six tigers. So he killed ninety nine tigers and was feverishly anxious to kill the hundredth but could not find. News about the presence of a tiger near a village proved disappointing. The Maharaja’s mood became worse and dismissed many and all were afraid to go near him. Dewan was also afraid and he made a plan to visit „People’s Park in Madras“ to bring the old tiger from there and placed it in the forest and informed Maharaja.

The Maharaja took great care and shot the tiger and left the place with great triumph. The bullet did not hit the tiger but out of fear and shock the tiger had collapsed. Then the staff killed the tiger and brought it in grand procession.

It was the third birthday of the Maharaja’s son and he wanted to buy a present from the toy shop. He bought a wooden tiger which was poorly carved. The Maharaja, while playing with the prince, a tiny sliver of the wooden tiger pierced his right hand which later caused his death. Thus the hundredth tiger takes his final revenge upon *The Tiger King*.

3. Journey to the end of the Earth

- Tishani Doshi



Tishani Doshi (1975)

Tishani Doshi (December 9, 1975) is an Indian poet, journalist and dancer based in Chennai. She was born in Madras, India, to a Welsh mother and Gujarati father. She completed a bachelor's degree in the United States, at Queen's College in Charlotte, North Carolina. She graduated with a master's degree in creative writing from the Johns Hopkins University. She works as a freelance writer and journalist. In 2006 she won the Forward Prize for her debut poetry book *Countries of the Body*. Her poetry book *A God at the Door* has been shortlisted for the 2021 Forward Prize under best poetry collection category.

TEXT BOOK LESSON LINK

<https://ncert.nic.in/textbook.php?levt1=3-8>

AUDIO BOOK LINK

<https://ciet.nic.in/pages.php?id=vistasxii&ln=en>

Gist of the Lesson

The author joined the *Akademik Shokalskiy*, a Russian research ship which was on its way to Antarctica, the oldest, driest and windiest continent in the world. The journey beginning at Madras (Chennai), passed through many areas, geographical, local, ecological and temporal. The narrator's first reaction to the continent was of relief, followed by wonder at its vastness, seclusion and geological history.

Before human evolution, Antarctica was part of a huge tropical landmass called Gondwana land which flourished 500 million years ago. Biological, geological and geographical changes occurred and Antarctica separated and moved away evolving into what it is today. A visit to Antarctica gave the narrator a deeper understanding of mountains, the earth's history, ecology and environment. The long summers, the silence broken occasionally by cracking ice sheets and avalanches, the blue whales and ice bergs, all contribute to an ecological implication that the future for human isn't good.

Humans, who are known to have existed for a mere 12000 years, have caused tremendous impact and played havoc with nature. Population explosion, putting a strain on available resources, carbon emissions, fossil fuels and global warming have all resulted in climatic and ecological imbalances that have also affected Antarctica. Antarctica, though unpopulated, has been affected and there are concerns for its half a million year old carbon records trapped under its ice sheets. The Students on Ice programme, an initiative of Canadian adventure educator, Geoff Green takes students on expedition to Antarctica, to create awareness in them, the future policy makers. The stark proof of global warming and environmental threats help students attain an understanding of ecosystems and biodiversity of our planet. An amazing display of food chain of the Southern Ocean helps in the understanding that further depletion of the ozone layer will set off a chain reaction that will affect the global carbon cycle. The simple truth is if the small things are taken care of automatically the bigger ones will be taken care.

The write got an opportunity to walk on the ocean at 65.55 degrees south before returning which made her realise that she was walking on 180 meters of ocean water, a rich kaleidoscope of life. Reaching home, she wondered whether Antarctica would ever be warm again, how much difference a million years can make and, that each day makes a difference.

4. The Enemy - Pearl S. Buck



Pearl S. Buck (1892 – 1973)

Pearl Sydenstricker Buck (June 26, 1892 – March 6, 1973), also known by her Chinese name Sai Zhenzhu was an American writer and novelist. She is best known for *The Good Earth* which was the best-selling novel in the United States in 1931 and 1932 and won the Pulitzer Prize in 1932. In 1938, Buck won the Nobel Prize for Literature “for her rich and truly epic descriptions of *peasant life in China*” and for her “masterpieces”, two memoir-biographies of her missionary parents. She was the first American Woman to win that prize.

TEXT BOOK LESSON LINK

<https://ncert.nic.in/textbook.php?levt1=4-8>

AUDIO BOOK LINK

<https://ciet.nic.in/pages.php?id=vistasxii&ln=en>

Gist of the Lesson

The story *The Enemy* by Pearl S. Buck was set in the days of World War. Japan was at war with America. Hana played an important role to make the situation normal when the servants denied serving the white man as well as Dr. Sadao. They took the final decision to leave the house. Dr. Sadao realised the importance of the situation and considered it a wake-up call. He informed as well as persuaded the General to get him rid of Tom, an American prisoner of war. General Takima's selfish nature indirectly facilitated the way to solution. His attitude in the matter of the enemy soldier was an example of delay of action and compromised on the national interest for the sake of his own interest.

The story is set in the day of World War. A prisoner of war was washed ashore at the door step of Japanese doctor. Dr. Sadao, who completed his education of medicine in America, has a dilemma to save the prisoner or to hand him over to the police. He was born and brought up in a Japanese traditional family.

He took the decision to give him urgent medical help that was required. His decision was respected by his wife Hana. But the servants openly disobeyed his order. They thought that their master was driven by the American influence and culture as he later spent his quality time in America. Dr. Sadao's professionalism overpowers his sense of patriotism.

Dr. Sadao, at last, could succeed to resolve the issue that made him very much depressed. He saved the life of American prisoner of war thrice. He brought him to his house. He operated upon him. He made him escape comfortably. There was a moment in doctor's life when he had to make a hard choice between his role as a private individual (professional doctor) and as a citizen with a sense of national loyalty. Dr. Sadao was engrossed with his professional ethics while helping the enemy soldier.

On the other hand, Hana, an example of love and affection, rendered her service in high spirit as a mother, sister and companion does. After all, it proves that excessive glorification of patriotism (Jingoism) is a state of mind driven by overloaded emotions during war period. It is for time-being. It lasts transiently. On the other hand, humanism is the way of life. It fosters the feeling of universal brotherhood forever. Service to man is service to God.

5. On the face of It

- *Susan Hill*



Susan Hill (1942)

Dame Susan Hill, Lady Wells (February 5, 1942) is an English author of fiction and non-fiction works. She was born in Scarborough, North Yorkshire. Her home town was later referred to in her novel *A Change for the Better* (1969) and in some short stories like *Cockies and Mussels*. She attended Scarborough Convent School where she became interested in theatre and literature. Her novels include *The Woman in Black*, *The Mist in the Mirror*, and *I'm the King of the Castle*, for which she received the Somerset Maugham Award in 1971. Her novels are written in a descriptive gothic style, especially her ghost story *The Woman in Black* (1983). Her novels turned into plays have run for over twenty years and was also made into a television film. She began a series of crime novels featuring detective Simon Serrailer, entitled *The Various Haunts of Men* (2004).

TEXT BOOK LESSON LINK

<https://ncert.nic.in/textbook.php?lev1=6-8>

Gist of the Lesson

The play has mainly two characters, an old man, Mr. Lamb with a tin leg and a small boy, Derry with a burnt face, meeting in the former's garden. The old man strikes up a friendship with the boy who is very withdrawn and defiant. The play depicts the grim world of the physically impaired. The pain caused by the attitude of the people causes more trouble and hurt than the acids or physical impairment.

People tell him inspiring stories to console him, and no one will kiss him except his mother that too on the other side of his face. Once he overheard a woman saying about his face that only a mother can love such a face. Derry was hurt, withdrawn, without any friends feeling lonely and had full of negative feelings about life. Mr. Lamb revives through his friendly talk bring back hope and positivity in Derry. Derry asks many questions to Mr. Lamb, his fear leaves him, becomes friendly with him and his mind set changes about people, things and life.

Mr. Lamb narrates a story about a man who locked himself as he was so scared of everything and at last inside the room, a picture fell off from the wall and got killed. He also gives the example of bees and weeds saying everything appears to be the same but different. He also tells Derry that his garden gates will always be opened. Derry inspired by Mr. Lamb's talk, promises him to come back.

Derry's mother stops him but he is very firm and adamant saying if he does not go now it would be never. When he comes back he sees Mr. Lamb lying on the ground. It is ironical that when he searches a new foothold to live happily, he finds Mr. Lamb dead. The play thus depicts the mental state of loneliness, alienation due to their physical disability and the attitude of the other people who never bothers about their remark and behaviour with such people. Also it brings out the positive side of life through Mr. Lamb. So beautifully the play brings out the two sides of a coin through Derry and Mr. Lamb.

AUDIO BOOK LINK

<https://ciet.nic.in/pages.php?id=vistasxii&ln=en>

6. Memories of Childhood

The Cutting of My Long Hair - *Zitkala Sa*

We too are Human Beings - *Bama*



Zitkala Sa (1876 – 1938)

Zitkala Sa (February 22, 1876 – January 26, 1938), also known by her missionary and married names Gertrude Simmons Bonnin, was a Yankton Dakota writer, editor, translator, musician, educator, and political activist. She wrote several works chronicling her struggles with cultural identity, and the pull between the majority culture in which she was educated, and the Dakota culture into which she was born and raised. Her later books were among the first works to bring traditional Native American stories to a widespread white English-speaking readership. She has been noted as one of the most influential Native American Activists of the 20th century.

TEXT BOOK LESSON LINK

<https://ncert.nic.in/textbook.php?levt1=8-8>

AUDIO BOOK LINK

<https://ciet.nic.in/pages.php?id=vistasxii&ln=en>



Bama (1958)

Bama (1958), also known as Bama Faustina Susairaj, is a Tamil Dalit feminist, teacher and novelist. She was born as Faustina Mary Fatima Rani in a Roman Catholic family belonging to Paraiyar community from Puthupatti in the then Madras State. Later she accepted „Bama“ as her pen name. Her father, Susairaj was employed in the Indian Army and her mother was named Sebasthiamma. She is the sister of famous Dalit writer Raj Gauthaman. Bama’s grandfather had converted from Hinduism to Christianity. Bama’s ancestors were born from the Dalit community and worked as agricultural labourers. She had her early education at village. Her early literary influences include Tamil writers like Jayakanthan, Akhilan, Mani, and Parthasarathy. In College, she read and enjoyed Kahlil Gibran and Rabindranath Tagore. She became a school teacher for very poor girls and later she served as a nun for seven years to escape caste-based discrimination and for helping in the advancement of poor girls.

Her autobiographical novel *Karukku* (1992) chronicles the joys and sorrows experienced by Dalit Christian women in Tamilnadu. She subsequently wrote two more novels, *Sangati* (1994) and *Vanman* (2002) along with three collections of short stories *Kusumbukkaran* (1996) and *Oru Tattiyum Erumaiyum* (2003), *Kandattam* (2009), in addition to this, she has written twenty short stories.

Gist of the Lesson

It is an autobiographical episode from the lives of two women - Zitkala-Sa an American Indian Woman born in the late nineteenth century and Bama a contemporary Tamil Dalit Writer - from marginalised communities who look back on their childhood, and reflect on their relationship with the mainstream culture.

Part 1

The excerpt begins with an account of a Native American woman, Zitkala Sa's first day in the land of apples, in a missionary Quaker boarding school in Wabash, Indiana. She was unaccustomed with the rules, procedures and customs of the place. She felt undignified and immodest seeing the Indian girls wearing *closely clinging dresses, tightly fitting clothes* and the small girls in *sleeved aprons and shingled hair* and wondered how they agreed to wear such clothes. She was embarrassed at the breakfast table as she did not know the table manners and was keenly observed by the paleface strange woman. This *eating by formula* was not the hardest trial for her but the blow came when her friend Judewin gave a terrible warning of cutting their long and heavy hair. Judewin knew few words of English and she overheard the paleface woman talk about cutting their hair. She remembered her mother say according to her custom *short hair was worn by mourners and shingled hair by cowards. Unskilled warriors who were captured had their hair shingled by the enemy.*

Zitkala Sa decided to struggle first unlike her friend who has decided to submit, when she heard from Judewin, her friend that they were planning to cut their hair. She crept up the stairs and disappeared into a room which was dim as dark green curtains covered the windows. She decided to rebel and protest by hiding herself under the bed, even though she knew it will be futile. Soon people start searching for her everywhere. Someone threw up the curtains and the room was filled with light. Someone stooped down to look under the bed and there they saw her hiding. They pulled her, dragged her and carried her downstairs. They tied her in a chair. She tried her might by *kicking, scratching wildly* and by *shaking* her head. She then lost her spirit and suffered extreme indignities. Her long hair was shingled like cowards. She moaned for her mother to comfort her but none turned out. She felt like an *animal driven by a herder*. This enduring moment had a long lasting imprint on her mind.

Part 2

This excerpt is taken from the autobiography *Karukku* by the Tamil Dalit writer Bama. She describes an incident happened when she was in the third class. She used to dawdle along the way from her school to home taking half an hour to an hour to cover ten minutes' walk, watching all the fun, games, *entertaining novelties and oddities* on the streets, shops and bazaars.

During one such time she observes an elderly person carrying a packet of *vadais* or green banana *bhajji* in such a funny manner kindled her curiosity. She followed him and the elder *bowed low* before the landlord and *extended the packet, cupping the hand that held the string with his other hand*. The landlord opened the parcel and ate the *vadais* without offering him.

Bama narrated the whole incident with all its *comic details* to her elder brother and burst out with laughter. But her Annan (elder brother) did not find it funny. Instead he explained to her since he belonged to a lower caste like theirs, these upper caste people treated them as untouchables. Hearing this Bama found the incident no funnier. She was deeply saddened and affected. Her brother narrated another incident to her. When he was home during one of his University holidays, one of the landlord's men asked his name and the street he lived while coming back from library, to know his caste as he looked unfamiliar. Her brother also told her that the only way to get honour or dignity or respect and throw away these indignities is by *working hard and learn*. That was a strong message conveyed to her by Annan made a very deep impression on her. She studied with all her *breath and being, in frenzy almost* and stood first in her class which attracted many people to become her friends.

Memories of Childhood presents autobiographical episodes of Zitkala-Sa and Bama who were the victims of racial and caste discriminations. They look back on their childhood and reflect on their relationship with the mainstream culture. Their bitter childhood experience sowed the seeds of rebellion in them.

Curriculum of Academic Year 2022 – 23

ENGLISH (CORE)

Code No. 301
(2022-23)

Background

Students are expected to have acquired a reasonable degree of language proficiency in English Language by the time they come to class XI, and the course aims, essentially, at promoting the higher-order language skills.

For a large number of students, the higher secondary stage will be a preparation for the university, where a fairly high degree of proficiency in English may be required. But for another large group, the higher secondary stage may be a preparation for entry into the professional domain. The Core Course should cater to both groups by promoting the language skills required for academic study as well as the language skills required for the workplace.

Competencies to be focused on:

The general objectives at this stage are to:

- listen and comprehend live as well as record in writing oral presentations on a variety of topics
- develop greater confidence and proficiency in the use of language skills necessary for social and academic purpose to participate in group discussions, interviews by making short oral presentation on given topics
- perceive the overall meaning and organisation of the text (i.e., correlation of the vital portions of the text)
- identify the central/main point and supporting details, etc., to build communicative competence in various lexicons of English
- promote advanced language skills with an aim to develop the skills of reasoning, drawing inferences, etc. through meaningful activities
- translate texts from mother tongue(s) into English and vice versa
- develop ability and acquire knowledge required in order to engage in independent reflection and enquiry
- read and comprehend extended texts (prescribed and non-prescribed) in the following genres: science fiction, drama, poetry, biography, autobiography, travel and sports literature, etc.
- text-based writing (i.e., writing in response to questions or tasks based on prescribed or unseen texts) understand and respond to lectures, speeches, etc.
- write expository / argumentative essays, explaining or developing a topic, arguing a case, etc. write formal/informal letters and applications for different purposes

- make use of contextual clues to infer meanings of unfamiliar vocabulary
- select, compile and collate information for an oral presentation
- produce unified paragraphs with adequate details and support
- use grammatical structures accurately and appropriately
- write items related to the workplace (minutes, memoranda, notices, summaries, reports etc.
- filling up of forms, preparing CV, e-mail messages., making notes from reference materials, recorded talks etc. The core course should draw upon the language items suggested for class IX-X and delve deeper into their usage and functions. Particular attention may, however, be given to the following areas of grammar:
 - The use of passive forms in scientific and innovative writings.
 - Convert one kind of sentence/clause into a different kind of structure as well as other items to exemplify stylistic variations in different discourses modal auxiliaries- uses based on semantic considerations.

A. Specific Objectives of Reading

Students are expected to develop the following study skills:

- skim for main ideas and scan for details
- refer to dictionaries, encyclopedia, thesaurus and academic reference material in any format
- select and extract relevant information, using reading skills of skimming and scanning
- understand the writer's purpose and tone
- comprehend the difference between the literal and the figurative
- differentiate between claims and realities, facts and opinions, form business opinions on the basis of latest trends available
- comprehend technical language as required in computer related fields, arrive at personal conclusion and logically comment on a given text.
- Specifically develop the ability to be original and creative in interpreting opinion, develop the ability to be logically persuasive in defending one's opinion and making notes based on a text.

Develop literary skills as enumerated below:

- respond to literary texts
- appreciate and analyse special features of languages that differentiate literary texts from non-literary ones, explore and evaluate features of character, plot, setting, etc.
- understand and appreciate the oral, mobile and visual elements of drama. Identify the elements of style such as humour, pathos, satire and irony, etc.
- make notes from various resources for the purpose of developing the extracted ideas into sustained pieces of writing

A. Listening and Speaking

Speaking needs a very strong emphasis and is an important objective leading to professional competence. Hence, testing of oral skills must be made an important component of the overall testing pattern. To this end, speaking and listening skills are overtly built into the material to guide the teachers in actualization of the skills.

Specific Objectives of Listening & Speaking

Students are expected to develop the ability to:

- take organized notes on lectures, talks and listening passages
- listen to news bulletins and to develop the ability to discuss informally a wide ranging issues like current national and international affairs, sports, business, etc.
- respond in interviews and to participate in formal group discussions.
- make enquiries meaningfully and adequately and to respond to enquiries for the purpose of travelling within the country and abroad.
- listen to business news and to be able to extract relevant important information.
- to develop public speaking skills.

B. Specific Objectives of writing

The students will be able to:

- write letters to friends, relatives, etc. to write business and official letters.
- open accounts in post offices and banks. To fill in railway/airline reservation forms.
- draft notices, advertisements and design posters effectively and appropriately
- write on various issues to institutions seeking relevant information, lodge complaints, express gratitude or render apology.
- write applications, fill in application forms, prepare a personal bio-data for admission into colleges, universities, entrance tests and jobs.
- write informal reports as part of personal letters on functions, programmes and activities held in school (morning assembly, annual day, sports day, etc.)
- write formal reports for school magazines/events/processes/ or in local newspapers about events or occasions.
- express opinions, facts, arguments in the form of speech or debates, using a variety of accurate sentence structures
- draft papers to be presented in symposia.
- take down notes from talks and lectures.
- write examination answers according to the requirement of various subjects.
- summarise a text.

C. More About Reading

Inculcating good reading habits in children has always been a concern for all stakeholders in education. The purpose is to create independent thinking individuals with the ability to not only create their own knowledge but also critically interpret, analyse and evaluate it with objectivity and fairness. This will also help students in learning and acquiring better language skills.

Creating learners for the 21st century involves making them independent learners who can learn, unlearn and relearn. If our children are in the habit of reading, they will learn to reinvent themselves and deal with the many challenges that lie ahead of them.

Reading is not merely decoding information or pronouncing words correctly. It is an interactive dialogue between the author and the reader in which the reader and the author share their experiences and knowledge with each other. Good readers are critical readers with an ability to arrive at a deeper understanding of not only the world presented in the book but also of the real world around them.

Consequently, they become independent thinkers capable of taking their own decisions in life rationally. Hence, a few activities are suggested below which teachers may use as a part of the reading project.

- Short review / dramatization of the story
- Commentary on the characters
- Critical evaluation of the plot, storyline and characters
- Comparing and contrasting the characters within the story, with other characters in stories by the same author or by different authors
- Extrapolating about the story read or life of characters after the story ends defending characters actions in the story
- Making an audio story out of the novel/text to be read aloud.
- Interacting with the author
- Holding a literature fest where students role-play as various characters to interact with each other
- Role playing as authors/poets/dramatists, to defend their works and characters
- Symposiums and seminars for introducing a book, an author, or a theme
- Creating graphic novels out of novel or short stories they read
- Dramatizing incidents from a novel or a story
- Creating their own stories
- Books of one genre to be read by the whole class.

Teachers may select books and e-books suitable to the age and level of the learners. Care ought to be taken to choose books that are appropriate in terms of language, theme and content and which do not hurt the sensibilities of a child.

Teachers may later suggest books from other languages by dealing with the same themes as an extended activity. The Project should lead to independent learning/reading skills and hence the chosen book should not be taught in class, but may be introduced through activities and be left for the students to read at their own pace. Teachers may, however, choose to assess a student's progress or success in reading the book by asking for verbal or written progress reports, looking at their diary entries, engaging in a discussion about the book, giving a short quiz or a work sheet about the book/short story. A befitting mode of assessment may be chosen by the teacher.

Methods and Techniques

The techniques used for teaching should promote habits of self-learning and reduce dependence on the teacher. In general, we recommend a multi-skill, learner-centred, activity based approach, of which there can be many variations. The core classroom activity is likely to be that of silent reading of prescribed/selected texts for comprehension, which can lead to other forms of language learning activities such as role-play, dramatization, group discussion, writing, etc., although many such activities could be carried out without the preliminary use of textual material. It is important that students be trained to read independently and intelligently, interacting actively with texts, with the use of reference materials (dictionary, thesaurus, etc.) where necessary. Some pre-reading activity will generally be required, and the course books should suggest suitable activities, leaving teachers free to devise other activities when desired. So also, the reading of texts should be followed by post reading activities. It is important to remember that students should be encouraged to interpret texts in different ways.

Group and pair activities can be resorted to when desired, although many useful language activities can be carried out individually. In general, teachers should encourage students to interact actively with texts and with each other. Oral activity (group discussion, etc.) should be encouraged.

ENGLISH CORE
CODE NO. 301
CLASS – XII 2022-23

Section A
Reading Skills

Reading Comprehension through Unseen Passage

20 Marks

I. One unseen passage to assess comprehension, interpretation and inference. Vocabulary and inference of meaning will also be assessed. The passage may be factual, descriptive or literary.

(**10x1=10 Marks**)

II. One unseen **case-based** passage with verbal/visual inputs like statistical data, charts etc.

(10x1=10 Marks)

Note: The combined word limit for both the passages will be 700-750 words.

Multiple Choice Questions / Objective Type Questions will be asked.

Section B

III. Creative Writing Skills

20 Marks

The section has Short and long writing tasks.

- i. Notice up to 50 words. One out of the two given questions to be answered. **(5 Marks:** Format: 1 / Organisation of Ideas: 1/Content: 2 / Accuracy of Spelling and Grammar: 1).
- ii. Formal/Informal Invitation and Reply up to 50 words. One out of the two given questions to be answered. **(5 Marks:** Format: 1 / Organisation of Ideas: 1/Content: 2 / Accuracy of Spelling and Grammar: 1).
- iii. Letters based on verbal/visual input, to be answered in approximately 120-150 words. Letter types include application for a job with bio data or resume. Letters to the editor (giving suggestions or opinion on issues of public interest) . One out of the two given questions to be answered. **(5 Marks:** Format: 1 / Organisation of Ideas: 1/Content: 2 / Accuracy of Spelling and Grammar:1).
- iv. Article/ Report Writing, descriptive and analytical in nature, based on verbal inputs, to be answered in 120-150 words. One out of the two given questions to be. **(5 Marks:** Format: 1 / Organisation of Ideas: 1/Content: 2 / Accuracy of Spelling and Grammar:1).

Section C

This section will have variety of assessment items including Multiple Choice Questions, Objective Type Questions, Short Answer Type Questions and Long Answer Type Questions to assess comprehension, analysis, interpretation and extrapolation beyond the text.

IV. Reference to the Context

40 Marks

- i. One Poetry extract out of two from the book **Flamingo** to assess comprehension, interpretation, analysis and appreciation. **(6x1=6 Marks)**
 - ii. One Prose extract out of two from the book **Vistas** to assess comprehension, interpretation, analysis and appreciation. **(4x1=4 Marks)**
 - iii. One prose extract out of two from the book **Flamingo** to assess comprehension, Interpretation and analysis. **(6x1=6Marks)**
- V.** Short answer type question (**from Prose and Poetry from the book Flamingo**), to be answered in 40-50 words. Questions should elicit inferential responses through critical thinking. Five questions out of the six given are to be answered. **(5x2=10 Marks)**
- VI.** Short answer type question, from **Prose (Vistas)**, to be answered in 40- 50 words. Questions should elicit inferential responses through critical thinking. Any 2 out of 3 questions to be done. **(2x2=4 Marks)**
- VII.** One Long answer type question, from **Prose/Poetry (Flamingo)**, to be answered in 120-150 words. Questions can be based on incident / theme / passage / extract / event as reference points to assess extrapolation beyond and across the text. The question will elicit analytical and evaluative response from student. Any 1 out of 2 questions to be done. **(1x5=5 Marks)**
- VIII.** One Long answer type question, based on the chapters from the book **Vistas**, to be answered in 120-150 words to assess global comprehension and extrapolation beyond the text. Questions to provide evaluative and analytical responses using incidents, events, themes as reference points. Any 1 out of 2 questions to be done. **(1x5=5 Marks)**

Prescribed Books

1. **Flamingo:** English Reader published by National Council of Education Research and Training, New Delhi

(Prose)

- The Last Lesson
- Lost Spring
- Deep Water
- The Rattrap
- Indigo
- Poets and Pancakes
- The Interview
- Going Places

(Poetry)

- My Mother at Sixty-Six
- Keeping Quiet
- A Thing of Beauty
- A Roadside Stand
- Aunt Jennifer's Tigers

2. **Vistas:** Supplementary Reader published by National Council of Education Research and Training, New Delhi

- The Third Level
- The Tiger King
- Journey to the end of the Earth
- The Enemy
- On the Face of It
- Memories of Childhood
 - The Cutting of My Long Hair
 - We Too are Human Beings

INTERNAL ASSESSMENT

Assessment of Listening Skills - 05 marks.
Assessment of Speaking Skills – 05 Marks
Project Work - 10 Marks

Question Paper Design 2022-23
Code No. 301
English CORE XII

Section	Competencies	Total marks
Reading Skills	Conceptual understanding, decoding, Analyzing, inferring, interpreting, appreciating, literary, conventions and vocabulary, summarizing and using appropriate format/s.	20
Creative Writing Sills	Conceptual Understanding, application of rules, Analysis, Reasoning, appropriacy of style and tone, using appropriate format and fluency, inference, analysis, evaluation and creativity.	20
Literature Text Books and Supplementary Reading Texts	Recalling, reasoning, critical thinking, appreciating literary convention, inference, analysis, creativity with Fluency.	40
	TOTAL	80
	Assessment of Listening and Speaking Skills	10
	Internal Assessment <ul style="list-style-type: none"> • Listening • Speaking • Project Work 	5 5 10
	GRAND TOTAL	100

English Medium

Rationalisation of Content in the Textbooks

In view of the COVID-19 pandemic, it is imperative to reduce content load on students. The National Education Policy 2020, also emphasises reducing the content load and providing opportunities for experiential learning with creative mindset. In this background, the NCERT has undertaken the exercise to rationalise the textbooks across all classes. Learning Outcomes already developed by the NCERT across classes have been taken into consideration in this exercise.

Contents of the textbooks have been rationalised in view of the following:

- Overlapping with similar content included in other subject areas in the same class
- Similar content included in the lower or higher class in the same subject
- Difficulty level
- Content, which is easily accessible to students without much interventions from teachers and can be learned by children through self-learning or peer-learning
- Content, which is irrelevant in the present context

This booklet contains information in tabular form about subject-wise contents which have been dropped and hence are not to be assessed.

Table for Rationalised Content

12074 – Flamingo — English Core

Chapter	Page No.	Dropped Topics/Chapters
<i>Poetry</i> Chapter 2: An Elementary School Classroom in a Slum by Stephen Spender	92–94	Full Chapter

English Medium

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Table for Rationalised Content

12075 – Vistas

Chapter	Page No.	Dropped Topics/Chapters
Chapter 5: Should Wizard hit Mommy by John Updike	48–55	Full Chapter
Chapter 7: Evans Tries an O-Level by Colin Dexter	70–92	Full Chapter

References

1. Flamingo, NCERT Text Book <https://ncert.nic.in/textbook.php?lefl1=4-14>
2. Vistas, NCERT Text Book <https://ncert.nic.in/textbook.php?levt1=0-8>
3. Wikipedia Links
 - https://en.wikipedia.org/wiki/Alphonse_Daudet
 - https://en.wikipedia.org/wiki/Anees_Jung
 - https://en.wikipedia.org/wiki/William_O._Douglas
 - https://en.wikipedia.org/wiki/Selma_Lagerl%C3%B6f
 - https://en.wikipedia.org/wiki/Louis_Fischer
 - <https://en.wikipedia.org/wiki/Ashokamitran>
 - https://en.wikipedia.org/wiki/A._R._H._Barton
 - https://en.wikipedia.org/wiki/Kamala_Surayya
 - https://en.wikipedia.org/wiki/Pablo_Neruda
 - https://en.wikipedia.org/wiki/John_Keats
 - https://en.wikipedia.org/wiki/Robert_Frost
 - https://en.wikipedia.org/wiki/Adrienne_Rich
 - https://en.wikipedia.org/wiki/Jack_Finney
 - https://en.wikipedia.org/wiki/Kalki_Krishnamurthy
 - https://en.wikipedia.org/wiki/Tishani_Doshi
 - https://en.wikipedia.org/wiki/Pearl_S._Buck
 - https://en.wikipedia.org/wiki/Susan_Hill
 - <https://en.wikipedia.org/wiki/Zitkala-Sa>
 - [https://en.wikipedia.org/wiki/Bama_\(writer\)](https://en.wikipedia.org/wiki/Bama_(writer))
4. Christopher Silvester - <https://www.livingobit.com/christopher-silvester>
5. Speak your Language, Save Your Heritage
<https://www.youtube.com/watch?v=RVUuc4M5bB0>
6. The Last Lesson Animated Video
<https://www.youtube.com/watch?v=Fz1GPDkk6k0>
7. Language Chauvinism is far more dangerous than terrorism – Debate
<https://www.youtube.com/watch?v=B0u9Vt4-qxY>
8. CIET AUDIO BOOKS LINK
<https://ciet.nic.in/pages.php?id=flamingo&ln=en> (Flamingo)
<https://ciet.nic.in/pages.php?id=vistasxii&ln=en> (Vistas)
9. Curriculum of the Academic Year 2022 – 23
https://cbseacademic.nic.in/web_material/CurriculumMain23/SrSec/English_core_SrSec_2022-23.pdf
10. Rationalisation of Content in the text books - Flamingo
<https://ncert.nic.in/textbook.php?lefl1=rc-14>
11. Rationalisation of Content in the text books – Vistas
<https://ncert.nic.in/textbook.php?levt1=rc-8>

KENDRIYA VIDYALAYA SANGATHAN



**ZONAL INSTITUTE OF EDUCATION AND
TRAINING, GWALIOR**

**INTERACTIVE STUDY
MATERIAL**

CHEMISTRY

CLASS XII 2022-23

Sh. JAIKISHAN KESWANI

TRAINING ASSOCIATE (CHEMISTRY)

INDEX

S.No	Title	Link
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2	Electrochemistry	<u>Click here</u>
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UNIT -1

SOLUTIONS

Points to Remember

1. The component that is having more number of moles is known as solvent. Solvent determines the physical state of the solution. Water is a universal solvent.
2. Mole fraction (X) is a unitless quantity.
3. Molality (m) and mole fraction are temperature independent quantities whereas molarity decreases with increase in temperature.
4. As the temperature increases Henry's law constant, K_H increases so the lower is the solubility of the gas in the liquid.
5. 11.7% w/w Helium is added to air used by scuba divers due to its low solubility in the blood.
6. Raoult's law becomes a special case of Henry's law in which K_H becomes equal to P_A^0 , i.e., vapour pressure of pure solvent.
7. Azeotropes having the same composition in liquid and vapour phase and boil at a constant temperature and therefore can't be distilled.
8. Azeotropes arise due to very large deviation from Raoult's law. Maximum boiling azeotropes form when solutions exhibit negative deviation from Raoult's law whereas minimum boiling azeotropes form when solutions exhibit positive deviation from Raoult's law.
9. Relative lowering in vapour pressure is a colligative property but lowering in vapour pressure is not.
10. Van't Hoff factor (i) is the ratio of the observed value of the colligative property in solution to the theoretically calculated value of the colligative property.
 - (a) A non-volatile solute undergoes dissociation, then $i > 1$.
 - (b) A non-volatile solute undergoes association, then $i < 1$.

[CLICK HERE FOR DETAILED PRESENTATION](#)

Some Important Formulae

1. Mole fraction (X)

If the number of moles of A and B are n_A and n_B respectively, the mole fractions of A and B will be

$$X_A = \frac{n_A}{n_A + n_B} \text{ and } X_B = \frac{n_B}{n_A + n_B}$$

$$X_A + X_B = 1$$

2. Molarity (M) = $\frac{\text{Moles of solute}}{\text{Volume of solution in liters}} \text{ mol L}^{-1}$

3. Molality (m) = $\frac{\text{Moles of solute}}{\text{Mass of solvent in kilograms}} \text{ mol kg}^{-1}$

4. Parts per million (ppm)

$$= \frac{\text{Number of parts of the compound}}{\text{Total number of parts of all components of the solution}} \times 10^6$$

5. Raoult's law for a solution of volatile solute in volatile solvent:

$$p_A = p_A^0 X_A$$

$$p_B = p_B^0 X_B$$

Where p_A and p_B are partial vapour pressures of component 'A' and component 'B' respectively in solution. p_A^0 and p_B^0 are vapour pressures of pure components 'A' and 'B' respectively.

6. Raoult's law for a solution of non-volatile solute and volatile solvent:

$$\frac{p_A^0 - p_A}{p_A^0} = i X_B = i \frac{n_B}{n_A} = i \frac{W_B \times M_A}{W_A \times M_B} \text{ (for dilute solutions)}$$

Where X_B is mole fraction of solute, i is Van't Hoff factor and $\frac{p_A^0 - p_A}{p_A^0}$ is relative lowering of vapour pressure.

VISUAL EXPLANATION

7. Elevation in boiling point (ΔT_b):

$$\Delta T_b = i \cdot K_b \cdot m$$

Where $\Delta T_b = T_b - T_b^0$ K_b = molal boiling point elevation constant

m = molality of solution

T_b = Boiling point of solution

T_b^0 = Boiling point of solvent

VISUAL EXPLANATION

8. Depression in freezing point (ΔT_f) :

$$\Delta T_f = i K_f m$$

Where $\Delta T_f = T_f^0 - T_f$

K_f = molal freezing point depression constant

m = molality of solution

T_f^0 = Freezing point of solvent

T_f = Freezing point of solution

VISUAL EXPLANATION

9. Osmotic pressure (π) of a solution:

$$\pi V = i nRT \quad \text{or} \quad \pi = i CRT$$

where π = osmotic pressure in bar or atm

V = volume in litres

i = van't Hoff factor

C = molar concentration in moles per litres

n = number of moles of solute

T = Temperature on Kelvin scale

$R = 0.083 \text{ L bar mol}^{-1} \text{ K}^{-1}$

$R = 0.0821 \text{ L atm mol}^{-1} \text{ K}^{-1}$

VISUAL EXPLANATION

10. Van't Hoff factor (i)

$$i = \frac{\text{Number of particles in solution after association or dissociation}}{\text{Number of particles actually dissolved in solution}}$$

$$i = \frac{\text{Observed colligative property}}{\text{Theoretically calculated colligative property}}$$

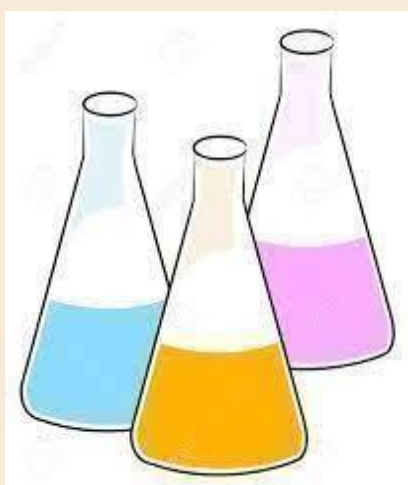
$$i = \frac{\text{Normal molar mass}}{\text{Abnormal molar mass}}$$

$i > 1$ For dissociation of solute

$i < 1$ For association of solute

$i = 1$ For ideal solution undergoing no association or dissociation

VISUAL EXPLANATION



UNIT -2

Electrochemistry

Points to Remember

Electrochemistry may be defined as the branch of chemistry which deals with the quantitative study of inter-relationship between chemical energy and electrical energy and inter-conversion of one form into other relationships between electrical energy taking place in redox reactions.

A cell is of two types:

- I. Galvanic cell
- II. Electrolytic cell

In Galvanic cell, the chemical energy of a spontaneous redox reaction is converted into electrical work.

In Electrolytic cell, electrical energy is used to carry out a non-spontaneous redox reaction.

1. Conductivity (k):

$$k = \frac{1}{\rho} = \frac{1}{R} \times \frac{l}{A}$$

where R is Resistance, l/A = cell constant (G^*) and ρ is resistivity.

2. Relation between k and Λ_m

$$\Lambda_m = \frac{1000 \times k}{C}$$

where Λ_m is molar conductivity, k is conductivity and C is molar concentration

VISUAL EXPLANATION.

Kohlrausch's law:

(a) In general, if an electrolyte on dissociation give γ_+ cations and γ_- anions, then its limiting molar conductivity (Λ_m°) is given by

$$\Lambda_m^\circ = \underset{m}{\nu} \underset{+}{\lambda}^\circ + \underset{-}{\nu} \underset{-}{\lambda}^\circ$$

Here, λ_+° and λ_-° are the limiting molar conductivities of cation and anion respectively and ν_+ and ν_- are the number of cations and anions furnished by one formula unit of the electrolyte.

(b) Degree of dissociation (α) is given by:

$$\alpha = \frac{\Lambda_m^c}{\Lambda_m^\circ}$$

Here, Λ_m^c is molar conductivity at the concentration C and Λ_m° is limiting molar conductivity of the electrolyte.

(c) Dissociation constant (K) of weak electrolyte:

$$K = \frac{\alpha^2 C}{1 - \alpha}$$

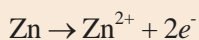
$$K = \frac{\left(\frac{\Lambda}{\Lambda_o}\right)^2 C}{1 - \frac{\Lambda}{\Lambda_o}} = \frac{\frac{\Lambda^2}{\Lambda_o^2} C}{\frac{\Lambda_o - \Lambda}{\Lambda_o}}$$

$$K = \frac{\Lambda^2 C}{\Lambda_o(\Lambda_o - \Lambda)}$$

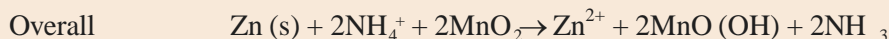
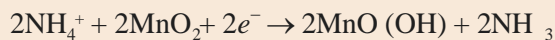
VISUAL EXPLANATION

Dry cell:

At anode (Oxidation)

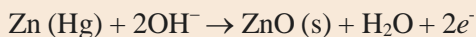


At cathode (Reduction)

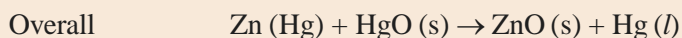
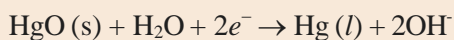


Mercury cell:

At anode (Oxidation)

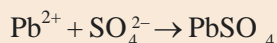
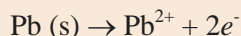


At cathode (Reduction)

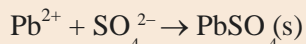
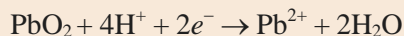


Lead storage cell

At anode (Oxidation)



At cathode (Reduction)



VISUAL EXPLANATION

3. Nernst Equation for electrode reaction:

$$E_{\text{cell}} \text{ or EMF} = E_{\text{cell}}^{\circ} - \frac{2.303RT}{nF} \log Q$$

where, n = total number of electrons lost or gained

$$1F = 96500 \text{ C, } T = 298 \text{ K}$$

$$R = 8.314 \text{ J/K}$$

$$Q = \text{reaction coefficient of overall reaction} = \frac{[\text{OS}]}{[\text{RS}]}$$

where, [OS] = concentration of oxidised state

[RS] = concentration of reduced state

$$E_{\text{cell}} = E_{\text{cell}}^{\circ} - \frac{0.0591}{n} \log Q$$

4. Relation between E_{cell}° and equilibrium constant (K):

$$\Delta G^{\circ} = -nFE_{\text{cell}}^{\circ} = -RT \ln K$$

$$\therefore nFE_{\text{cell}}^{\circ} = RT \ln K$$

$$\therefore E_{\text{cell}}^{\circ} = \frac{RT}{nF} \ln K$$

$$\text{OR } E_{\text{cell}}^{\circ} = \frac{2.303 RT}{nF} \log_{10} K$$

At 25°C,

$$\frac{2.303 \times RT}{F} = \frac{2.303 \times 8.314 \times 298}{96500} = 0.0592$$

$$\therefore E_{\text{cell}}^{\circ} = \frac{0.0592}{n} \log_{10} K$$

5. $\Delta G^{\circ} = - nF E^{\circ}_{\text{cell}}$

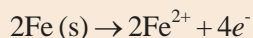
where ΔG° = standard Gibbs energy change and nF is the number of Faradays of charge passed. E°_{cell} is standard cell potential.

$$\Delta G^{\circ} = - 2.303 RT \log K_c$$

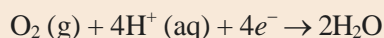
Corrosion of metals is an electrochemical phenomenon.

In corrosion, metal is oxidized by loss of electrons to oxygen and formation of oxides.

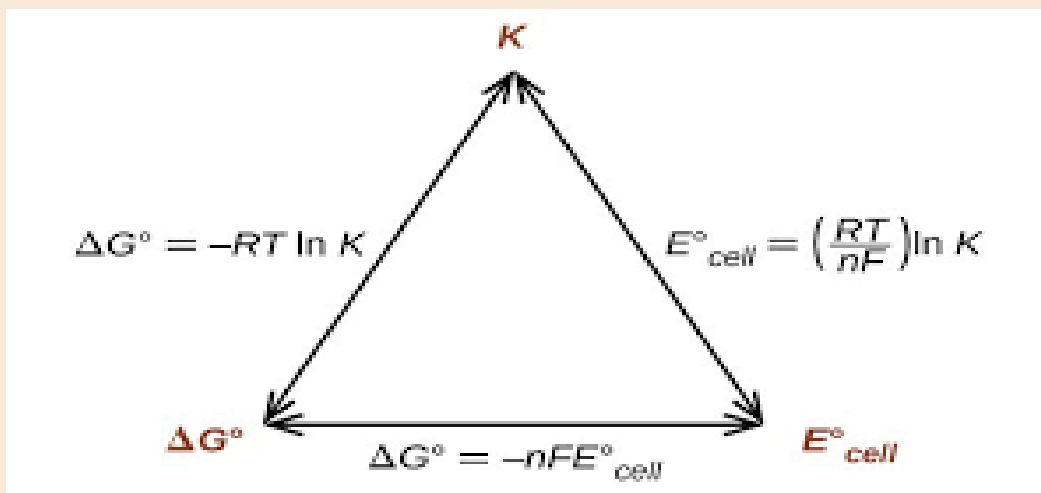
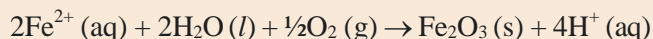
At anode (Oxidation) :



At cathode (Reduction) :



Atmospheric oxidation :



[CLICK HERE FOR DETAILED EXPLANATION](#)

UNIT -3

Chemical Kinetics

CONCEPTS

Chemical Kinetics : The branch of physical chemistry which deals with the study of rate of reaction and factors affecting rate.

Rate of chemical reaction : The change in concentration of any reactant or product per unit time is called rate of reaction.

Types of Rate of Reaction :

1. **Average rate of reaction :** The rate of reaction measured over the long time interval is called average rate of reaction.
2. **Instantaneous rate of reaction :** The rate of reaction measured at a particular time is called instantaneous rate of reaction.

Factors affecting Rate of Reaction

1. Concentration of reactant
2. Surface area
3. Temperature
4. Nature of reactant
5. Presence of catalyst
6. Radiation in photochemical reaction

VISUAL EXPLANATION

Rate constant (k) : It is equal to the rate of reaction when molar concentration of reactant is at unity.

Rate law : The rate of reaction is directly proportional to the product of concentration of reactant and each concentration is raised to the equal to no of moles actually participating in the reaction.



where powers p and q are determined experimentally.

Molecularity : The total number of reactants taking part in elementary chemical reaction is called molecularity.

Order of reaction : The sum of powers to which the concentration terms are raised in a rate law expression is called order of reaction.

For above case, Order = P + Q

Orders of reaction is determined experimentally.

VISUAL EXPLANATION

Half-life period : The time during which the concentration of the reactant is reduced to half of its initial concentration is called half-life period.

Activation energy : The minimum extra amount of energy absorbed by reactant molecules so that their energy becomes equal to the threshold energy is called activation energy.

$$\text{Activation energy} = \text{Threshold energy} - \text{Kinetic energy}$$

Temperature coefficient : The ratio of rate constant at two temperatures having difference of 10°C is called temperature coefficient.

$$\text{Temperature coefficient} = \frac{\text{Rate constant at } T + 10^\circ\text{C}}{\text{Rate constant at } T^\circ\text{C}}$$

Arhenius Equation :

Arrhenius Equation

$$k = Ae^{-E_a/RT}$$

k	rate constant
A	"pre exponential factor"
E_a	Activation energy
R	Gas constant
T	Temperature

$$\log k_2 - \log k_1 = \frac{E_a}{2.303 R} \left[\frac{1}{T_1} - \frac{1}{T_2} \right]$$

$$\log \frac{k_2}{k_1} = \frac{E_a}{2.303 R} \left[\frac{1}{T_1} - \frac{1}{T_2} \right]$$

$$\log \frac{k_2}{k_1} = \frac{E_a}{2.303 R} \frac{T_2 \times T_1}{T_1 \times T_2}$$

1. **Integrated rate law equation for zero order reaction is given as below :**

$$(a) k = \frac{[R]_0 - [R]_t}{t}$$

Where k is rate constant and $[R]_0$ is initial molar concentration.

$$(b) t_{1/2} = \frac{[R]_0}{2k}, t_{1/2} \text{ is half-life period of zero order reaction.}$$

2. **Integrated rate law equation for first order reaction :**

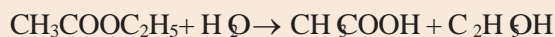
$$(a) k = \frac{2.303}{t} \log \frac{[R]_0}{[R]_t}$$

where k is rate constant, $[R]_0$ is initial molar concentration and $[R]_t$ is final concentration at time 't'.

(b) Half-life period ($t_{1/2}$) for first order reaction :

$$t_{1/2} = \frac{0.693}{k}$$

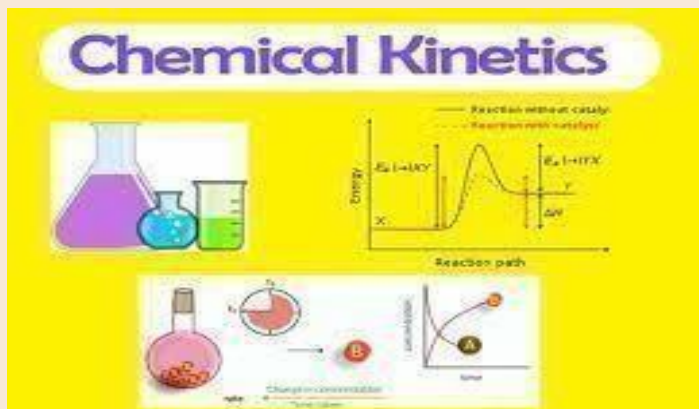
Pseudo chemical reaction : The chemical reaction which looks like higher order reaction but in real it follows lower order reaction.



$$\text{Rate} = k[\text{CH}_3\text{COOC}_2\text{H}_5]^1$$

Order = 1

[Click here for Visual Explanation of the Chapter](#)



UNIT -4

d and f block elements

1. Introduction

d-block elements are present from fourth period onwards. There are mainly three series of the transition metals – 3*d* series (Sc to Zn), 4*d* series (Y to Cd) and 5*d* series (La to Hg, omitting Ce to Lu).

d-block elements are known as transition elements because their position in the periodic table is between the s-block and p-block elements. Electronic configuration of the *d*-block elements is $(n-1)d^{1-10}ns^{0-2}$ but Cu^+ , Zn, Cd, Hg etc. $[(n-1)d^{10}]$ are *d*-block elements, but not transition metals because these have completely filled *d*-orbitals.

Transition Metals of *d*-block Elements

3rd group ns^2	4th group $d^1ns^2d^1$	5th group ns^2d^5	6th group ns^2d^6	7th group ns^2d^7	8th group ns^2d^8	9th group ns^2d^9	10th group ns^2d^8	11th group ns^2d^{10}	12th group ns^2d^{10}
$(n-1)$	$(n-1)$	$(n-1)$	$(n-1)$	$(n-1)$	$(n-1)$	$(n-1)$	$(n-1)$	$(n-1)$	$(n-1)$
Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd
La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg

VISUAL EXPLANATION

2. General Properties of the Transition Elements

(i) Atomic and Ionic Radii

In transition metals, left to right net nuclear charge increases due to poor shielding effect. Due to this, the atomic and ionic radii for transition elements for a given series show a decreasing trend for first five elements and then becomes almost constant for next five elements of the series.

(ii) Enthalpies of Atomisation

Transition elements exhibit higher enthalpies of atomization because of large number of unpaired electrons in their atoms. They have stronger interatomic interaction and hence, stronger bond.

(iii) Ionisation Enthalpies

- In a series from left to right, ionization enthalpy increases due to increase in nuclear charge.

- The irregular trend in the first ionization enthalpy of the $3d$ metals, though of little chemical significance, can be accounted for by considering that the removal of one electron alters the relative energies of $4s$ and $3d$ orbitals.

(iv) Oxidation States

- Transition metals shows variable oxidation state due to two incomplete outermost shells. Only stable oxidation states of the first row transition metals are

Sc(+3), Ti(+4), V(+5), Cr(+3, +6), Mn(+2, +7), Fe(+2, +3), Co(+2, +3), Ni(+2), Cu(+2), Zn(+2)

- The transition elements in their lower oxidation states (+2 and +3) usually forms ionic compounds. In higher oxidation state compounds are normally covalent.

- Only Os and Ru show +8 oxidation states in their compounds.

- Ni and Fe in $\text{Ni}(\text{CO})_4$ and $\text{Fe}(\text{CO})_5$ show zero oxidation state.

VISUAL EXPLANATION

(v) Trends in the Standard Electrode Potentials

- Transformation of the solid metal atoms to M^{2+} ions in solution and their standard electrode potentials.

- If sum of the first and second ionization enthalpies is greater than hydration enthalpy standard potential ($E_{\text{M}^{2+}/\text{M}}^\circ$) will be positive and reactivity will be lower and vice-versa.

(vi) Trends in Stability of Higher Oxidation States

The higher oxidation numbers are achieved in TiX_4 , VF_5 and CrF_6 . The +7 state for Mn is not represented in simple halides but MnO_3F is known and beyond Mn no metal has a trihalide except FeX_3 and CoF_3 and increasing order of oxidizing power in the series $\text{VO}_2^+ < \text{Cr}_2\text{O}_7^{2-} < \text{MnO}_4^-$.

(vii) Magnetic Properties

- When a magnetic field is applied to substances, mainly two types of magnetic behavior are observed : diamagnetism and paramagnetism. Paramagnetism due to presence of unpaired electrons, each such electron having a magnetic moment associated with its spin angular momentum.

- The magnetic moment is determined by the number of unpaired electrons.

$$\text{Magnetic moment} = \sqrt{n(n+2)}$$

where, n = number of unpaired electrons.

If all electrons are paired, substance will be diamagnetic and magnetic moment will be zero.

(viii) Formation of Coloured Ions

- The d -orbitals are non-degenerated in presence of ligands. When an electron from a lower energy d -orbital is excited to a higher energy d -orbital, the energy of required wavelength is absorbed and rest light is transmitted out. Therefore, the colour observed corresponds to the complementary colour of the light absorbed.

- In V_2O_5 , V is in + 5 oxidation state. It is coloured due to defects in crystal lattice.

(ix) Formation of Complex Compounds

- Transition metals have small size high nuclear charge which facilitates the acceptance of lone pair of electron from ligands.

- They have vacant d -orbitals of appropriate energy in order to accommodate the lone pair of electrons.

(x) Catalytic Properties

- Transition metals have two outermost shells incomplete and ability to adopt multiple oxidation states and to form complexes, therefore used as a catalyst.

- Transition metals also provide larger surface area for the reactant to be adsorbed.

(xi) Formation of Interstitial Compounds

- Small size of non-metals (H, C, N) fit into the voids of crystalline solid of transition metals and form interstitial compounds.

- The principal physical and chemical characteristics of these compounds are as follows :

- (i) They have high melting points, higher than those of pure metals.

- (ii) They are very hard, some borides approach diamond in hardness.

- (iii) They retain metallic conductivity.

- (iv) They are chemically inert.

(xii) Alloy Formation

Alloy is the homogeneous mixture of two or more metals. Transition metals have approximate same size therefore, in molten form they can fit to each other crystalline structure and form homogeneous mixture and form the alloy.

E.g., Brass (copper-zinc) and bronze (copper-tin) etc.

VISUAL EXPLANATION

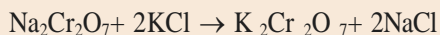
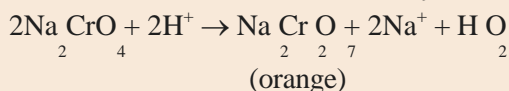
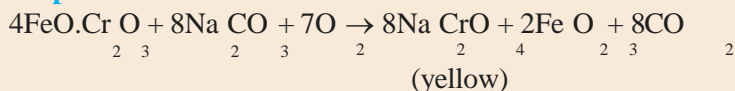
3. Some Important Compounds of Transition Elements

Potassium Dichromate ($K_2Cr_2O_7$)

(i) Ore

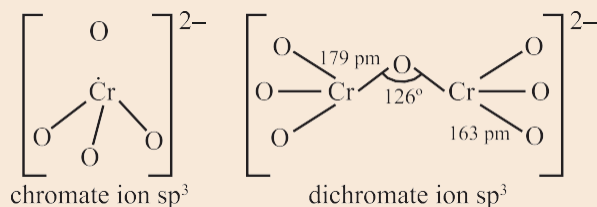
Ferrochrome or chromate ($FeO \cdot Cr_2O_3$) or ($FeCr_2O_4$)

(ii) Preparation



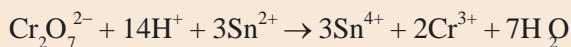
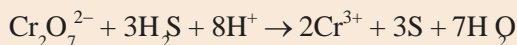
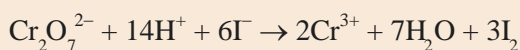
Sodium dichromate is more soluble than potassium dichromate.

• Chromates and dichromates are interconvertible in aqueous solution depending upon pH of the solutions.



(iii) Properties

Sodium and potassium dichromates are strong oxidizing agents, thus, acidified $K_2Cr_2O_7$ will oxidise iodides to iodine, sulphides to sulphur, tin (II) to tin (IV) and iron (II) salts to iron (III).



(iv) Uses

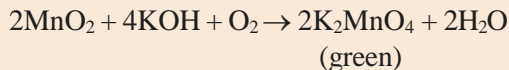
- $K_2Cr_2O_7$ is used as oxidizing agent in volumetric analysis.
- It is used in mordant dyes, leather industry, photography (for hardening of film).
- It is used in chromyl chloride test.
- It is used in cleaning glassware.

Potassium Permanganate (KMnO₄)

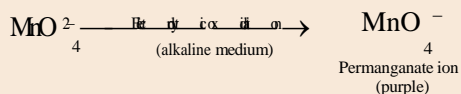
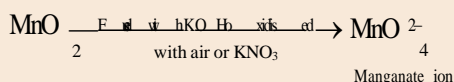
(i) Ore

Pyrolusite (MnO₂)

(ii) Preparation



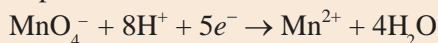
(iii) Commercial preparation



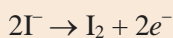
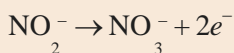
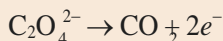
(iv) Properties

KMnO₄ acts as strong oxidizing agent.

(a) In presence of dilute H₂SO₄, KMnO₄ is reduced to manganous salt.



Acidic KMnO₄ solution oxidizes oxalates to CO₂, iron (II) and iron (III), nitrites to nitrates and iodides to iodine. The half reactions of reductants are



To acidify KMnO₄, only H₂SO₄ is used and not HCl or HNO₃ because HCl reacts with KMnO₄ and produce Cl₂ while HNO₃, itself acts as oxidizing agent.

(b) In alkaline medium, KMnO₄ is reduced to insoluble MnO₂.



Alkaline or neutral KMnO₄ solution oxidizes I⁻ to IO₃⁻, SO₃²⁻ to SO₄²⁻,

Mn²⁺ to MnO₂ etc.

(v) Uses

(a) In laboratory preparation of Cl₂.

(b) KMnO₄ is used as an oxidizing agent, disinfectant.

(c) In making Baeyer's reagent.

VISUAL EXPLANATION

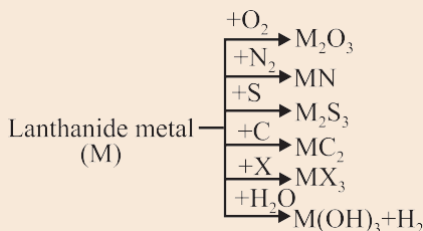
4. The Inner Transition Elements (*f*-Block)

The *f*-block consists of the two series, lanthanoids and actinoids. Lanthanoids are known as rare earth metals and actinoids are known as radioactive elements (Th to Lr).

Lanthanoids

General characteristics

- General configuration [Xe] $4f^{1-14}, 5d^{0-1}, 6s^2$.
- Atomic and ionic size from left to right, decreases due to increase in nuclear charge. This is known as lanthanoid contraction.
- All the lanthanoids are silvery white soft metals and tarnish rapidly in air.
- Many trivalent lanthanoid ions are coloured both in the solid state and in aqueous solutions. Neither La^{3+} nor Lu^{3+} ion shows any colour but the rest do so.
- The lanthanoid ions other than the f^0 type (La^{3+} and Ce^{4+}) and the f^{14} type (Yb^{2+} and Lu^{3+}) are all paramagnetic. The paramagnetism arises to maximum in neodymium.
- Oxidation states $\rightarrow \text{Ce}^{4+}$; (Some elements) is favoured by its noble gas configuration, but it is a strong oxidant reverting to the common + 3 state. The E°_{value} for $\text{Ce}^{4+}/\text{Ce}^{3+}$ is + 1.74 V, the reaction rate is very slow and hence, Ce(IV) is a good analytical reagent. Pr, Nd, Tb and Dy also exhibit + 4 state but only in oxides. Eu^{2+} is formed by losing the two s-electrons and its f^7 configuration accounts for the formation of this ion. However, Eu^{2+} is a strong reducing agent changing to the common + 3 state. Similarly, Yb^{2+} which has f^{14} configuration is a reductant, Tb^{4+} has half-filled *f*-orbitals and is an oxidant.
- Lanthanoid are very reactive metals like alkaline earth metals.



- Misch metals, contain lanthanoids about 90-95% (Ce 40-5%, Lanthanum and neodymium 44%) iron 4.5%, calcium, carbon and silicon, used in cigarette and gas lighters, toys, tank and tracer bullets.

Actinoids

- General configuration [Rn] $5f^{1-14}, 6d^{0-2}, 7s^2$.
- Actinoids exhibit a range of oxidation states due to comparable energies of 5*f*, 6*d* and 7*s* orbitals. The general oxidation state of actinoids is + 3.
- All the actinoids are strong reducing agents and very reactive.
- Actinoids are radioactive in nature and therefore, it is difficult to study their chemical nature

VISUAL EXPLANATION

UNIT -5

COORDINATION COMPOUNDS

1. Introduction

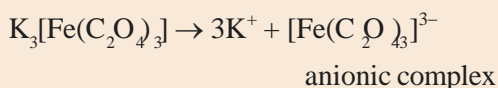
Complex compounds or coordination compounds are those molecular compounds which retain their identity in solid as well as in solution are known as complex compounds.

Example,

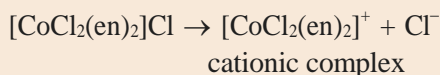


2. Types of Complex

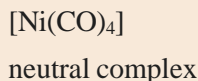
(i) Anionic complex



(ii) Cationic complex



(iii) Neutral complex



3. Ligands

VISUAL EXPLANATION

The ions or molecules bound to the central atom/ion in the coordination entity are called ligands.

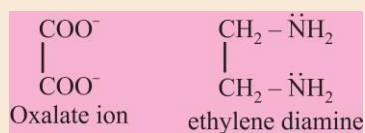
Types of Ligands

(i) Unidentate, a ligand which is bound to a metal ion through a single donor atom.

e.g., H_2O , NH_3 , CO , Cl^- , NH_2^- etc.

(ii) Didentate, a ligand which is bound to a metal ion through a two donor atoms.

e.g.,



(iii) Polydentate, a ligand which is bound to a metal ion through a several donor atoms.

e.g., ethylene diamine tetraacetate ion $[\text{EDTA}]^{4-}$.

(iv) Ambidentate ligands, which can ligate through two different atoms.

e.g., $-\text{NO}_2 - \text{ONO}$, $-\text{SCN} - \text{NCS}$ etc.

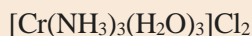
(v) Chelate ligands, these may be a di- or polydentate ligand which form closed ring with central metal ion. Closed ring is known as chelate ring. Number of more chelate ring in complex, complex will be more stable. The number of such ligating groups is called the denticity.

4. Homoleptic and Heteroleptic Complexes

Complexes in which a metal is bound to only one kind of donor groups *e.g.*, $\text{Co}(\text{NH}_3)_6]^{3+}$ are known as homoleptic. Complexes in which a metal is bound to more than one kind of donor groups *e.g.*, $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$, are known as heteroleptic.

5. Nomenclature of Coordination Compounds

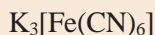
Cationic Complex



triamminetriaquachromium (III) chloride

- (i) Prefixes mono, di, tri, etc. are used to indicate the number of the individual ligands and ligands are named in an alphabetical order.
- (ii) Central metal atom and oxidation state indicated by Roman numeral in parenthesis.
- (iii) Name of ionisable anion.

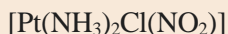
Anionic Complex



Potassium hexacyanoferrate (III)

- (i) Name of ionisable metal and oxidation state
- (ii) Name of ligand in an alphabetical order
- (iii) Central metal atom + ate and oxidation state

Neutral Complex



Diammine chloronitrito-N-platinum (II)

- (i) Name of ligands in an alphabetical order
- (ii) Central metal atom and oxidation state

VISUAL EXPLANATION

6. Isomerism in Coordination Compounds

Stereo isomerism and structural isomerism are the two principal types of isomerisms which are known among coordination compounds.

Stereo Isomerism

It occurs due to different arrangements of ligands around central metal atom. It is of two types : geometrical isomerism and optical isomerism.

Geometrical Isomerism

It arises in heteroleptic complexes due to different possible geometric arrangements of the ligands. Important examples of this behavior are found in square planar and octahedral complexes.

- (i) **Square planar complex of formula $[MX_2L_2]$ (X and L are unidentate)**, the two ligands X may be arranged adjacent to each other in a *cis* isomer, or opposite to each other in a *trans* isomer.

e.g., $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$

- (ii) **Square planar complex of the type $[MABXL]$ (where A, B, X, L are unidentates)** shows three isomers – **two *cis* and one *trans***. Such isomerism is not possible for tetrahedral geometry.

e.g., $[\text{Pt}(\text{NH}_3)(\text{Br})(\text{Cl})(\text{Py})]$

- (iii) **Octahedral complexes of formula $[MX_2L_4]$** in which the two ligands X may be oriented *cis* or *trans* to each other.

e.g., $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$

- (iv) **Octahedral complexes of formula $[MX_2A_2]$** where X are unidentates and A are didentate and form *cis* and *trans* isomers.

e.g., $[\text{CoCl}_2(\text{en})_2]$

- (v) **Octahedral coordination entities of the type $[Ma_3b_3]$** like $[\text{Co}(\text{NH}_3)_3(\text{NO}_2)_3]$. If three donor atoms of the same ligands occupy adjacent positions at the corners of an octahedral face, we have the facial (*fac*) isomer. When the positions are around the meridian of the octahedron, we get the meridional (*mer*) isomer.

Optical Isomerism

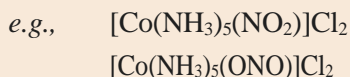
- It arises when mirror images cannot be superimposed on one another. These mirror images are called as enantiomers. The two forms are called *dextro* (*d*) and *laevo* (*l*).
- Optical isomerism is common in octahedral complexes but at least one didentate ligand should be present.

e.g., $[\text{Co}(\text{en})_3]^{3+}$, $[\text{PtCl}_2(\text{en})_2]^{2+}$ etc.

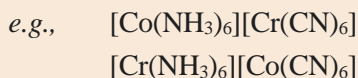
Structural Isomerism

In structural isomerism, isomers have different bonding pattern. Different types of structural isomerism is as follows :

(i) **Linkage isomerism**, arises in a coordination compound containing ambidentate ligand.



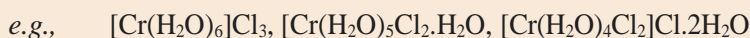
(ii) **Coordination isomerism**, arises from the interchange of ligands between cationic and anionic entities of different metal ions present in a complex.



(iii) **Ionisation isomerism**, when the ionisable anion exchange with anion ligand.



(iv) **Solvate isomerism**, is also known as 'hydrate isomerism'. In this case water is involved as a solvent.



VISUAL EXPLANATION

7. Bonding in Coordination Compounds

Werner's Theory

(i) In complex compounds, metal atom exhibit two types of valencies – primary valency and secondary valency.

(ii) Primary valencies are satisfied by anions only while secondary valencies are satisfied by ligands. Primary valency depends upon oxidation number of central metal atom while secondary valency represents coordination number of central metal atom.

(iii) Primary valencies are ionisable and are non-directional while secondary valencies are non-ionisable and directional. Therefore, geometry of complex is decided by secondary valencies.

Valence Bond Theory

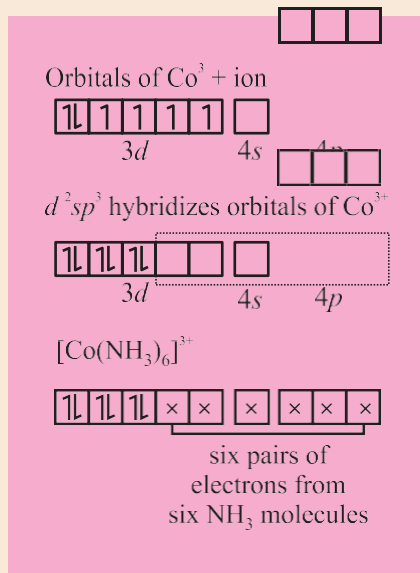
According to this theory, the metal atom or ion under the influence of ligands form inner orbital and outer orbital complex. These hybridized orbitals are allowed to overlap with ligand orbitals that can donate electron pairs for bonding.

(i) **Six ligands (unidentate) (octahedral entity)** Generally central atom belongs 3d series and ligands can be monodentate or didentate but coordination number should be six and shape of complexes will be octahedral and form two types of complexes.

(a) **Inner orbital complexes**, which are formed due to participation of $(n-1)d$ orbitals in hybridisation is (d^2sp^3) and shape of complex will be octahedral.

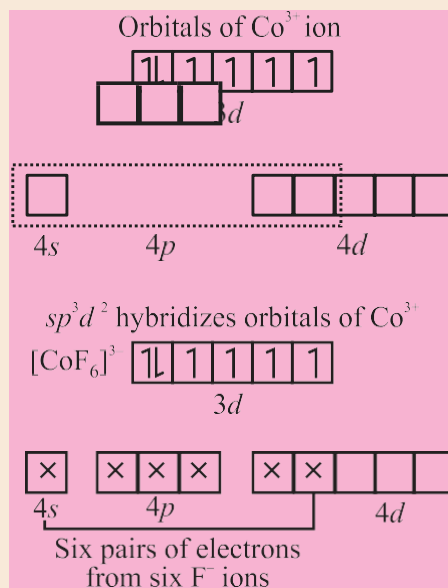
(b) **Outer orbital complexes**, which are formed due to participation of nd orbitals in hybridisation is (sp^3d^2) . Generally halides (F^- , Cl^- , Br^- , I^-), SCN^- , S^{2-} form outer orbital complexes and other ligands form inner orbital complexes.





All electrons are paired therefore, complex will be diamagnetic in nature.

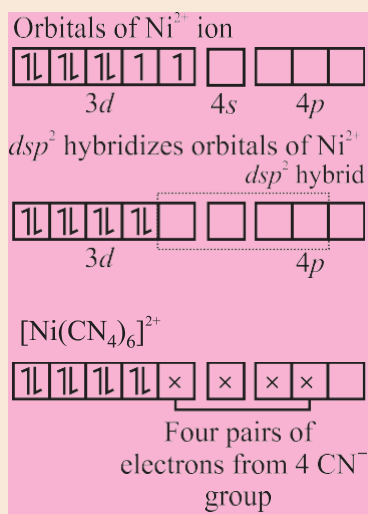
e.g., **Outer orbital complex**, $[\text{CoF}_6]^{3-}$



Complex has unpaired electrons, therefore, complex will be paramagnetic in nature.

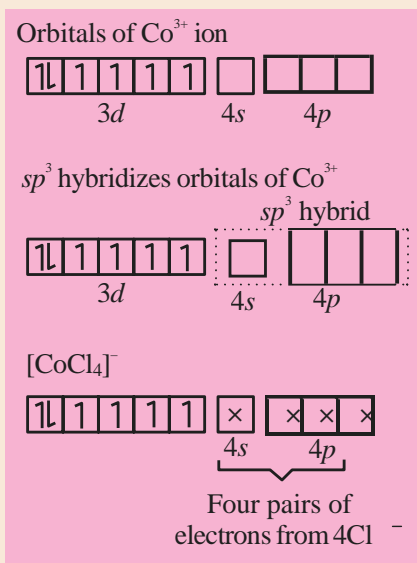
Complexes with coordination number : 4

1. $[\text{Ni}(\text{CN})_4]^{2-}$



All electrons are paired. Complex will be diamagnetic in nature.

2. $[\text{CoCl}_4]^-$



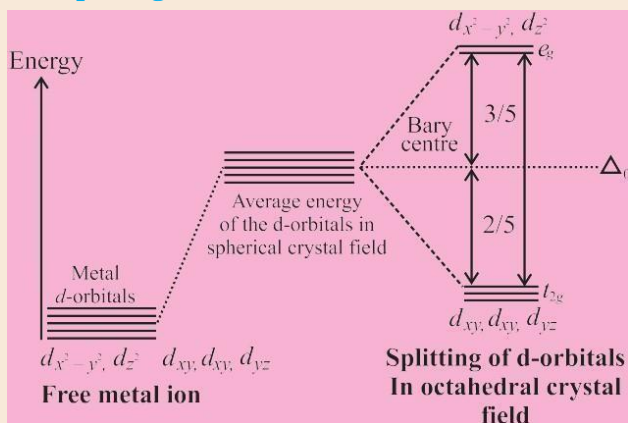
Complex has unpaired electrons. Complex will be paramagnetic in nature.

VISUAL EXPLANATION

Crystal Field Theory

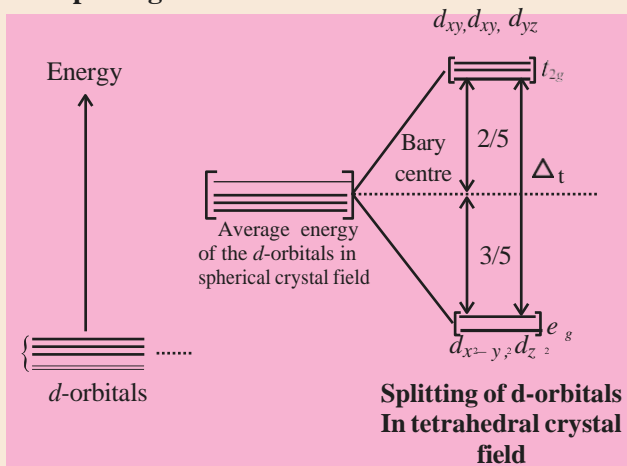
The five d -orbitals are split into lower and higher energy level due to approach of ligands is known as crystal field theory. The five d -orbitals in a gaseous metal atom/ion have same energy.

(i) Crystal field splitting in octahedral coordination entities.



- Energy separation is denoted by Δ (the subscript o is for octahedral).
- The energy of the two e_g orbitals (higher energy orbitals) will increase by $(3/5)\Delta_o$ and that of the three t_{2g} (lower energy orbitals) will decrease by $(2/5)\Delta_o$.
- If $\Delta_o < p$, the fourth electron enters one of the e_g orbitals giving the configuration $t_{2g}^3 e_g^1$. Ligands for which $\Delta_o < p$ are known as weak field ligands and form high spin complexes.
- If $\Delta_o > p$, it becomes more energetically favourable for the fourth electron to occupy a t_{2g} orbital with configuration t_{2g}^4 . Ligands which produce this effect are known as strong field ligands and form low spin complexes, where p represents the energy required for electron pairing in a single orbital.

(ii) Crystal field splitting in tetrahedral coordination entities.



- In tetrahedral coordination entities, $\Delta = (4/9)\Delta$. Consequently the orbital splitting energies are not sufficiently large for forcing pairing and, therefore, low spin configurations are rarely observed.

- Due to less crystal field stabilization energy, it is not possible to pair electrons and so all the tetrahedral complexes are high spin.

8. Colour in Coordination Compounds

- In complex compounds *d*-orbitals split in two sets t_{2g} and e_g . These have different energies. The difference in energies lies in visible region and electron jump from ground state t_{2g} level to higher state e_g level. This is known as *d-d* transition and it is responsible for colour of coordination compounds.

- *d-d* transition takes place in d^1 to d^9 ions, so the ions having d^1 to d^9 configuration are coloured. On the other hand, the ions d^0 and d^{10} configuration do not show *d-d* transition.

9. Importance and Applications of Coordination Compounds

- Hardness of water is estimated by simple titration with Na EDTA. The Ca^{2+} and Mg^{2+} ions form stable complexes with EDTA.

- Some important extraction processes of metals, like those of silver and gold make use of complex formation.

- Similarly, purification of metals can be achieved through formation and subsequent decomposition of their coordination compounds. For example, impure nickel is converted to $[Ni(CO)_4]$, which is decomposed to yield pure nickel.

- Coordination compounds are used as catalysts for many industrial processes. Examples include rhodium complex, $[(Ph_3P)_3RhCl]$, a Wilkinson catalyst, is used for the hydrogenation of alkenes.



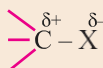
SELF TESTING CUM VISUAL EXPLANATION

UNIT -6

HALOALKANES AND HALOARENES

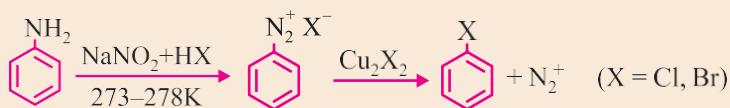
Points to Remember

1. Haloalkanes (Alkyl halides) are halogen derivatives of alkanes with general formula $[C_nH_{2n+1}X]$. (X = F, Cl, Br or I)
2. Haloarenes (Aryl halides) are halogen derivatives of arenes with general formula $Ar - X$.
3. Since halogen is more electronegative than C, hence C - X bond is polar.

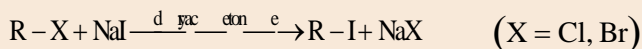


4. Named Reactions :

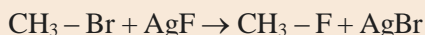
(a) Sandmeyer Reaction :



(b) Finkelstein Reaction :

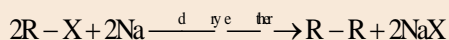


(c) Swartz Reaction :

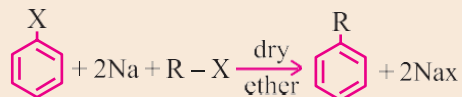


Instead of Ag - F, other metallic fluoride like Hg_2F_2 , CoF_2 or SbF_3 can also be used.

(d) Wurtz Reaction :

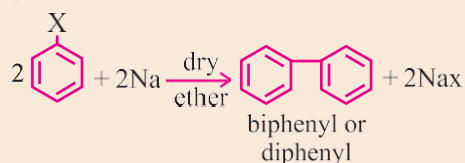


(e) Wurtz-Fittig Reaction :



VISUAL EXPLANATION

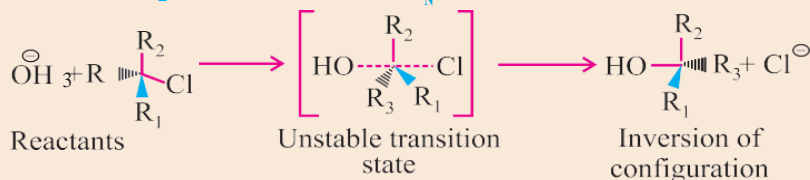
(f) Fittig Reaction :



5. Nucleophilic Substitution Reactions :



(a) Substitution nucleophilic bimolecular (S_N2):



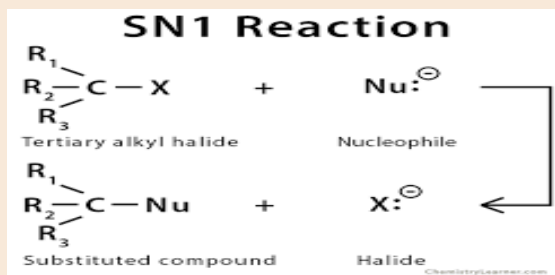
1. 1° haloalkane
2. Bimolecular, 2nd order
3. One step

Order of reactivity : $1^\circ > 2^\circ > 3^\circ$

Deciding factor : Steric hindrance

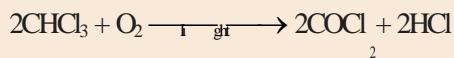
(b) Substitution nucleophilic unimolecular (S_N1):

1. 3° haloalkane
2. Unimolecular, 1st order
3. Two steps



Order of reactivity: $3^\circ > 2^\circ > 1^\circ$

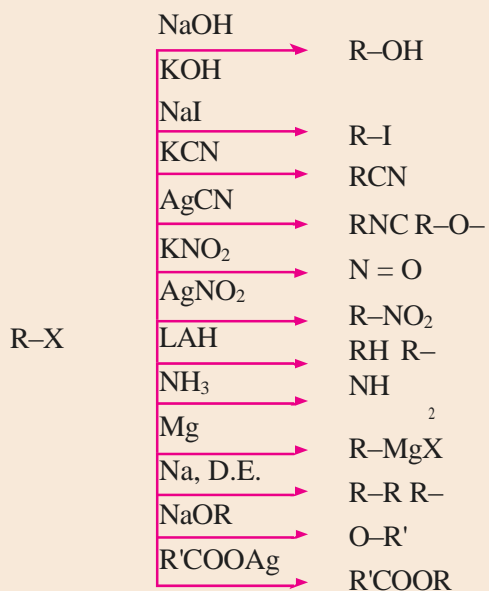
6. Aryl halides are much less reactive towards nucleophilic substitution reactions than haloalkanes.
7. Halogen is deactivating but *o*, *p*-directing in electrophilic substitution reaction of haloarenes.
8. CHCl_3 is stored in dark bottles upto brim so that formation of poisonous gas phosgene in presence of air and light can be avoided.



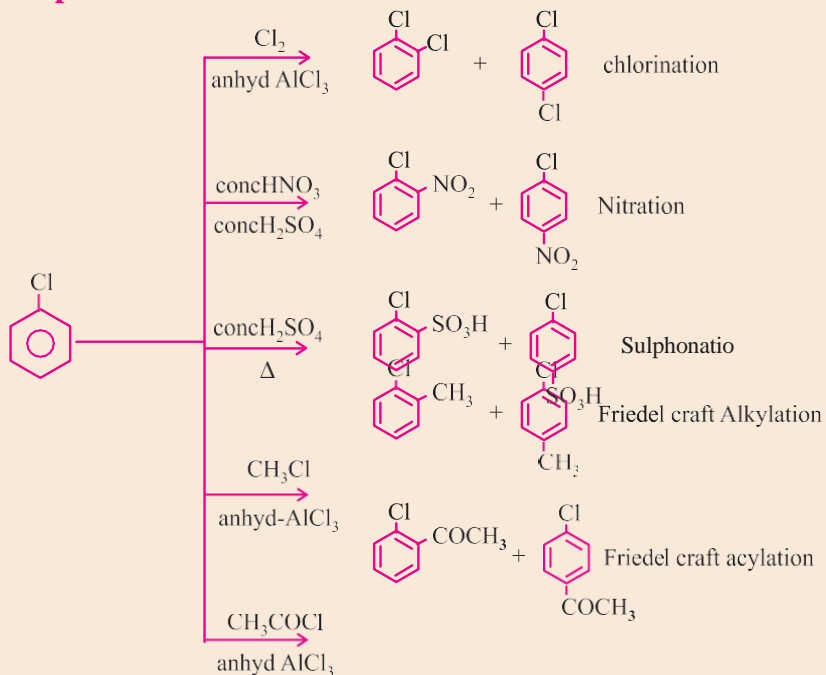
Chloroform Carbonyl chloride (phosgene)

VISUAL EXPLANATION

9. Reaction of Haloalkanes :



10. Electrophilic Substitution Reaction of Haloarenes :



11. Elimination reaction: Two groups or atoms attached to two adjacent carbon atom and simultaneous formation of multiple bonds between these carbon atom.
[Reverse of addition]

Two types (i) β -Elimination \longrightarrow $E_1 \longrightarrow$ Two step eliminate
(ii) α -elimination $E_2 \longrightarrow$ One step eliminate

Saytza's Rule

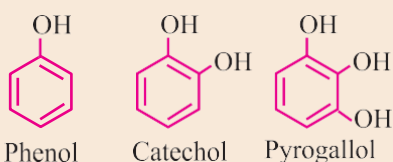
VISUAL EXPLANATION

UNIT -7

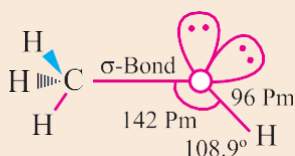
ALCOHOLS PHENOLS AND ETHERS

Points to Remember

1. Hydroxyl (–OH) derivatives of alkane are called alcohols.
2. Alcohols are classified as 1°, 2° and 3°.
3. –OH group is attached to sp^3 hybridized carbon. Alcohols further may be monohydric, dihydric and polyhydric on the basis of OH group.
4. **Phenols** : Compounds containing –OH group bound directly to benzene ring.



5. **Structure** : Oxygen atom is sp^3 hybridised and tetrahedral geometry of hybrid atomic orbitals ROH bond angle depends upon the R group. R – O – H angle for $\text{CH}_3 - \text{OH}$ is 108.9° .

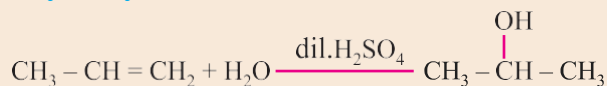


6. **Isomerism** :
 - (i) Functional isomerism
 - (ii) Chain isomerism
 - (iii) Positional isomerism

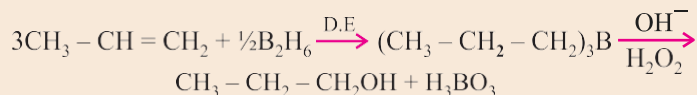
VISUAL EXPLANATION

7. **General Methods of Preparation** :

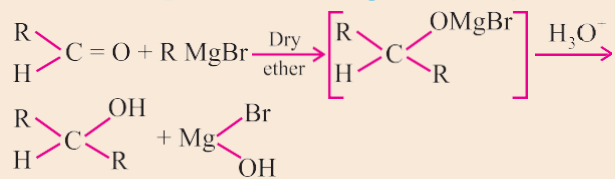
(i) Acid catalysed hydration of alkenes :



(ii) Hydroboration oxidation :

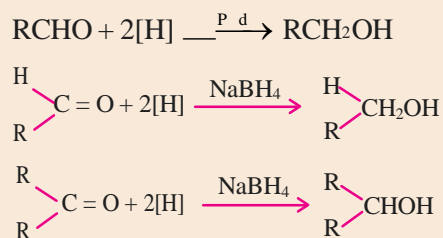


(iii) From carbonyl compounds with Grignard's reagent :



Formaldehyde gives 1° alcohol and ketones gives tertiary alcohol.

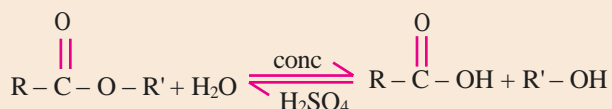
(iv) By reduction of carbonyl compounds :



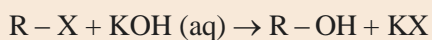
(v) By reduction of esters with LiAlH₄ or Na/C₂H₅OH :



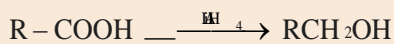
(vi) By hydrolysis of esters :



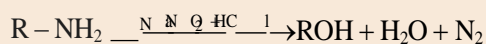
(vii) From alkyl halides :



(viii) By reduction of acids and their derivatives :



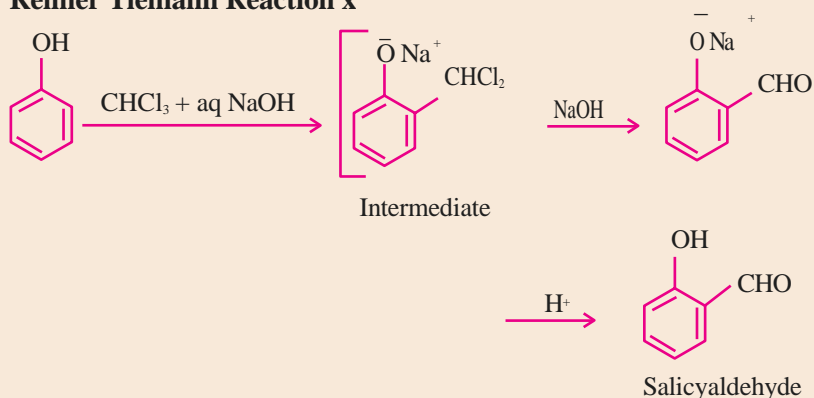
(ix) From 1° amines :



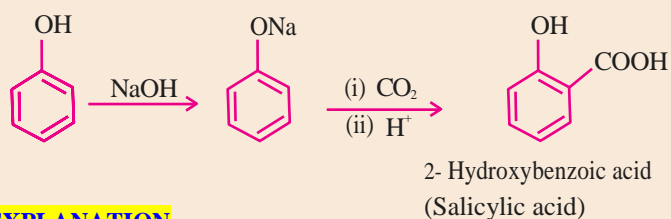
VISUAL EXPLANATION

NAME REACTIONS

1. Reimer Tiemann Reaction

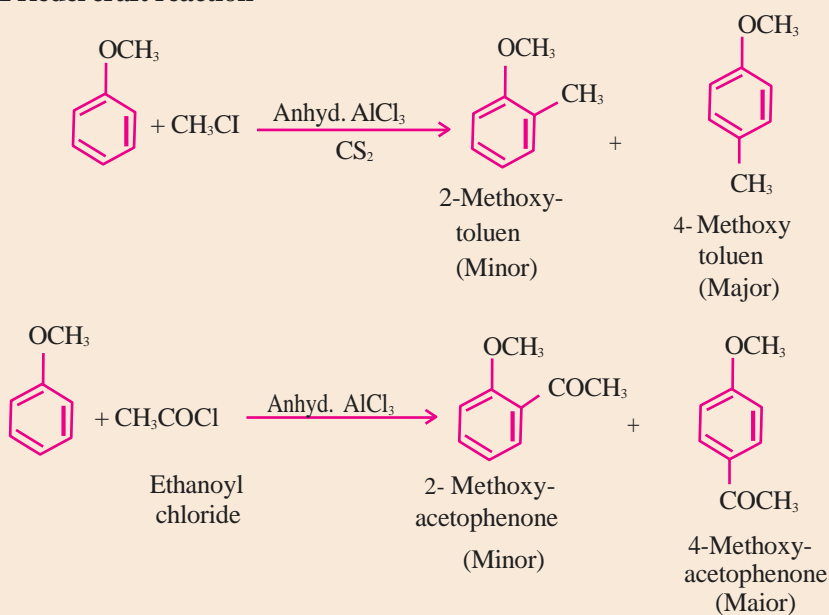


2. Kolbe reaction

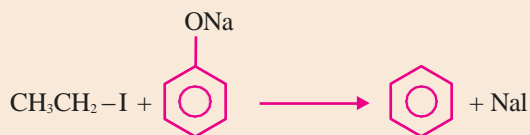


VISUAL EXPLANATION

3. Friedel craft reaction



4. Williamson synthesis: Reaction with alkyl halide with sodium alkoxide or sod. Phenoxide is called Williamson synthesis.

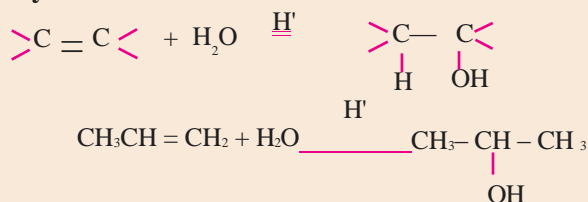


Both simple and mixed ether can be produced.

Depending upon structure and cleavage of unsymmetrical ethers by halogen acid may occur either by SN^2 or SN^1 mechanism.

MECHANISMS

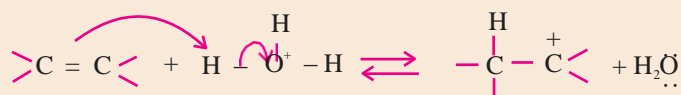
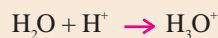
1. Hydration of Alkene :



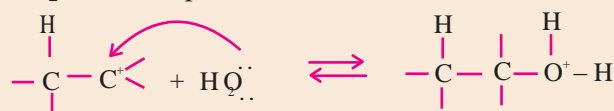
Mechanism

The mechanism of the reaction involves the following three steps:

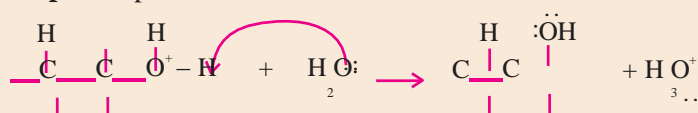
Step 1: Protonation of alkene to form carbocation by electrophilic attack of H_3O^+ .



Step 2: Nucleophilic attack of water on carbocation.

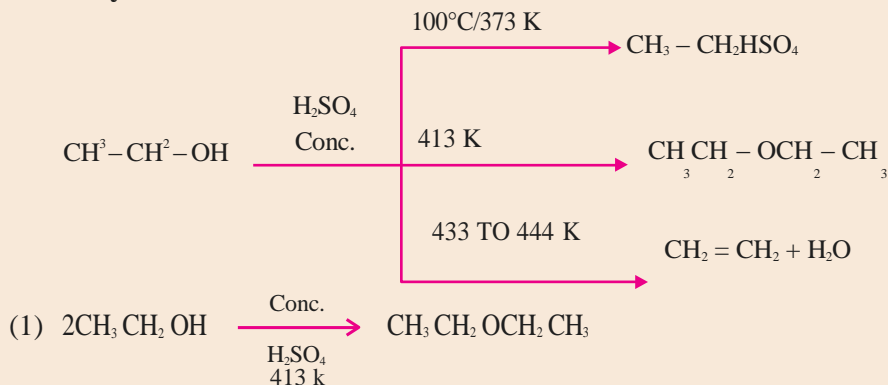


Step 3: Deprotonation to form an alcohol.

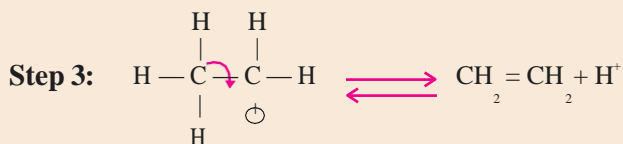
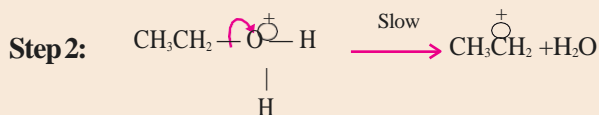
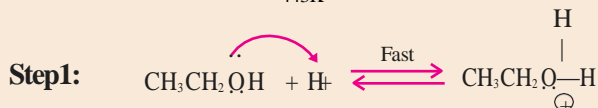
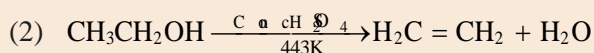
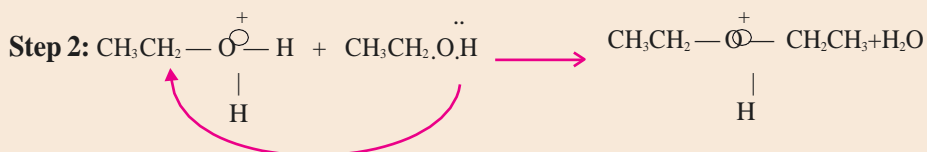
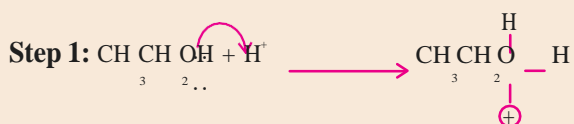


VISUAL EXPLANATION

2. Dehydration Reaction



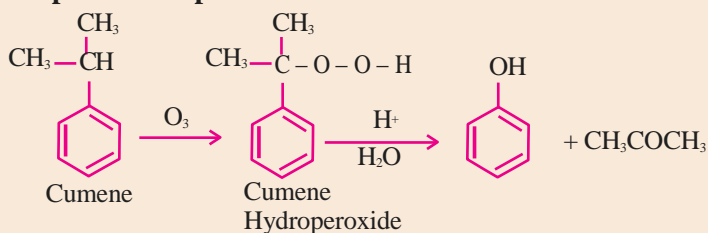
Mechanism:



[CLICK HERE FOR POWER POINT PRESENTATION](#)

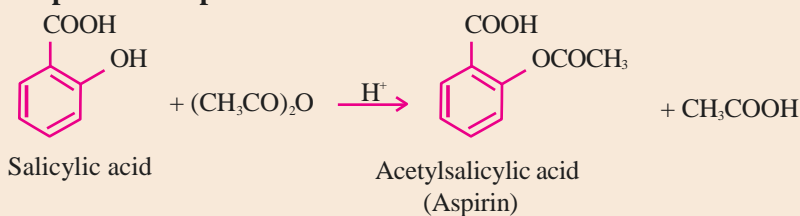
IMPORTANT PREPARATIONS

(1) Preparation of phenol from Cumene

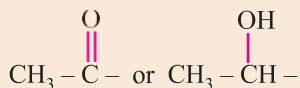


VISUAL EXPLANATION

(2) Preparation of Aspirin



- Ethers are dialkyl derivatives of water or monoalkyl derivatives of alcohols with formula $R - O - R'$
- Lucas test can be used to distinguish primary, secondary and tertiary alcohols ($ZnCl_2 + HCl$).
(3° turbidity – instant, 2° - 5 minutes, 1° - heating for 60 minutes)
- Ethers are relatively inert and hence are used as solvents.
- 100% ethanol is known as absolute alcohol.
- 95% ethanol is called rectified spirit.
- A mixture of 20% ethanol and 80% gasoline is known as power alcohol.
- Iodoform test is used for distinguishing compounds having the groups



- Presence of EWGs increase the acid strength of phenols while EDG decrease the acid strength.
EWG : $-NO_2, -X, -CN, -COOH$ etc.
EDG : $-R, -OR, -OH, -NH_2$ etc.
- 3° alcohols are resistant to oxidation due to lack of α -hydrogen.
- Intermolecular H-bonds of *p*- and *m*-nitrophenol increases water solubility/acid strength while intramolecular H-bonds in *o*-nitrophenol decreases these properties.
- In the reaction of alkyl aryl ether (anisole) with HI, the products are always alkyl halide and phenol because $O - R$ bond is weak than $O - Ar$ bond which has partial double character due to resonance.
- $C - O - C$ bond in ether is bent and hence the ether is always polar molecule even if both alkyl groups are identical.

UNIT -8

ALDEHYDES KETONES AND CARBOXYLIC ACIDS

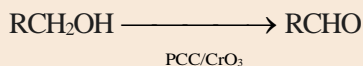
Points to Remember

1. Aldehydes and ketones, are commonly called as carbonyl compounds.
2. In Rosenmund's reduction, poisoning of Pd with BaSO₄ prevent reduction of R – CHO to R – CH₂OH.
3. In the reaction of toluene with CrO₃, acetic anhydride is used to protect benzaldehyde by forming benzylidenediacetate to avoid its oxidation to benzoic acid.
4. Order of reactivity of aldehydes and ketones towards nucleophilic addition is :
 - (i) HCHO > CH₃CHO > CH₃CH₂CHO.
 - (ii) HCHO > RCHO > R CO R.
 - (iii) ArCHO > Ar COR > Ar CO Ar.
5. Benzaldehyde does not reduce Fehling's reagent.
6. Aldehydes and ketones with atleast one α-H atom get condensed in presence of a base. This is known as Aldol condensation.
7. Aldol condensation involves carbanion as intermediate.
8. Aldehydes with no α-H atoms under Cannizzaro's reaction.
9. Ketones react with dihydric alcohols to form cyclic ketals.
10. Monocarboxylic acids having (C₁₂–C₁₈) carbon atoms, are called fatty acids.
11. Boiling points of carboxylic acids is greater than corresponding alcohols.
12. Presence of EWGs enhances the acidic character of carboxylic acids.
13. –COOH group is *m*-directing in electrophilic substitution reactions.
14. Compounds containing –CHO group are named as carbaldehydes if –CHO groups are three or more.
15. Isomerism : Chain, position and functional.
16. Structure of –CHO group *sp*² hybridised.



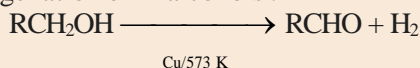
17. General Methods of Preparation:

(i) Controlled oxidation of 1° alcohols :

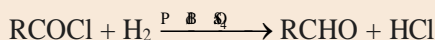


(Collin's reagent)

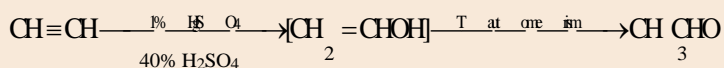
(ii) Dehydrogenation of 1° alcohols :



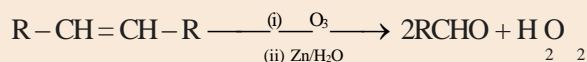
(iii) From Rosenmund reaction/reduction :



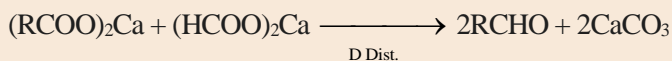
(iv) Hydration of alkynes :



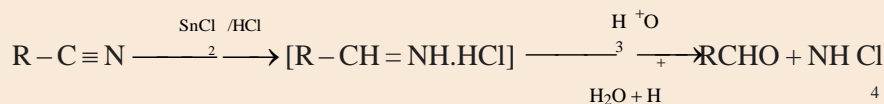
(v) Reductive ozonolysis of alkenes :



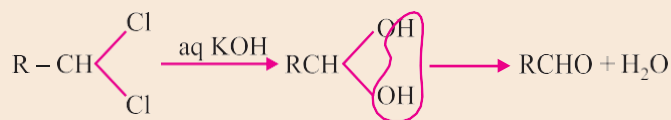
(vi) From salts of fatty acids :



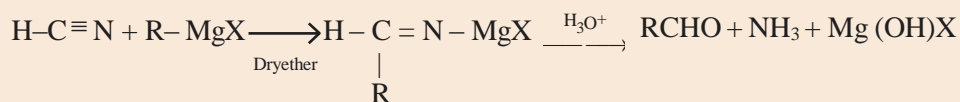
(vii) Stephen's reduction of nitrile compounds :



(viii) Hydrolysis of geminal halides :

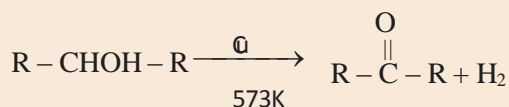


(ix) From Grignard's reagent :

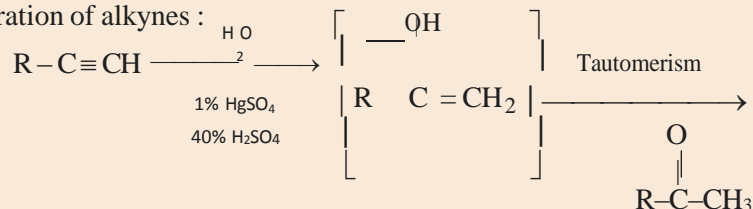


General Methods of Preparation of Ketones only

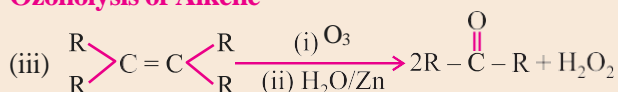
(i) Dehydrogenation of 2° alcohols :



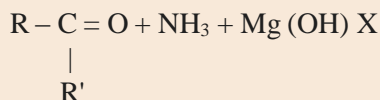
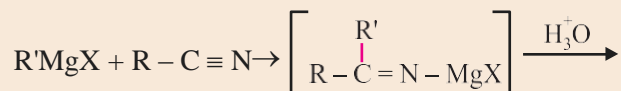
(ii) Hydration of alkynes :



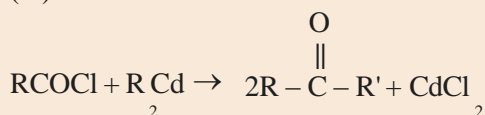
Ozonolysis of Alkene



(iv) From Grignard's reagents :



(iv) From acid chlorides :



Physical Properties:

HCHO is a gas at normal temperature. Formalin is 40% as solution of HCHO. Due to polarity they have high values of boiling point. Solubility in water is only for lower members.

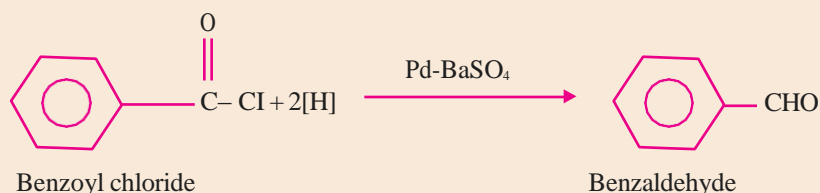
Reactivity :

- (i) + I effect of alkyl groups decreases the +ve charge on carbonyl carbon.
- (ii) Steric hindrance : Bulky group hinder approach of nucleophile.
- (iii) α -hydrogen atom is acidic due to resonance.

[CLICK HERE FOR PRESENTATION](#)

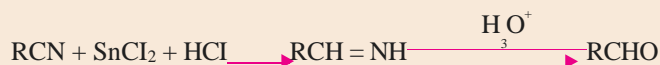
1. ROSENMUND REDUCTION:

Acyl chlorides when hydrogenated over catalyst, palladium on barium sulphate yield aldehydes



2. STEPHEN REACTION

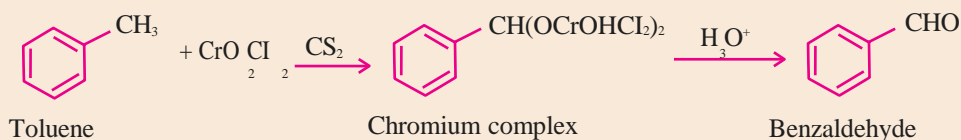
Nitriles are reduced to corresponding imines with stannous chloride in the presence of Hydrochloric acid, which on hydrolysis give corresponding aldehyde.



3. ETARD REACTION

On treating toluene with chromyl chloride CrO_2Cl_2 , the methyl group is oxidized to a chromium complex, which on hydrolysis gives corresponding benzaldehyde.

OR

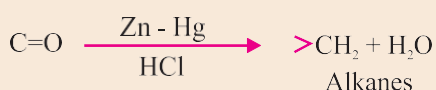


This reaction is called Etard reaction

4. CLEMMENSEN REDUCTION

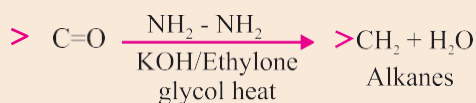
VISUAL EXPLANATION

The carbonyl group of aldehydes and ketone is reduced to $-\text{CH}_2$ group on treatment with zinc amalgam and conc. Hydrochloric acid.



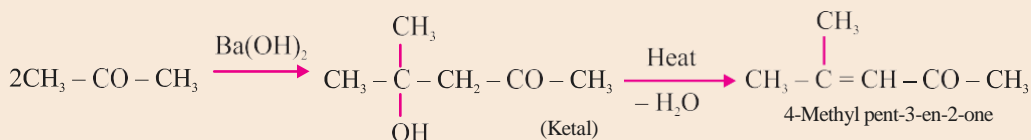
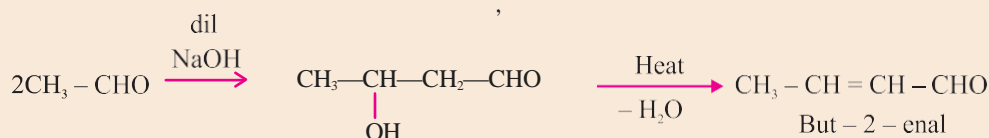
5. WOLFF- KISHNER REDUCTION

On treatment with hydrazine followed by heating with sodium or potassium hydroxide in high boiling solvent like ethylene glycol



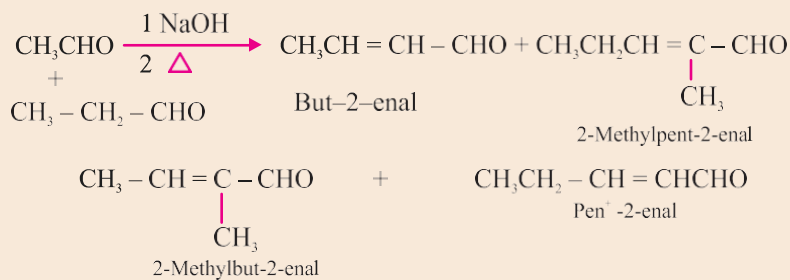
6. ALDOLCONDENSATION

Aldehydes and ketones having at least one α -hydrogen condense in the presence of dilute alkali as catalyst to form β -hydroxy aldehydes (aldol) or β -hydroxy ketones (ketol).



7. CROSS-ALDOL CONDENSATION

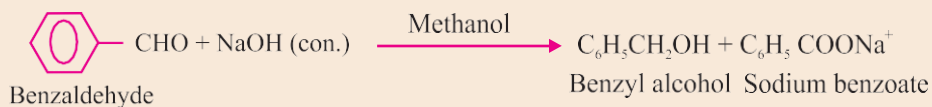
When aldol condensation is carried out between two different aldehydes and / or ketones, a mixture of self and cross-aldol products are obtained.



VISUAL EXPLANATION

8. CANNIZZARO REACTION

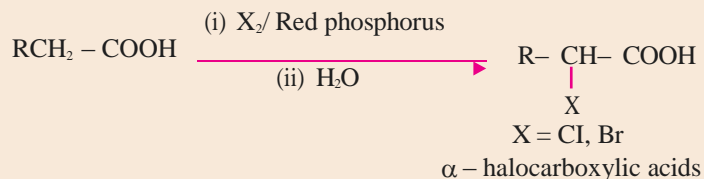
Aldehydes which do not have an α -hydrogen atom, undergo self oxidation and reduction (disproportionation) reaction on treatment with concentrated alkali, to yield carboxylic acid salt and an alcohol respectively.



CARBOXYLIC ACID

1. HELL-VOLHARD-ZELINSKY REACTION (HVZ)

Carboxylic acids having an α - hydrogen are halogenated at the α -position on treatment with chlorine or bromine in the presence of small amount of red phosphorus to give α -halocarboxylic acids.



2. ESTERIFICATION

Carboxylic acids react with alcohols or phenols in the presence of a mineral acid such as conc. H_2SO_4 as catalyst to form esters.



18. Vinegar is 8 to 10% solution of CH_3COOH .
19. α -hydrogen atoms in carboxylic acid are acidic in nature and can be easily replaced by halogen atoms in HVZ reaction.
21. Relative acid strength of $\text{RCOOH} > \text{HOH} > \text{ROH} > \text{HC} \equiv \text{CH} > \text{NH}_3$. It is because a strong acid has weak conjugate base.
22. Some dicarboxylic acids bearing general formula $\text{HOOC} - (\text{CH}_2)_n - \text{COOH}$ where $n = 0, 1, 2, \dots$ etc.

$\text{HOOC} - \text{COOH}$ Oxalic acid 1, 2 ethanedioic acid

$\text{HOOC} - \text{CH}_2 - \text{COOH}$ Malonic acid 1, 3 propanedioic acid

$\text{HOOC} - (\text{CH}_2)_2 - \text{COOH}$ Succinic acid 1, 4 butanedioic acid

$\text{HOOC} - (\text{CH}_2)_3 - \text{COOH}$ Glutonic acid 1, 5 pentanedioic acid

$\text{HOOC} - (\text{CH}_2)_4 - \text{COOH}$ Adipic acid 1, 6 hexanedioic acid

23. Melting points: Higher: Even carbon atoms than next lower or higher homologues containing even number of carbon atoms due to symmetry and closer packing of molecules in the crystal lattice.

VISUAL EXPLANATION

UNIT -9

AMINES

Points to Remember

1. Amines are alkyl and/or aryl derivatives of NH_3 .
2. Functional groups of 1° , 2° and 3° amines are respectively as given below :

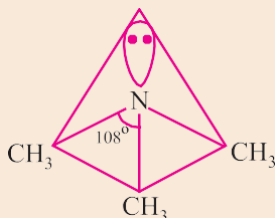


3. Gabriel phthalimide synthesis can't be used for the preparation of 2° and 3° amines. It gives aliphatic primary amine only.
4. Hoffmann's bromamide reaction gives 1° amines having one carbon atom less than parent primary amide.
5. The order of basic strength of aliphatic amines is :
 - (i) Aliphatic amines are more basic than NH_3 .
 - (ii) In aqueous solution medium, the order is $2^\circ > 1^\circ > 3^\circ$ (for $-\text{CH}_3$ group) and $2^\circ > 3^\circ > 1^\circ$ for $-\text{C}_2\text{H}_5$ group.
 - (iii) In non-aqueous medium or gaseous phase, the order is $3^\circ > 2^\circ > 1^\circ$.
6. Basic strength of aromatic amines :
 - (i) Aromatic amines are weaker bases than NH_3 .
 - (ii) ERGs like $-\text{CH}_3$, $-\text{OR}$, $-\text{NH}_2$ etc. increase basic strength while EWGs like $-\text{NO}_2$, $-\text{CN}$ etc. decrease the basic strength. The effect of substituents is more at para positions and less at meta position.

VISUAL EXPLANATION

7. Basic strength of amines is expressed in terms of K_b or $\text{p}K_b$.
8. 1° , 2° and 3° amines can be distinguished by Hinsberg's test.
9. Hinsberg's reagent is benzenesulphonyl chloride ($\text{C}_6\text{H}_5\text{SO}_2\text{Cl}$).
10. 3° amines like trimethylamine are used as insect attractants.
11. Diazonium salts are represented by the general formula $[\text{Ar N} \equiv \text{N}]^+ \text{X}^-$.

12. **Structure of amines :** Pyramidal for trimethyl amine $(\text{CH}_3)_3\text{-N}$. They are Lewis bases.



13. Carbylamine test only given by 1° amines.
14. Manich reaction involves the reaction of ketones with HCHO and NH₃ (or amine) in acidic medium to form Manich bases.
15. 1° amines give effervescence with HNO₂.
16. -NH₂ group in aniline is *o*- and *p*- directing and is highly activating in nature.
17. Acylation of aniline is done before subjecting it to nitration or halogenation.
18. Aliphatic diazonium salts are very unstable and do not exist while aromatic salts are relatively stable.
19. These salts are prepared from 1° aryl amines by diazotization reactions.
20. Diazotised salts (diazonium salts) are used to prepare a variety of aromatic compounds.
21. R - C ≡ N have generally pleasant odours but alkyl isocyanides have highly unpleasant odours.
22. Alkyl isocyanides have lower boiling points than that of isomeric alkyl cyanides due to lower dipole moments.
23. Arenediazonium salts are highly reactive compounds and reactivity is due to excellent leaving ability of diazo group as N₂ gas.

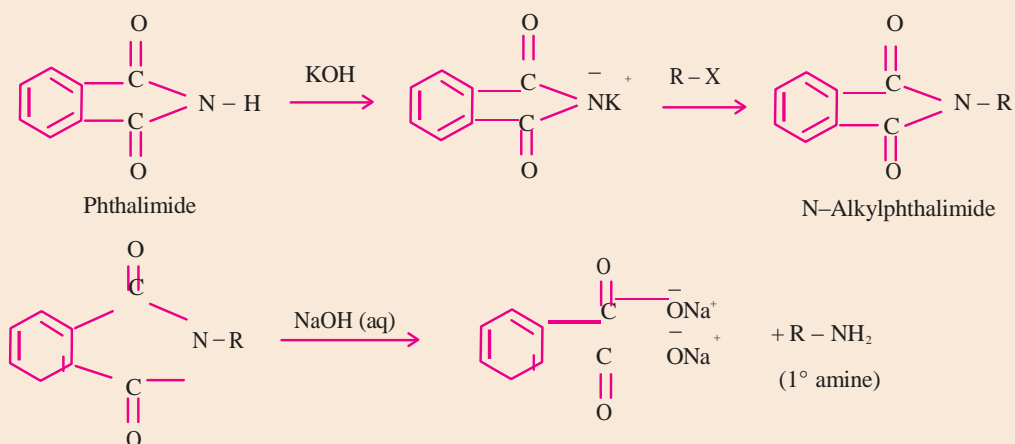
VISUAL EXPLANATION

NAME REACTIONS

1. Gabriel phthalimide synthesis

Gabriel synthesis is used for the preparation of primary amines. Phthalimide on treatment with ethanolic potassium hydroxide forms potassium salt of phthalimide which on heating with alkyl halide followed by alkaline hydrolysis produces the corresponding primary amine. Aromatic primary amines cannot be prepared

by this method because aryl halides do not undergo nucleophilic substitution with the anion formed by phthalimide.



2. Hoffmann bromamide degradation reaction

Hoffmann developed a method for preparation of primary amines by treating an amide with bromine in an aqueous or ethanolic solution of sodium hydroxide. The amine so formed contains one carbon less than present in the amide.



3. Carbylamine reaction

Aliphatic and aromatic primary amines on heating with chloroform and ethanolic potassium hydroxide form isocyanides or carbylamines which are foul smelling substances. Secondary and tertiary amines do not show this reaction. This reaction is known as carbylamine reaction or isocyanide test and is used as a test for primary amines.

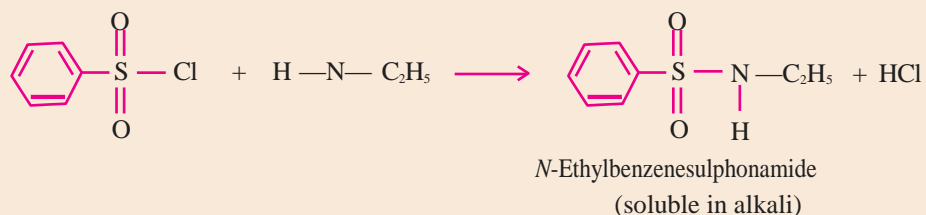


VISUAL EXPLANATION

4. Hinsberg Test:

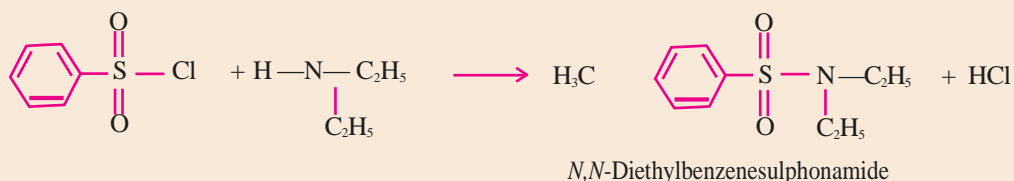
Benzenesulphonyl chloride (C₆H₅SO₂Cl), which is also known as Hinsberg's reagent, reacts with primary and secondary amines to form sulphonamides.

(a) The reaction of benzenesulphonyl chloride with primary amine yields N-ethylbenzenesulphonyl amide.



The hydrogen attached to nitrogen in sulphonamide is strongly acidic due to the presence of strong electron withdrawing sulphonyl group. Hence, it is soluble in alkali.

(b) In the reaction with secondary amine, N, N-diethylbenzenesulphonamide is formed.

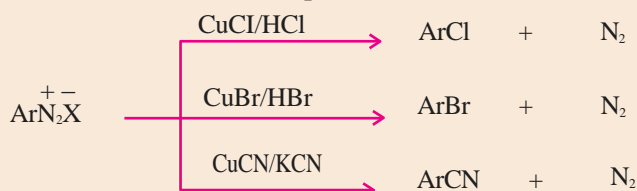


Since N, N-diethylbenzene sulphonamide does not contain any hydrogen atom attached to nitrogen atom, it is not acidic and hence insoluble in alkali.

(c) Tertiary amines do not react with benzenesulphonyl chloride. This property of amines reacting with benzenesulphonyl chloride in a different manner is used for the distinction of primary, secondary and tertiary amines and also for the separation of a mixture of amines.

5. Sandmeyer Reaction

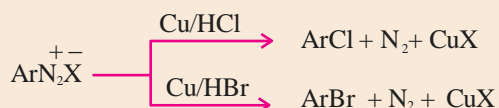
The Cl⁻, Br⁻ and CN⁻ nucleophiles can easily be introduced in the benzene ring of diazonium salts in the presence of Cu(I) ion.



VISUAL EXPLANATION

6. Gatterman Reaction

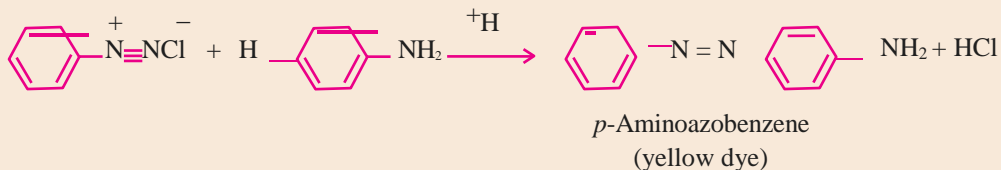
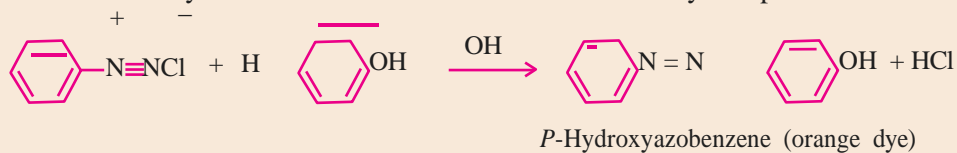
Chlorine or bromine can be introduced in the benzene ring by treating the diazonium salt solution with corresponding halogen acid in the presence of copper powder.



7. Coupling reactions

The azo products obtained have an extended conjugate system having both the aromatic rings joined through the -N=N- bond. These compounds are often coloured and are used as dyes. Benzene diazonium chloride reacts with phenol in which the phenol molecule at its para position is coupled with the diazonium salt to form p-hydroxyazobenzene. This type of reaction is known as coupling reaction.

Similarly the reaction of diazonium salt with aniline yields p-aminoazobenzene.



VISUAL EXPLANATION

DISTINCTION BETWEEN PAIRS OF COMPOUNDS

Give one chemical test to distinguish between the following pairs of compounds.

- (i) Methylamine and dimethylamine
- (ii) Secondary and tertiary amines
- (iii) Ethylamine and aniline



UNIT -10

BIOMOLECULES

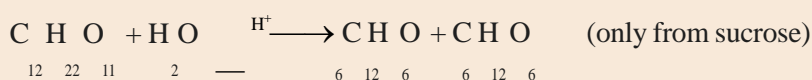
Points to Remember

1. **Carbohydrates :** These are optically active polyhydroxy aldehydes or ketones or the compounds which produce these on hydrolysis.
2. **Classification :**
 - (i) **Monosaccharides :** Those carbohydrates which cannot be hydrolysed into further simpler carbohydrates. *E.g.*, glucose, fructose, galactose etc.
 - (ii) **Disaccharides :** Those carbohydrates which produces two monosaccharides on hydrolysis. *E.g.*, sucrose, maltose and lactose.
 - (iii) **Oligosaccharides :** Those carbohydrates which give two to ten monosaccharides on hydrolysis.
 - (iv) **Polysaccharides :** Those carbohydrates which on hydrolysis give large number of monosaccharides hydrolysis. *E.g.*, starch, cellulose, glycogen.
3. **Sugar :** Carbohydrates which are sweet in taste.
 - (i) **Reducing sugars :** Those which reduce Fehling's or Tollen's reagent due to availability of free aldehydic groups. *E.g.*, glucose, fructose, galactose.
 - (ii) **Non-reducing sugars :** Those which do not reduce Fehling's or Tollen's reagent. They do not have free aldehydic group. *E.g.*, sucrose.
4. **Glucose :** It is a monosaccharide with molecular formula $C_6H_{12}O_6$

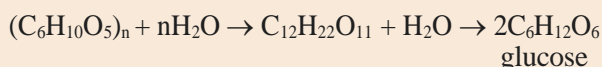
VISUAL EXPLANATION

Preparation :

- (i) **From sucrose :**

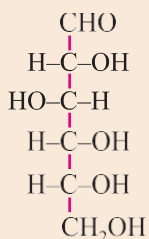


- (ii) **From starch :** glucose Fructose



5. **Structure :**

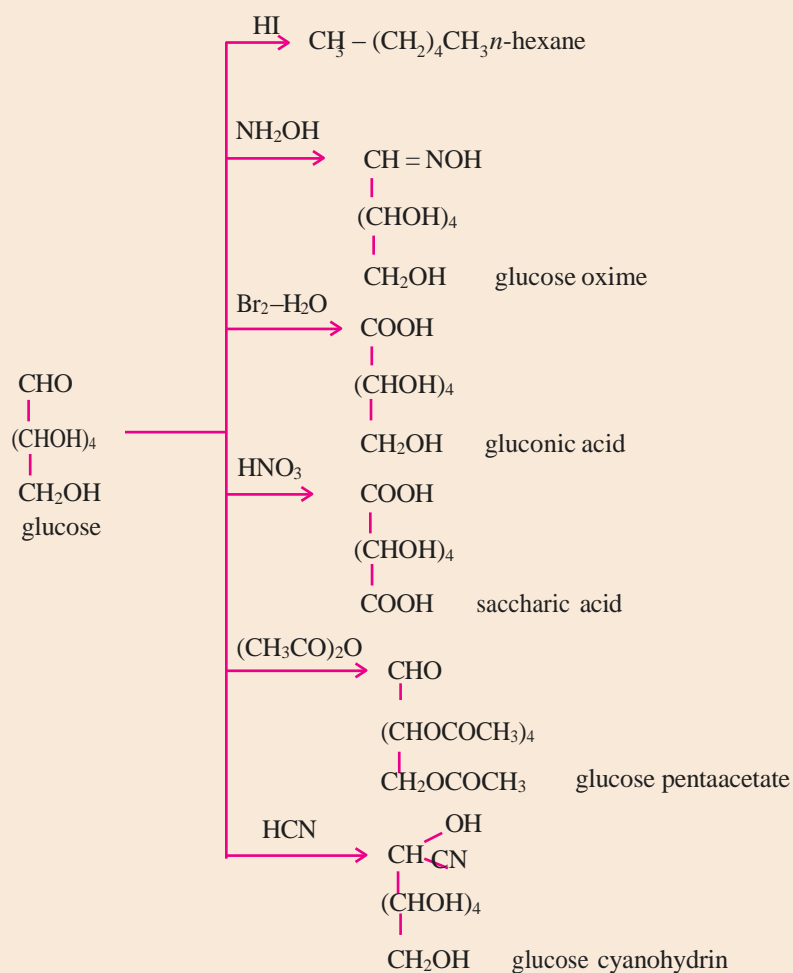
Fischer structure : (+) glucose has 'D' configuration as shown



D-(+)-glucose

'D'- means – OH group on first chiral 'C' from the bottom is on right hand and (+) means it is dextrorotatory *i.e.*, it rotates plane polarized light towards right.

Reactions of glucose :



Objections against open chain structure of glucose

The open chain structure was unable to explain the following reactions :

- It does not give the 2, 4-DNP test, Schiff's test and does not form the hydrogensulphite product with NaHSO_3 .
- The pentacetate of glucose does not react with NH_2OH , indicating the absence of free aldehydic group.
- Glucose exist in 2 different crystalline forms α and β forms. These are called anomers. They differ in optical rotation, they also differ in melting point.

After which a close chain (cyclic) structure of glucose was proposed by Haworth.

* Anomers are isomers which have a different configuration at C-1 functional group c-atom

- Glycosidic linkage** : The linkage between two monosaccharide units through oxygen is called the glycosidic linkage.

VISUAL PRESENTATION

- Proteins** : These are macro molecules made up of amino acids joined by amide linkage $[-(-\text{CONH}-)-]$ is here called as peptide linkage. These are required for growth and development of the body.
- Amino acids** : These contain an amino ($-\text{NH}_2$) and an acidic ($-\text{COOH}$) group and are therefore amphoteric in nature. In solution they exist in the form of zwitter ion (a dipolar ion).
- Classification**

Fibrous Protein	Glubular Protein
(i) Polypeptide chains run parallel or anti-parallel and held together by hydrogen and disulphide bonds.	(i) Chains of polypeptide coil around to give a spherical shape.
(ii) Generally insoluble in water <i>e.g.</i> , keratin, collagen, myosin, fibroin.	(ii) Usually soluble in water, <i>e.g.</i> , insulin, thyroglobin, albumin, haemoglobin and fibrinogen gets converted into fibrous protein fibroin on clotting of blood.

10. Structure and shape of protein (Ref. page no. 416 NCERT Book)

Primary structure	Secondary structure	Tertiary structure	Quaternary structure
The specific sequence of amino acids in the polypeptide chain. Change in amino acids sequence changes the protein completely. They have covalent bonds.	It is the shape in which the long polypeptide chain can exist. It is of two types : α -helix and β -pleated. These structures arise due to regular folding of the backbone of the polypeptide chain due to H-bonding between the C=O and -NH- groups of the peptide bond.	Represent overall folding of the polypeptide chain. It gives rise to the fibrous or globular molecular shapes. Forces stabilizing the 2° and 3° structures are hydrogen bonds, disulphide linkages, van der Waal's and electrostatic forces of attraction.	Protein can be composed of two or more polypeptide chains called sub-units. The spatial arrangement of these sub-units with respect to each other is quaternary structure of the protein.

- Native state of protein :** The parental state or the natural state in which the protein is found.
- Denaturation of protein :** Destruction of the native state of protein is denaturation. It can be brought by physical and chemical methods. The 2° and 3° structures are destroyed, only 1° structure is retained.

VISUAL EXPLANATION

Enzymes : These are biocatalyst and generally globular proteins *e.g.*, invertase, zymase, phenylalanine hydroxylase, urease etc.

Main characteristics of enzymes :

- It speed up the biological reaction upto million times.
 - It is highly specific and work on lock and key theory.
 - It is highly sensitive to pH and temperature.
- Vitamins :** They are organic compounds required in the diet in small amounts to perform specific biological functions for maintenance of optimum growth and health of the organism. They are classified as follows :
 - Fat soluble vitamins :** Vitamin A, D, E and K. They are stored in liver and adipose tissues.

- (ii) **Water soluble vitamins** : B group vitamins and vitamin C. They need to be supplied regularly in diet as they are excreted in urine and cannot be stored (except vitamin B₁₂) in our body.

Their deficiency causes diseases. (Ref. table in page no. 418 of NCERT Book)

Biotin (Vit H) is however neither fat nor water soluble. Its deficiency leads to loss of hair.

14. **Nucleic acids** : These are biomolecules which are long chain polymers of nucleotides. They are of two types :

(i) **Deoxyribonucleic acid (DNA)**

(ii) **Ribonucleic acid (RNA)**

15. Vitamin	Deficiency disease
A	Xerophthalmia (eye fails to produce tears), night blindness
B ₁	Beri-beri(severe lethargy)
B ₂	Ariboflavinosis, cheilosis, burning sensation of skin
B ₁₂	Pernicious anaemia(gradual loss of RBCs), inflammation of tongue and mouth
C	Scurvy
D	Rickets & osteomalacia(softening of bones)
E	Increased fragility of RBC and muscular weakness
K	Increased blood clotting time
H	Loss of hair

VISUAL EXPLANATION

16. Hormones are chemical substances which are produced in ductless glands in the body.

17. Nucleoside = Base + Sugar

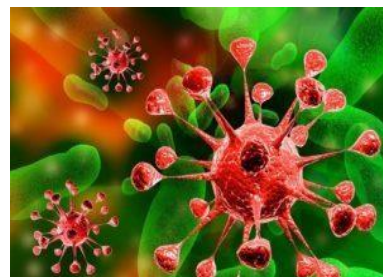
Nucleotide = Base + Sugar + Phosphoric acid

18. DNA	RNA
(i) Double helical.	(i) Single stranded.
(ii) Sugar is 2-deoxyribose.	(ii) Sugar is ribose.
(iii) Bases : A, T, G, C.	(iii) Bases : A, U, G, C.
(iv) Property of replication.	(iv) Do not replicate.
(v) It is responsible for transmission of heredity character.	(v) Helps in protein biosynthesis.

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INTERACTIVE STUDY MATERIAL FOR CLASS XII
(BIOLOGY)



Smt Shajila P, Training Associate (Biology)

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CLASS XII- BIOLOGY (2022-23)

Unit-Wise Weightage:

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	Total	70

Please click the link:

For Class XII Syllabus for 2022-23:

https://drive.google.com/file/d/1URNn1b7o1XPYRi12BnilDzZmBurKSqJt/view?usp=share_link

For sample paper:

<https://drive.google.com/file/d/1L0mpnsZ51Dvs2nSbtbBH14HNsSvEOHXM/view?usp=sharing>

https://drive.google.com/file/d/1E-XcKQBEXqWPEltVy201VqF_QPQkLHGz/view?usp=sharing

UNIT VI - REPRODUCTION

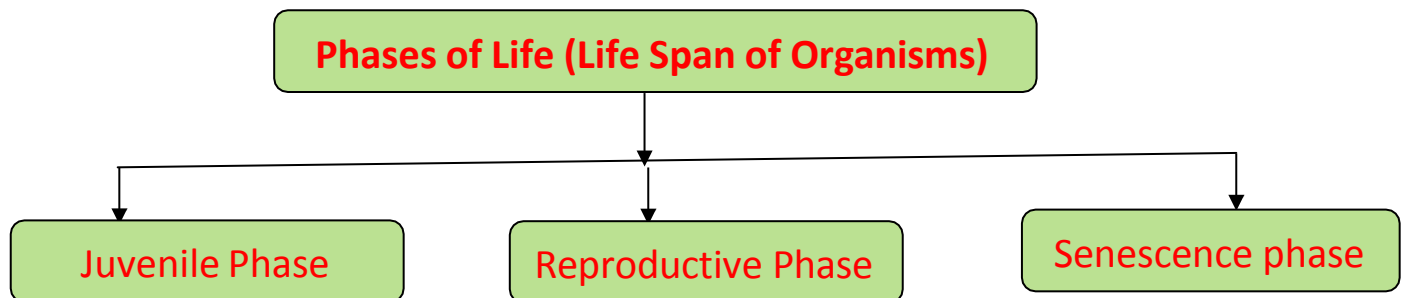
CHAPTER 1

REPRODUCTION IN ORGANISMS

Note: This chapter is deleted for the year 2022-23. Here it is given as an introduction for the unit.

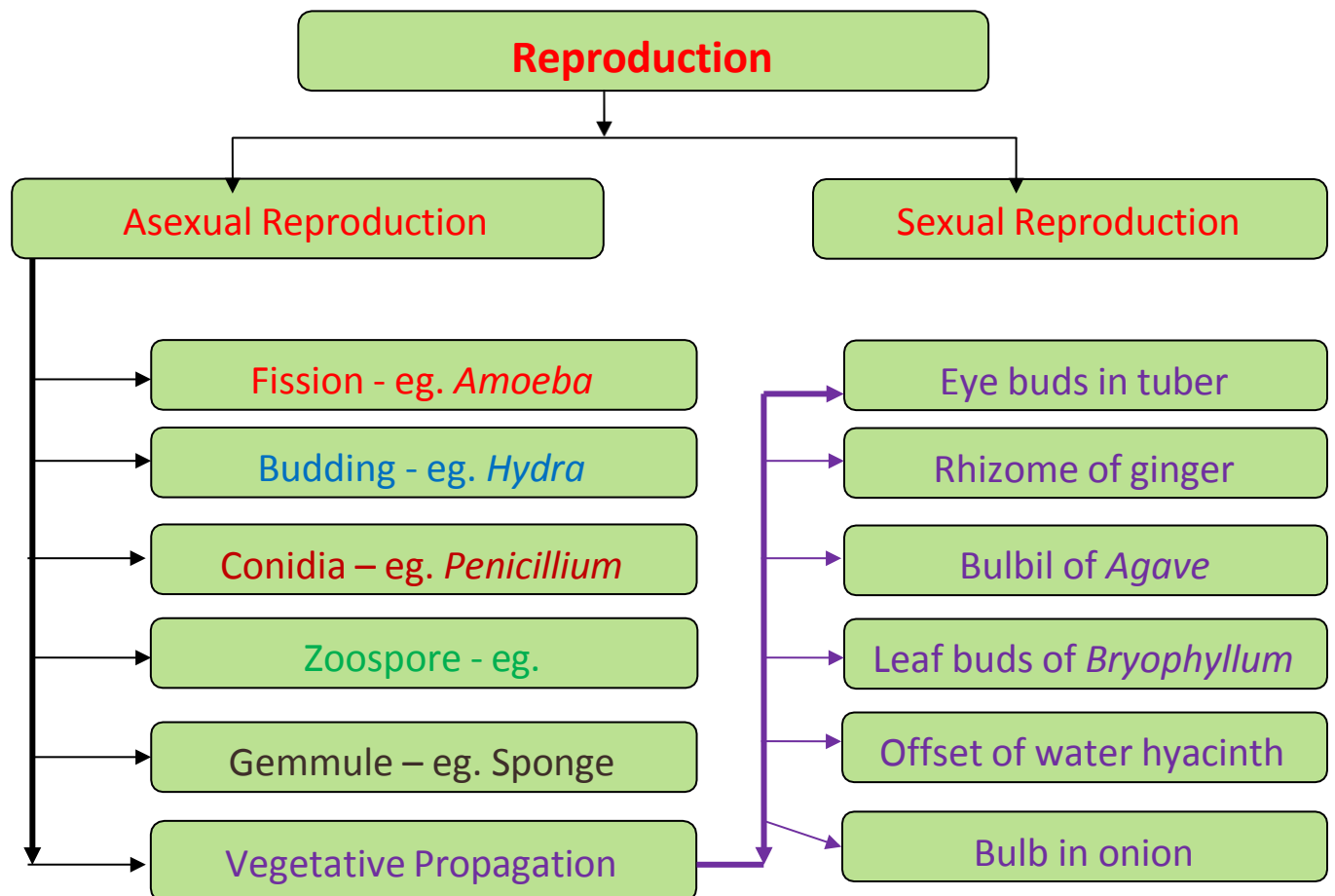
Reproduction:

Defined as a biological process in which an organism gives rise to young ones (offspring) similar to itself.



PPT link for further explanations

https://docs.google.com/presentation/d/1Y_pLa7PkWt6fnI9tg0_1dOz7iWamXjpa/edit?usp=share_link&ouid=107171444976724466844&rtpof=true&sd=true

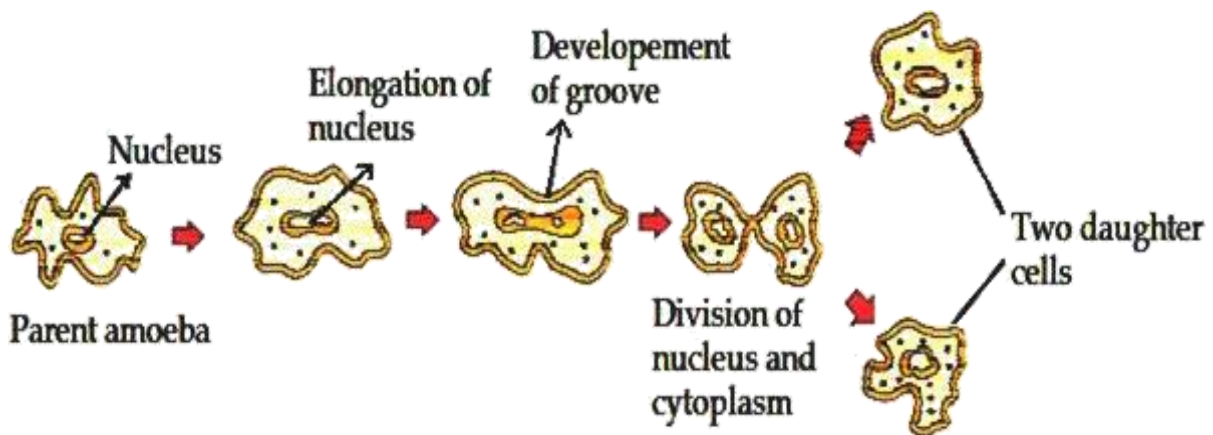


Asexual reproduction	Sexual reproduction
Offsprings are produced by single parents	Offsprings are produced by the involvement of single or two parents
Does not involve gamete formation and gamete fusion	Gamete formation and gamete fusion takes place.
No zygote formation	Gametes are fused to form a diploid zygote (2n) and zygote develops into embryo.
Offsprings are <i>genetically identical</i> to their parents	Offsprings are not <i>genetically identical</i> to their parents

Asexual reproduction

Methods of asexual reproduction:

- Binary fission; e.g. *Amoeba*, *Paramecium*.
- Budding: e.g. yeast.
- Asexual reproductive structures:
 - Zoospores:** aquatic fungi, eg. *Chlamydomonas*.
 - Conidia:** *Penicillium*.
 - Bud:** *Hydra*
 - Gemmules:** *sponges*.
- Vegetative propagation units in plant: (Vegetative propagules)
Rhizome, tuber, offset, bulb.etc.



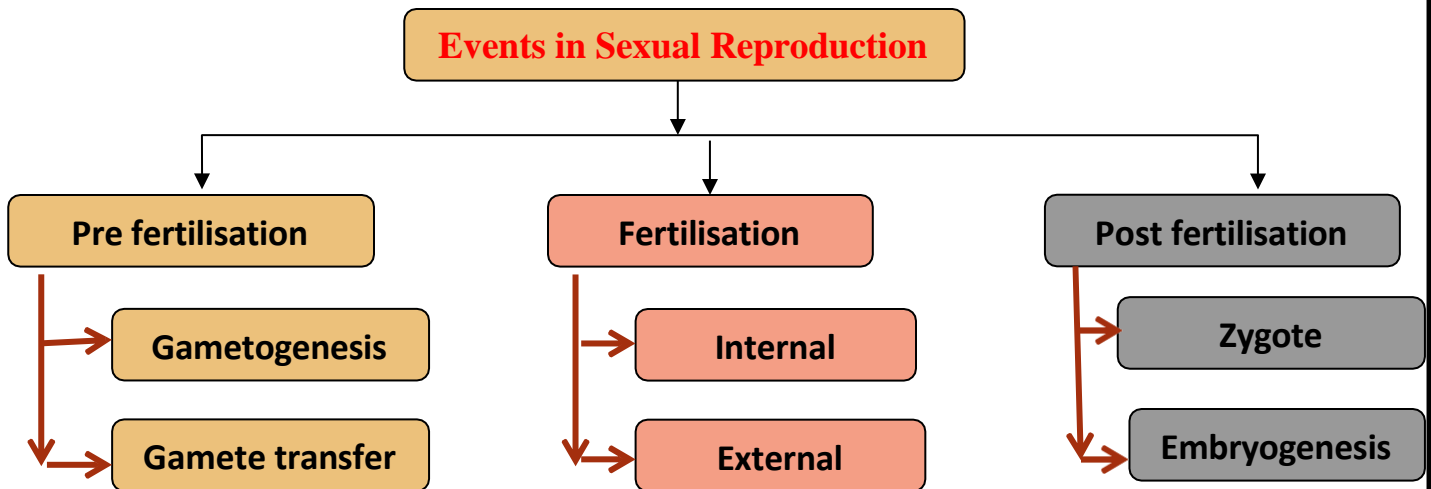
Binary fission in Amoeba

For more examples -

https://drive.google.com/file/d/17zJdXsZwRx9M9faQIHee9Ar3cbkNZ_WH/view?usp=sharing

Sexual reproduction

Features of sexual reproduction:



Pre-fertilization events:

Gametogenesis: Process of gamete formation.

There are two types of gametes- **isogametes:** (when two gametes are morphologically similar) and **heterogametes:** (when the two gametes produced are morphologically different)

Male gamete is called **antherozoids** or **sperm** and the female gamete is called **ovum** or **egg**.

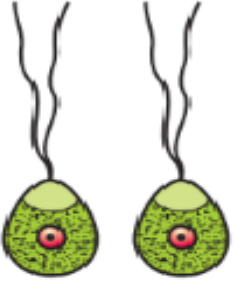
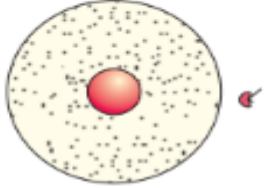

There are two types of plants based on their sexuality.

- i) **Monoecious Plants:** Possess both male and female sex organs.
- ii) **Dioecious Plants:** Possess only one sex organ, male or female.

Gamete transfer: During this event both male and female gametes are physically brought together to facilitate fertilization.

- * In most cases male gametes are motile, female gametes are non-motile.
- * In case of few fungi and algae, both male and female gametes are motile.
- * In most cases water is the medium for gamete transfer.
- * Male gametes are produced in several thousand times the number of female gametes produced to compensate the loss during transfer.

Types of Gametes

			<p>Isogametes of <i>Cladophora</i></p>
			<p>Heterogametes of <i>Fucus</i></p>
			<p>Heterogametes of <i>Homo sapiens</i></p>

Fertilization:

- * Fusion of male and female gamete is called **fertilization or syngamy**.
- * **Two types of fertilization- Internal** (Gametic fusion takes place inside the body) **and External** (Gametic fusion takes place outside the body)
- * The female gamete undergoes development to form new organism without fertilization. This phenomenon is called **parthenogenesis**.

Post Fertilisation Events:

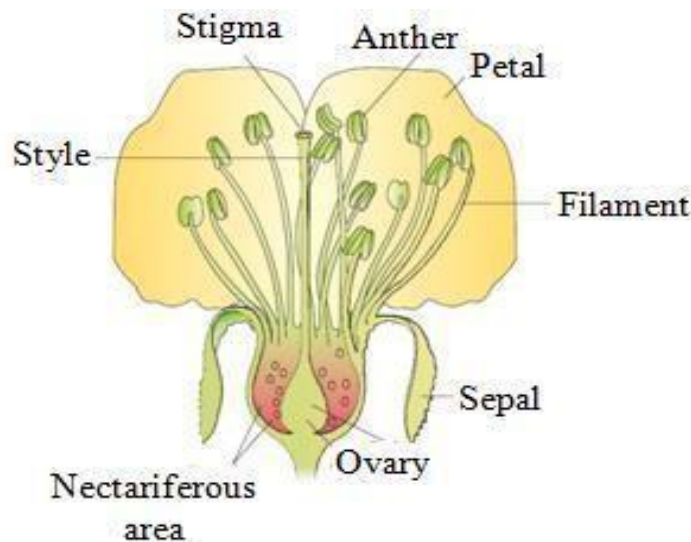
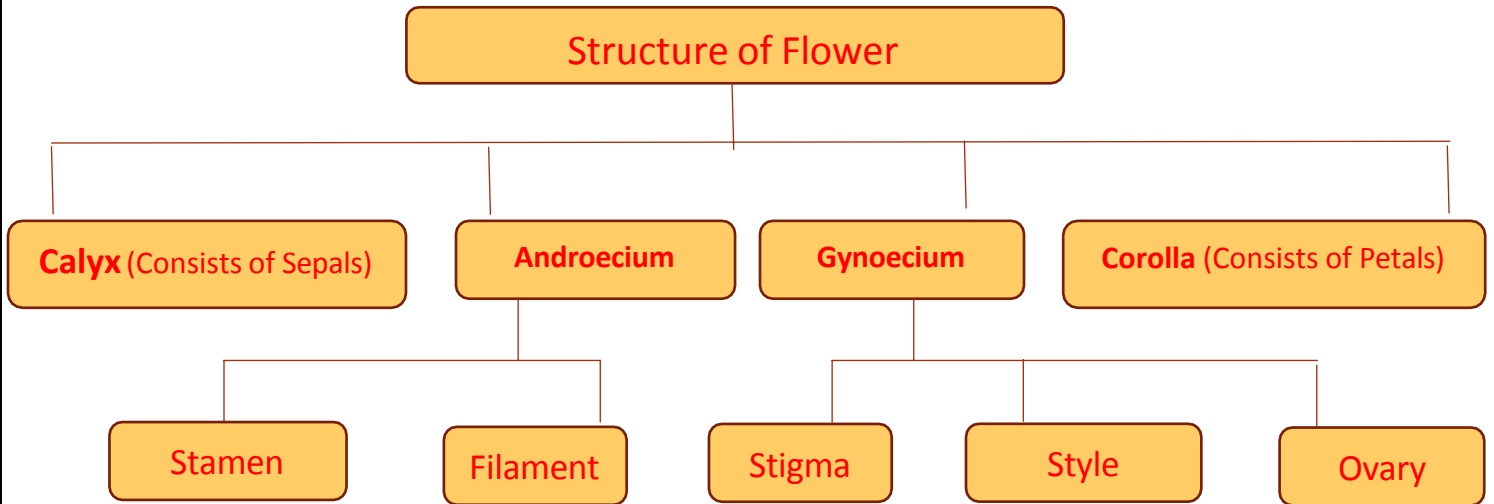
Zygote formation: Fusion of male and female gametes results in the formation of zygote.

Embryogenesis: Development of zygote into an embryo is called **embryogenesis**.

Zygote undergoes **cell division** (mitosis) and **cell differentiation**. Cell division increase the number of cells and cell differentiation helps to form specialized tissues and organs.

CHAPTER 2

SEXUAL REPRODUCTION IN FLOWERING PLANTS



Pre fertilization events:

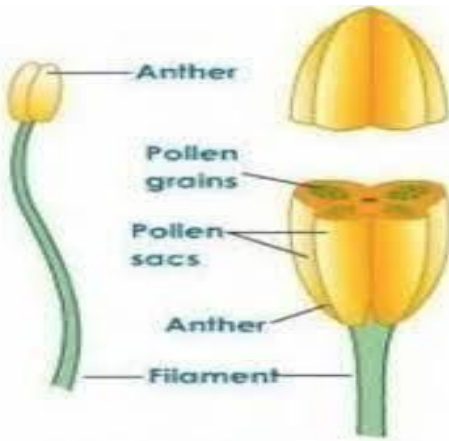
This stage is characterised by the production of male and female gametes and transfer of gametes for fertilization process. During this stage androecium (stamen) and gynoecium (pistil) are fully developed for the production of gametes.

Structure of Stamen:

Typical **stamen** consists of two parts, long and slender stalk called **filament** and terminal bilobed structure called **anther**.

Anther:

Atypical angiosperm anther is a **bilobed and ditheous** structure. Each anther contains four **microsporangia** located at the corners, two in each lobe. Microsporangia become **pollen sacs** and are packed with pollen grains.



Structure of microsporangium:

Each microsporangium surrounded by four wall layers

- * Epidermis
 - * Endothecium
 - * Middle layer.
 - * Tapetum. →
- Protects the inner tissues.
- Nourishes the developing pollen grain.

The center of each microsporangium contains homogenous cells called **sporogenous tissues**.

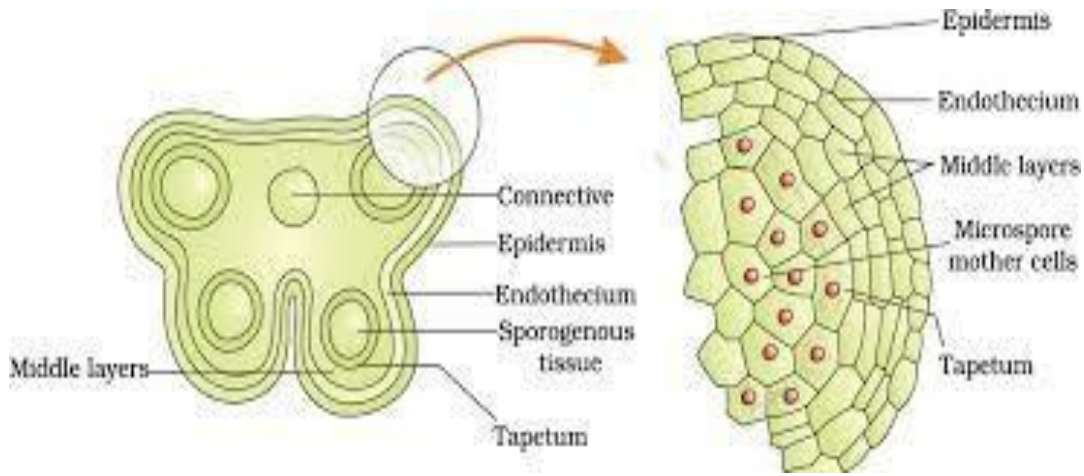
Microsporogenesis:

- * The process of formation of microspores from pollen mother cell through meiosis is called **microsporogenesis**.
- * The sporogenous tissue of microsporangium differentiated into **microspore mother cell** or **pollen mother cell**.
- * Each microspore mother cell undergoes meiosis and gives rise to haploid **microspore tetrad**.
- * On dehydration microspore tetrad dissociated to form four **microspores**.
- * Each microspore developed into a **pollen grain**.

[Video link for Microsporogenesis](#)

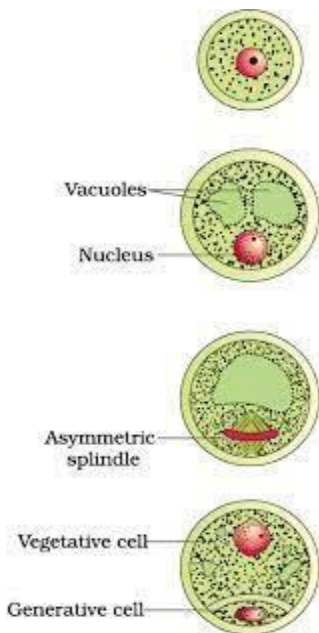
https://drive.google.com/file/d/1oARpDAhFiVjnCFHWyBcKcsIHf4IEvNyr/view?usp=share_link

<https://www.youtube.com/watch?v=Vus-IgBrIV8>



PPT link for Microsporogenesis and structure of pollen grain

<https://docs.google.com/presentation/d/1m7C99e6twj35bFdRTjHwm1d6eXzjd98O/edit?usp=sharing&ouid=107171444976724466844&rtpof=true&sd=true>



(a)

(b)



(a) Stages of a microspore maturing into a pollen grain

(b) Enlarged view of pollen grain tetrad

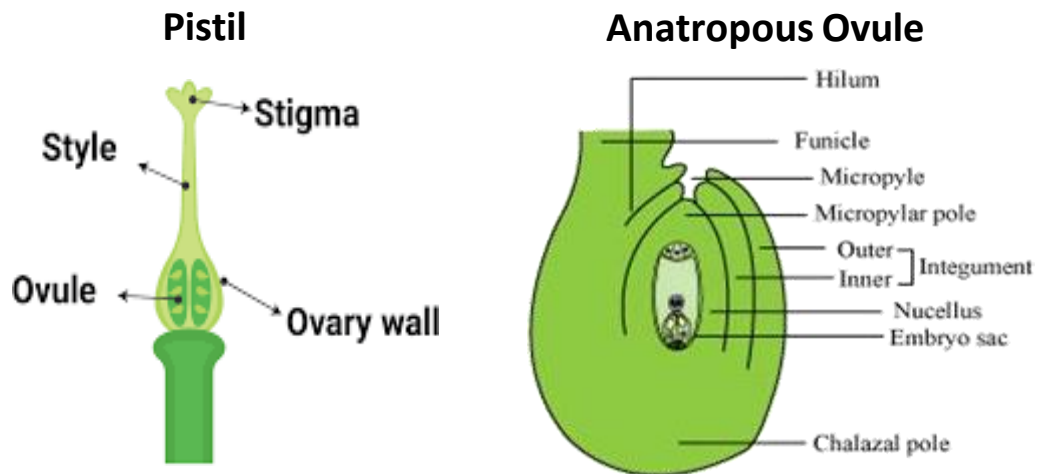
The Pistil:

Pistil has three parts the **stigma**, **style** and **ovary**. Inside the ovary is the **ovarian cavity (locule)**.

Megasporangia or **ovules** arise from the placenta. The number of ovule inside the ovary may be **single** or **many**.

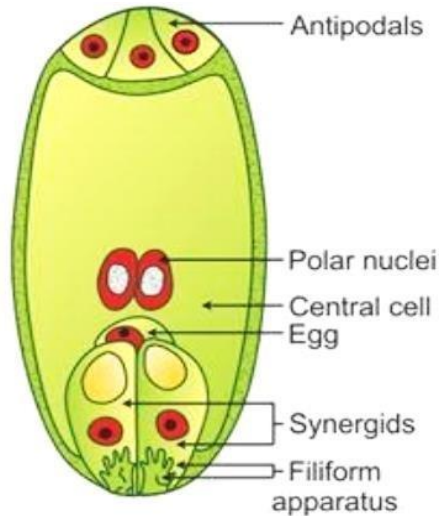
The Megasporangium (Ovule):

Megasporangium is attached to the placenta of locule with a stalk called **funicle**. The body of the ovule fused with the funicle in the region called **hilum**. **Hilum** is the junction between the funicle and ovule. Each ovule has one or two protective envelopes called integuments with an opening called **micropyle**. Opposite of the micropylar end, is the **chalaza**, representing the basal part of the ovule.



Megasporogenesis:

- * The process of formation of **megaspores** from the **megaspore mother cell** is called **Megasporogenesis**.
- * In the centre of the ovule there is a mass of tissue called **nucellus**.
- * Cells of nucellus have abundant reserve food materials.
- * One cell of the nucellus towards micropylar end differentiated into **megaspore mother cell (MMC)**.
- * It is a large **diploid cell**, dense **cytoplasm** with **prominent nucleus**.
- * The MMC undergo **meiotic** division resulting four haploid **megaspores**.



Mature Embryo Sac

PPT Link for Megasporogenesis

<https://docs.google.com/presentation/d/10Cpgs8v17bGxC-BQKv89sWS2BQROAQQ9/edit?usp=sharing&ouid=107171444976724466844&rtpof=true&sd=true>

Pollination:

Transfer of pollen grains from the anther to the stigma of a pistil is termed as pollination.

Kinds of pollination:

Autogamy	Geitonogamy	Xenogamy
Pollination within same flower.	Pollination between two flowers of the same plant.	Transfer of pollen grains from the anther to the stigma of different plant.
Self-Pollination	Pollination by pollinating agent.	It is commonly called as cross-pollination.
Genetically similar plants are produced	Genetically similar to the autogamy.	It brings genetically different types of pollen grains to the stigma and genetically different plants are produced.

Viola, *Oxalis* and *Commelina* produce two types of flowers:

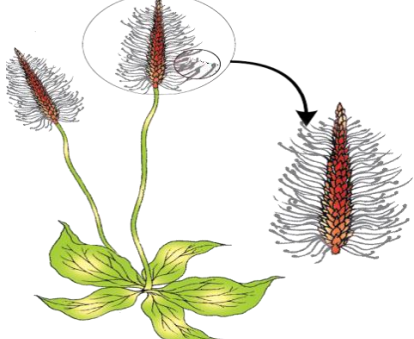
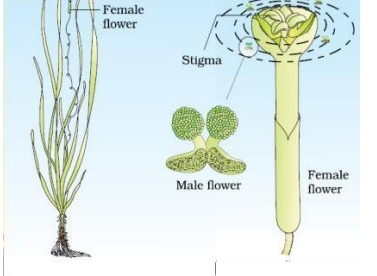

Chasmogamous: With exposed anther and stigma

Cleistogamous: With closed anther and stigma.

Cleistogamous flower is invariably **autogamous** and **assured seed** set even in the absence of the pollinator.

Agents of pollination:

Anemophily	Hydrophily	Entomophily
Pollinating agent is wind.	Pollination by water.	Pollinating agent is insect particularly bees are the dominant biotic agents for pollination.
Produces more number of pollen to compensate the uncertainties of pollination.	<i>Vallisneria</i> , <i>Hydrilla</i> and <i>Zostera</i> are the common example for Hydrophily.	flowers are very large, colorful, fragrant and rich in nectar.
Flowers with well exposed stamens.	Pollen grains released into the surface of water and carried to the stigma by air current as in <i>Vallisneria</i> .	Small flowers present in cluster to make them conspicuous.
Large feathery stigma to trap air-borne pollen grains.	This type of pollination is very rare, mostly monocot. In sea grass the flowers remained submerged .	Flower pollinated by flies and beetles secrete foul odours.
Contains single ovule in one ovary and numerous flower	Pollen grains are long, ribbon like and carried	Contains single ovule in one ovary and

packed into an inflorescence e.g. corn cob.	passively inside the water	
Pollen grains are light and non-sticky.	Pollen grains are protected from wetting by mucilaginous covering.	
		

Outbreeding Devices:

- * Pollen released and stigma receptivity is not synchronized.
- * Spatial separation of anthers and stigmas
- * Anther and stigma are placed at different positions.
- * Self incompatibility.
- * Production of unisexual flowers.

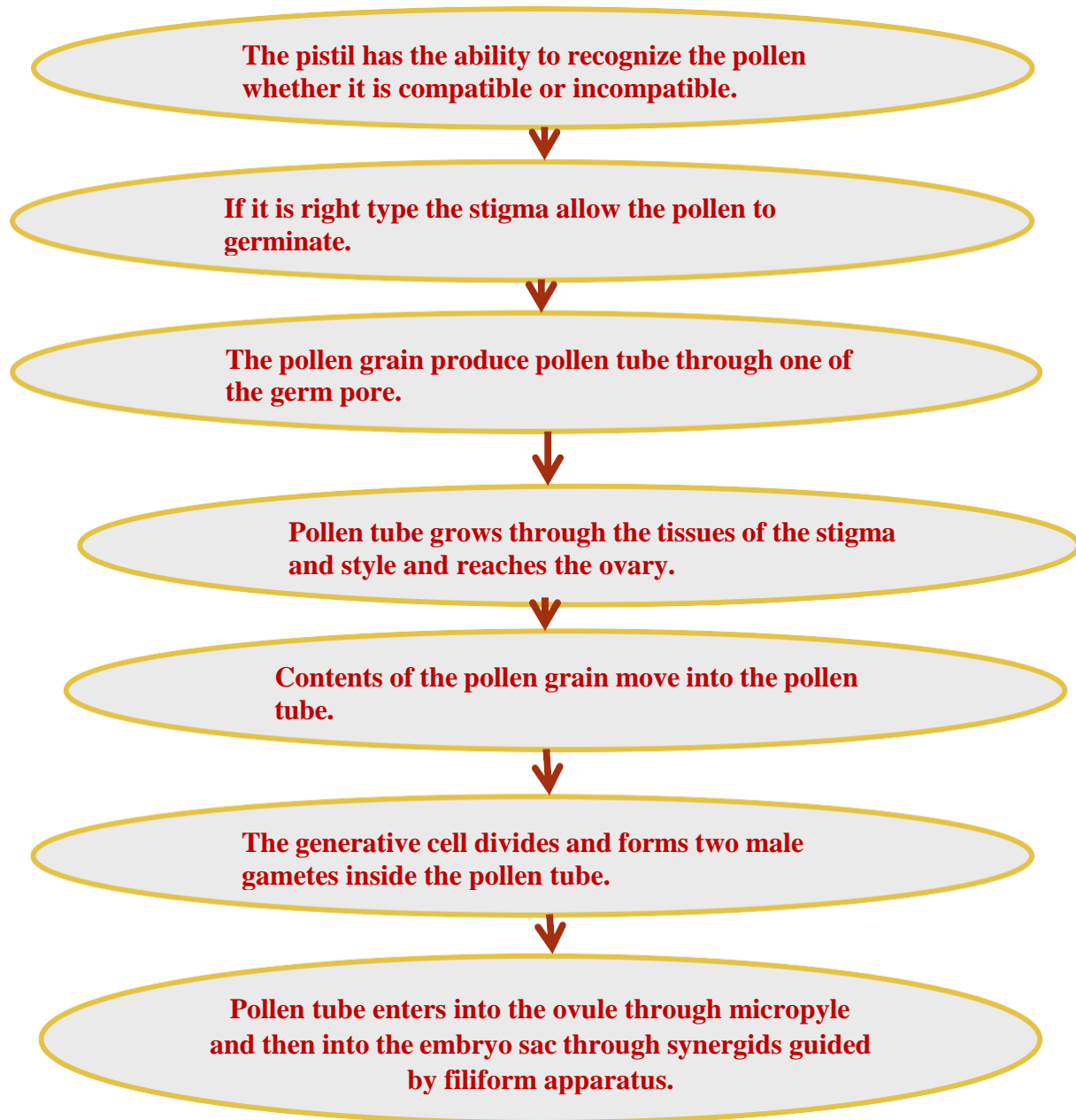
[PPT Link for Double fertilisation](#)

<https://drive.google.com/file/d/1KHylpTc-cWR8hfwy4Un7R4JRR6PNG8Z/view?usp=sharing>

[Video link for Double fertilization](#)

<https://www.youtube.com/embed/dgFY7WUTASQ>

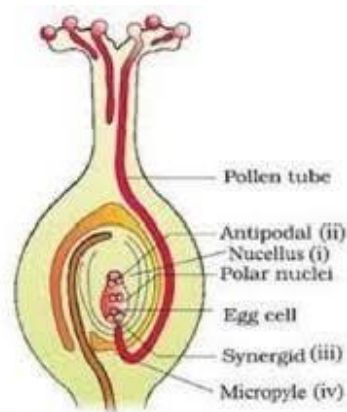
Pollen pistil Interaction: All the events – from pollen deposition on the stigma until pollen tubes enter the ovule – are together referred as **pollen-pistil interaction**.



Double fertilization:

- * After entering one of the synergids, the pollen tube releases two male gametes into the cytoplasm of the synergids.
- * **Syngamy:** one of the male gamete fused with egg cell, to form a diploid **zygote**.
- * Two polar nuclei of central cell fused to form a diploid **secondary nucleus**.

- * **Triple fusion:** The second male gamete fused with the secondary nucleus to form a triploid **primary endosperm nucleus**.
- * Since two type of fusion, syngamy and triple fusion take place in the embryo sac the phenomenon is termed as **double fertilization**.
- * The central cell after triple fusion becomes **primary endosperm cell** and developed into the **endosperm**.
- * The zygote developed into an embryo.



Longitudinal section of a pistil showing growth of pollen tube

POST- FERTILIZATION : STRUCTURE AND EVENTS

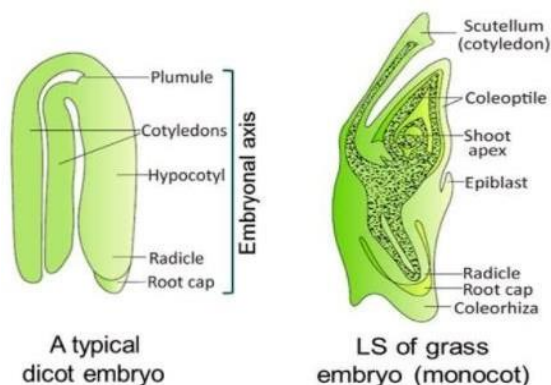
Events of endosperm and embryo development, maturation of ovule into seed and ovary into fruit, are collectively termed as **post-fertilization events**.

Endosperm:

- * Development of endosperm takes place before the embryo development.
- * Primary endosperm cell divides repeatedly to form a triploid endosperm.
- * PEN undergoes successive nuclear division to give rise to free nuclei. This is called free-nuclear endosperm.

Embryo:

- * Zygote formed and placed at the micropylar end of the embryo sac and undergoes cell division and develop into embryo.



APOMIXIS AND POLYEMBRYONY.

- Apomixis is very common in Asteraceae and grasses.
- Seeds are produced without fertilization.
- Apomixis is a type of asexual reproduction which mimics the sexual reproduction.
- Diploid egg cell is formed without meiosis and develops into seed without fertilization.
- In *Citrus* and *Mango* the nucellar cells starts dividing, protrude into the embryo sac and develop into embryo.
- Ovule having more than one embryo is termed as **polyembryony**.
- Hybrid plants are developed by apomixis to maintain the genetic identity.

CHAPTER 3

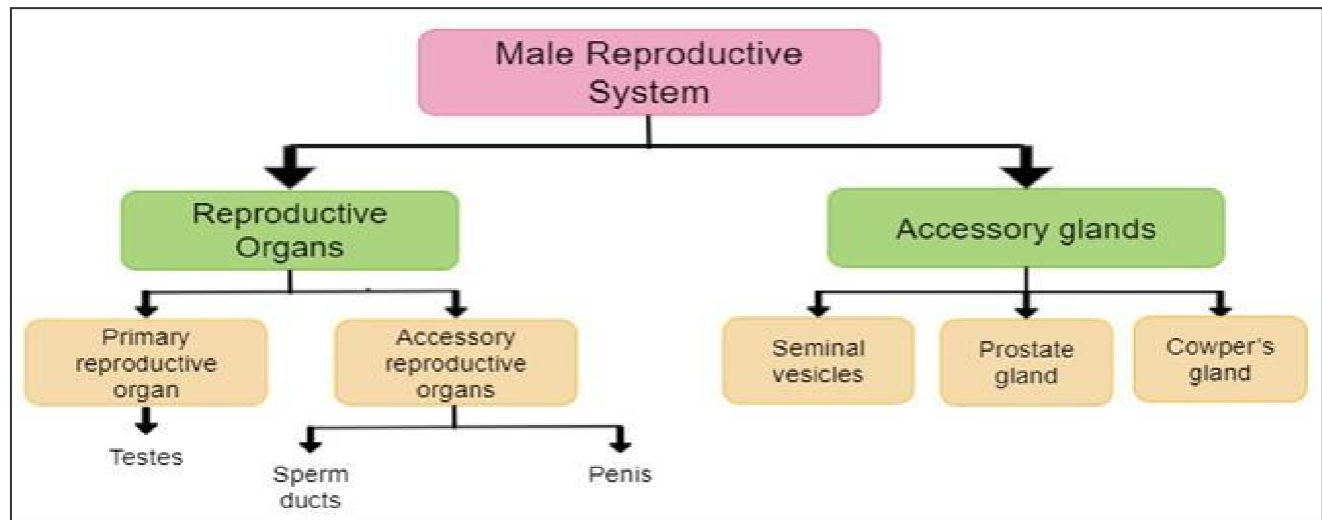
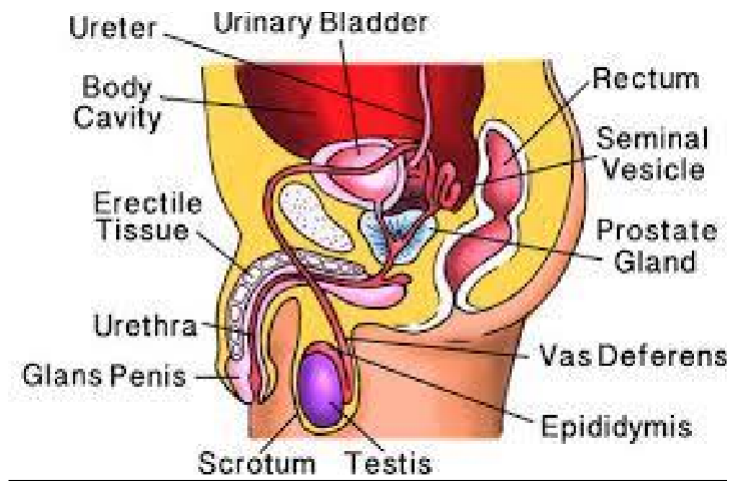
HUMAN REPRODUCTION

THE MALE REPRODUCTIVE SYSTEM.

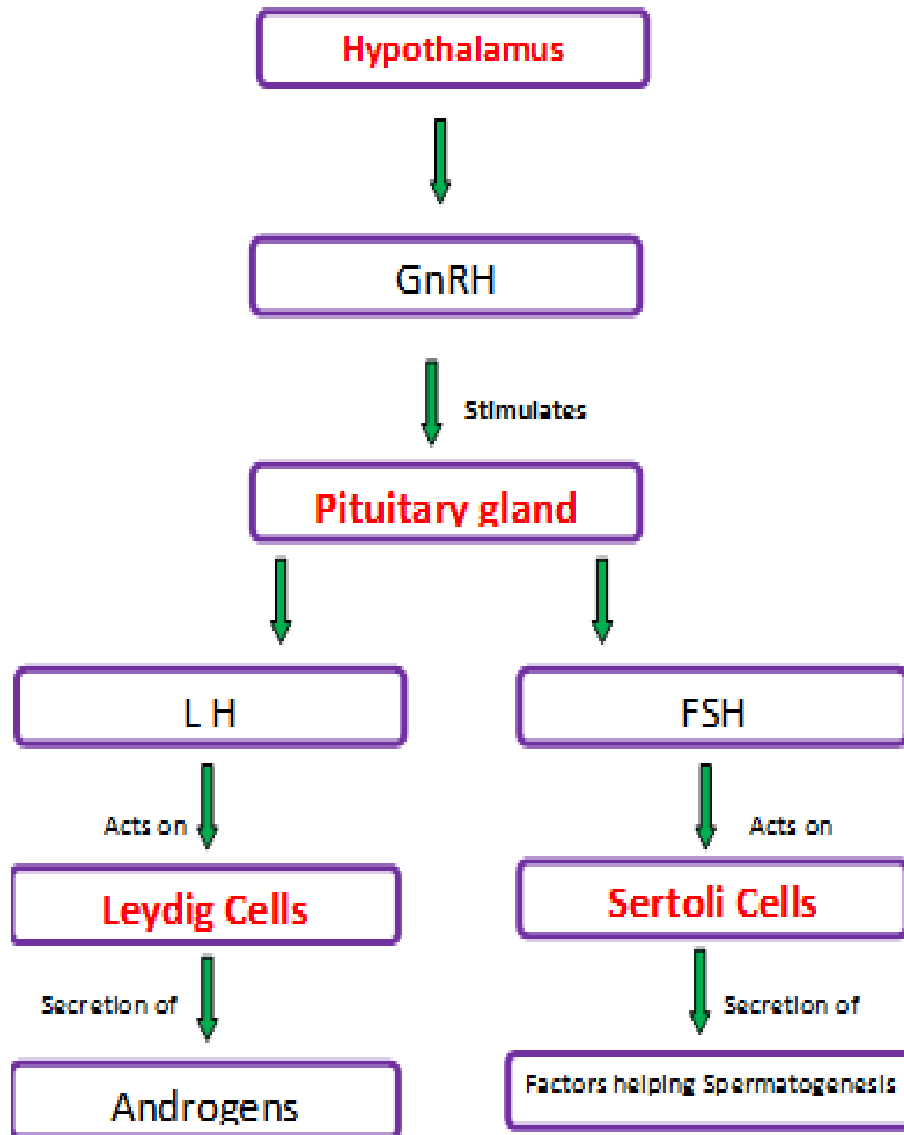
Male reproductive system includes a pair of testes, accessory ducts, accessory glands and external genitalia

Testes:

Testes is located outside the abdominal cavity within a pouch called **scrotum**. Scrotum provides **low temperature** required for spermatogenesis. Each testis has about 250 compartments called **testicular lobules**. Each lobule contains one to three seminiferous tubules. Male germ cell undergoes **meiosis** and produce **sperm**. Sertoli cells provide **nutrition** to the germ cell and the sperm. In between the seminiferous tubule there is **interstitial cell** or **Leydig cells** that produce testicular hormones called **androgen (testosterone)**.

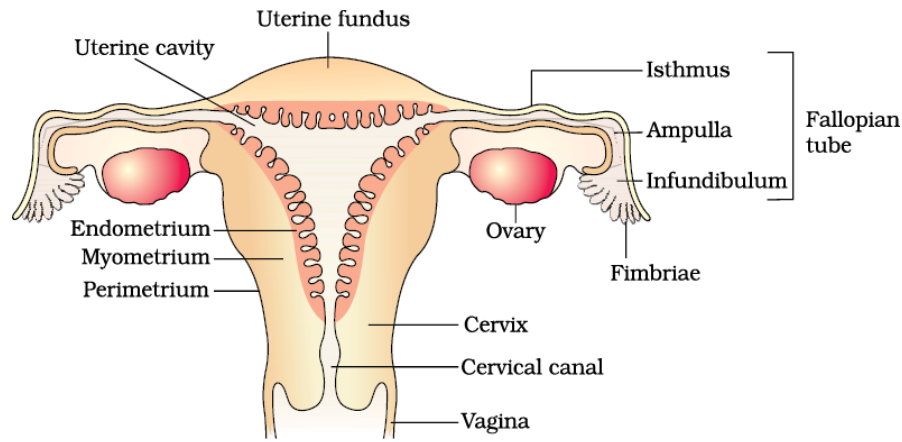


Hormones involved in the regulation of Spermatogenesis



THE FEMALE REPRODUCTIVE SYSTEM

The female reproductive system includes a **pair of ovaries**, a **pair of oviduct**, **uterus and cervix**, **vagina**, **external genitalia** and a **pair of mammary gland**.



Oviduct:

- * Oviducts, uterus and vagina constitute the female accessory ducts.
- * Each fallopian tube is about 10-12 cm long and extends from the periphery of each ovary to the uterus.
- * Close to the ovary the oviduct has a funnel shaped structure called **infundibulum**?
- * The edges of the infundibulum possess finger-like projections called **fimbriae**, which helps in collection of the ovum after ovulation.
- * The infundibulum leads to a wider part of the oviduct called **ampulla**.
- * The last part of the oviduct is called **isthmus** which joined to uterus.

Uterus:

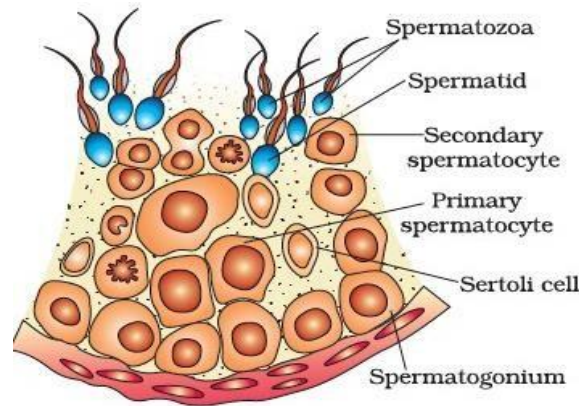
- * Attached the pelvic wall by ligaments.
- * The uterus opens into vagina through a narrow cervix.
- * The lumen of cervix is called cervical canal.
- * Cervical canal along with vagina form the birth canal.
- * The wall of the uterus has three layers of tissues **Perimetrium, Myometrium and Endometrium**.
- * Endometrium undergoes cyclical changes during menstrual cycle.
- * Myometrium exhibits strong contraction during delivery of the baby.

GAMETOGENESIS: (formation of gametes)

Spermatogenesis:

Link for Spermatogenesis:

https://drive.google.com/file/d/1fiTw5LSOkXIRu_FbodaTJIAYRrwKAs9x/view?usp=sharing



Sectional view of seminiferous tubule

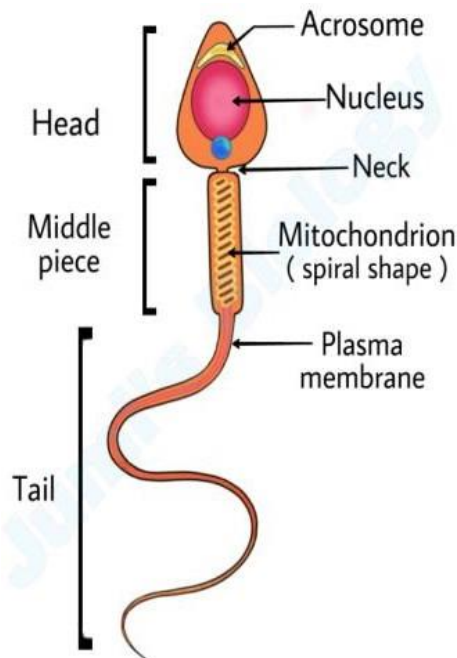
Hormonal control of spermatogenesis:

- * This process is initiated at puberty due to secretion of gonadotrophins releasing hormone (GnRH) GnRH secreted from hypothalamus and stimulates anterior pituitary to secrete two gonadotrophins. Luteinizing hormone (LH) and Follicle stimulating Hormone (FSH).
- * LH acts on Leydig cells and stimulates synthesis of androgens.
- * Androgen stimulates spermatogenesis.
- * FSH acts on Sertoli cells and stimulates spermatogenesis in other ways.

Structure of sperm:

- * Ultrastructure of sperm consists of a **head**, **neck**, a **middle piece** and a **tail**.
- * Whole body of sperm surrounded by plasma membrane.
- * The sperm head contains an elongated haploid nucleus.
- * Above the nucleus a cap-like structure is present called **acrosome**.
- * The acrosome contains **enzymes** which help in fertilization of ovum.
- * The middle piece contains **mitochondria**, which provide energy for movement of tail that facilitates sperm motility.
- * Sperm released from seminiferous tubules enters into accessory ducts.
- * On their way fluids from seminal vesicle and prostate gland are added which collectively are called as **Semen**.

Link for spermatogenesis- Video: <https://www.youtube.com/embed/6fBa8UqEano>



Structure of Sperm

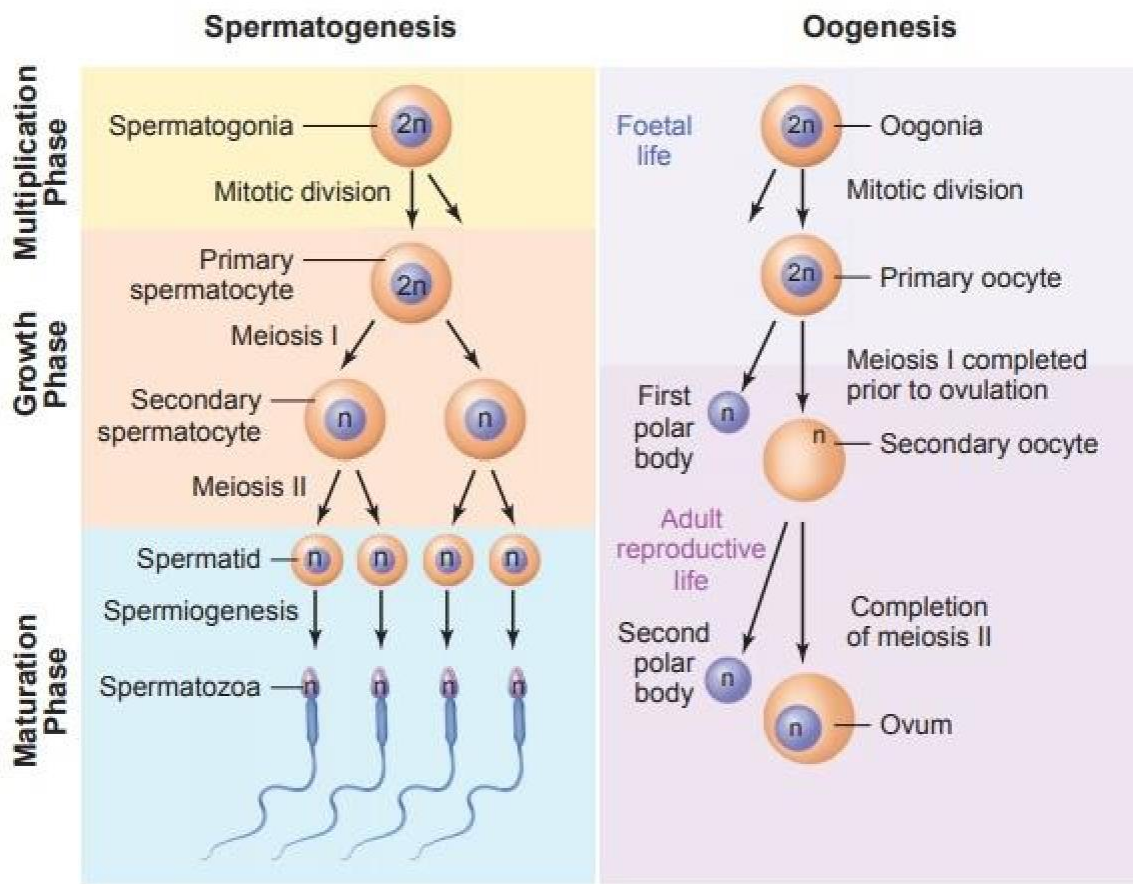
Oogenesis:

Formation of a mature female gamete or ovum is called **oogenesis**.

Link for Oogenesis:

<https://drive.google.com/file/d/14nIrhCzc8ZFALyjVcBU7YWvqggbTrSRc/view?usp=sharing>

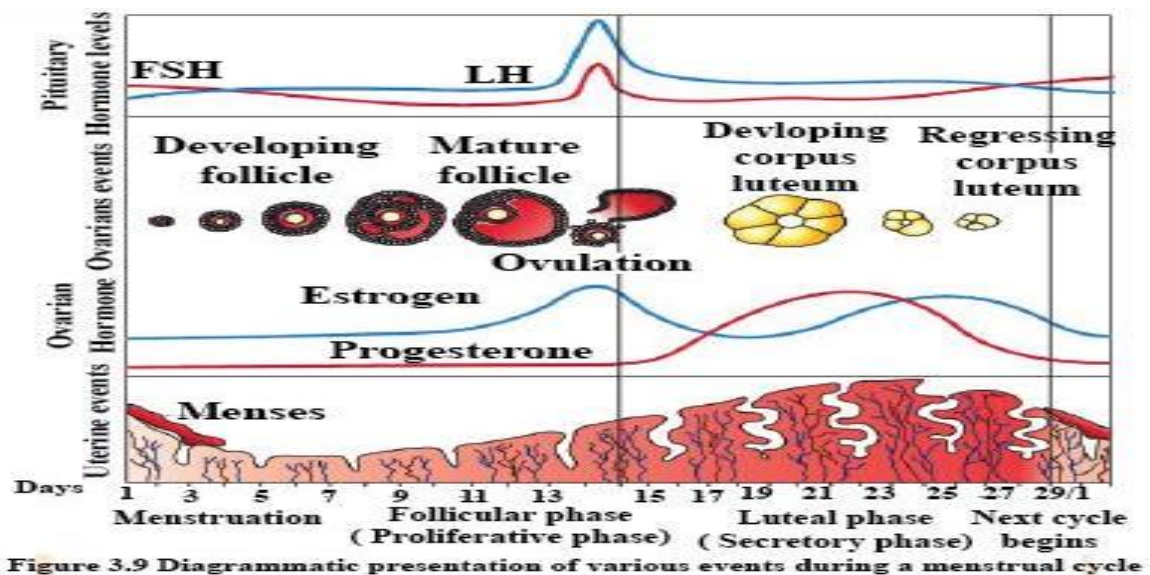
Link for oogenesis- Video: <https://www.youtube.com/embed/hKa57JPfKDE>



Gametogenesis

Menstrual cycle:

- * Reproductive cycle of female primates is called **menstrual cycle**.
- * The first menstruation begins at puberty is called **Menarche**.
- * Menstrual cycle repeated at an average interval of 28/29 days.
- * One ovum is released in the middle of each menstrual cycle.



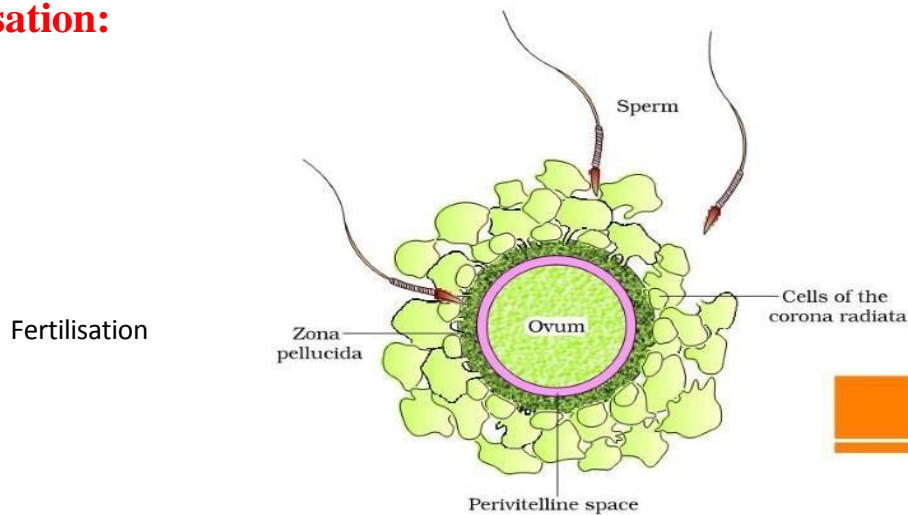
Video of Menstrual cycle

<https://www.youtube.com/embed/ZNM8KsSQerk>

Menstrual cycle has four phases:

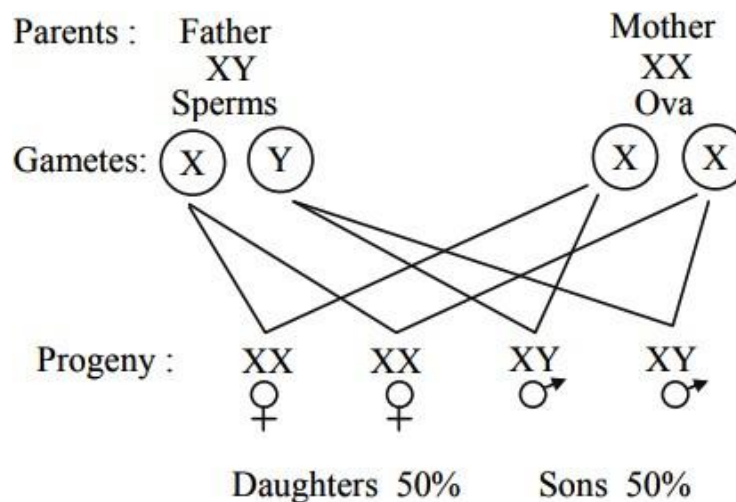
i) Menstrual phase, ii) Follicular phase, iii) Ovulatory phase and iv) Luteal phase.

Fertilisation:



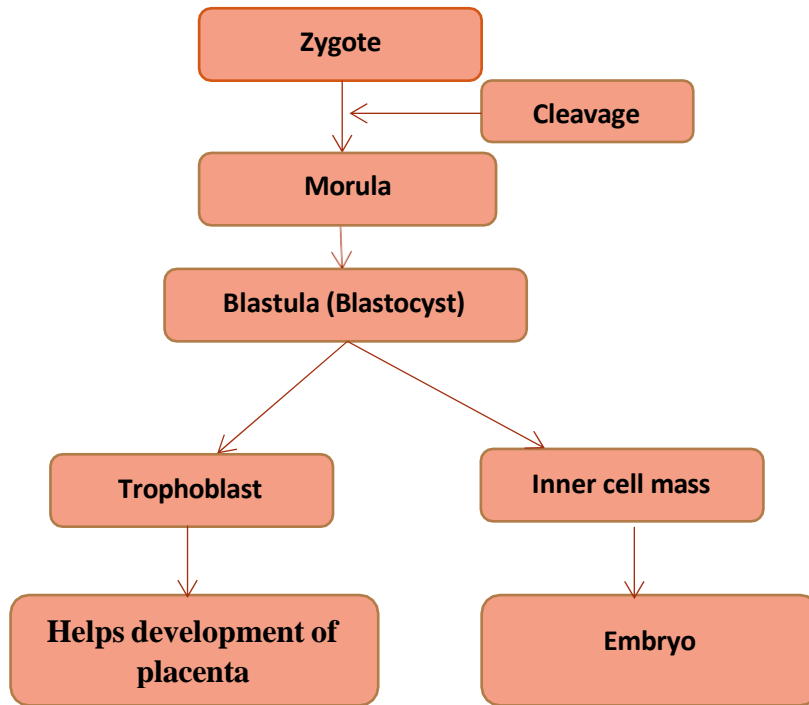
Sex determination:

- * Sex of a baby has been decided during fertilization and in the zygote.
- * Sex is determined by the sex-chromosomes present in gametes.
- * Human female contain two XX chromosomes.
- * Human male contain XY chromosomes.
- * All the female gametes produced with only 'X' chromosome.
- * Sperms produced by male, 50% with 'X' and 50% with 'Y' chromosome.
- * After fertilization zygote either carries XX or XY chromosomes.
- * Zygote with XX chromosomes develop into female and with XY chromosome develops into male.

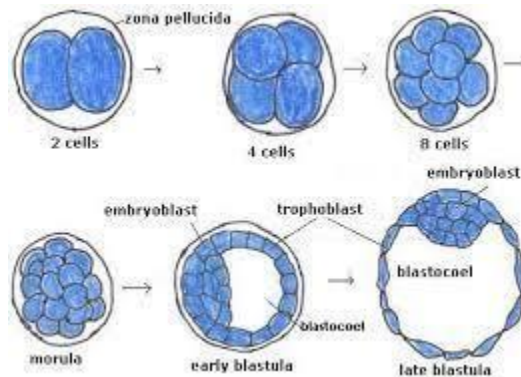


Sex determination in Human beings

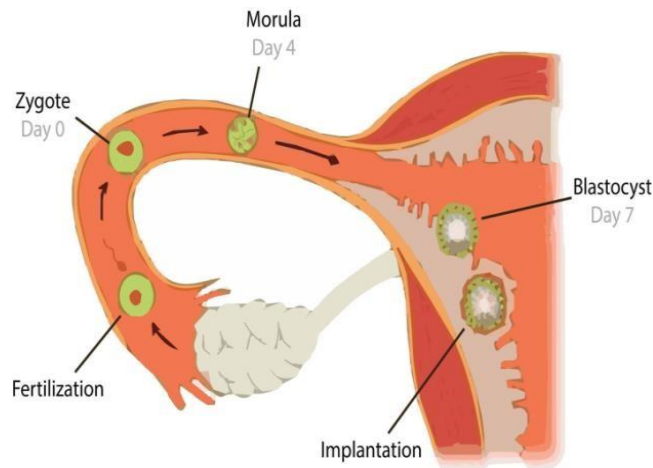
Cleavage: Repeated mitotic division of the zygote without growth resulting a multicellular ball like embryo is called **cleavage**.



Cleavage and formation of blastocyst



Implantation: The attachment of blastocyst in the uterine endometrium is called Implantation..



Pregnancy and embryonic development:

- * After implantation, finger like projections appears on the trophoblast called **chorionic villi**.
- * Chorionic villi surrounded by uterine tissue and maternal blood.
- * chorionic villi and uterine tissue become interdigitated with each other and jointly form a structural and functional unit between developing embryo (foetus) and maternal body called **placenta**.

Function of placenta:

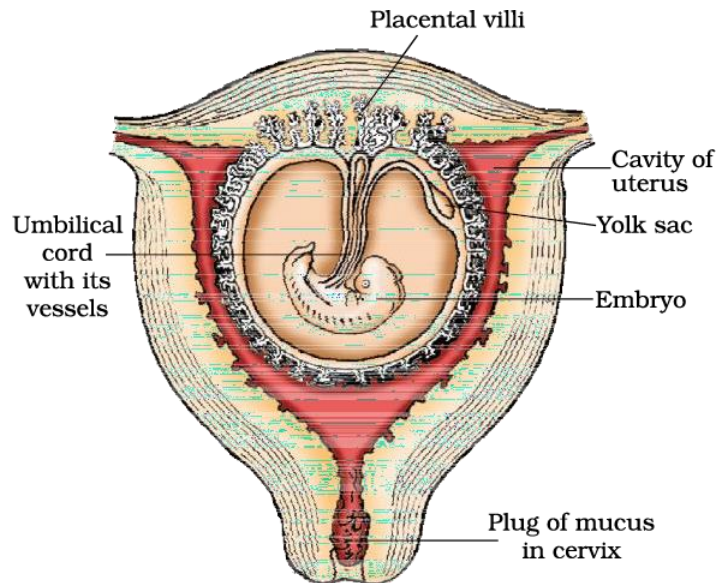
- * The embryo connected to the placenta by umbilical cord, which transports substances to and from the embryo.
- * Facilitate transport of oxygen and nutrient from mother to embryo.
- * Removes CO₂ and waste material from the embryo.
- * Acts as endocrine gland and produces several hormones like: Human chorionic gonadotrophins (hCG), Human placental lactogen (hPL), Estrogen, Progesterone and Relaxin produced from the ovary in the later stage of pregnancy.

Embryonic development:

- * After implantation the inner cell mass of blastocyst differentiated into an outer layer called **ectoderm** and an inner layer called **endoderm**.
- * **Mesoderm** differentiated in-between ectoderm and endoderm.
- * The inner cell mass thus called **stem cells**, having potency to produce all types of cell, tissues and organs by differentiation.

Organogenesis:

- * Formation of different organs in the embryo is called **organogenesis**.
- * Human pregnancy lasts for **9 months**.
- * After one month of pregnancy **heart** is formed in the embryo.
- * By the end of 2nd month the foetus develops **limbs and digits**.
- * By the end of 12 weeks (**first trimester**) most of organ system is formed (limbs and external genitalia are well developed).
- * First movement of foetus and appearance of hairs observed in 5th month.
- * By the end of 24th week (**2nd trimesters**) the body is covered with fine hairs, eye-lids separate, and eyelashes are formed.
- * By the end of 9 months the foetus is fully developed and is ready for delivery.



PARTURATION:

The period of pregnancy is called gestation period. (9 months).

- Ejection or expulsion or delivery of foetus is called **parturition**.
- Parturition is due to vigorous contraction of **uterine Myometrium**.
- The signal of parturition is originated from the fully developed foetus and the placenta which induces mild contraction of uterus called **fetal ejection reflex**.
- Fetal ejection reflex triggers the release of **Oxytocin** from pituitary.
- Oxytocin induces stronger contraction of uterine endometrium.
- Stimulatory reflex continues stronger contraction leads to expulsion.
- After delivery the placenta is also expelled out of the uterus.

CHAPTER 4

REPRODUCTIVE HEALTH

Abbreviations:

Abbreviations	Expanded form
IUCD	Intra Uterine Contraceptive Device
RCH	Reproductive and Child Health care
STD	Sexually Transmitted Disease
HIV	Human Immuno deficiency virus.
AIDS	Acquired immuno deficiency syndrome
CDRI	Central Drug Research Institute
MMR	Maternal Mortality Rate
IMR.	Infant mortality rate
MTP	Medical Termination of Pregnancy
VD	Venereal Disease
RTI	Reproductive Tract Infection
PID	Pelvic Inflammatory Disease
ART	Assisted Reproductive Technologies
IVF	In Vitro Fertilisation
ZIFT	Zygote Intra Fallopian Transfer
AI	Artificial insemination
IUI	Interna uterine insemination.

ET	Embryo transfer.
IUT	Intra uterine transfer.
ICSI	Intra Cytoplasmic Sperm Injection

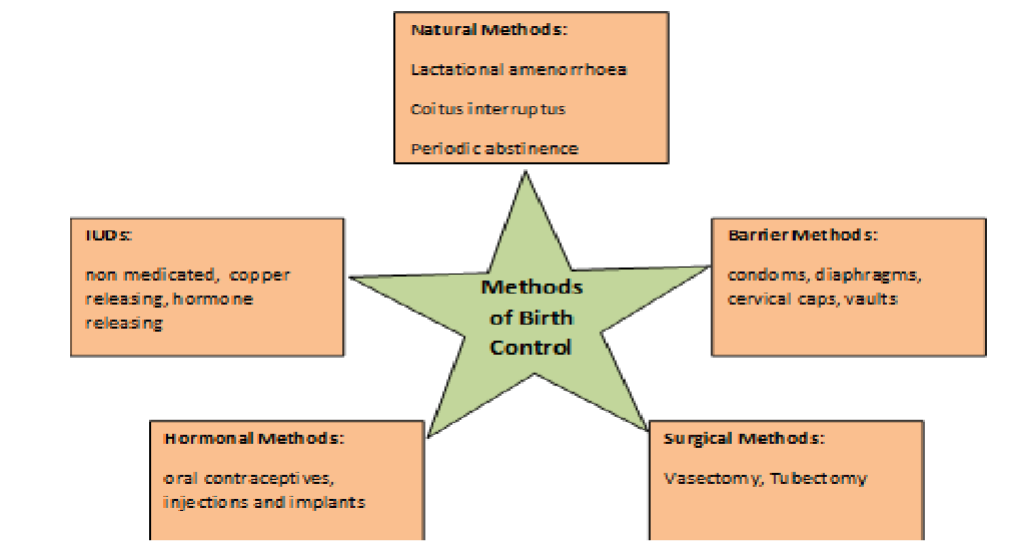
POPULATION EXPLOSION AND BIRTH CONTROL:

- * Increased health facilities, better living conditions are the cause of population explosion.
- * Out of 6 billion world population 1 billion are Indians.
- * Rapid decline in death rate, **maternal mortality rate (MMR)** and **infant mortality rate (IMR)** are major cause of population growth.
- * Indian population growth rate is around 1.7 percent.

Characteristics of ideal contraceptive.

- * User friendly.
- * Easily available.
- * Effective
- * Nor or least side – effects.
- * No way interferes with sexual drive.

BIRTH CONTROL METHODS:



Natural methods: Principle of working: Avoiding chances of ovum and sperms meeting.

i) **Periodic abstinence**

ii) **Withdrawal or coitus interruption**

iii) **Lactational amenorrhea**

Barrier methods: Principle of working: prevents physical meeting of sperm and ovum.
Condoms, Diaphragm, cervical caps and vaults.

Intra Uterine Devices: Eg. Non-medicated IUDs e.g. Lippes loop, Copper releasing IUDs (CuT, Cu7, Multiload 375), Hormone releasing IUDs (Progestasert, LNG-20).

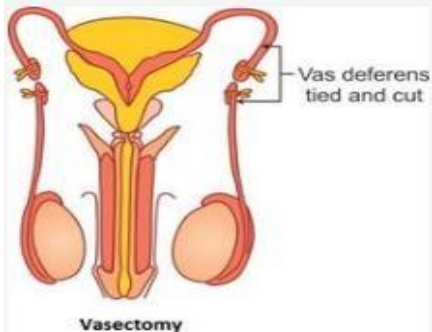
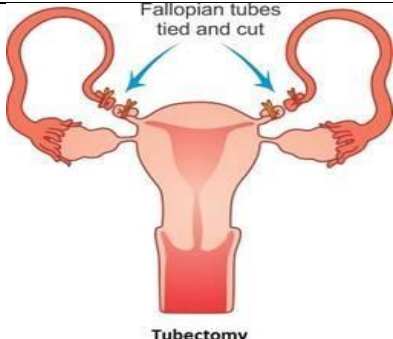
Principle of working:

- * Increase phagocytosis of sperm within the uterus.
- * Cu ion released suppresses sperm motility and fertilizing capacity of sperm.
- * Hormone releasing IUDs make the uterus unsuitable for implantation and the cervix hostile to the sperm.

Oral contraceptives: Principle of working:

- * Inhibit ovulation, Inhibit implantation.
- * Alter the quality of cervical mucus to prevent/retard entry of sperms.
- * **Saheli-** a **non steroidal** preparation used as oral contraceptive pills.

Surgical methods:

Vasectomy	Tubectomy
Sterilization process in male. A small part of the vas deferens is removed or tied up.	Sterilization process in female. A small part of the fallopian tube is removed or tied up.
	

MEDICAL TERMINATION OF PREGNANCY:

Intentional or voluntary termination of pregnancy before full term is called **medical termination of pregnancy (MTP)** or **induced abortion**.

INFERTILITY: The couple unable to produce children inspite of unprotected sex.

In case there no corrections are possible, some special technologies used to have children called **assisted reproductive technologies (ART)**.

Assisted reproductive technologies:

- (a) **In vitro fertilization:**
- (b) **Embryo transfer: ZIFT- Zygote intra fallopian transfer. IUT- Intra Uterine transfer** (embryo with more than 8 blastomeres).
- (c) **Gamete intra fallopian transfer- GIFT**
- (d) **Intra cytoplasmic sperm injection (ICSI):**
- (e) **Artificial insemination (AI)**

UNIT VII – GENETICS AND EVOLUTION

CHAPTER 5

PRINCIPLES OF INHERITANCE AND VARIATION















PRINCIPLES OF INHERITANCE AND VARIATION

- * **Genetics:** deals with the inheritance, as well as the variation of characters from parents to offsprings.
- * **Inheritance:** is the process by which characters are passed on from parent to progeny.
- * **Variation:** is the degree by which progeny differ from their parents.

MENDEL'S LAWS OF INHERITANCE:

- * Gregor Mendel. Conducted hybridization experiments on garden peas for seven years (1856 – 1863) and proposed laws of inheritance.
- * Mendel conducted artificial pollination/cross pollination experiments using several true-breeding pea lines.
- * A true breeding line is one that, having undergone continuous self-pollination for several generations.
- * Mendel selected 14 true-breeding peas' plant varieties, as pair's which were similar except for one character with contrasting traits.

True breeds selected by Mendel

Traits	Shape of seeds	Colour of seeds	Colour of pods	Shape of pods	Plant height	Position of flowers	Flower colour
Dominant trait	Round 	Yellow 	Green 	Full 	Tall 	At leaf junction 	Purple 
Recessive trait	Wrinkled 	Green 	Yellow 	Flat, constricted 	Short 	At tips of branches 	White 

Seven pairs of contrasting traits in pea plant

INHERITANCE OF ONE GENE: (Monohybrid cross)

- * Mendel crossed tall and dwarf pea plants to study the inheritance of one gene.
- * He collected the seeds produced as a result of this cross and grew them to generate plants of the first hybrid generation. This generation is called **filial progeny** or the **F₁**.
- * Mendel observed that all the F₁ progeny plants are tall, like one of its parents; none were dwarf.
- * He made similar observations for the other pairs of traits – he found that the F₁ always resembled either one of the parents, and that the trait of the other parent was not seen in them.
- * Mendel then self – pollinated the tall F₁ plants and to his surprise found that in the F₂ generation some of the offsprings were 'dwarf'; the character that was not seen in the F₁ generation was now expressed.
- * The proportion of plants that were dwarf was 1/4th of the F₂ plants while 3/4th of the F₂ plants were tall.

- * The tall and dwarf traits were identical to their parental type and did not show any **blending**, that is all the offsprings were either tall or dwarf, none were of in between height.
- * Similar results were obtained with the other traits that he studied: only one of the parental traits was expressed in the F₁ generation while at the F₂ stage both the traits were expressed in the proportion of 3:1.
- * The contrasting traits did not show any blending at either F₁ or F₂ stage.

Mendel's proposition:

- * Mendel proposed that something was being stably passed down, unchanged, from parent to offspring through the gametes, over successive generations. He called these things as '**factors**'.
- * Now a day we call them as **genes**.
- * Gene is therefore are the **units of inheritance**.
- * Genes which codes of a pair of contrasting traits are known as **alleles**, i.e. they are slightly different forms of the same gene.

Terminologies used in Genetics

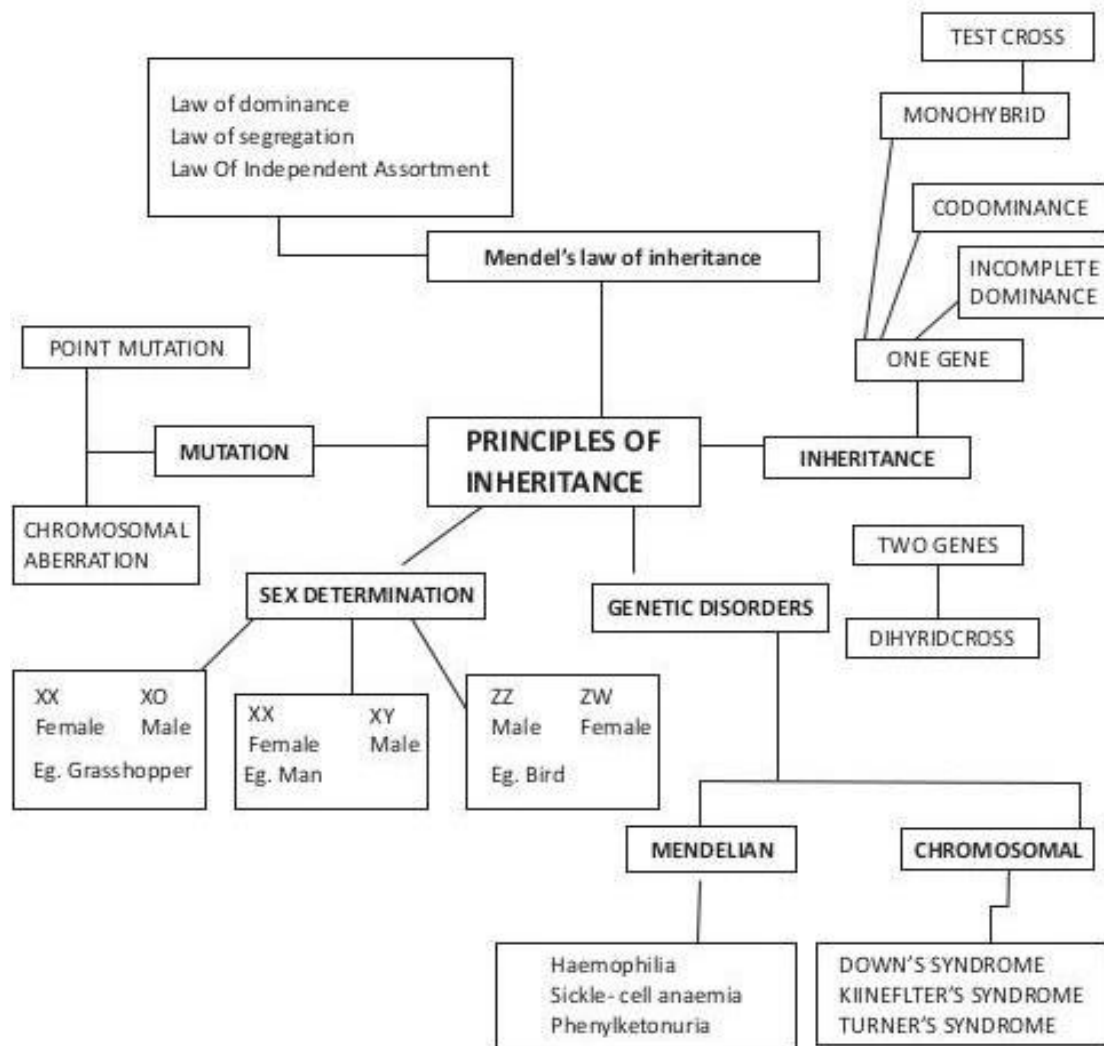
Genetic Terms	Definition	Example
Allele	Different forms of a gene, which produce variations in a genetically inherited trait.	Different alleles produce different hair colors—brown, blond, red, black, etc.
Genes	Genes are parts of DNA and carry hereditary information passed from parents to children.	Genes contain blue-print for each individual for her or his specific traits.
Dominant	Dominant version (allele) of a gene shows its specific trait even if only one parent passed the gene to the child.	When a child inherits dominant brown-hair gene form (allele) from dad, the child will have brown hair.
Recessive	Recessive gene shows its specific trait when both parents pass the gene to the child.	When a child inherits recessive blue-eye gene form (allele) from both mom and dad, the child will have blue eyes.
Homozygous	Two of the same form of a gene—one from mom and the other from dad.	Inheriting the same blue eye gene form from both parents result in a homozygous gene.
Heterozygous	Two different forms of a gene—one from mom and the other from dad are different.	Inheriting different eye color gene forms from mom and dad result in a heterozygous gene.
Genotype	Internal heredity information that contain genetic code.	Blue eye and brown eye have different genotypes—one is coded for blue and the other for brown.
Phenotype	Outwardly expressed traits or characteristics.	Both having or not having a widow's peak are phenotypes.

Mendelian Inheritance

A simple genetic rule where a gene only comes in dominant or recessive forms.

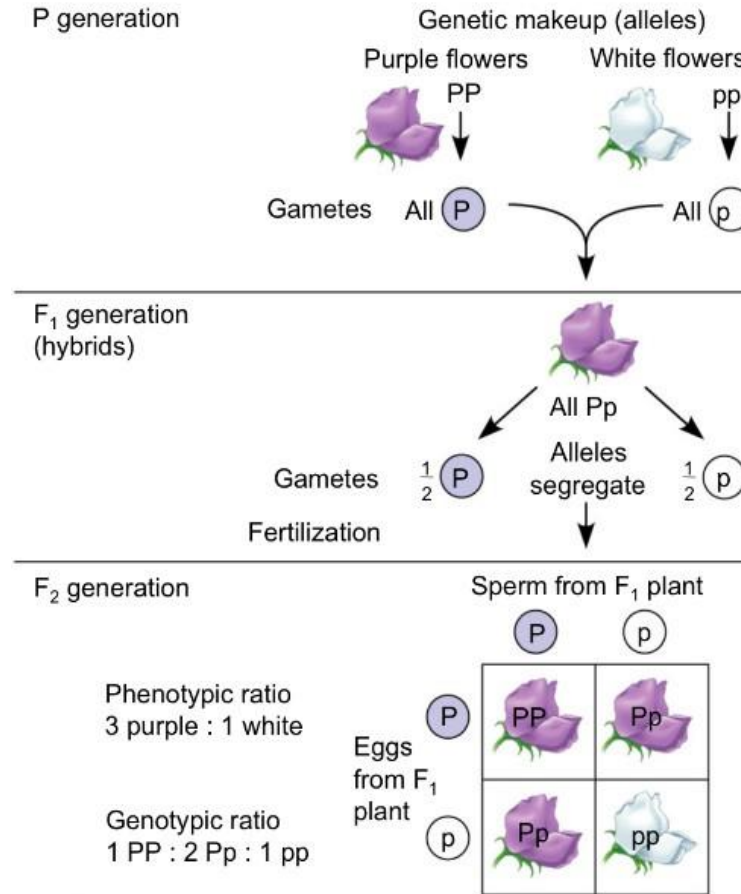
Some genetic traits follow Mendelian Inheritance, while other genetic traits follow different inheritance patterns or rules.

**CHAPTER – 5 : PRINCIPLES OF INHERITANCE AND VARIATION
(CONCEPT MAP)**



Law of Dominance:

- Characters are controlled by discrete units called factors.
- Factors occur in pairs.
- In a dissimilar pair of factors one member of the pair dominates (dominant) the other (recessive).



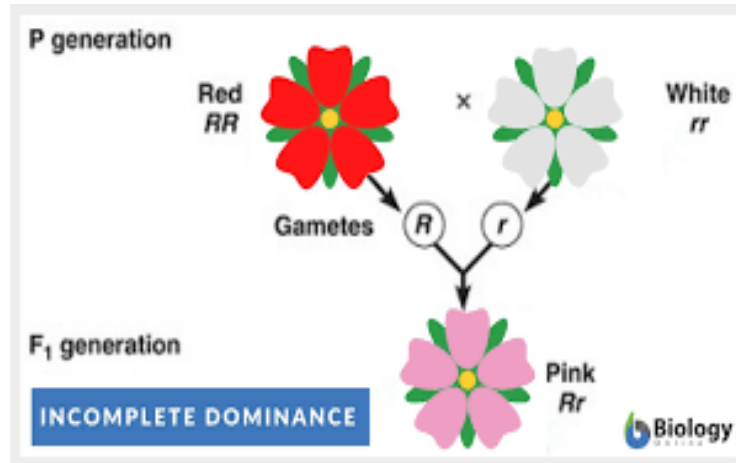
Law of Segregation:

- The alleles do not show any blending and that both the characters are recovered as such in the F₂ generation though one of these is not seen at the F₁ stage.
- The parents contain two alleles during gamete formation; the factors or alleles of a pair segregate or separate from each other such that a gamete receives only one of the two factors.
- Homozygous parent produces all gametes that are similar i.e contain same type of allele.
- Heterozygous parents' produces two kinds of gametes each having one allele with equal proportion.

Incomplete dominance:

- When a cross between two pure breed is done for one contrasting character, the F₁ hybrid phenotype does not resemble either of the two parents and was in between the two, called **incomplete dominance**.
- Inheritance of flower color in the **dog flower (snapdragon or Antirrhinum sp.)** is a good example of incomplete dominance.

- F₂ generation phenotypic ratio is 1:2:1 in stead of 3:1 as Mendelian monohybrid cross.
- Genotypic ratio of F₂ generation is 1:2:1.



For Mendel's Laws of Inheritance click the following link:

<https://www.youtube.com/embed/mD0Onu2ArGA>

For Deviations from Mendelian Laws click the link given below.

<https://drive.google.com/file/d/1OYeU7D48jbOkouen6Mc3yiNzXhB-wKVr/view?usp=sharing>

Co – dominance:

- * F₁ resembled either of the two parents (**complete dominance**).
- * F₁ offspring was in-between of two parents (**incomplete dominance**).
- * F₁ generation resembles both parents (**co-dominance**).
- * Best example of co-dominance is the ABO blood grouping in human.
- * ABO blood group is controlled by the **gene I**.
- * The plasma membrane of the RBC has sugar polymers (antigen) that protrude from its surface and the kind of sugar is controlled by the **gene-I**.
- * The gene I has three alleles I^A , I^B and i .
- * The alleles I^A and I^B produce a slightly different form of sugar while allele i doesn't produce any sugar.
- * Each person possesses any two of the three I gene alleles.
- * I^A and I^B are completely dominant over i .
- * When I^A , and I^B present together they both express their own types of sugar; this because of co-dominance. Hence red blood cells have both A and B type sugars.

Genotype	Blood type
$I^A I^A$	A
$I^A I^B$	AB
$I^A i$	A
$I^B I^B$	B
$I^B i$	B
$i i$	O

Multiple Alleles:

- * Example of ABO blood grouping produces a good example of multiple alleles.
- * There are more than two alleles. i.e. three allele governing the same character.

A single gene product may produce more than one effect:

Eg. Starch synthesis in pea seeds is controlled by one gene. It has two alleles **B** and **b**. Starch is synthesized effectively by **BB** homozygote and therefore, large starch grains are produced. The '**bb**' homozygous has less efficiency hence produce smaller grains. After maturation of the seeds, **BB seeds** are **round** and the **bb seeds** are **wrinkle**. **Heterozygous (Bb)** produce round seed and so B seems to be dominant allele, but the starch grains produced are of intermediate size. If starch grain size is considered as the phenotype, then from this angle the alleles show incomplete dominance.

INHERITANCE OF TWO GENES: (Dihybrid Cross)

Law of independent Assortment:

When two characters (dihybrid) are combined in a hybrid, segregation of one pair of traits is independent of the other pair of traits.

CHROMOSOMAL THEORY OF INHERITANCE:

- * Proposed by **Walter Sutton** and **Theodore Bovery** in 1902.
- * The behavior of chromosomes was parallel to the behavior of genes and used chromosome movement to explain Mendel's laws.
- * Sutton united the knowledge of chromosomal segregation with Mendelian principles and called it the **chromosomal theory of inheritance**.
 - Chromosome and genes are present in pairs in diploid cells.
 - Homologous chromosomes separate during gamete formation (meiosis)
 - Fertilization restores the chromosome number to diploid condition.
 - The chromosomal theory of inheritance claims that, it is the chromosomes that segregate and assort independently.

Linkage: Physical association of genes on a chromosome.

Recombination: The generation of **non-parental** gene combinations.

POLYGENIC INHERITANCE:

The inheritance one trait by three or more genes are called **polygenic inheritance**. In a polygenic trait the phenotype reflects the contribution of each allele i.e. the effect of each allele is additive.

Eg. Human skin colour.

Eg: Inheritance of Human skin colour-

Link for explanations as PPT-

<https://drive.google.com/file/d/14SqO36KUMrNZ9wX6axUvEJDs0CCMzDPO/view?usp=sharing>

Link for Video:

https://www.youtube.com/embed/yMN_wbRb38M

(Darkest) AABbcc X aabbcc (Fairest) (P)



AaBbCc (Intermediate) (F1)

AaBbCc X AaBbCc

F2



	ABC	ABc	AbC	Abc	aBC	aBc	abC	abc
ABC	AABbcc 6	AABbCc 5	AABbCC 5	AABbCc 4	AaBbcc 5	AaBbCc 4	AaBbCC 4	AaBbCc 3
ABc	AABbCc 5	AABbcc 4	AABbCc 4	AABbcc 3	AaBbCc 4	AaBbcc 3	AaBbCc 3	AaBbcc 2
AbC	AABbCC 5	AABbCc 4	AAbbCC 4	AAbbCc 3	AaBbCC 4	AaBbCc 3	AabbCC 3	AabbCc 2
Abc	AABbCc 4	AABbcc 3	AAbbCc 3	AAbbcc 2	AaBbCc 3	AaBbcc 2	AabbCc 2	Aabbcc 1
aBC	AaBbcc 5	AaBbCc 4	AaBbCC 4	AaBbCc 3	aaBbcc 4	aaBbCc 3	aaBbCC 3	aaBbCc 2
aBc	AaBbCc 4	AaBbcc 3	AaBbCc 3	AaBbcc 2	aaBbCc 3	aaBbcc 2	aaBbCC 2	aaBbCc 1
abC	AaBbCC 4	AaBbCc 3	AabbCC 3	AabbCc 2	aaBbCC 3	aaBbCc 2	aabbCc 2	aabbcc 1
abc	AaBbCc 3	AaBbcc 2	AabbCc 2	Aabbcc 1	aaBbCc 2	aaBbcc 1	aabbCc 1	aabbcc 0

PLEIOTROPY:

- * A single gene can exhibit multiple phenotypic expression, such gene is called **pleiotropic gene**.
- * The mechanism of pleiotropy in most cases is the effect of a gene on metabolic pathways which contributes towards different phenotypes.
- * **Phenylketonuria** a disease in human is an example of pleiotropy.
- * This disease is caused due to **mutation** in the gene that code for the enzyme **phenyl alanine hydroxylase**.
- * **Phenotypic expression characterized by:** Mental retardation, reduction in hairs and reduction in skin pigmentation.

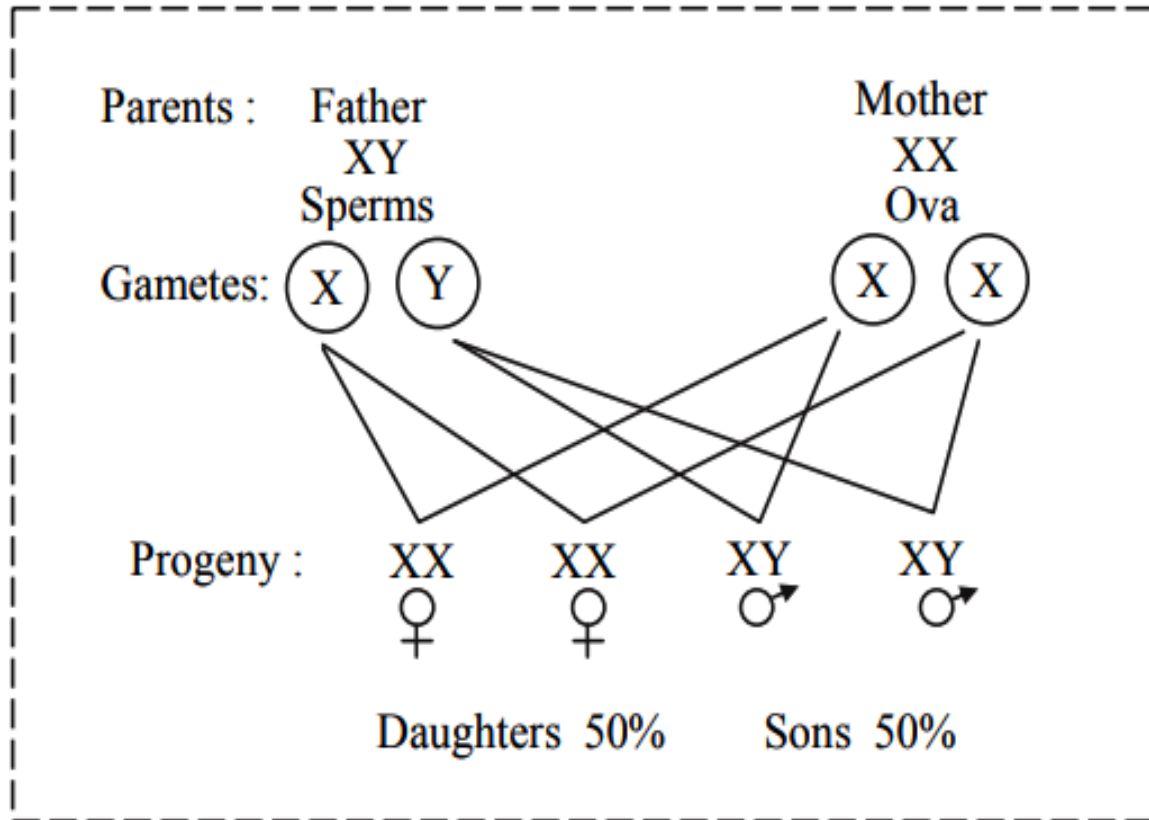
SEX DETERMINATION:

Sex-determination of grass hopper:

- * Sex-determination in grasshopper is **XX-XO type**.
- * All egg bears one 'X' chromosome along with autosomes.
- * Some sperms (50%) bear's one 'X' chromosome and 50% do not.
- * Egg fertilized with sperm (with 'X' chromosome) became female (22+XX).
- * Egg fertilized with sperm (without 'X' chromosome) became male (22 + X0)

Sex determination in Human beings (XX-XY type):

- * Both male and female have the same number of chromosomes.
- * Females have autosomes and a pair of X chromosomes. (AA+ XX)
- * Males have autosomes and one large 'X' chromosome and one very small 'Y-chromosome'. (AA+XY)
- * This is called **male heterogamety** and **female homogamety**.



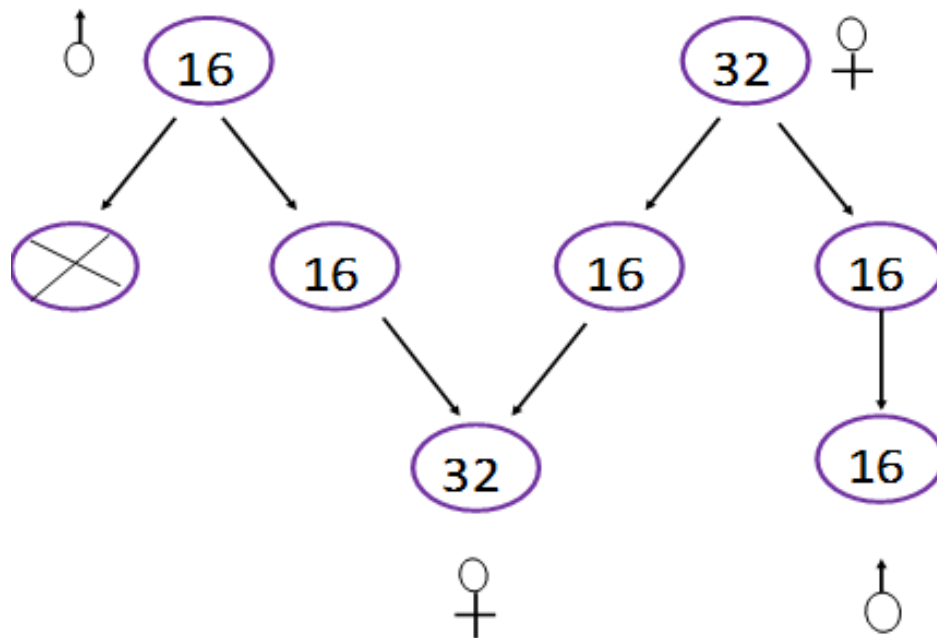
Sex determination in birds:

- * Female birds have two different sex chromosomes designated as **Z** and **W**.
- * Male birds have two similar sex chromosomes and called **ZZ**.
- * Such type of sex determination is called **female heterogamety** and **male homogamety**.

Sex determination in Honey bee:

- * Sex determination in honey bee based on the number of sets of chromosomes an individual receives.
- * An offspring formed from the fertilization of a sperm and an egg developed into either queen (female) or worker (female).
- * An unfertilized egg develops as a male (drone), by means of parthenogenesis.
- * The male have half the number of chromosome than that of female.
- * The female are diploid having 32 chromosomes and males are haploid i.e. having 16 numbers of chromosomes.
- * This is called **haplodiploid sex determination system**.
- * Male produce **sperms by mitosis**, they don't have father and thus cannot have sons, but have **grandsons**.

Sex Determination in Honey Bee



Pedigree Analysis:

- Analysis of traits in several of generations of a family is called the **pedigree analysis**.
- In the pedigree analysis the inheritance of a particular trait is represented in the family tree over generations.

GENETIC DISORDERS:

Hemophilia:

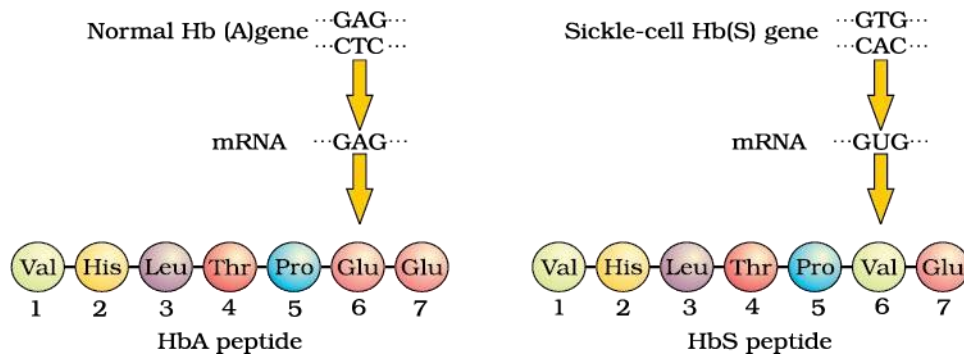
In this disease a single protein that is a part of the cascade of proteins involved in the clotting of blood is affected. Due to this in an affected individual a simple cut will result in non-stop bleeding.

- * Sex linked recessive disease.
- * The diseases transmitted from unaffected carrier female to some of the male progeny.
- * Female becoming hemophilic is extremely rare because mother of such a female at least carrier and the father should be hemophilic.
- * Affected transmits the disease only to the son not to the daughter.
- * Daughter can receive the disease from both mother and father.

Sickle cell anaemia:

- * This is an autosomes linked recessive trait.
- * The defect is caused due to substitution of Glutamic acid (Glu) by Valine (Val) at the sixth position of the beta globin chain of the haemoglobin molecule.
- * Substitution of amino acid takes place due to the single base substitution at the sixth codon of the beta globin gene from GAG to GUG.

- * Transmitted from parents to the offspring when both the parents are carrier for the gene (heterozygous).
- * This disease is controlled by single pair of allele, HbA, and HbS.
- * There are three possible genotypes (HbA HbA, HbA HbS, and HbSHbS).
- * Only homozygous individuals for HbS (HbS HbS) show the diseased phenotype.
- * Heterozygous (HbA HbS) individuals appear unaffected but they are carrier of the disease as there is 50 percent probability of transmission of the mutant gene to the progeny.



Phenylketonuria:

- * Autosomal recessive trait.
- * Inborn error of metabolism.
- * The affected individual lack one enzyme called phenyl alanine hydroxylase that converts the amino acid phenyl alanine to tyrosine.
- * In the absence of the enzyme phenyl alanine accumulated and converted into phenylpyruvic acid and other derivatives.
- * Accumulation of these results in mental retardation.
- * These derivatives excreted through kidney.

Chromosomal disorders:

- * Caused due to absence or excess or abnormal arrangement of one or more chromosome.
- * Failure of segregation of chromatids during cell division cycle results in the gain or loss of chromosome(s), called **Aneuploidy**.
- * Failure of cytokinesis after telophase stage of cell division results in an increase in a whole set of chromosome in an organism and this phenomenon is called **polyploidy**.

Trisomy: additional copy of a chromosome may be included in an individual ($2n+1$).

Monosomy: an individual may lack one of any one pair of chromosomes ($2n-1$)

Down syndrome:

- * Caused due to presence of an additional copy of the chromosome number **21 (trisomy of 21)**.
- * This disorder was first described by **Langdon Down (1866)**.
 - o Short stature with small round head.
 - o Furrowed tongue

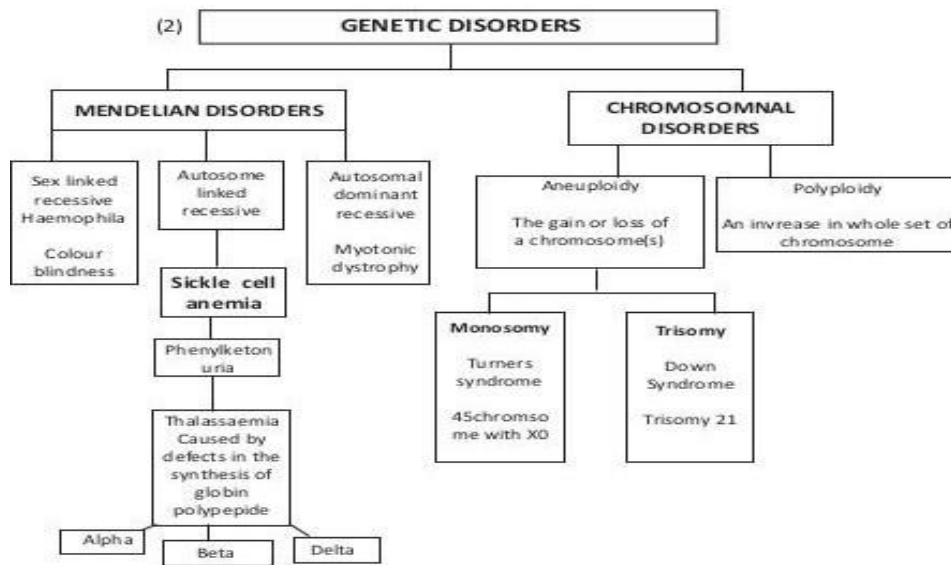
- Partially opened mouth
- Palm is broad with characteristic palm crease.
- Physical, psychomotor and mental development is retarded.

Klinefelter's syndrome:

- * Caused due to the presence of an additional copy of X-chromosome resulting into a karyotype of 47, (44+XXY).
- Overall masculine development.
- Also develop feminine character (development of breast i.e. Gynaecomastia)
- Individuals are sterile.

Turner's syndrome:

- * Caused due to the absence of one of the X- chromosomes i.e. **45 (44 + X0)**
- * Such females are sterile as ovaries are rudimentary.
- * Lack of other secondary sexual characters.

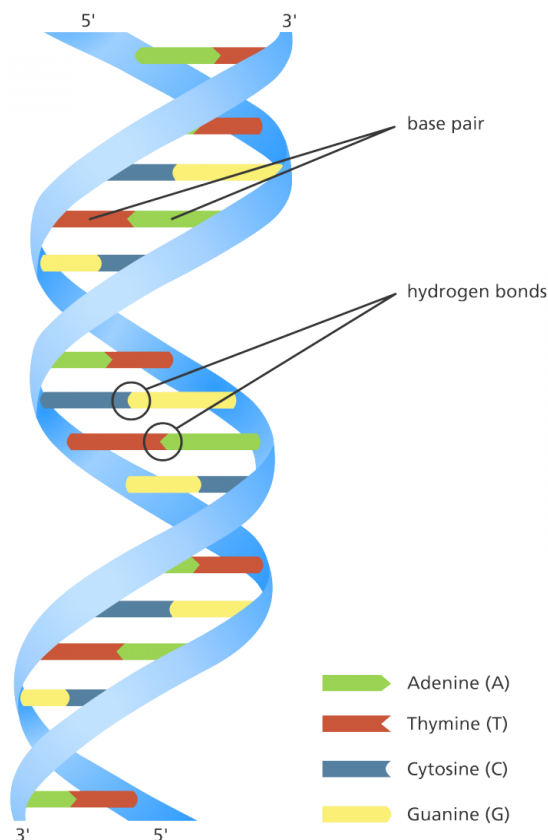


CHAPTER – 6

MOLECULAR BASIS OF INHERITANCE

THE DNA:

- DNA is a long polymer of deoxyribonucleotides.
- The length of the DNA depends on, number of nucleotide pair present in it.
- Characteristics of the organism depend on the length of the DNA.

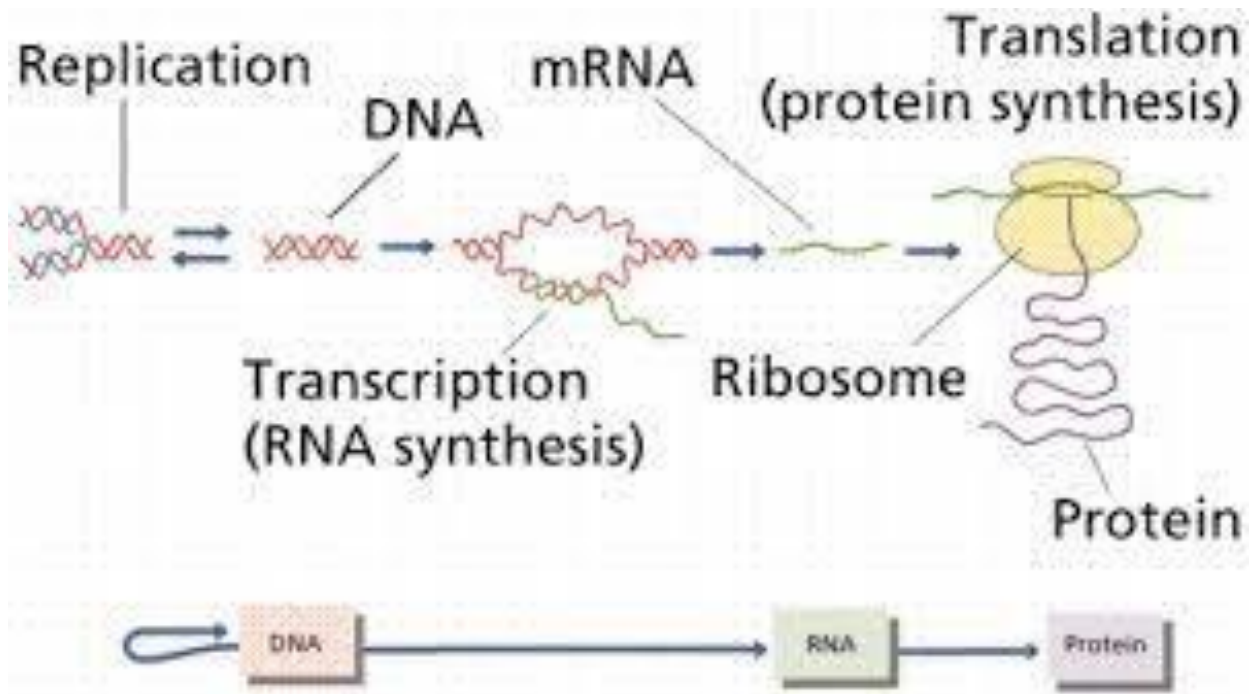
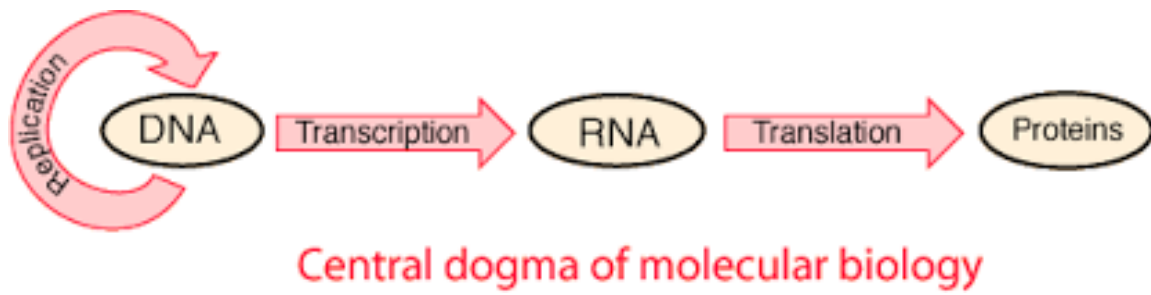


Structure of polynucleotide chain:

- * A nucleotide has three component:-
 - i) A nitrogen base
 - ii) A pentose sugar (ribose in RNA and deoxyribose in DNA)
 - ii) A phosphoric acid.
- * There are two types of nitrogen bases:
 - i) **Purines** (Adenine and Guanine)
 - ii) **Pyrimidines** (Cytosine, Uracil and Thymine)
- * Adenine, Guanine and Cytosine is common in RNA and DNA.
- * Uracil is present in RNA and Thymine is present in DNA in place of Uracil.
- * Pentose sugar is **ribose** in RNA and **Deoxyribose** in DNA.
- * A nitrogen base attached to the pentose sugar at C¹ of pentose sugar by **N-glycosidic** linkage to form a nucleoside.
- * Phosphoric acid attached to the nucleoside by **Phosphodiester linkage** a corresponding nucleotide is formed. (Ribonucleotide or deoxyribonucleotides depending on the sugar unit).

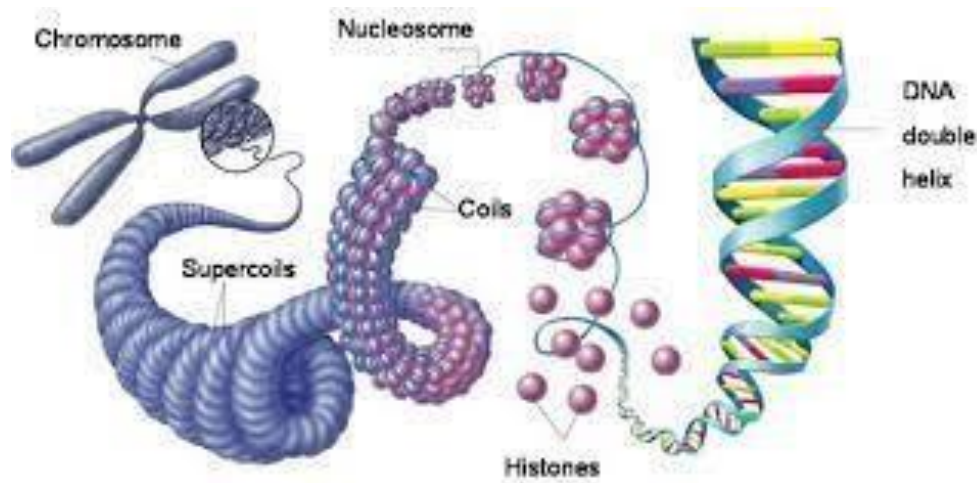
- * Two nucleotides are joined by 3'-5' Phosphodiester linkage to form dinucleotide.
- * More than two nucleotides joined to form polynucleotide chain.
- * The backbone of the polynucleotide chain is sugar and phosphate.
- * Nitrogen bases linked to the sugar (ribose or deoxyribose)
- * In RNA Uracil is found in place of thymine.

Central dogma of Molecular Biolog: Flow of genetic information.



Packaging of DNA Helix:

Distance between two conjugative base pairs is 0.34nm, the length of the DNA in a typical mammalian cell will be 6.6×10^9 bp $\times 0.34 \times 10^{-9}$ /bp, it comes about 2.2 meters.



Packaging in prokaryotes:

- * They do not have definite nucleus.
- * The DNA is not scattered throughout the cell.
- * DNA is held together with some proteins in a region is called 'nucleoid'.

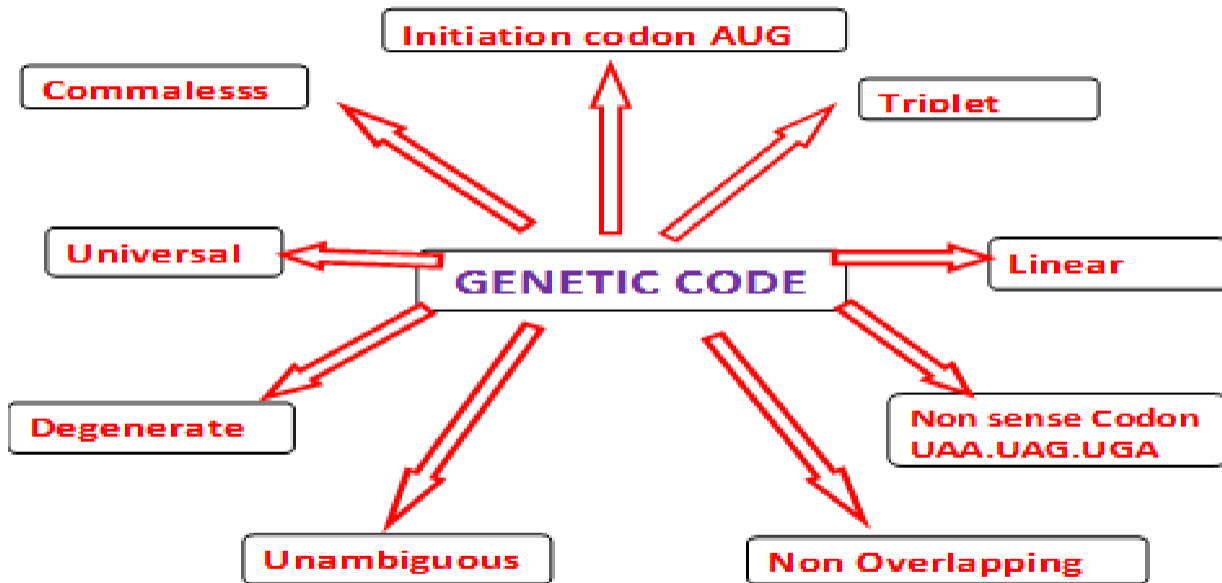
The DNA in nucleoid is organized in large loops held by proteins.

Packaging in Eukaryotes:

- * There is a set of positively charged, basic protein called **Histones**.
- * Histones are positively charged due to rich in basic amino acids like **Lysines** and **arginines**.
- * Histones are organized to form a unit of eight molecules called **histone octamer**.
- * Negatively charged DNA wrapped around positively charged histone octamer to form a structure called **nucleosome**.
- * The nucleosomes are seen as '**beads-on-string**' structure when viewed under electron microscope.
- * The chromatin is packaged to form **chromatin fibers** that are further coiled and condensed at metaphase stage to form **chromosome**.
- * Packaging at higher level required additional set of proteins called **Non-histone Chromosomal (NHC) proteins**.
- * In a typical nucleus some loosely coiled regions of chromatin (light stained) is called **euchromatin**.
- * The chromatin that more densely packed and stains dark are called **Heterochromatin**.
- * Euchromatin is **transcriptionally active** chromatin and heterochromatin is inactive.

GENETIC CODE- Salient Features:

CONCEPT MAP OF GENETIC CODE

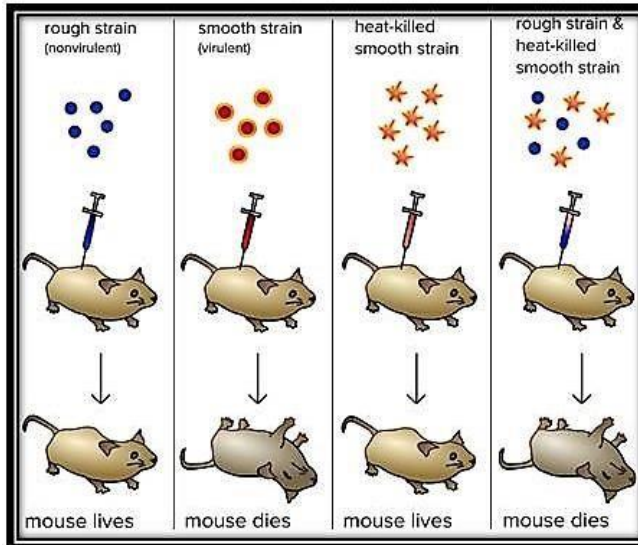


THE SEARCH OF GENETIC MATERIAL:

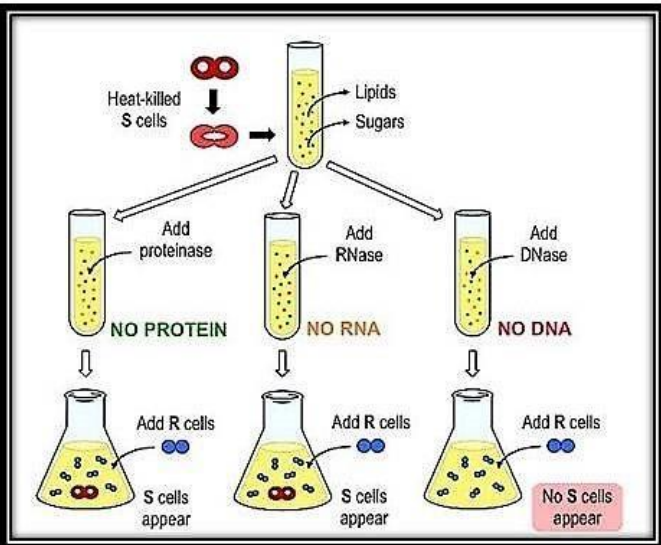
Transforming principle:

Experiment:

- * Given by **Frederick Griffith** in 1928.
- * His experiment based on *Streptococcus pneumoniae* (caused pneumonia).
- * There is change in physical form of bacteria.
- * There are two colonies of bacteria:
 - * Smooth shiny colonies called **S strain**.
 - * Rough colonies called **R strain**.



GRRIFITH'S EXPERIMENT



OSWALD AVERY'S EXPERIMENT

Conclusion of experiment:

- * R – Strain bacteria had some how been **transformed** by the heat killed S-Strain bacteria.
- * Some '**transforming principle**', transferred from heat killed S-Strain bacteria, had enabled the R-Strain to synthesize smooth polysaccharide coat and become virulent (S Strain).
- * The transformation of R-Strain to S-Strain is due to transfer of **Genetic material**.
- * However the biochemical nature of genetic material was not defined from his experiment.
- * Protein of heat killed S-Strain is not the genetic material
- * RNA of heat killed S-Strain is not the genetic material.
- * DNA of heat killed S-Strain is the genetic material, because DNA digested with DNase mixed with R-strain unable to transform R-Strain to S-Strain.

Biochemical characterization of transforming principle:

- * Biochemical nature of transforming principle was discovered by **Oswald Avery, Colin Macleod and Maclyn McCarty**. (1933-44)
- * They purified biomolecules (proteins, DNA and RNA) from the heat killed S cells to see which one could transform live R cells to S cells.
- * Heat killed S-Strain + protease + Live R-Strain → transformation.
- * Heat killed S-Strain + RNase + Live R-Strain → transformation.
- * Heat killed S-Strain + DNase + Live R-Strain → transformation.

The Genetic Material is DNA:

- * 'DNA is the genetic material' is proved by **Alfred Hershey and Martha Chase** (1952).
- * They worked on the virus that infects bacteria called **bacteriophage**.
- * During normal infection the bacteriophage first attaches the bacteria cell wall and then inserts its genetic material into the bacterial cell.
- * The viral genetic material became integral part of the bacterial genome and subsequently manufactures more virus particle using host machinery.
- * Hershey and Chase worked to discover whether it was protein or DNA from the viruses that entered the bacteria.

Experiment : (Blenders experiment)

- * They grew some viruses on a medium having **radioactive phosphorus** and some others on medium having **radioactive sulfur**.

- * Viruses grown in **radioactive Phosphorus** have **radioactive DNA** but not radioactive protein because Phosphorus present in DNA not in protein.
- * Viruses grown in **radioactive sulfur** have **radioactive protein** not radioactive DNA because sulfur present in protein but not in DNA.
- * **Infection:** radioactive phages were allowed to attach to E.coli bacteria; the phages transfer the genetic material to the bacteria.
- * **Blending:** the viral coats were separated from the bacteria surface by agitating them in a blender.
- * **Centrifugation:** The virus particles were separated from the bacteria by spinning them in a centrifuge machine.

Observation:

- * Bacteria infected with viruses that had radioactive DNA were radioactive and no radioactivity in the supernatant.
- * Bacteria infected with viruses that had radioactive protein were not radioactive, but radioactivity found in the supernatant.

Conclusion of Experiment:

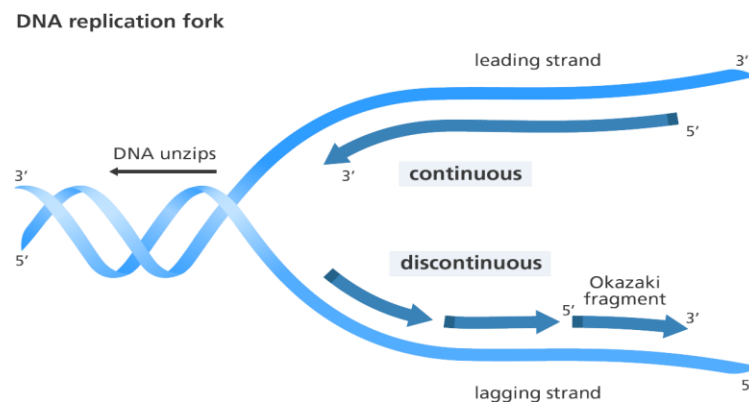
- * **DNA is the infecting agent that made the bacteria radioactive hence DNA is the genetic material not the protein.**

Harshey and chase Experiment: Link for the video

<https://www.youtube.com/embed/i4511RsIGwM>

REPLICATION: THE PROCESS:

- * **Watson and Crick** proposed a scheme for replication of DNA.
- * The Original statement that “It has not escaped our notice that the specific pairing we have postulated immediately suggests a possible copying mechanism for the genetic material (Watson and Crick, 1953)
- * The scheme suggested that the two strands would separate and act as template for the synthesis of new complementary strands.
- * New DNA molecule must have one parental strand and one new strand.
- * This scheme of replication is called **Semiconservative** type of replication.



Experimental Proof of semiconservative nature of replication:

- * It is now proved experimentally that replication is semiconservative type.
- * It was first shown in *Escherichia coli* and subsequently in higher organism.
- * **Mathew Messelson** and **Franklin Stahl** performed the following experiment in 1958.

Link for Semiconservative mode of DNA replication video:

<https://www.youtube.com/embed/4gdWOWjioBE>

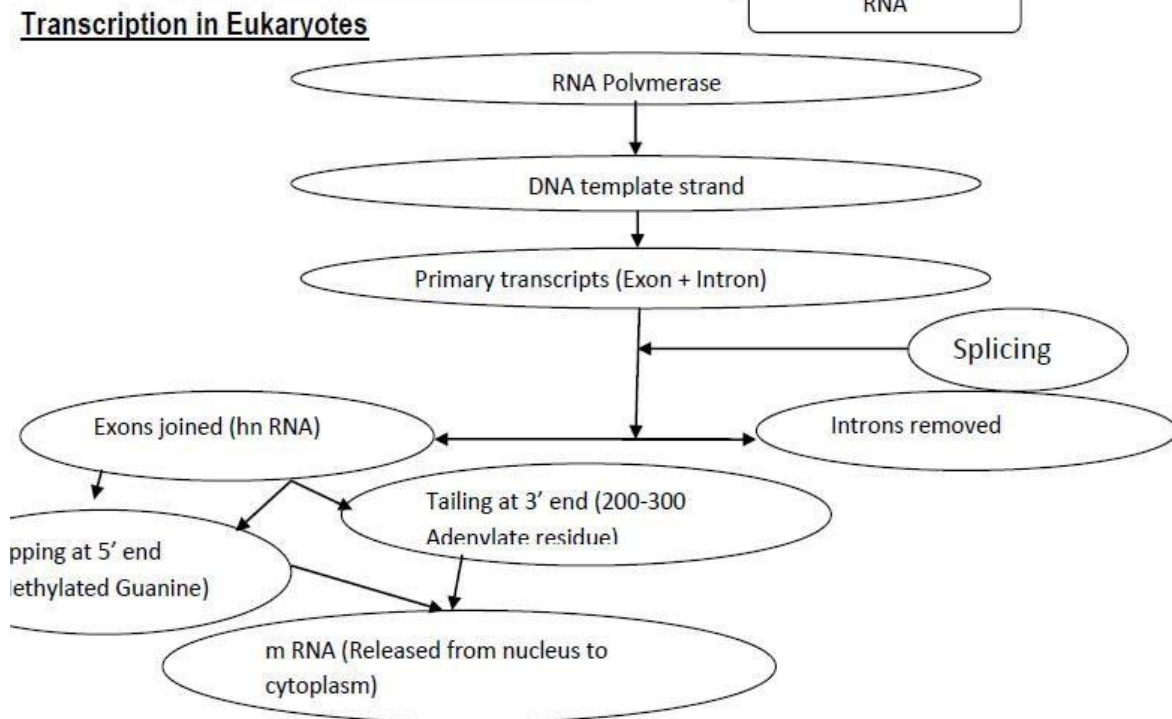
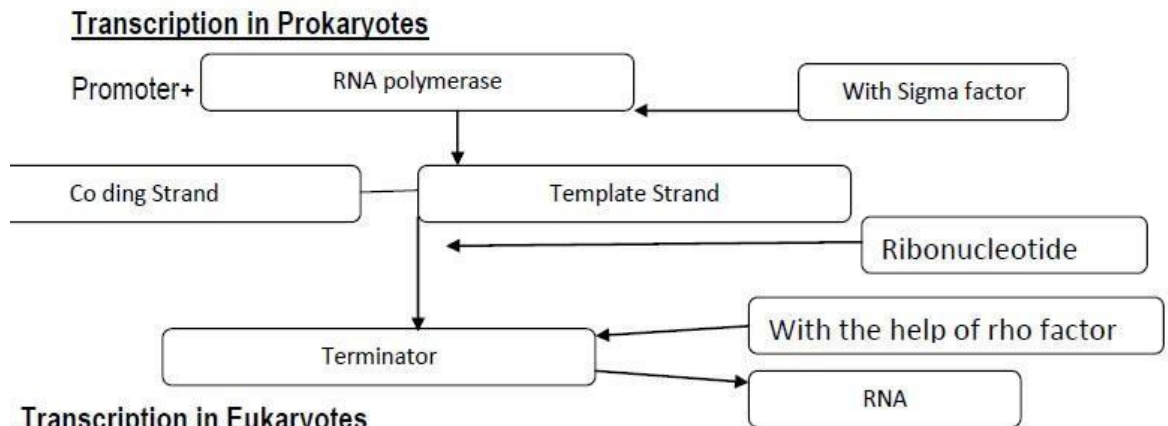
STEPS OF THE EXPERIMENTS:

- * They grew *E.coli* in $^{15}\text{NH}_4\text{Cl}$ medium for many generations. (^{15}N is heavy nitrogen not radioactive element)
- * The result was that ^{15}N was incorporated into newly synthesized DNA and other nitrogen containing compound as well.
- * This heavy DNA molecule could be distinguished from normal DNA by centrifugation in a cesium chloride (CsCl) density gradient.
- * Then they transferred the *E.coli* into a medium with normal $^{14}\text{NH}_4\text{Cl}$ and let them grow. (*E.coli* divides in 20 minutes)
- * They took samples at definite time intervals as the cells multiplied, and extracted the DNA that remained as double-stranded helices.
- * Various samples were separated independently on **CsCl gradients** to measure the densities of DNA.
- * The DNA that was extracted from the culture one generation after the transfer from ^{15}N to ^{14}N medium had a **hybrid** or **intermediate density**.
- * DNA extracted from the culture after another generation (after 40 min.) was composed of equal amount of this hybrid DNA and of 'light' DNA.

Experiment by Taylor and colleagues:

- * Used **radioactive thymidine** to detect distribution of newly synthesized DNA in the chromosomes.
- * They performed the experiment on *Vicia faba* (faba beans) in 1958.
- * They proved the semiconservative nature of DNA replication in eukaryotes.

TRANSCRIPTION:



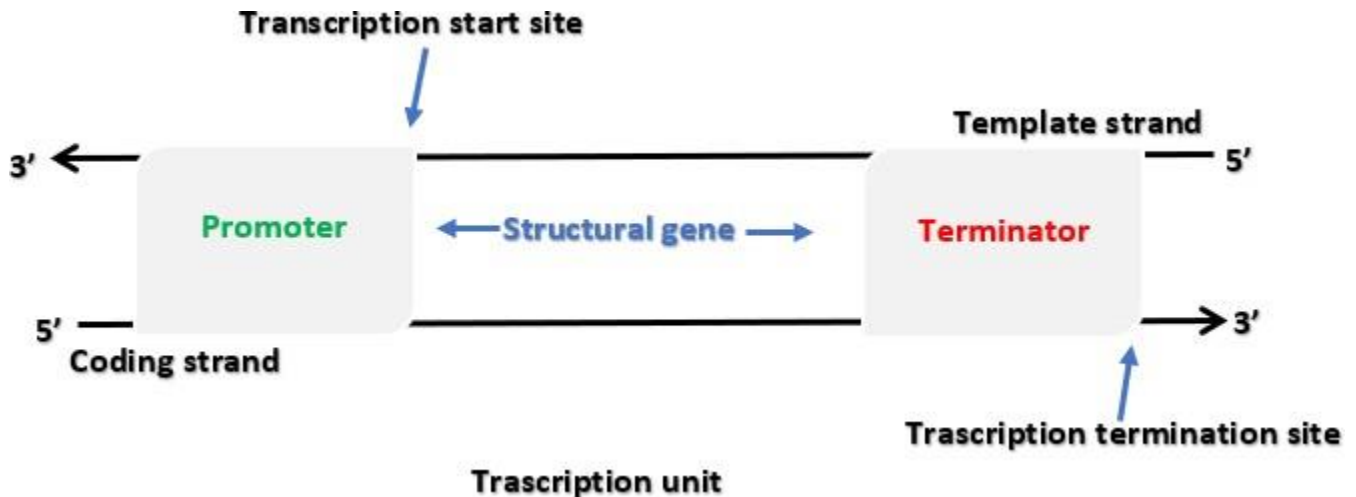
‘The process of copying genetic information from one strand of the DNA into RNA is termed as transcription’.

Transcription vs. Replication:

- * Principle of **complementarity** governs the process of transcription except Adenosine of DNA forms base pair with the **Uracil** instead of thymine. During replication Adenine pairs with **thymine** instead of uracil.
- * During replication once started the **whole DNA** is duplicated, where as transcription takes place only **a segment of DNA**.
- * In replication **both strand** acts as template, where as in transcription only **one strand** is acts as template to synthesize RNA.
- * In replication **DNA copied** from a DNA, where as in transcription **RNA copied** from the DNA.
- * Only one strand is acting as template for transcription. If both strand of DNA acts as template, they would code for RNA molecule with different sequences and in turn if they code for proteins, the sequence of amino acids in the protein would be different. Hence one segment of DNA would be coding for two different proteins.
- * The two RNA molecules if produced from simultaneously would be complementary to each other, hence will form double stranded RNA. This would prevent RNA translation into protein.

Transcription unit:

- * A transcription unit in DNA consists of three regions:
- * A promoter
- * The structural gene
- * A terminator.
- * **DNA dependent RNA polymerase** catalyses the polymerization in only one direction that is $5' \rightarrow 3'$.



Process of transcription: prokaryotes.

There is a single **DNA dependent RNA polymerase** that catalyses transcription or synthesis of all three types of RNAs in prokaryotes. The process of transcription completed in three steps:

Initiation, Elongation and Termination.

There are **three** different types of RNA polymerases in eukaryotes.

- i) **RNA polymerase I** transcribes **rRNA (28S, 18S, and 5.8S)**
- ii) **RNA polymerase II** transcribes **heterogeneous nuclear RNA (hnRNA)**.
- iii) **RNA polymerase III** transcribes **tRNA, 5srRNA and snRNA**.

- **Post transcriptional processing: (occurs inside the nucleus)**

(a) Splicing:

Primary transcript (**hn RNA**) consists of both **exons** (coding) and **introns** (non coding) and required to be processed before translation. Therefore the introns are removed and exons are joined in a defined order. This process is called splicing. This is catalyzed by **SnRNP**, introns removed as **spliceosome**.

(b) **Capping:** An unusual nucleotide called **methyl guanosine triphosphate** is added to the 5' end of hnRNA.

(c) **Tailing:** Adenylate residues (200-300) are added at 3' end of hnRNA in a template independent manner. The processed hnRNA is now called mRNA and transported out of the nucleus for translation.

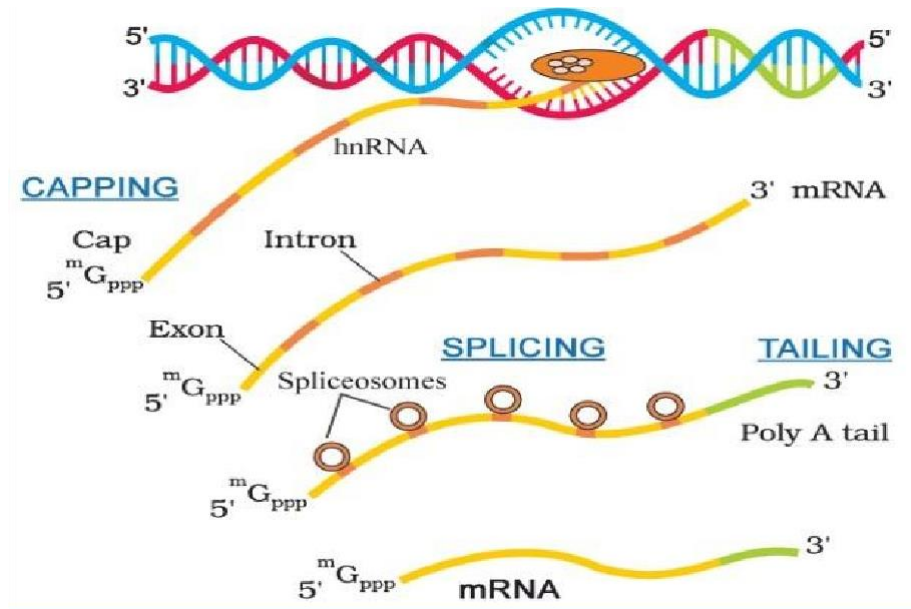


Fig. Transcription in eukaryotes

tRNA-the Adaptor molecule:

- * The tRNA is called sRNA (soluble RNA)
- * It acts as an adapter molecule.
- * tRNA has an **anticodon loop** that base complementary to the codon.
- * It has an **amino acid acceptor end** to which it binds with amino acid.
- * Each tRNA bind with specific amino acid i.e 61 types of tRNA found.
- * One specific tRNA with anticodon UAC called **initiator tRNA**.
- * **There is no tRNA for stop codons. (UAA, UGA, UAG)**
- * The secondary structure is like clover-leaf.
- * The actual structure of tRNA is compact, looks like inverted 'L'.

Link for Transcription, Translation - From DNA to Protein- Video

<https://www.youtube.com/embed/gG7uCskUOrA>

Link for PPT- From DNA to Protein-

https://docs.google.com/presentation/d/19-d119DvY1VE5q0rjDVPDSR7uvWeK3n9/edit?usp=share_link&ouid=107171444976724466844&rtpof=true&sd=true

TRANSLATION:

- * It refers to polymerization of amino acids to form a polypeptide.
- * The number and sequence of amino acids are defined by the sequence of bases in the mRNA.
- * The amino acids are joined by **peptide bond**.
- * Amino acids are activated in the presence of ATP and linked to their specific tRNA is called **charging of tRNA** or **aminoacylation of tRNA**.
- * Ribosome is the cellular factory for protein synthesis.
- * Ribosome consists of structural rRNA and 80 different proteins.
- * In inactive state ribosome(70S) present in two subunits:-
- * Large sub unit 50S and small sub unit 30S

Initiation:

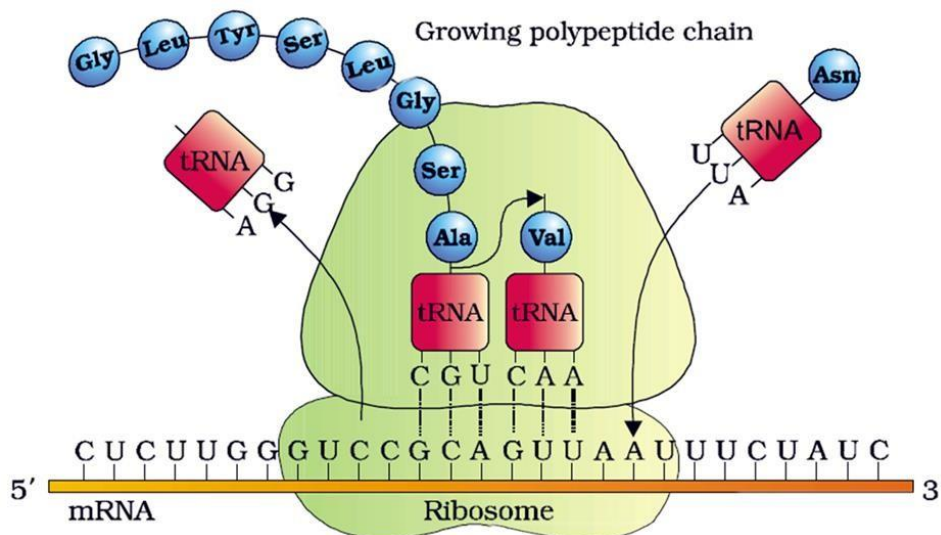
- The process of translation or protein synthesis begins with attachment of mRNA with small subunit of ribosome.
- The ribosome binds to the mRNA at the start codon (AUG).
- AUG is recognized by the initiator tRNA.

Elongation:

- Larger subunit attached with the initiation complex.
- Larger subunit has two site 'A' site and 'P' site.
- Initiator tRNA accommodated in 'P' site of large subunit, the subsequent amino-acyl-tRNA enters into the 'A' site.
- The subsequent tRNA selected according to the codon of the mRNA.
- Codon of mRNA and anticodon of tRNA are complementary to each other.
- Formation of peptide bond between two amino acids of 'P' and 'A' site, catalyzed by **ribozyme**, (23S rRNA in bacteria)
- The ribosome moves from codon to codon along the mRNA called **translocation**.

Termination:

- Elongation continues until a stop codon arrives at 'P' site.
- There is no tRNA for stop codon.
- A **release factor** binds to the stop codon.
- Further shifting of ribosome leads to separation of polypeptide.
- An mRNA also has some additional sequences that are not translated called **untranslated regions (UTR)**.



Link for Transcription, Translation - From DNA to Protein- Video

<https://www.youtube.com/embed/gG7uCskUOrA>

Link for PPT- From DNA to Protein-

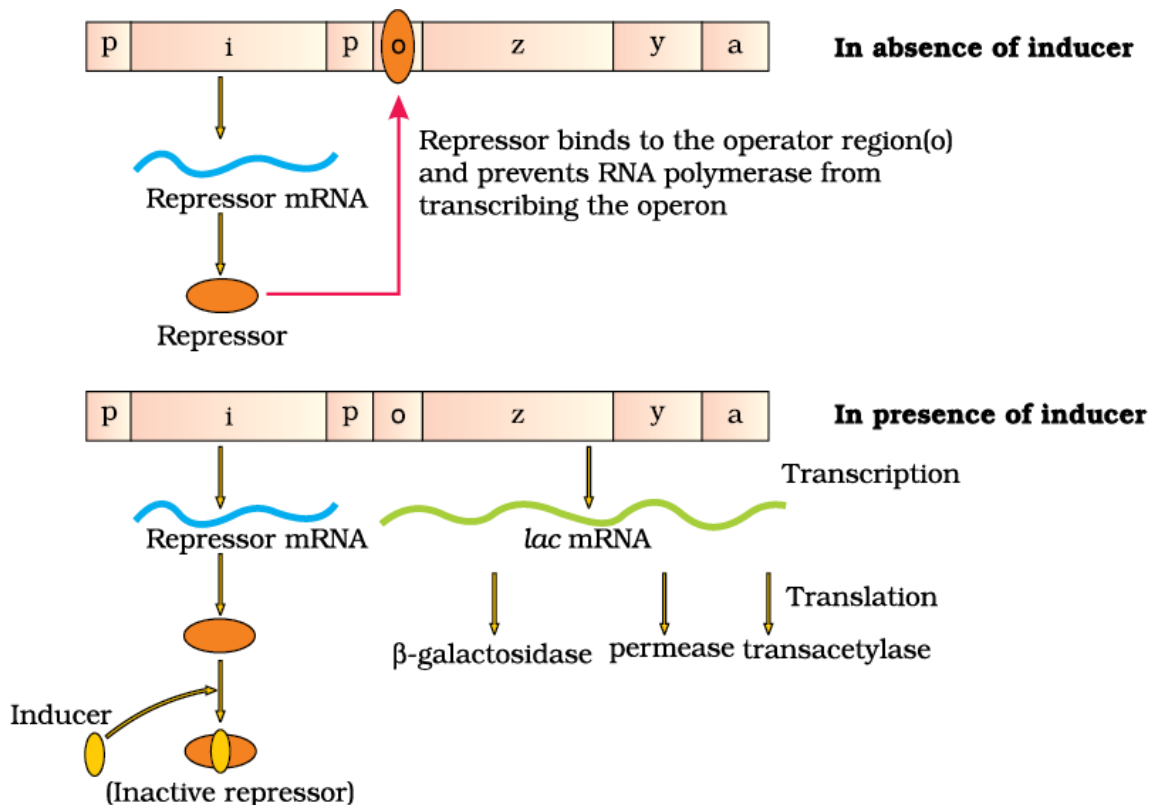
https://docs.google.com/presentation/d/19-d1I9DyY1VE5q0rjDVPDSR7uvWeK3n9/edit?usp=share_link&ouid=107171444976724466844&rtpof=true&sd=true

REGULATION OF GENE EXPRESSION:

- Regulation of gene expression in eukaryotes takes place in different level:
- Transcriptional level (formation of primary transcript)
- Processing level (regulation of splicing)
- Transport of mRNA from nucleus to the cytoplasm.
- Translational level.
- In prokaryotes control of rate of transcriptional initiation is the predominant site for control of gene expression.
- The activity of RNA polymerase at the promoter is regulated by accessory proteins, which affects its ability to recognize the start site.
- The regulatory proteins can acts both positively (activators) or negatively (repressor)
- The regulatory proteins interact with specific region of DNA called **operator**, which regulate the accessibility of RNA polymerase to promoter.

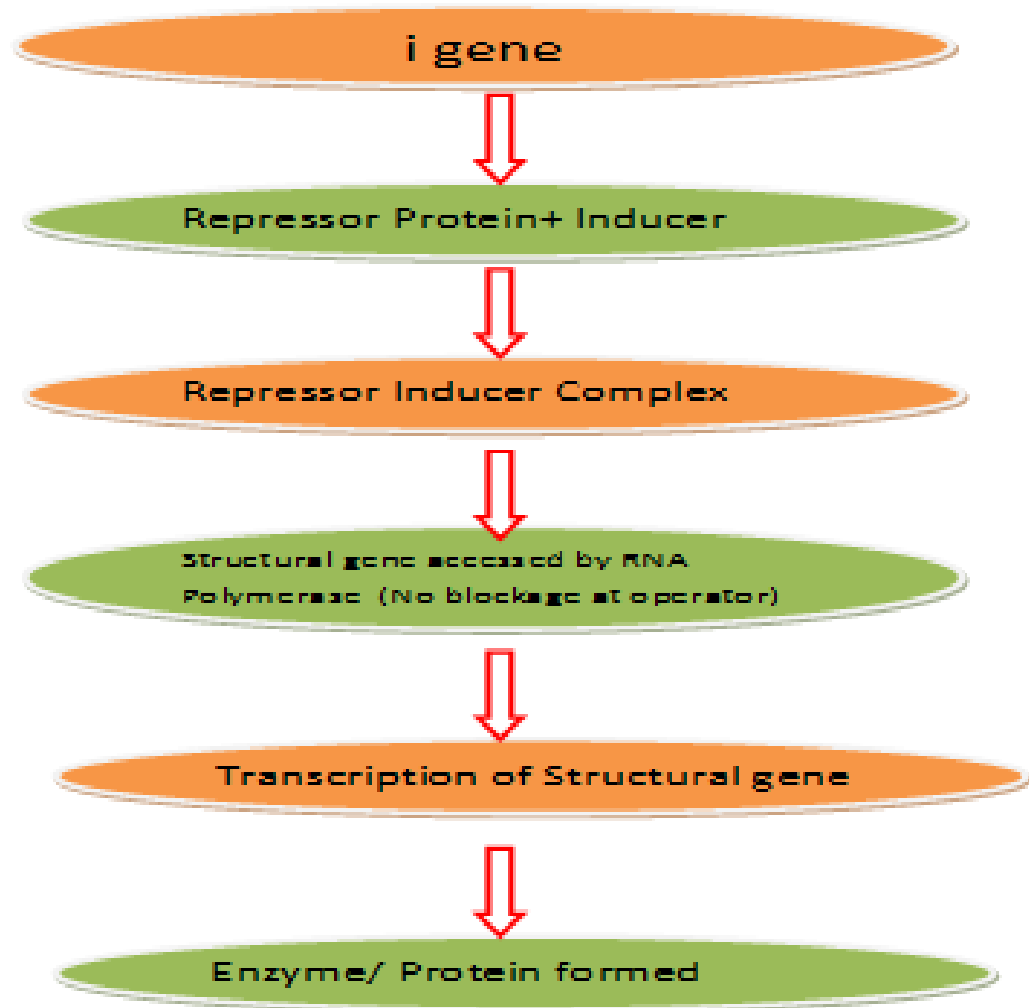
Lac operon:

- **Francois Jacob and Jacque Monod** first to describe a transcriptionally regulated system of gene expression.
- A polycistronic structural gene is regulated by common promoter and regulatory genes. Such regulation system is common in bacteria and is called **operon**.
- Lac operon consists of:-
 - One regulator gene (i-gene)
 - Three structural genes (z,y,a)
 - Operator. (binding site of repressor protein)
 - Promoter.(binding site of the RNA polymerase)



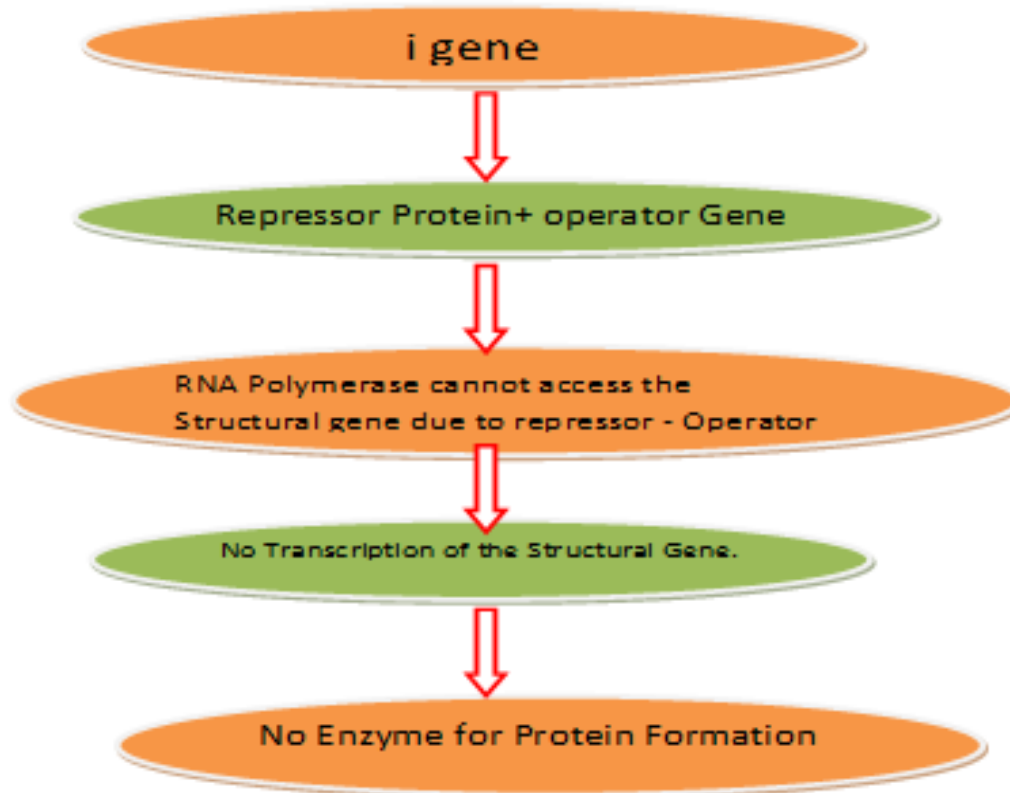
CONCEPT MAP OF LAC OPERON

SWITCH ON CONDITION



CONCEPT MAP OF LAC OPERON

SWITCH OFF CONDITION



HUMAN GENOMIC PROJECT:

- Genetic make-up of an organism or an individual lies in the DNA sequences.
- Two individual differs in their DNA sequences at least in some places.
- Finding out the complete DNA sequence of human genome.
- Sequencing human genome was launched in 1990.

Goals of HGP:

- Identify all the approximately 20,000 – 25,000 genes in human DNA.
- Determine the sequence of all 3 billion chemical base pairs.
- Store this information in data bases.
- Improve tools for data analysis.
- Transfer related technologies to other sectors, such as industries.

Address the ethical, legal, and social issues (ELSI) that may arise from the project.

Methodology:

- To identify all the genes that expressed as RNA referred as **Expressed Sequence Tags (ESTs)**.
- Simply sequencing the whole set of genome that contained all the coding and non-coding sequence, and later assigning different regions in the sequence with functions called **Sequence Annotation**.

- The commonly used hosts for sequencing were bacteria and yeast and vectors were called as **BAC** (bacterial artificial chromosome) and **YAC** (yeast artificial chromosome).

DNA FINGER PRINTING:

- DNA finger printing is a very quick way to compare the DNA sequences of any two individuals.
- DNA fingerprinting involves **identifying differences in some specific regions in DNA** called **repetitive DNA**, because in these sequences, a small stretch of DNA is repeated many times.
- During centrifugation the bulk DNA forms major peak and the other **small peaks** are called **satellite DNA**.
- Depending on base composition (A:T rich or G:C rich), length of segment, and number of repetitive units, the satellite DNA classified into many types, such as mini –satellite and micro – satellite.
- These sequences dose not code for any proteins.
- These sequences show high degree of polymorphism and form basis of DNA fingerprinting.
- Polymorphism in DNA sequence is the basis of genetic mapping of human genome as well as of DNA fingerprinting.
- **Polymorphism** (variation at genetic level) arises due to mutations.
- If an inheritable mutation is observed in a population at high frequency it is referred as **DNA polymorphism**.

The process:

- DNA fingerprinting was initially developed by **Alec Jeffreys**.
- He used satellite DNA as the basis of DNA fingerprinting that shows very high degree of polymorphism. It was called as **Variable Number Tandem Repeats.(VNTR)**
- **Different steps of DNA fingerprinting are:-**
 - **Isolation of DNA.**
 - **Digestion of DNA by restriction endonucleases.**
 - **Separation of DNA fragments by gel electrophoresis.**
 - **Transferring (blotting) of separated DNA fragments to synthetic membranes, such as nitrocellulose or nylon.**
 - **Double stranded DNA made single stranded.**
 - **Hybridization using labeled VNTR probe.**
 - **Detection of hybridized DNA fragments by autoradiography.**
- The VNTR belongs to a class of satellite DNA referred to as mini-satellite.
- The size of VNTR varies from 0.1 to 20 kb.
- After hybridization with VNTR probe the autoradiogram gives many bands of different sizes. These bands give a characteristic pattern for an individual DNA. It differs from individual to individual.
- The DNA from a single cell is enough to perform DNA fingerprinting.

Applications:

- Test of paternity.
- Identify the criminals.
- Population diversity determination.
- Determination of genetic diversity.

Chapter 7- EVOLUTION

Evolution is a process that results in heritable changes in population spread over many generations leading to diversity of organisms on earth.

ORIGIN OF LIFE:

The Big Bang theory:

The Big Bang theory states that a huge explosion occurred, the universe expanded, temperature came down and hydrogen and helium were formed later. The galaxies were then formed due to condensation of gases under gravitation. A singular huge explosion unimaginable in physical term. In the solar system of the Milky Way galaxy, earth was supposed to have been formed about 4.5 billion years back.

Conditions prevailed in the primitive atmosphere:

- * There was no atmosphere on primitive earth.
- * Water vapor, methane, carbon dioxide and ammonia released from molten mass covered the surface.
- * The UV rays from the sun broke up water into Hydrogen and oxygen and lighter H_2 escaped.
- * Oxygen combined with ammonia and methane to form water, CO_2 and others.
- * The ozone layer was formed.
- * As it cooled, the water vapor fell as rain, to fill all the depressions and form oceans.
- * Life appeared 500 Million years after the formation of earth.

Theories of **Origin of life**:

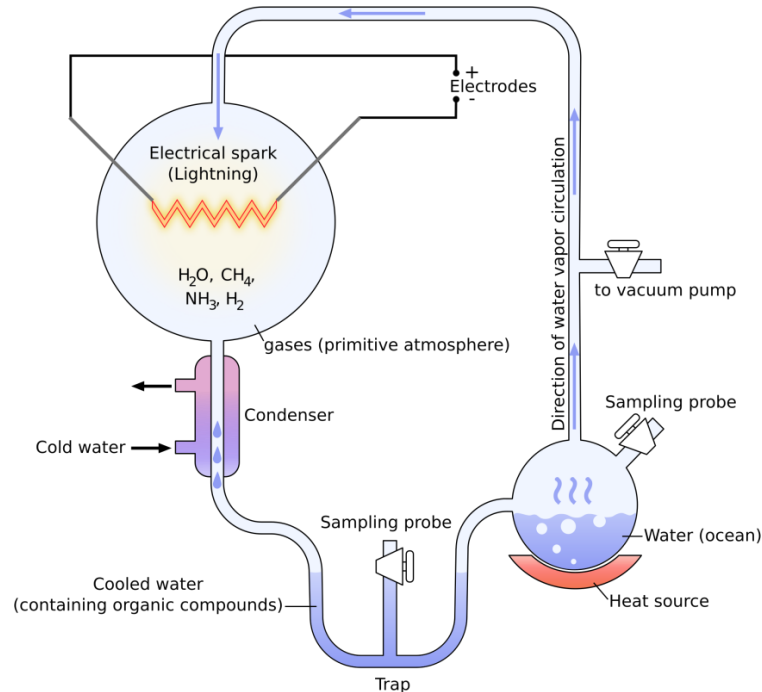
- (i) Theory of special creation states that God created life by his divine act of creation.
- (ii) Theory of panspermia/cosmozoic theory, given by early Greek thinkers states that the spores or panspermia came from outer space and developed into living forms.
- (iii) Theory of spontaneous generation states that life originated from decaying and rotting matter like straw, mud, etc. (a) Louis Pasteur rejected the theory of spontaneous generation and demonstrated that life came from pre-existing life. (b) In his experiment, he kept killed yeast cells in pre-sterilised flask and another flask open into air. The life did not evolved in the former but new living organisms evolved in the second flask.
- (iv) Theory of chemical evolution or Oparin-Haldane theory states that life originated from pre-existing non-living organic molecules and that formation of life was preceded by chemical evolution. The conditions on the earth that favoured chemical evolution were very high temperature, volcanic storms and reducing atmosphere that contained CH_4, NH_3 , water vapour, etc.

Urey and Miller experiment:

In 1953, S.L. Miller an American Scientist created similar primitive earth conditions in a laboratory and simulated the primitive earth.

- * **The conditions created for simulating the primitive earth were** - High temperature, Volcanic storms and Reducing atmosphere containing CH_4, NH_3 etc.
- * He created **electric discharge** in a closed flask to raise temperature upto $800^{\circ}C$ as it was in primitive earth.
- * Used CH_4, H_2, NH_3 and water vapor inside the flask.
- * He observed the formation of **amino acids**.

- * Miller observed the synthesis of amino acids from simple inorganic chemicals in simulated condition in the laboratory.
- * In similar experiments others observed, formation of sugars, nitrogen bases, pigment and fats.
- * Analysis of meteorite content also revealed similar compounds indicating that similar processes are occurring elsewhere in space.



Theory of biogenesis:

- * The first non-cellular forms of life could have originated 3 billion years back.
- * They would have been giant molecules (RNA, proteins, Polysaccharides, etc).
- * These capsules reproduced their molecules perhaps, named as **coaservates**.
- * The first cellular form of life did not possibly originate till about 2000 millions years ago.
- * The first cellular forms of life were probably unicellular.
- * All life forms were in water environment only.
- * This theory of **biogenesis** from **non-living molecules** was accepted by majority.

EVOLUTION OF LIFE FORMS – A THEORY:

- Conventional religious literature tells us about the **theory of special creation**.
- **The theory of special creation has three connotations:-**
 - All the living organisms (species types) that we see today were created as such.
 - The diversity was always the same since creation and will be same in future.
 - Earth is about 4000 years old.

Challenge to special creation theory:

- Observation made during a sea voyage in a sail ship called H.M.S. Beagle round the world. Charles Darwin concluded that existing life forms share similarities to varying degrees not only among themselves but also with life forms that millions of years ago.
- Many such life forms exist any more. There had been extinctions of different life forms in the years gone by just as new forms of life arose at different periods of history of earth.
- There has been gradual evolution of life forms.
- Any population has built in variation in characteristics.

- Those characteristics which enable some to survive better in natural conditions (climate, food, physical factors, etc) would outbreed others that are less-endowed to survive under such natural condition.
- Survival of the fittest. The fitness according to Darwin refers ultimately and only leaves more progeny than others.
- These, therefore, will survive more and hence are selected by nature. He called it as **natural selection**.
- **Alfred Wallace**, a naturalist who worked in **Malay Archipelago** had also come to similar conclusions around the same time.

The geological history of earth closely correlates with the biological history of earth.\

EVIDENCES FOR EVOLUTION

Paleontological evidence:

- * Fossils are remained of hard parts of life-forms found in rocks.
- * Different-aged rock sediments contain fossils of different life-forms who probably died during the formation of the particular sediment.
- * They represent the extinct organisms (e.g. Dinosaurs).
- * A study of fossils in different sedimentary layers indicates the geological period in which they existed.
- * The study showed that life-forms varied over time and certain life forms are restricted to certain geological time-span.
- * Hence new lives have arisen at different times in the history of earth.
- * All this called **Paleontological evidence**.

Comparative anatomy and morphological evidence:

- * Comparative anatomy and morphology shows similarities and differences among organisms of today and those that existed years ago.

Divergent evolution:

- * Whale, bats, cheetah and human share similarities in the pattern of bones of forelimbs.
- * These forelimbs perform different functions in these animals, they have similar anatomical structure – all of them have humerus, radius, ulna, carpals, metacarpals and phalanges in their forelimbs.
- * Hence in these animals, the same structure developed along different directions due to adaptation to different needs.
- * This is **divergent evolution** and these structures are **homologous**.
- * Homology indicates common ancestry.
- * Other examples of homologous organ are vertebrate hearts and brains.
- * **Thorn of *Bougainvillea* and tendrils of *Cucurbita*** represent homology.

Convergent evolution:

- * Wings of butterfly and of birds look alike.
- * They are anatomically similar structure though they perform **similar function**.
- * Hence **analogous** structures are a result of **convergent evolution**.
- * **Eye of octopus and eye of mammals.**
- * **Flippers of Penguins and Dolphins.**
- * **Sweat potato (root modification) and potato (stem modification).**

Biochemical evidences:

- * Similarities in proteins and genes performing a given function among diverse organisms give clues to common ancestry.

Embryological support for evolution:

- * Proposed by **Ernst Haeckel** based upon observation of certain features during embryonic stage common to all vertebrates that are absent in adult.

- * The embryos of all vertebrates including human develop a row of vestigial gill slits just behind the head but it is a functional organ only in fish and not found in any other adult vertebrates.
- * This is **disproved** on careful study performed by **Karl Ernst von Baer**. He noted that embryos never pass through the adult stages of other animals.

Evolution by natural selection:

- * Based on observation of moth population in England made in 1850.
- * Before industrialization set in, it was observed that there were more white-winged moths on trees than dark-winged or melanised moths.
- * After industrialization i.e. 1920 there were more dark-winged moths in the same area i.e. the proportion was reversed.

Evolution by anthropogenic action:

- * Excess use of herbicides, pesticides etc., has only resulted in selection of resistant varieties in a much lesser time scale.
- * This is also true for microbes against which we employ antibiotics or drugs against eukaryotic organisms/cell.
- * Hence resistance organisms/cells are appearing in a time scale of months or years and not in centuries.
- * These are the examples of evolution by **anthropogenic action**.
- * **Evolution is a stochastic process based on chance events in nature and chance mutation in the organisms.**

ADAPTIVE RADIATION

Darwin's Finches:

Link for the Video of Adaptive Radiation:

<https://www.youtube.com/embed/rMCP2n7VXH8>



- * In Galapagos Islands Darwin observed small black birds later called Darwin's Finches.
- * He realized that there were many varieties of finches in the same island.
- * All the varieties, he came across, evolved on the island itself.
- * From the original seed-eating features, many other forms with altered beaks arose, enabling them to become insectivorous and vegetarian finches
- * This process of evolution of different species in a given geographical area starting from a point and literally radiating to other areas of geography (habitats) is called **adaptive radiation**.

Australian marsupial:

- * A number of marsupials each different from the other evolved from an ancestral stock. But all within the Australian island continent.
- * When more than one adaptive radiation appeared to have occurred in an isolated geographical area (representing different habitats), one can call this **convergent evolution**.
- * **Placental mammals** in Australia also exhibit adaptive radiation in evolving into varieties of such placental mammals each of which appears to be 'similar' to a corresponding **marsupial** (e.g. placental wolf and Tasmanian wolf-marsupial).

BIOLOGICAL EVOLUTION:

- * The essence of Darwinian Theory about evolution is natural selection.
- * The rate of appearance of new forms is linked to the life cycle or the life span.
- * There must be a genetic basis for getting selected and to evolve.
- * Some organisms are better adapted to survive in an otherwise hostile environment.
- * Adaptive ability is inherited.
- * It has genetic basis.
- * Fitness is the end result of the ability to adapt and get selected by nature.
- * **Branching descent and natural selection are the two key concepts of Darwinian Theory of Evolution.**

Lamarck theory of evolution: (theory of inheritance of acquired characters)

- * French Naturalist Lamarck had said that evolution of life forms had occurred but driven by use and disuse of organs.
- * He gave the example of Giraffes who in an attempt to forage leaves on tall trees had to adapt by elongation of their necks.
- * They passed on this acquired character of elongated neck to succeeding generations.
- * Giraffes, slowly over the years, came to acquire long necks.

MECHANISM OF EVOLUTION:

- * In the first decade of twentieth century, **Hugo deVries** based on his work on **evening primrose** brought fourth the idea of **mutations**.
- * Mutation is the large difference arising suddenly in a population.

How deVries theory of mutation differs from Darwin's theory of natural selection?

- * It is the mutation which causes evolution and not the minor variations that Darwin talked about.
- * Mutations are random and directionless while Darwinian variations are small and directional.
- * Evolution for Darwin was gradual while deVries believed mutation caused speciation and hence called it **saltation** (single step large mutation).

HARDY – WEINBERG PRINCIPLE:

- * In a given population one can find out the frequency of occurrence of alleles of a gene on a locus.
- * This frequency is supposed to remain fixed and even remain the same through generations.
- * Hardy-Weinberg principle stated it using algebraic equations.
- * The principle states that allele frequencies in a population are stable and is constant from generation to generation.
- * The gene pool (total genes and their alleles in a population) remains a constant. This is called **genetic equilibrium**:
- * Sum total of all the allelic frequencies is 1.
- * $(p + q)^2 = p^2 + 2pq + q^2 = 1$.
- * When frequency measured, differs from expected values, the difference (direction) indicates the extent of evolutionary change.
- * Disturbance in genetic equilibrium, or i.e. change of frequency of alleles in a population would then be interpreted as resulting in evolution.

- * Five factors are known to affect Hardy-Weinberg equilibrium:
 - i) **Gene migration or gene flow.**
 - ii) **Genetic drift.**
 - iii) **Mutation.**
 - iv) **Genetic recombination.**
 - v) **Natural selection.**
- * **Gene migration:** When migrations of a section of population to another place occur, gene frequencies change in the original as well as in the new population. New genes /alleles are added to the new population and these are lost from the old population.
- * **Gene flow:** Gene migration occurs many time is termed as gene flow.
- * **Genetic drift:** change in gene frequency takes place by chance.
- * **Founder effect:** sometimes the change in allelic frequency is so different in the new sample of population that they became a different species. The original drifted population becomes **founder species** and the effect is called **founder effect**.

Operation of natural selection on different trait:

- Natural selection can lead to :
 - **Stabilization:** in which more individuals acquire mean character value.
 - **Directional changes** i.e. more individuals acquire value other than the mean character value.
 - **Disruption:** more individuals acquire peripheral character value at both ends of the distribution curve.

ORIGIN AND EVOLUTION OF MAN:

- * About 15 mya primates called *Dryopithecus* and *Ramapithecus* were existing.
- * They were hairy and walked like gorillas and chimpanzees.
- * *Ramapithecus* was more **man like** while *Dryopithecus* was more **ape-like**.
- * Few fossils of man-like bones have been discovered in Ethiopia and Tanzania.
- * Two mya *Australopithecines* probably lived in East African grasslands.
- * The first human-like being the hominid and was called *Homo habilis*.
- * Fossils discovered in Java in 1891 revealed the next stage i.e. *Homo erectus* about 1.5 mya.
- * **Neanderthal man:**
- * *Homo sapiens:* Arose in Africa and moved across continents and developed distinct races.

Evolution video:

<https://www.youtube.com/embed/RTX9si5RBb0>

Chapter 8 - HUMAN HEALTH AND DISEASE

HEALTH :- Health is defined as the state of complete physical , mental and social well being.

DISEASE :- Disease is the condition when the functioning of one or more organs or systems of the body is / are adversely affected

- * Factors important to maintain good health:-

Good Health can be attained by the following :-

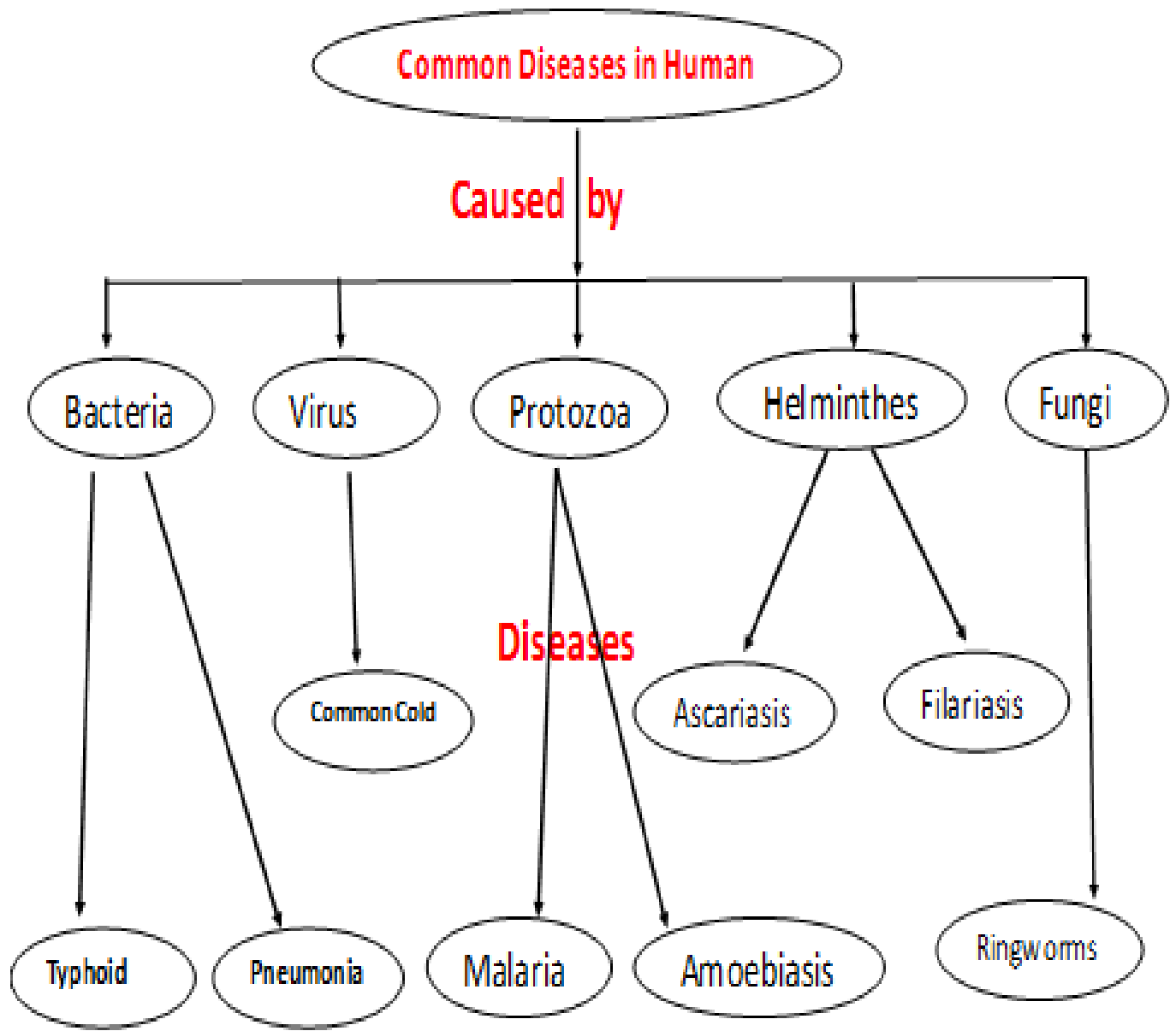
- * Balanced Diet
- * Personal Hygiene
- * Regular Exercise
- * Good Habit
- * Awareness about diseases
- * Vaccination
- * Proper waste disposal
- * Control of vectors
- * Consumption of hygienic (clean) food and water

Types of Diseases

SL	COMMUNICABLE/INFECTIOUS DISEASES	NON COMMUNICABLE / NON INFECTIOUS DISEASES
1	These are the diseases that are easily transferred from diseased to a healthy person	These are the diseases that are not transferred from diseased to a healthy person
2	They are caused by pathogens eg. Bacteria, Viruses, Fungi, Helminthes, Protozoa etc	They are caused due to genetic factors, nutritional deficiencies, unhealthy life styles etc.

Some common Infectious Diseases :

- * BACTERIAL DISEASES :- Pneumonia, T.B. , Cholera , Typhoid etc.
- * VIRAL DISEASES :- Common Cold, AIDS , Chikungunya , Dengue, Hepatitis , Polio , Measles
- * FUNGAL DISEASES :- Ring worm
- * PROTOZOAL DISEASES :- Amoebiasis , Malaria
- * HELMINTHIC DISEASES :- Ascariasis , Filariasis , Taeniasis
- * VIRAL DISEASES :-



COMMON COLD :- Causal Organism :- Rhinoviruses

Organs Affected :- Nasal & Respiratory passages

Spreads By :-

- i. Droplets released during cough & sneezing by an infected person.
- ii. Contaminated objects / articles.

Symptoms :-

- i. Nasal congestion & discharge
- ii. Sore throat
- iii. Cough
- iv. Tiredness
- v. Headache

vi. Hoarseness

* **DENGUE**

* Causal Organism :- Dengue Virus

Organs Affected :-

Spreads By :- Bite of *Aedes aegypti* mosquito.

Symptoms :-

- i. Fever
 - ii. Headache
 - iii. Muscle & joint Pain
 - iv. Characteristic skin rash (like measles)
 - v. In severe cases it becomes haemorrhagic fever , where the platelet count of blood decreases
- Prevention :- By controlling the vector mosquito.

CHIKUNGUNYA

* Causal Organism :-Alpha Virus having ss RNA as its genome

Organs Affected :-

Spreads By :- Bite of *Aedes aegypti* mosquito.

Symptoms :-

- i. High fever
- ii. Rashes on the trunk
- iii. Nausea
- iv. Vomiting
- v. Multiple joint pain

Prevention & Control :-

Mosquito control is the effective prevention method.

TYPHOID

* Causal Organism :- *Salmonella typhi* (Bacteria)

Organs Affected :- Small Intestine . Intestinal perforations leading to death may occur in severe cases.

Spreads By :- Contaminated food and water

Symptoms :-

- i. Sustained high fever (103 – 104 ° F)
- ii. Stomach Pain
- iii. Loss of appetite
- iv. Constipation
- v. Headache

How to Confirm :- Widal Test

PNEUMONIA

* Causal Organism :- i) *Streptococcus pneumoniae* & ii) *Haemophilus influenzae*

Organs Affected :- Lung Alveoli . Alveoli become filled with a fluid , resulting in severe difficulty in breathing / respiration.

Spreads By :-

- i. Droplets from an infected person
- ii. Sharing the contaminated articles

Symptoms :-

- i. Fever
- ii. Headache
- iii. Cough
- iv. Chills
- v. In severe cases , the lips and fingernails may turn greyish

MALARIA (a protozoal disease)

Causal Organism :- Plasmodium species

- * P. malariae
- * P. vivax
- * P. falciparum (Malignant malaria)

Organs Affected :-

Spreads By :- Bite of Female Anopheles mosquito that transfers the Sporozoites (Infectious stage) of Plasmodium.

Symptoms :-

- i. High fever and chill

Prevention & Control :-

Disease can be controlled by eradicating the mosquitoes & avoiding mosquito bite by using mosquito repellents , mosquito nets etc.

Treatment :- Use of Chloroquins.

LIFE CYCLE OF MALARIAL PARASITE :-

1. The sporozoites enter the body at the bite of mosquito, reach the liver through blood and multiply within the liver cells.
2. Such liver cells burst and release the parasites into blood.
3. In the blood the parasite attacks RBCs , multiply asexually and cause their rupture. The rupture of RBC releases a toxin called Haemozoin , which is responsible for the recurring High Fever and the Chill
4. Sexual stages (Gametocytes) develop in the red blood cells.
5. The parasite then enters the female anopheles mosquito along with the blood when it bites the infected person.
6. Further development occurs in the stomach wall of the mosquito
7. The gametes fuse to form a zygote .
8. The zygote undergoes further development in the body of the mosquito to form sporozoites.
9. The Sporozoites are transported to and stored in the Salivary gland of the mosquitoes and are transferred to the human body during the bite of the mosquito.

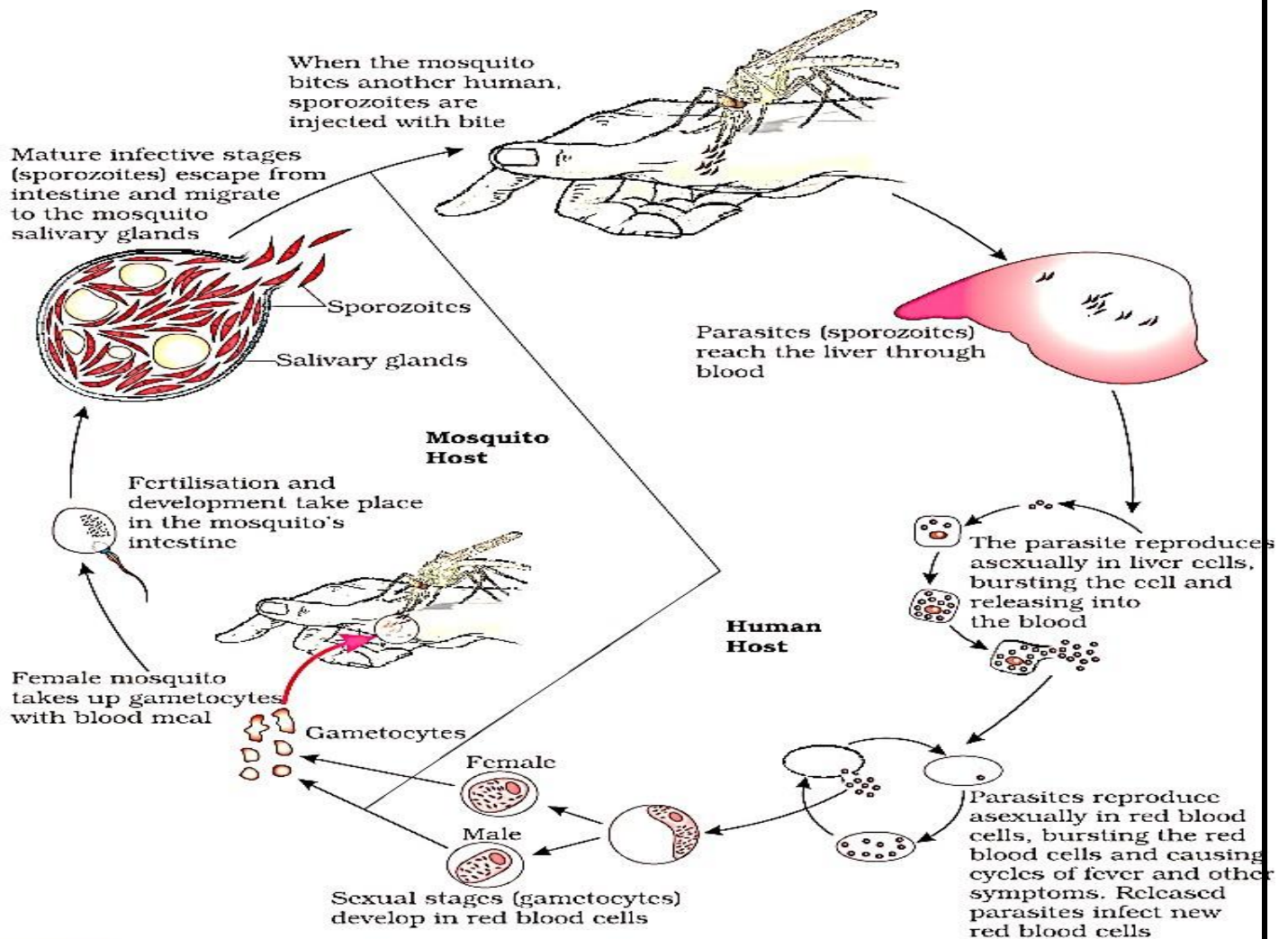
Common Diseases:

<https://www.youtube.com/embed/YA9KiI7gW5Q>

PPT for Common Human Diseases :

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Figure 8.1 Stages in the life cycle of *Plasmodium*

AMOEBIC DYSENTRY (Protozoal Disease)

- * Causal organism :- Entamoeba histolytica
- * Mode of Dispersal :- Through contaminated food and water.
- * House flies act as mechanical carriers and transfer the parasite from the faeces of infected person to the food articles and water.
- * Organ Affected : The parasite resides in the large intestine.
- * Symptoms :
- * i) Abdominal pain and cramps.
- * Stool with excess mucus and blood clots.
- * Constipation alternating with diarrhoea.

RING WORM (FUNGAL DISEASE)

- * Causal Organism : Microsporium , Epidermophyton , and Trichophyton.
- * Symptoms :
- * i) Dry scaly lesions on skin , nails , and scalp.
- * ii) Lesions are accompanied by itching.

Ringworms are generally acquired from soil or by direct contact.

ASCARIASIS (HELMINTHIC DISEASE)

Causal Organism :- Ascaris lumbricoides (Round Worm)

Symptoms :-

- i) Blockage of the intestinal passage
- ii) Anaemia
- iii) Abdominal / Muscular pain
- iv) Internal bleeding
- v) Nausea and headache

Mode of Dispersal :

Through contaminated food and water as eggs of parasite excreted by the infected person contaminate soil, plants and water

FILARIASIS (ELEPHANTIASIS) Protozoal Disease

- * Causal Organism : Wuchereria bancrofti and W. malayi which cause them to swell like that of an (Filarial Worm)
- * Mode of Dispersal : Through the bite of Female Culex Mosquito
- * Symptoms :-
- * i) They normally cause inflammation of the organs in which they live for many years.
- * ii) They normally affect the lymph vessels , of the lower limbs, causing them to swell like that of an Elephant , hence called Elephantiasis.
- * iii) Genital Organs may also be affected leading to gross deformation.

PREVENTION & CONTROL OF INFECTIOUS DISEASES :-

- * i) Maintenance of personal hygiene.
- * Maintenance of Public hygiene.
- * Eradication of vectors and their breeding places.
- * Vaccination and immunisation for disease like Polio , Diphtheria, tetanus etc.
- * Use of antibiotics and drugs to treat the infected person.

AIDS : ACQUIRED IMMUNODEFICIENCY SYNDROME

- * Causal Organism : HIV (Human Immunodeficiency Virus) a retrovirus
- * Transmission of HIV occurs in one or more of the following ways :
- * i) By sexual contact with the infected person .
- * ii) Transfusion of the contaminated blood and blood products.
- * iii) Sharing of infected needles.
- * iv) From infected mother to the developing baby (inside uterus) through placenta.
- * Following individuals are at high risk of getting the disease :
- * i) Those who have multiple sexual partners.
- * ii) Drug addicts taking the drugs intravenously.

- * iii) Individuals who require repeated blood transfusion.
- * iv) Children born to an infected woman.
- * **LIFE CYCLE OF HIV :-**
- * i) The Virus after getting into the body of a person , enters the Macrophages.
- * ii) The RNA replicates and DNA is formed by Reverse Transcriptase.
- * The viral DNA gets incorporated with the host cell DNA and directs the infected cell to produce the viral particles.
- * The Macrophages continue to produce Virus particles
- * The virus then enters the helper T-Lymphocytes (T_H), replicates and forms the progeny viruses.
- * The progeny viruses released in the blood attack other helper T- Lymphocytes and there is a progressive decrease in the number of helper T-Lymphocytes in the body of the infected persons.
- * The person becomes easily infected by bacteria like Mycobacterium , viruses and even parasites like Toxoplasma.
- * The person is unable to protect himself / herself against any infection.

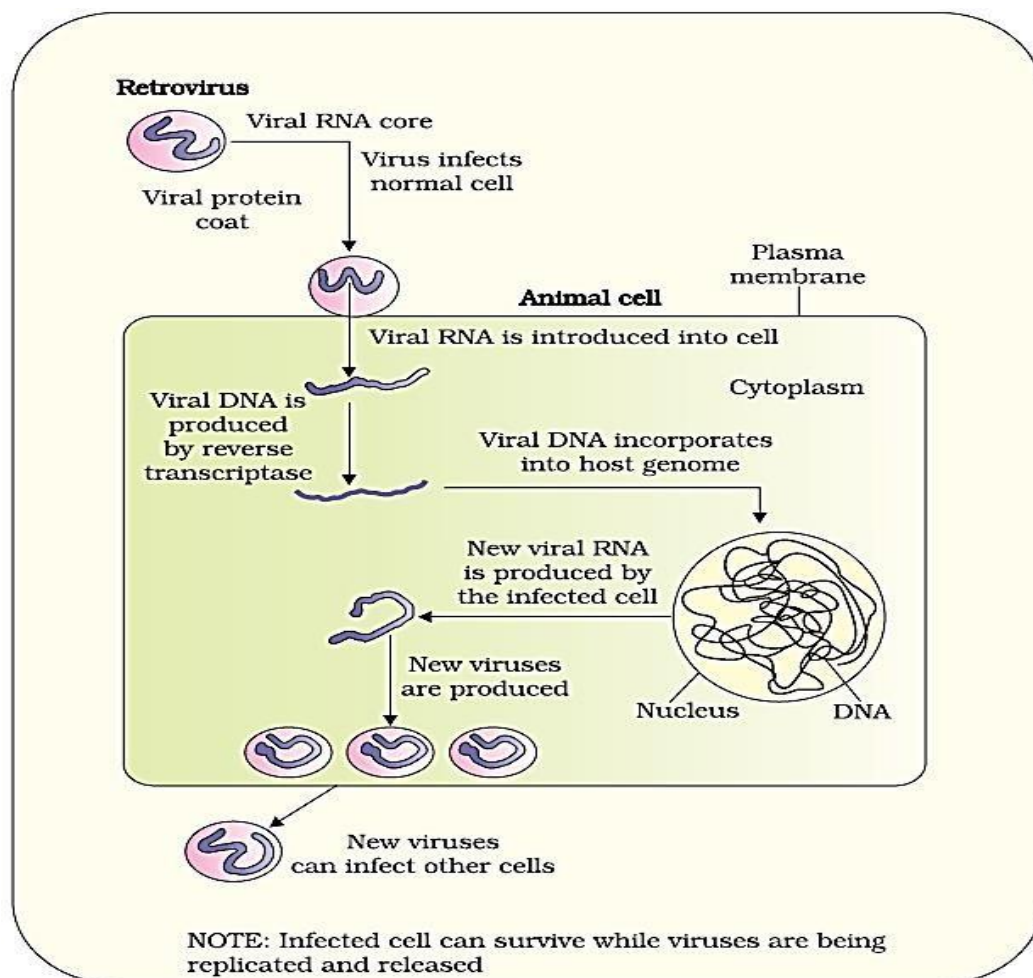


Figure 8.6 Replication of retrovirus

- * **Prevention of AIDS :**

- * NACO (National AIDS Control Organisation) and Non-governmental organisations are trying their best to educate people about AIDS.
- * WHO (World Health Organisation) has started a number of programmes to prevent spreading of HIV infection. Some such steps are :-
 - * i) Ensuring use of disposable needles & syringes.
 - * ii) Checking blood for HIV
 - * iii) Free distribution of condoms and advocating safe sex.
 - * iv) Controlling drug abuse.
 - * v) Promoting regular check-up for HIV susceptible populations etc.
- * **DIAGNOSIS OF AIDS :**
- * By ELISA Test :(Enzyme – Linked Immuno Sorbant Assay)

TREATMENT : Treatment with anti-retroviral drugs is only partially effective. They can only prolong the life of the patient but cannot prevent death.

CANCER :- GENERAL ACCOUNT

- * Transformation of normal cells into cancerous cells is induced by carcinogens.
- * Carcinogens are those physical, chemical , and biological agents which bring about uncontrolled proliferation of cells (Cancer)
- Types of Carcinogens :
- * i) Physical Carcinogens :Eg. U.V. Rays, X – rays , gamma rays.
- * ii) Chemical Carcinogens : Eg. Aniline dyes, chemicals present in tobacco smoke.
- * iii) Tumour viruses (Oncogenic Viruses)
- * Difference between cancerous cells and Normal Cells)
- * i) There is breakdown of the regulatory mechanism which control normal cells growth , cell division , and differentiation.
- * ii) Cancer cells do not show contact inhibition and show uncontrolled cell divisions.
- * iii) Cancer cells show Metastasis i.e. they detach from the tumours and move to distant sites through body fluids and develop secondary tumours.

TYPES OF TUMOURS :

- i) Benign Tumours :- They remain confined to their original location and do not spread to other parts. They cause little damage.
- ii) Malignant Tumours :-
 - a) They are masses of neoplastic / proliferating cells which grow rapidly , invade and damage the surrounding normal tissue/cells.
 - b) These cells compete with the normal cells for vital nutrients and disrupt the normal metabolism.
 - c) These cells show the property of Metastasis.

DIAGNOSIS OF CANCER

- i) Biopsy and Histopathological studies of the tissue.
- ii) Blood and Bone Marrow Tests for increased cell counts as in Leukaemia.
- iii) Use of techniques like Radiography, MRI (Magnetic Resonance Imaging) and CT – Scan (Computed Tomography) for cancer of internal organs.
- iv) Use of Antibodies against cancer specific antigens.

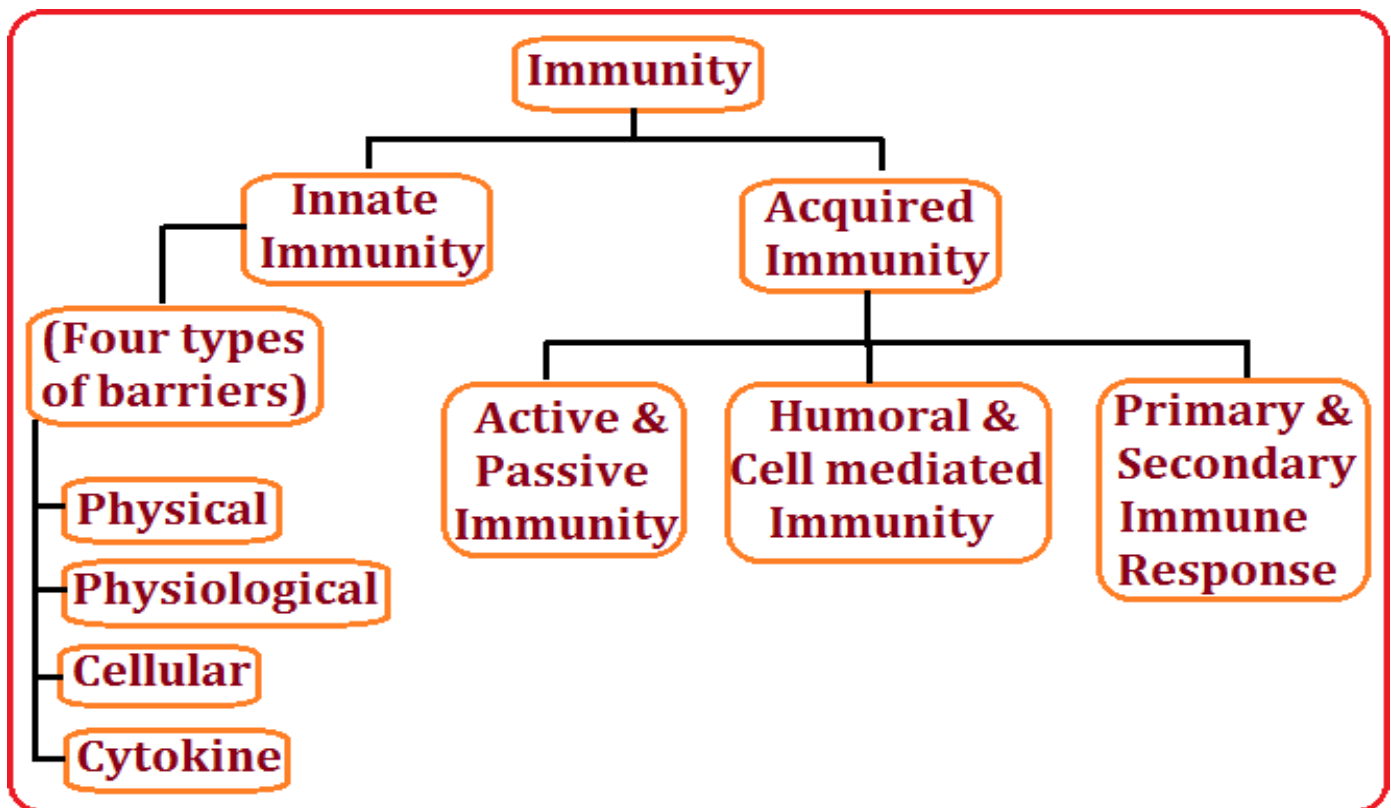
v) Applying principles of Molecular Biology to detect gene in individuals with inherited susceptibility to certain cancers.

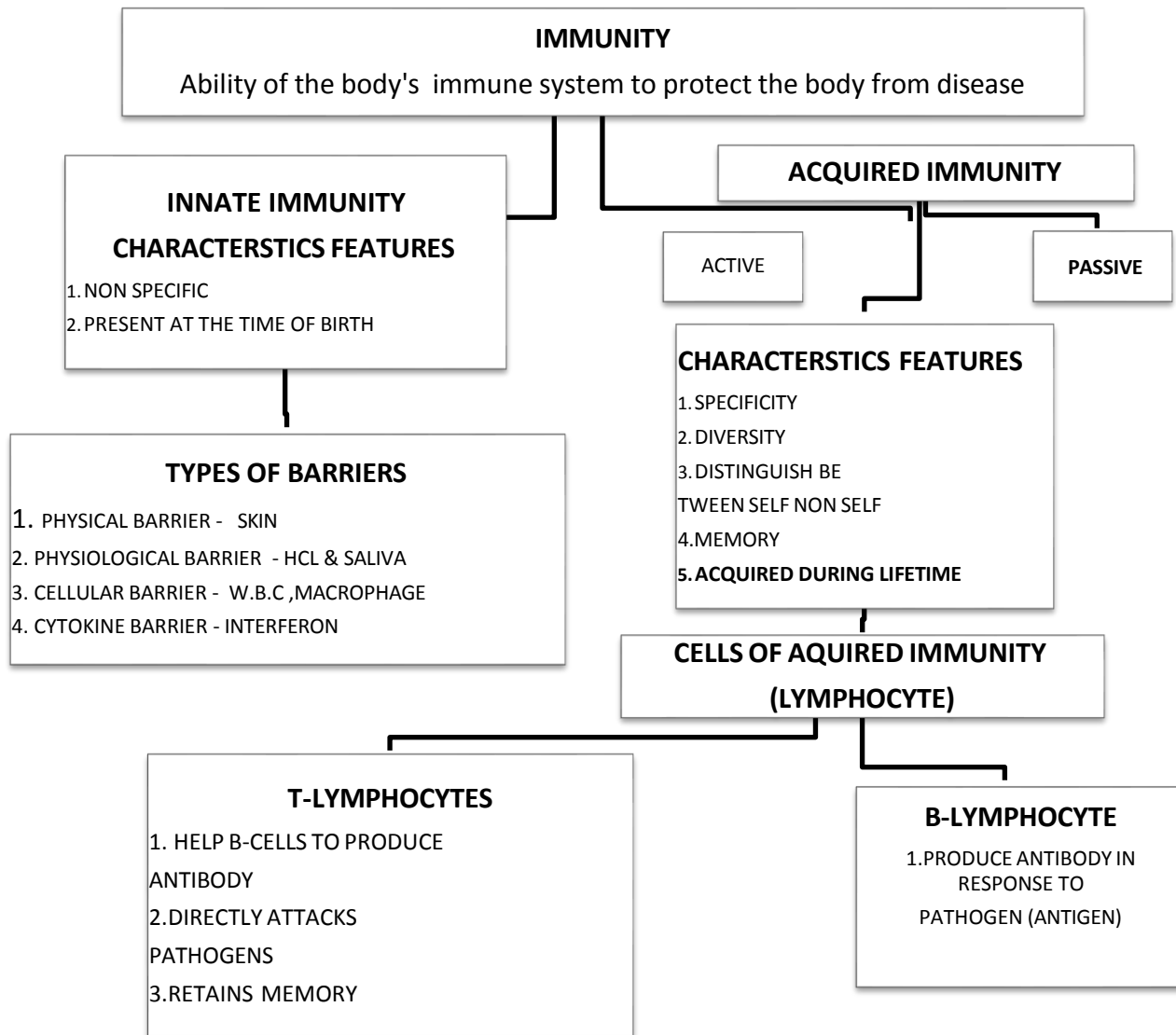
TREATMENT OF CANCER

- i) SURGERY :- The Tumour cells are surgically removed to reduce the load of cancerous cells.
- ii) RADIOTHERAPY :- The Tumour cells are irradiated wholly but taking care of the surrounding normal cells.
- iii) CHEMOTHERAPY :- Certain drugs are used to kill the cancerous cells , but majority of the drugs have side effects like hair loss. Anaemia, etc.
- iv) IMMUNOTHERAPY :- This involves the use of biological response modifiers like alpha interferon , which activate the immune system and help in destroying the tumour.

IMMUNE SYSTEM

Definition of Immunity :- It refers to the overall ability of a living body to fight against diseases.



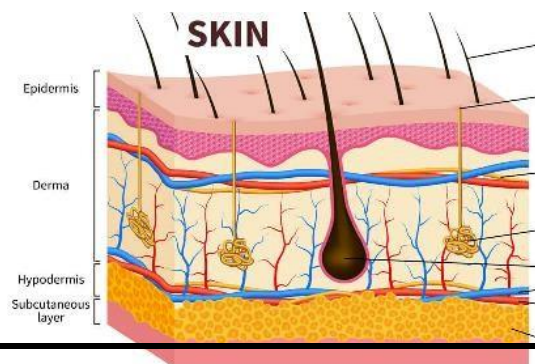


INNATE IMMUNITY :- It refers to all the defense elements with which an individual is born and is always available to protect the body. It is nonspecific and of four different types.

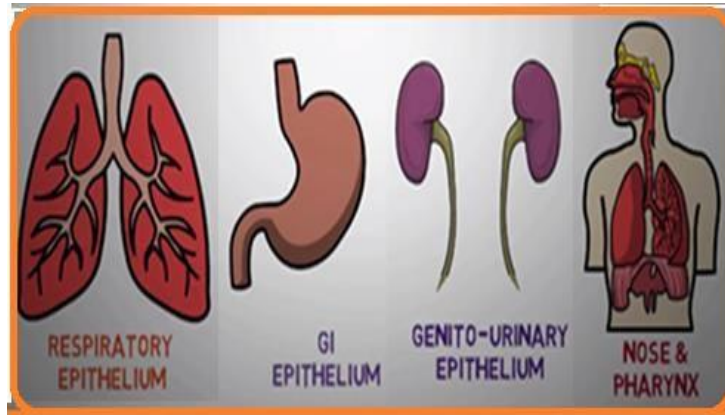
1. PHYSICAL BARIERS :

i) **The Skin - main barrier :** (Surface Area=1.73 m²)

ii) **The mucus-coated epithelium lining of the**
a) **Respiratory,**

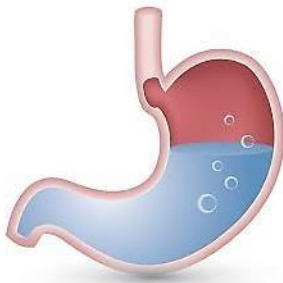


- b) Gastro-intestinal,
- c) Urogenital tracts,
where mucus helps in trapping the microbes.

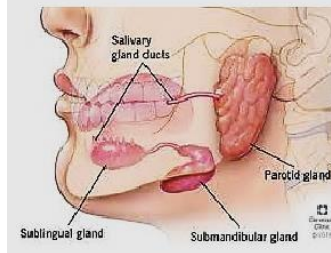


2. PHYSIOLOGICAL BARRIERS: They prevent microbial growth : Examples:

a) HCl in Stomach



b) Saliva (Lysozyme) in Mouth



c) Tears (Lysozyme) in Eyes

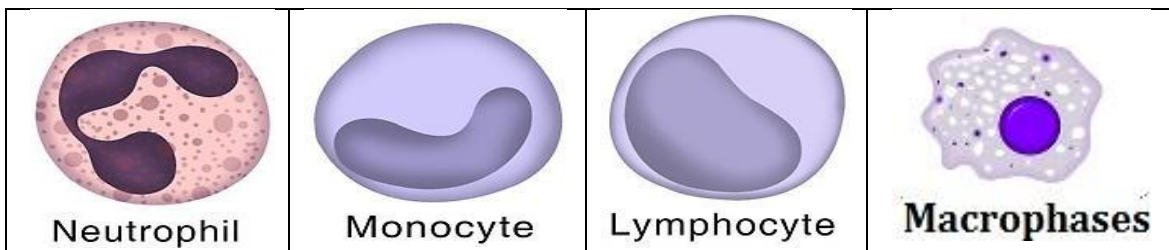


3. CELLULAR BARRIER : They include the :

A. Leucocytes (WBC) which phagocytose and destroy the microbes.

- i) PMNL - Neutrophils
- ii) Monocytes
- iii) Lymphocytes (Natural killers)

B. Macrophages (in the Tissues)



4. CYTOKINE BARRIER :

Interferon (Proteins) produced by viral infected cells & protect the non-infected cells from further Viral infections.

ACQUIRED IMMUNITY: It refers to the immunity a person acquires after birth, either by contracting the disease or by vaccination.

Characteristic features of acquired immunity:

- i) **SPECIFICITY:** It is pathogen specific.
- ii) **MEMORY:** The memory cells produced during the first encounter with the pathogens evoke a heightened immune response in the further encounters.
- iii) Distinguishes between self and non self.

Types of Immunity Link for the video:

https://www.youtube.com/embed/odIdD_uwIPE

Immunity - Presentation:

<https://docs.google.com/presentation/d/1DdZLgJ1nNNyHY4ek9OmdvIn5q0AVDt6E/edit?usp=sharing&oid=107171444976724466844&rtpof=true&sd=true>

TYPES OF IMMUNE RESPONSES:-

1. **PRIMARY IMMUNE RESPONSE :-** An Immune Response of low Intensity, when our body encounters a pathogen for the first time
2. **SECONDARY IMMUNE RESPONSE :-** (Anamnestic Response) A highly intensified Immune Response when our body encounters the same pathogen for the second time. Why ? Because our body keeps a memory of the pathogen when encountered it for the first time.

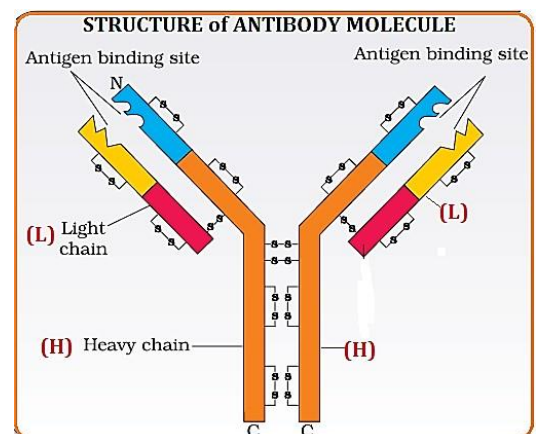
TYPES OF ACQUIRED IMMUNITY:

A) **HUMORAL or ANTIBODY MEDIATED IMMUNITY :-**

- i) It consists of the antibodies, that are circulating in the body fluids (Humors)
- ii) The antibodies produced by B- Lymphocytes in response to the antigens are collectively called Immunoglobins and are of various types like IgA, IgD, IgE, IgG, IgM .

ANTIBODY MOLECULE (Immunoglobins):

- i) Each antibody consists of four polypeptide chains, held together in the form of Y where the tips of two upper arms bind to the antigens in a lock and key manner to form antigen-antibody complex.
- ii) The two polypeptide chains are long and called heavy(H) chains , while the other two are short and called light (L) chains. Hence, the antibody is referred to



as H₂L₂.

B) CELL MEDIATED IMMUNITY : CMI

It is mediated by T-Lymphocytes. There are two groups of T-Lymphocytes

- i) Cytotoxic / Killer T-Cells – which kill the specific target cell by a variety of mechanisms.
- ii) Helper T – cells : which activate the specific B-cells to produce antibodies.
T-Lymphocytes are responsible for graft rejection.

On the basis of Involvement of body in the production of Antibodies, immunity is of two types :

- a) **Active Immunity** and b) **Passive Immunity**.

Sl No.	Active Immunity	Passive Immunity
i)	When the antibodies are developed by our own cells in response to the antigens, it is called active immunity	When antibodies developed in other vertebrates in response to deliberate injection of antigen , are injected into our body, it constitutes passive immunity.
ii)	It takes time to develop immunity(slow response)	It shows fast response hence it is used when immune response has to be faster. E.g. in case of snake bite.
iii)	It stays in body for longer period.	It stays in body for short period.
	Example : a) Immunity developed during natural exposure to pathogens b) Immunity developed by vaccination.	Example : a) Immunity given to the infant by antibodies in colostrum b) Immunity given by Tetanus Antitoxin

VACCINATION :-

Vaccination is the process of introducing a preparation of antigenic proteins of pathogens or killed or inactivated /attenuated pathogens into the body, to generate the immune response / antibodies.

ALLERGY :- It refers to the exaggerated / hypersensitive response of the immune system to certain antigens in the environment.

ALLERGENS :- The substance / agent which causes the hypersensitive reaction of the immune system to certain antigens present in the environment.

Example :- Dust , Mites , Pollen Grains , Animal Dander etc.

The antibodies produced in response to allergens are Ig E type.

COMMON SYMPTOMS OF ALLERGY :-

Under the influence of allergens certain chemicals like Histamine and Serotonin are released from mast cells. These chemicals induce the symptoms of allergy.

- i) Sneezing (ii) Watery eyes (iii) Rashes (iv) Running nose (v) Difficulty in breathing.

CAUSES OF ALLERGY: Somehow, modern - day life style has resulted in lowering of immunity and more sensitivity to allergens. More & more children in metro cities of India suffer from allergies and asthma due to sensitivity to the environment.

Allergy is due to the release of chemicals like histamine and serotonin from the mast cells.

AUTOIMMUNITY :

Autoimmunity or autoimmune disorders are those disorders which are caused when the body's immune system goes off the track and start destroying 'Self Cells' and molecules.

Example : Hashimoto's Thyroiditis, Systemic Lupus, Rheumatoid Arthritis etc.

MAIN FUNCTIONS of IMMUNE SYSTEM

To recognize the foreign molecules(Antigens), respond to them and keep a memory of them.

COMPONENTS OF IMMUNE SYSTEM :-

1. Lymphoid Organs
2. Lymphoid Tissues
3. Lymphoid Cells
4. Soluble Molecules like Antibodies.

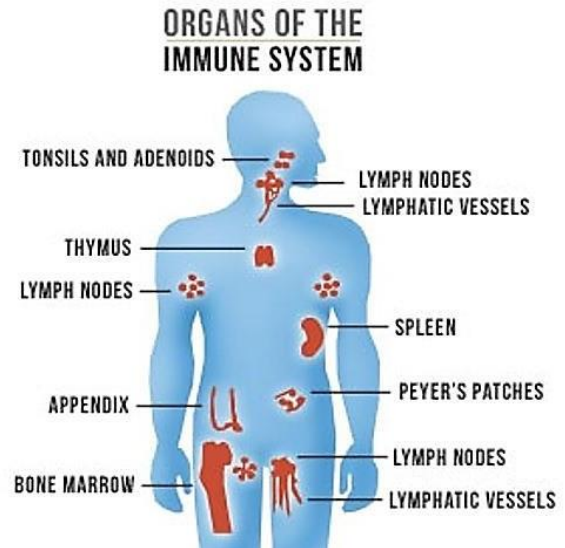
FUNCTIONS OF PRIMARY LYMPHOID ORGANS :-

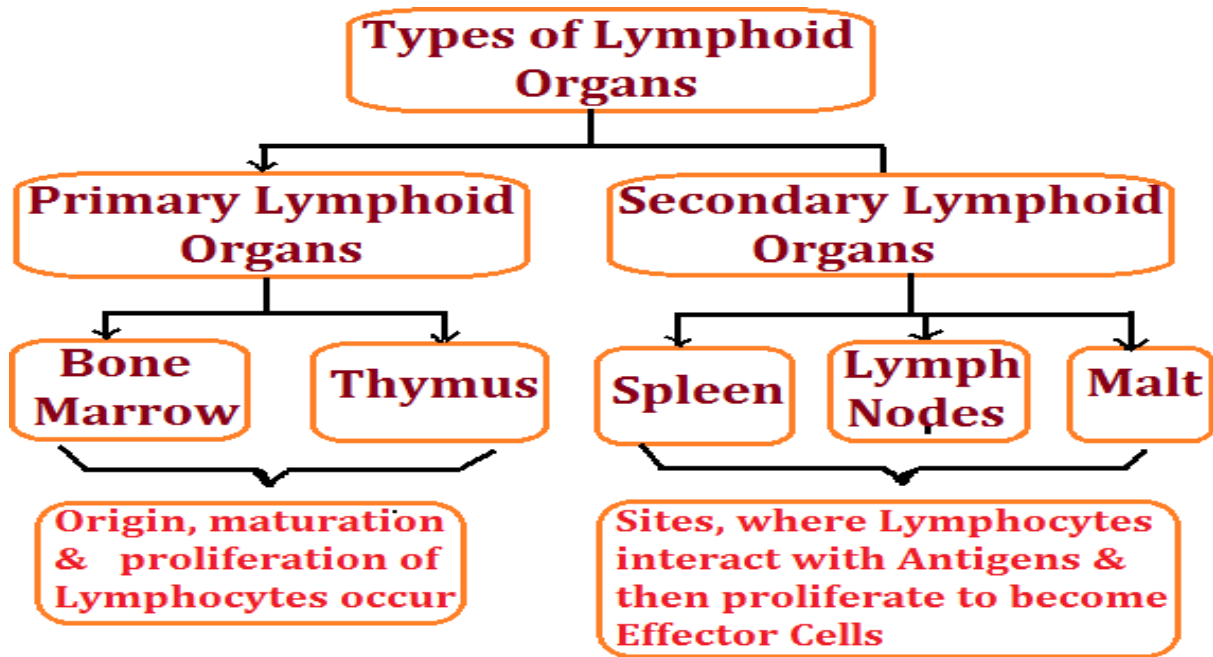
1. Bone Marrow :- Here all kinds of blood cells are produced
2. Thymus :- Provides a micro environment for the development and maturation of lymphocytes.

FUNCTIONS OF SECONDARY LYMPHOID ORGANS :

1. **SPLEEN :-**
 - i) It mainly contains lymphocytes and phagocytes.
 - ii) It acts as filter of blood by trapping blood borne microbes
 - iii) It also acts as a reservoir of Erythrocytes (RBCs)
2. **LYMPH NODES :-** They act as filters and trap the microbes that have entered the lymph.
3. **MALT :-** Mucosal Associated Lymphoid Tissues:- Lymphoid tissue located within the mucosal lining of the major tracts (respiratory , digestive, urogenital tracts) is called MALT.

Different types of lymphoid organs and their functions is being summarized by the help of following flow diagrams





Chapter 9 - MICROBES IN HUMAN WELFARE

A. MICROBES IN HOUSEHOLD PRODUCTS

SL NO	NAME OF FOOD ITEM	MICROBE INVOLVED
01	CURD	LACTOBACILLUS & other LAB (Lactic Acid bacteria)
02	DOUGH (For Idli & Dosa)	Fermented by bacteria. Dough rises due to CO ₂ produced during fermentation.
03	DOUGH (For making Bread)	Saccharomyces cerevisiae (Backers Yeast)
04	CHEESE a) Swiss Cheese has large holes due to production of CO ₂ b) Roquefort Cheese	Propionibacterium sharmanii. Ripened by growing a specific fungus in it.

B. MICROBES IN INDUSTRIAL PRODUCTS

SLNO	NAME OF PRODUCT	MICROBE INVOLVED
1	BEEVERAGES :- a) ETHANOL :- (By fermentation of fruit juices & malted cereals)	Sacharomyces cerevisiae (Yeast)
	Remark :- Type of alcoholic drink varies with the type of Raw material & nature of processing. a) With Distillation :- Whisky , Brandy & Rum. b) Without Distillation :- Beer & Wine.	
2	ANTIBIOTICS a) Penicillin :-	Penicillium notatum (Fungi)
	Remark :- Penicillin discovered by Alexander Fleming, while working on Staphylococci bacteria, but it was established as an effective drug by Ernst Chain & Howard Florey. The Three were awarded Nobel prize in medicine in 1945.	
3	ORGANIC ACIDS a) Citric Acid b) Acetic Acid c) Butyric Acid d) Lactic Acid	Aspergillus niger (Fungus) Acetobacter aceti (Bacterium) Clostridium butylicum (Bacterium) Lactobacillus delbrueckii (Bacterium)
4	ENZYMES a) Lipases b) Proteases & c) Pectinases d) Streptokinases	Used in detergent formulations. Used to clear fruit juices. A 'clot buster' produced by genetically modified Streptococcus.

Remark :-Streptokinase is used for removing blood clots in blood vessels of patients suffering from Myocardial Infractions.

5	BIOACTIVE MOLECULES	
	a)Cyclosporin A (Used as Immuno suppressant)	Trichoderma polysporum. (Fungus)
	b)Statins (Used for lowering blood cholesterol)	Monascus purpureous (Yeast)
6	BIOGAS PRODUCTION	Methanogens like Methanobacterium

Remark :- Methanogens produce Methane,CO₂,H₂ & H₂S by acting over cellulosic compounds present in cattle dung. They are found in i) Anaerobic sludge, ii)Rumen of cattle, iii) Flooded Rice Fields, & iv) Marshy places.

7	MICROBES AS BIOCONTROL AGENTS	It refers to the use of controlling pests that relies on natural predators
	a)Bacillus thuringiensis ----- b)Trichoderma ----- c)Baculoviruses (Genus : Nucleopolyhedroviruses) c)Ladybird (a beetle with red & black markings) d)Dragonfly -----	A bacterium whose spores are toxic to certain insect larvae (butterfly caterpillars) & kill them. A fungus(free living in soil &root ecosystems) is effective against several plant pathogens. They attack insects and other arthropods. These viruses are excellent candidates for species specific, narrow spectrum insecticidal applications, Useful in IPM in ecologically sensitive area Used to get rid of Aphids Used to get rid of Mosquitoes
8	MICROBES AS BIOFERTILIZERS	They fix atmospheric Nitrogen, Organic matter & other soil nutrients.
a	BACTERIA (Fix Atmospheric N ₂) i)Symbiotic Bacteria ----- ii)Free Living bacteria -----	Rhizobium. Azotobacter & Azospirillum.
b	CYANOBACTERIA	Nostoc,oscillatoria,Anabaena,Aulosira.
c	FUNGI/MYCORRHIZAE	Symbiotic association of fungi with the roots of higher plants. e.g. Glomus

Remark :- Mycorrhizae are beneficial in the following manner :-

- i)They absorb phosphorus & passes it on to the plant.**
- ii)Provide resistance to root borne pathogens.**
- iii)Tolerance to salinity.**
- iv)Overall increase in the plant growth & development.**

Microbes in Human welfare:

https://www.youtube.com/embed/65sh_0kBuM8

SEWAGE TREATMENT :- Municipal waste water is called sewage which may contain large amount of organic matter & microbes(which may be Pathogenic)Therefore Sewage is Treated in Sewage Treatment Plant before it is released in the water bodies.

Sewage treatment consists of two steps :-

I. PRIMARY TREATMENT :- Physical process to remove insoluble large & small particles through Filtration & Sedimentation.

Filtration :- Sewage is passed through wire mesh to remove floating insoluble objects like polythene.

Sedimentation :- Sewage is then passed into grit chamber, where the grit(soil & small pebbles)are removed by sedimentation.

All the solids that settled , form the Primary Sludge and the supernatant forms the effluent which is taken to another tank for secondary treatment.

II. SECONDARY TREATMENT :- (Biological Treatment) Two step treatment.

AEROBIC TREATMENT :-

The primary effluent is passed into large aeration tank where it is constantly agitated mechanically and air is pumped into it. This allows vigorous growth of useful microbes into flocs (Flocs = Mass of bacteria + fungal hyphae)

While growing , these microbes consume the major part of the organic matter in the effluent. This significantly reduces the biochemical oxygen demand(BOD)

A) ANAEROBIC TREATMENT :-

i) The effluent is then passed into a tank where the bacterial flocs are allowed to sediment. This sediment is called activated sludge.

ii) A small part of the activated sludge is pumped back into the aeration tank to serve as the inoculum. The remaining major part of the sludge is pumped into large tanks called anaerobic sludge digestors. Here, anaerobic bacteria grow and digest the sludge.

During this digestion bacteria produce a mixture of gases called Biogas (Methane- 75%,CO₂,H₂ & H₂S)

BIOGAS PLANT :- Its technology was developed in India due to the efforts of IARI & KVIC.

Models of Biogas plant :-

- a) Fixed Dome Type &
- b) Floating Gas Holder Type.

BIOCONTROL AGENTS :- It refers to the use of controlling pests that relies on natural predators

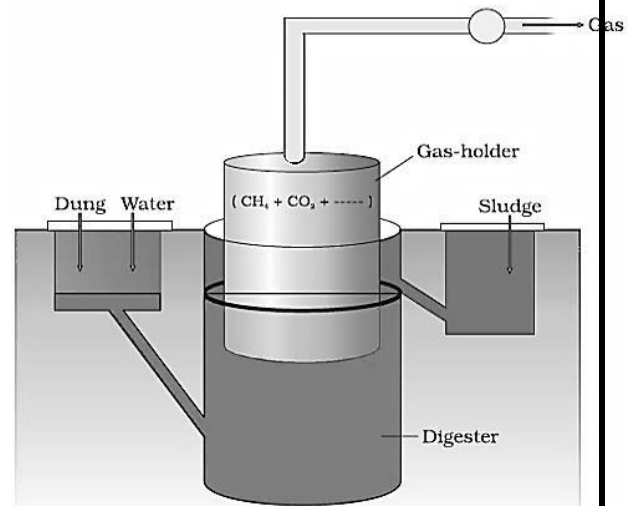


Figure 10.8 A typical biogas plant

Chapter 11 - BIOTECHNOLOGY: PRINCIPLES AND PROCESSES

Biotechnology deals with techniques of using live organisms or enzymes from organisms to produce products and processes useful to humans.

- ⊙ According to EFB, European Federation of Biotechnology -Biotechnology is defined as ‘The integration of natural science and organisms, cells, parts thereof, and molecular analogues for products and services’.
- ⊙ Current Definition:- It is used in a restricted sense today, to refer to such of those processes which use genetically modified organisms to achieve the same on a larger scale.

Further many other processes and techniques are also included in the biotechnology :-

- i) Test tube baby programme.
- ii) Synthesizing a gene and using it.
- iii) Developing a DNA vaccine.
- iv) Correcting a defective gene(Gene Therapy).

The two core techniques that enabled the birth of modern biotechnology :-

(i) **Genetic engineering : Techniques to alter the** chemistry of genetic material (DNA and RNA), to introduce these into host organisms and thus change the phenotype of the host organism.

(ii) **Maintenance of sterile (microbial contamination-free) ambience** in chemical engineering processes to enable growth of only the desired microbe/eukaryotic cell in large quantities for the manufacture of biotechnological products like antibiotics,vaccines, enzymes, etc.

⊙ **Three basic steps in genetically modifying an organism —**

- (i) Identification of DNA with desirable genes;
- (ii) Introduction of the identified DNA into the host;
- (iii) Maintenance of introduced DNA in the host and transfer of the DNA to its progeny.

⊙ **Genetic engineering :-**

It involves the alteration of the genetic makeup of cell by deliberate and artificial means. It involves transfer or replacement of genes to create recombinant DNA.

TOOLS OF GENETIC ENGINEERING:-

1. Enzymes :-

- a) Restriction Endonuclease enzyme(Molecular scissors)
- b) DNA Polymerase enzyme.
- c) **DNA Ligases (Molecular glues)**

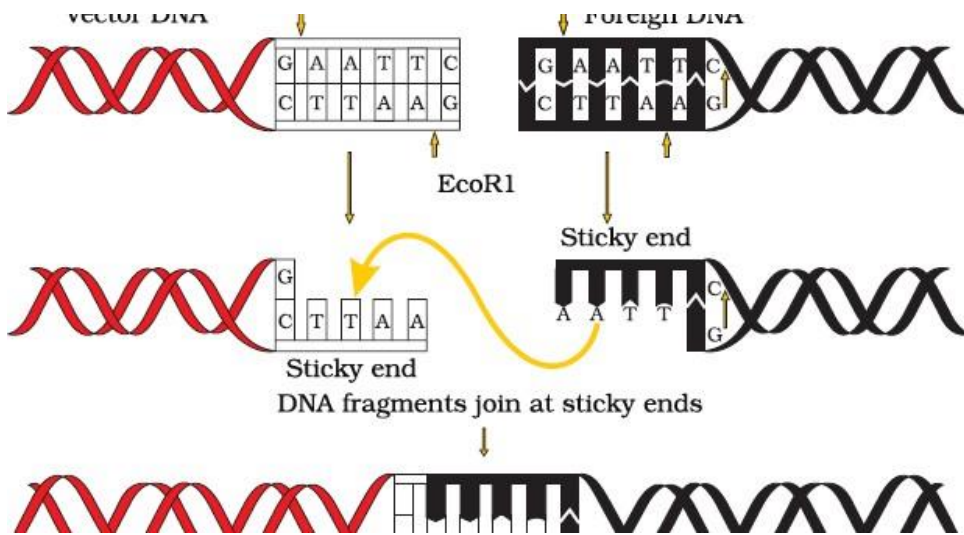
2. Cloning Vectors: -

Restriction enzymes (R.E.) belong to a larger class of enzymes called **nucleases**. Each R.E functions by inspecting the length of a DNA sequence. Once it finds its specific recognition sequence, it will bind to the DNA and cut each of the two strands of the double helix at specific points in their sugar phosphate backbone. Each restriction endonuclease enzyme recognizes a specific palindromic sequence in the DNA.

e.g. 5'- GAATTC-3'
 3'- CTTAAG- 5'

R.E. cut the DNA strand a little away from the centre of the palindrome sites, but between the same two bases on the opposite strands. This causes the production of two DNA segments with sticky ends.

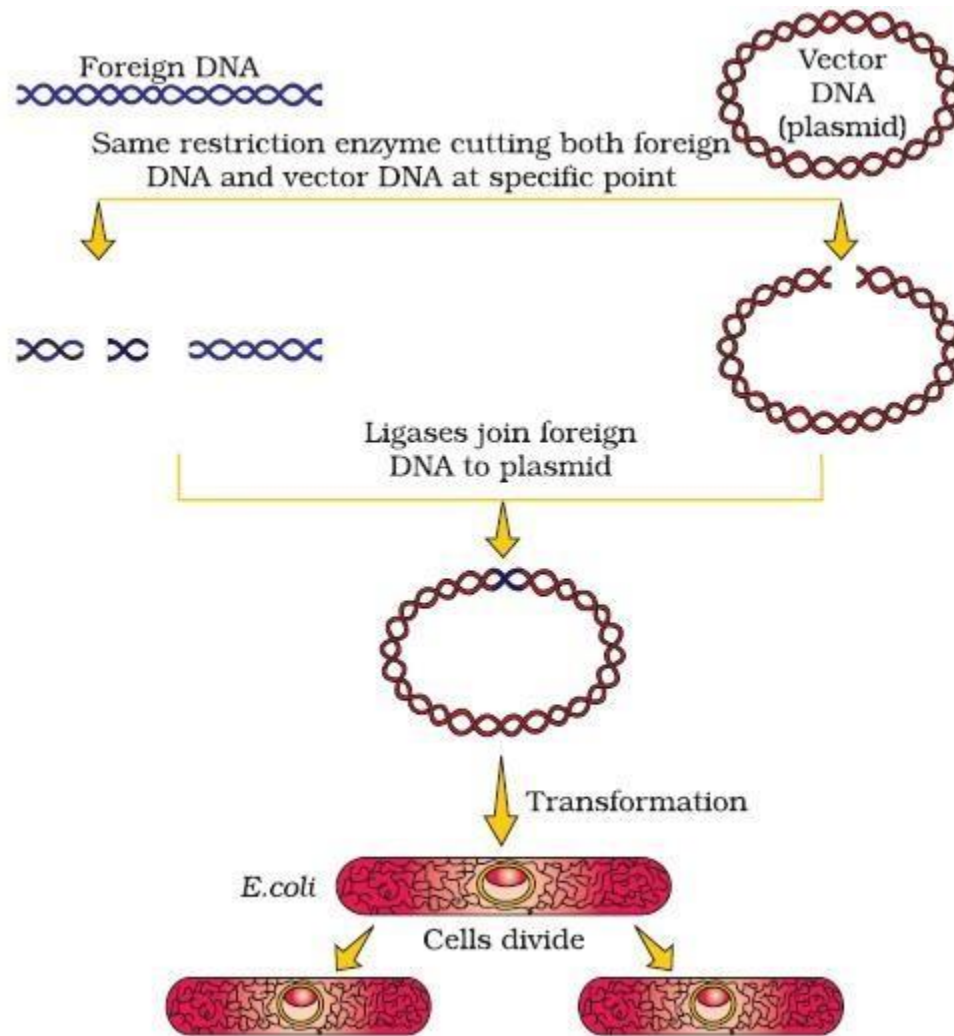
<https://youtu.be/pMKhOCi7X8w>



Restriction enzymes are named in the following manner?

- i)The first letter of the name comes from the name of the genus of the source bacteria.
- ii)The second two letters come from the species of the prokaryotic cell from which they are isolated.
- iii)The letter R is derived from the name of the strain .
- iv)Roman numbers following the names indicate the order in which the enzymes were isolated from that strain of bacteria. **e.g. EcoRI**

Diagrammatic representation of recombinant DNA technology :-



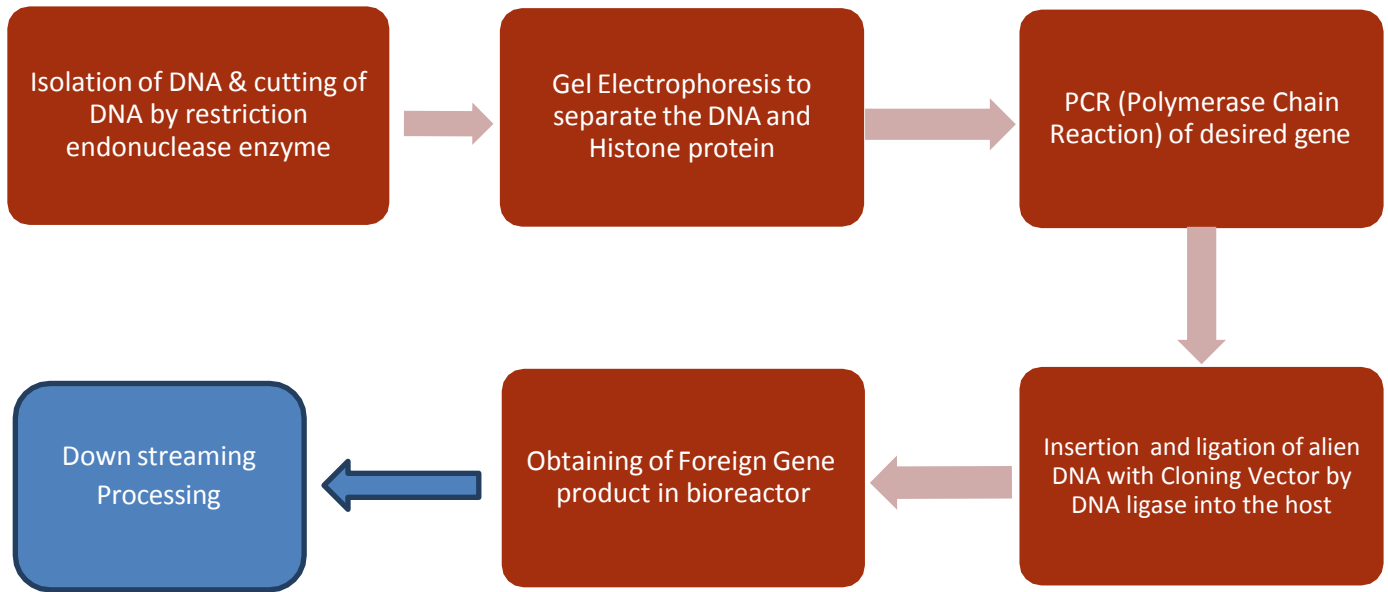
PROCESSES (STEPS) OF RECOMBINANT DNA TECHNOLOGY :-

1. Isolation of DNA
2. Fragmentation of DNA by restriction enzymes.
3. Isolation of the desired DNA fragment.
4. Amplification of the gene of interest.
5. Ligation of the DNA fragment into a vector using DNA ligase.
6. Transfer of recombinant DNA into the host.
7. Culturing the host cells on a suitable medium on a large scale.
8. Extraction of the desired product.
9. Down stream processing of the product as a finished product ready for marketing.

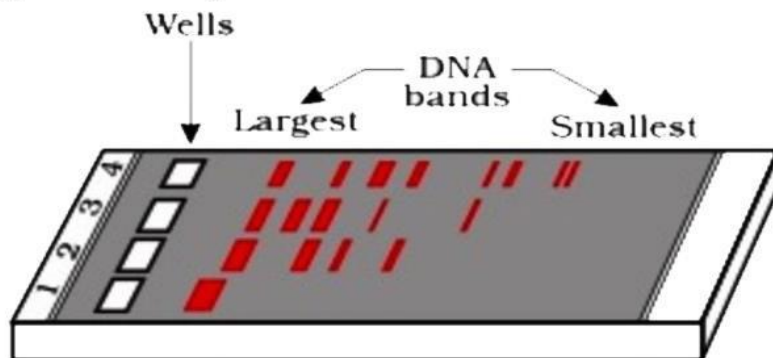
rDNA Technology

<https://www.youtube.com/embed/xZAD11Sc-a8>

rDNA Technology at a glance



Given diagram showing a typical agarose gel electrophoresis showing migration of DNA fragments . The undigested DNA fragment will be present in the lane



Separation & isolation, Visualisation & extraction of DNA fragments :-

DNA has to be isolated in pure form for the action of restriction enzymes.

- i) DNA can be released from cells by digesting the cell envelop by the use of enzymes like lysozyme for bacterial cells, chitinase for fungal cells, and cellulase for plant cells.
- ii) Since DNA is intertwined with histone proteins and RNA, proteins are removed by proteases and RNA are removed by ribonucleases.
- iii) Other impurities bare removed by employing suitable treatments.
- iv) The purified DNA is precipitated by the addition of chilled ethanol. It is seen as fine threads in suspension.

Gel Electrophoresis is the technique of separating DNA segment, in which the negatively charged DNA segments are forced to move towards anode(+ve electrode) under an electric field through a medium or matrix.(Commonly Agarose gel)

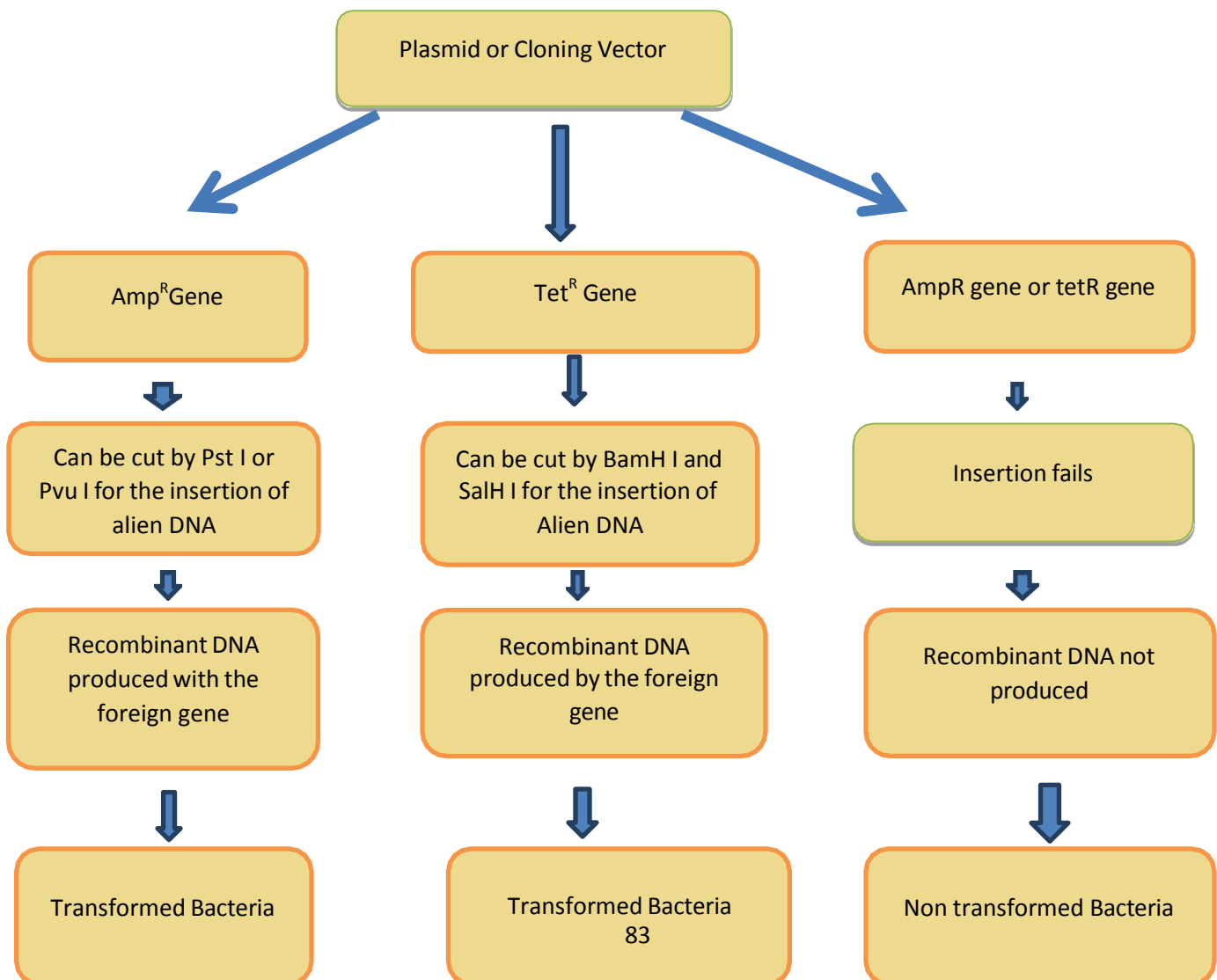
Visualisation :-The separated DNA fragments can be visualised after staining the DNA by ethidium bromide followed by exposure to UV rays. A bright orange coloured bands of DNA is observed.

Extraction:- The separated bands of DNA are cut out from the agarose gel & extracted from the gel piece. This process is called as elution.

CLONING VECTORS :-

- ⊙ PLASMIDS AND BACTERIOPHAGES ARE COMMONLY USED CLONING VECTORS.
- ⊙ NOWADAYS , GENETICALLY ENGINEERED /SYNTHETIC VECTORS ARE ALSO USED FOR EASILY LINKING THE FOREIGN DNA AND SELECTION OF RECOMBINANTS FROM NONRECOMBINANTS.

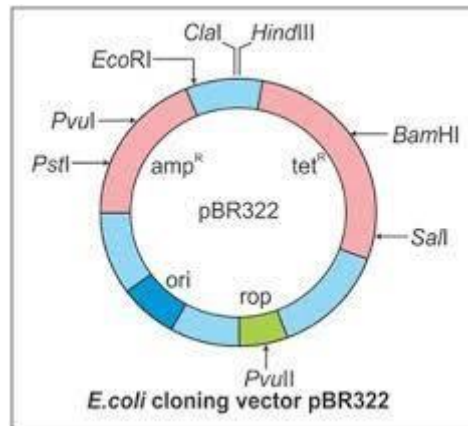
Making of rDNA at a glance:



FOLLOWING FEATURES ARE REQUIRED TO FACILITATE CLONING IN A VECTOR :-

- I) **ORIGIN OF REPLICATION :- (ori)** This is a sequence of base pairs on DNA where replication starts. Any piece of DNA linked to this sequence can be made to replicate with in the host cells. This sequence is also responsible for controlling the copy number of linked DNA.
- II) **SELECTABLE MARKER :-** Marker is a gene which helps in selecting the transformants (those host cells which contain the gene of interest) and eliminating the non transformants.

Common selectable markers for E.coli include the genes encoding resistance to antibiotics such as ampicillin, chloramphenicol, tetracycline and canamycin or gene for b-galactosidase which can be identified by colour reaction



- III) **CLONING / RECOGNITION SITE :-** In order to link the alien DNA , the vector needs to have very few, preferably single recognition site for the commonly used restriction enzymes.

The ligation of alien DNA is carried out at a restriction site present in one of the two antibiotic resistant genes. Eg. A foreign DNA is inserted at BAMHI site of tetracycline resistant gene in the vector PBR322 (A plasmid).

Some cloning vectors :-

- a) **Agrobacterium tumefaciens :-** It is the bacterium that infects a number of dicot plants and transfers a piece of its DNA known as tDNA, which transforms the normal plant cells into tumor cells. Ti plasmid (Tumor inducing plasmid) of this bacterium has been modified (Disarmed) and used as a cloning vector.
- b) **Retro Viruses :-** They infect normal cells and transform them into cancerous cells. Such retroviruses have been modified (Disarmed) and used as vectors for transferring DNA into animal cells.

- IV) **SMALL SIZE OF THE VECTOR :-**

Methods of introducing a recombinant DNA into a competent host :-

Since DNA is hydrophilic molecule, it cannot pass through cell membranes. Four methods to introduce the gene of interest into a host.

1. For Bacterial Cell :- (a prokaryotic cell)

a) In order to force bacteria to take up the plasmid, the bacterial cells must first be made 'competent' to take up DNA. This is done by treating them with a specific divalent Cation, eg. Calcium ion, which increases the efficiency with which DNA enters the bacterium through pores in its cell wall.

b) Recombinant DNA can then be forced into such cells by incubating the cells with recombinant DNA on ice, followed by placing them briefly at 42⁰C (heat Shock), and then putting them back on ice. This enables the bacteria to take up the recombinant DNA.

2. MICROINJECTION:- (Suitable for animal cells) In this method, recombinant DNA is directly injected into the nucleus of an animal cell.

3. BIOLISTICS or GENE GUN :- (Suitable for plants) In this method plant cells are bombarded with high velocity microparticles of gold or tungsten coated with DNA.

4. DISARMED PATHOGEN VECTORS :- Such vectors when allowed to infect the cell, transfer the recombinant DNA into the host.

PCR :- polymerase chain reaction (Discovered by K Mullis)

It is a technique by which any piece of DNA can be quickly amplified (copied many times) without using cells. Each cycle of PCR consists of three steps :-

1. Denaturation of DNA :- Double stranded DNA is denatured by using high temperature.
2. Primer Annealing :- Primers are chemically synthesised oligonucleotides that are complementary to the regions of DNA segments of interest.
3. Extension of Primers :- Thermostable DNA Polymerase enzyme (Taq Polymerase) extends the primers using the nucleotides provided in the medium and the genomic DNA as template.

PCR - Link for the video:

<https://www.youtube.com/embed/09whdt6PPs0>

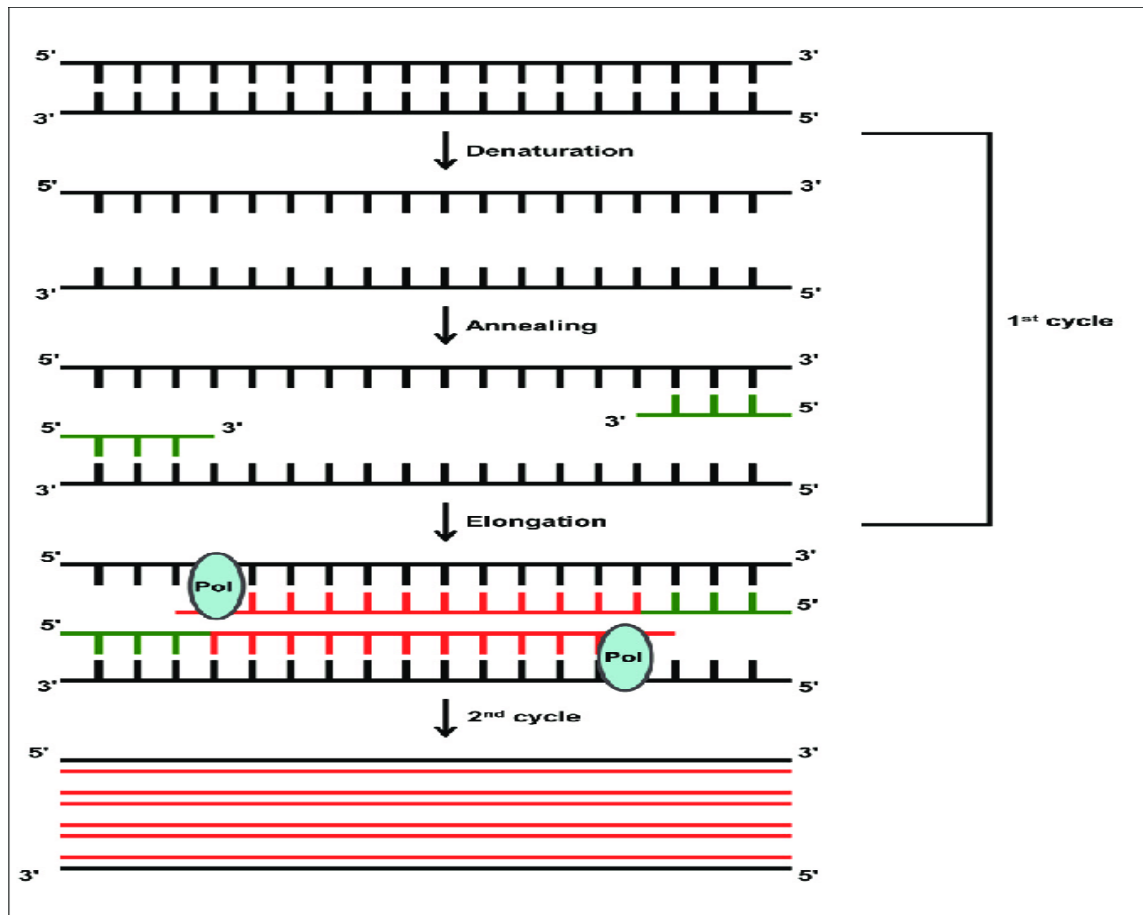
PCR

Polymerase Chain Reaction

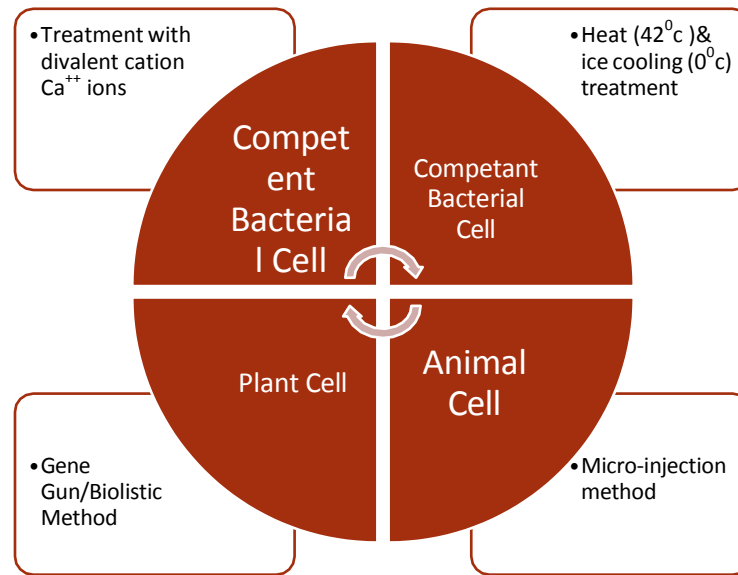
Denaturation 94^oc
Separation of DNA Strands

Annealing Use of Primers

Extension Use of Taq Polymerase -> Polymerisation



Introduction of Alien DNA in the competent host at a glance:



BIOREACTORS :-

The bioreactors can be thought of as vessels in which raw materials are biologically converted into specific products by microbes, plants and animal cells and/or their enzymes.

A bioreactor has the following components :-

- i) An agitator system.
- ii) An oxygen delivery system.
- iii) A foam control system.
- iv) A temperature control system.
- v) pH control system.
- vi) Sampling ports.

Downstream processing :-

The products obtained from the genetically modified microorganisms in a bioreactor is subjected to a series of processes (collectively called downstream processing) before it is made into a finished product ready for marketing.

The two main processes are :-

- a) Separation and b) Purification.

The product is then formulated with suitable preservatives. Such formulations have to undergo clinical trials, in case of drugs.

Chapter 12 - BIOTECHNOLOGY AND ITS APPLICATIONS

Critical areas of Biotechnology:

- Providing the best catalyst in the form of improved organism usually a microbe or pure enzyme.
- Creating optimal condition through engineering for a catalyst to act.
- Downstream processing technologies to purify the protein/organic compound.

BIOTECHNOLOGICAL APPLICATIONS IN AGRICULTURE:

The focus have been made to increase the food production through Biotechnology in the following areas.

- Agrochemical based agriculture
- Organic Agriculture
- Genetically engineered crop- based agriculture

Plants, bacteria, fungi and animals whose genes have been altered by manipulation are called **Genetically Modified Organisms (GMO)**.

Advantages of Genetic Modification in plants.

- Made crops more tolerant to abiotic stresses (cold, drought, salt, heat)
- Reduce reliance on chemical pesticides (pest resistant crop)
- Helped to reduce post harvest losses.
- Increased efficiency of mineral usage by plants.
- Enhanced nutritional values of food e.g. vitamin A enriched rice.

Bt Cotton:

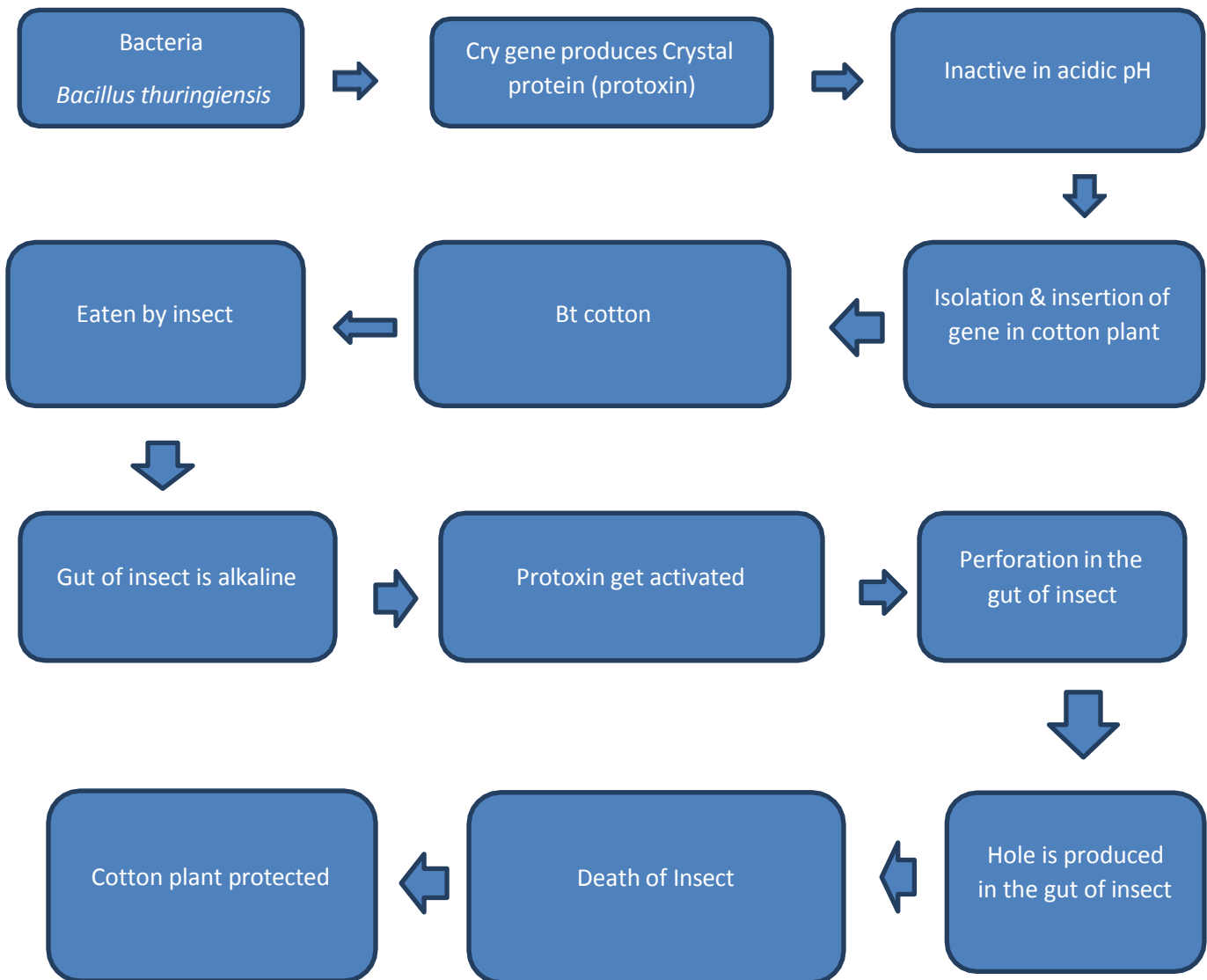
APPLICATIONS OF BIOTECHNOLOGY

PRODUCTION OF PEST RESISTANT PLANTS :-

(A) Bt Cotton :-

- i) The soil bacterium *Bacillus thuringiensis* produces crystal proteins called Cry proteins that are toxic to larvae of insects like tobacco budworm, armyworm, beetles and mosquitoes.
- ii) The cry proteins exist as inactive protoxins and get converted into active toxin when ingested by the insect, as the alkaline pH of the gut solubilises the crystals.
- iii) The activated toxin binds to the surface of the epithelial cells of midgut and create pores.
- iv) This causes swelling and lysis of cells leading to the death of the insect (larva).
- v) The cry genes encoding this protein isolated from the bacterium and incorporated into several crop plants like cotton , tomato,, corn, rice, soyabean etc.
- vi) The proteins encoded by the following cry genes control the pest given against them :-
- vii) Cry I Ac and Cry II Ab control cotton boll worms
- viii) Cry I Ab controls corn borer.

Action of cry gene at a glance:



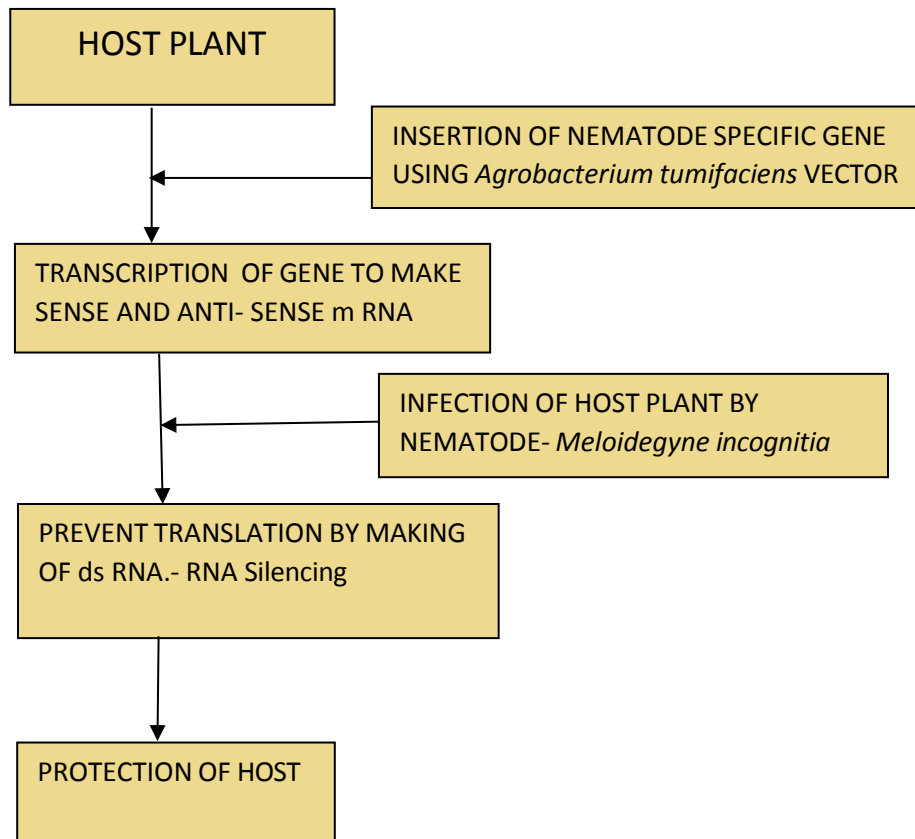
(B) PROTECTION AGAINST NEMATODES

A nematode *Meladogyne incognita* infects tobacco plants and reduces their yield. This nematode is controlled by a method called RNA interference :-

- The specific genes (in the form of cDNA) from the parasite are introduced into the plant using *Agrobacterium* as the vector.
- The genes are introduced in such a way that both sense/coding RNA and antisense RNA (complementary to the sense / coding RNA) are produced.
- Since these two RNAs are complementary , they form a Double stranded RNA (dsRNA)
- This neutralises the specific RNA of the nematode by a process called RNA – interference.

As a result the parasite cannot live in the transgenic host and the transgenic plant is protected from the pest.

PEST RESISTANT PLANT - TOBACCO



APPLICATIONS OF BIOTECHNOLOGY IN MEDICINE

1. The rDNA technology has been used in the production of safe and more effective therapeutic drugs.
2. The recombinant therapeutics do not induce unwanted immunological responses, that are commonly observed with similar products isolated from non – human sources.
3. At present about thirty recombinant therapeutics have been approved for human use, of which twelve are being marketed in India.

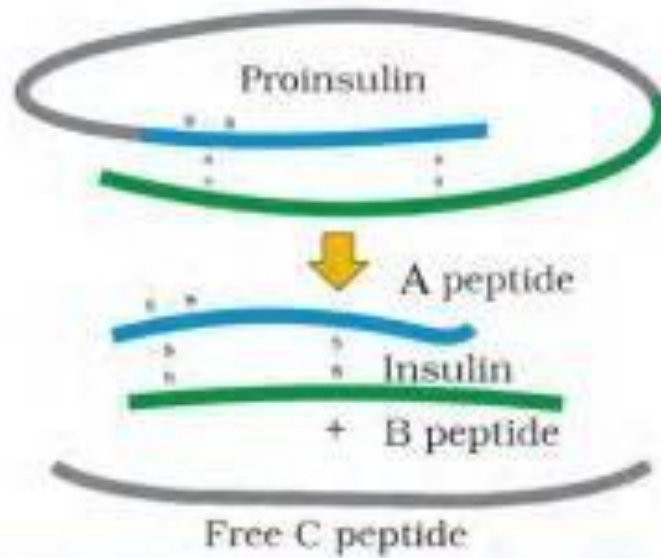
GENETICALLY ENGINEERED INSULIN (HUMILIN)

- a) Human insulin consists of two short polypeptide chains:- Chain A and Chain B, linked by disulphide bridges.
- b) Insulin is secreted as prohormone which has to be processed before it becomes a mature and functional hormone.
- c) The prohormone contains another polypeptide called C – peptide., which is removed during maturation.
- d) In 1983, Eli Lilly, an American company, prepared two DNA sequences coding for chains A and B of human insulin and introduced them into the *E.coli* to produce insulin.

e) The two chains produced were extracted and combined by creating disulphide bridges.

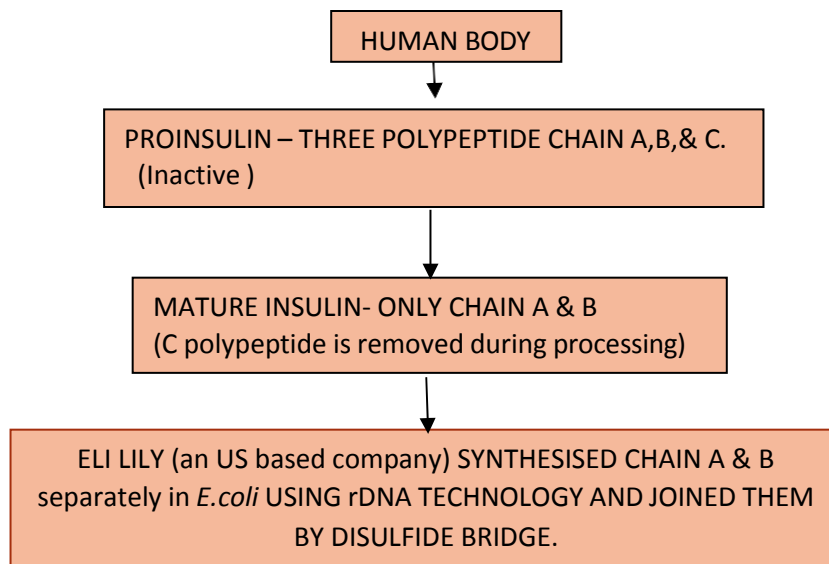
INSULIN PRODUCTION BY r-DNA TECHNOLOGY

Maturation of proinsulin to insulin



Maturation of Pro insulin to insulin:

<https://www.youtube.com/embed/uST-u8flcow>

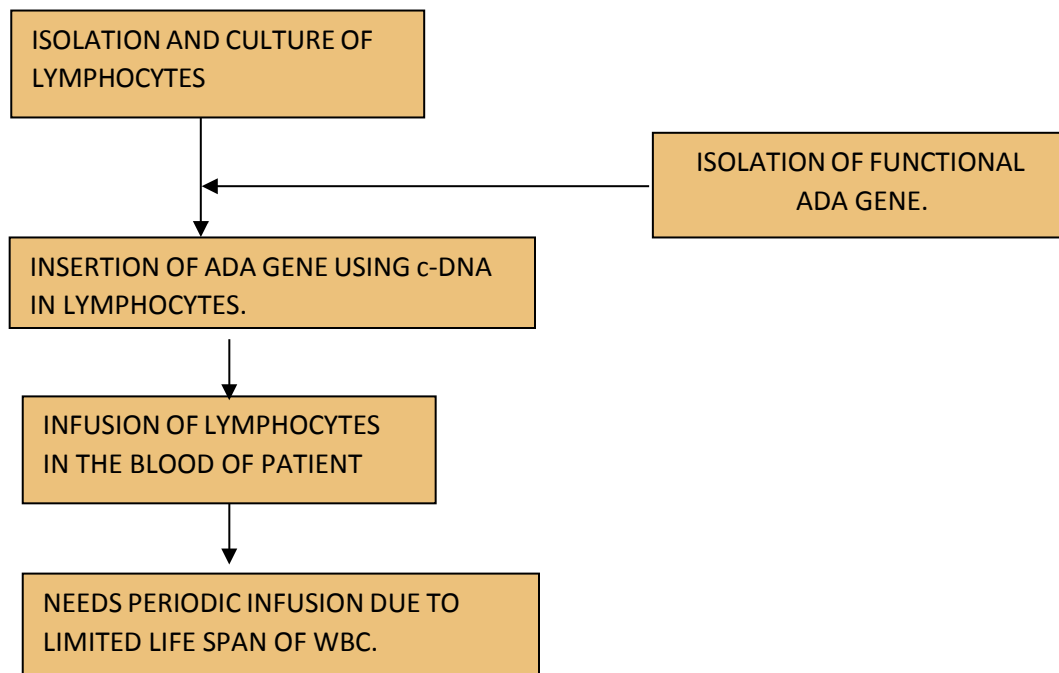


<https://www.youtube.com/watch?v=HSaFemVKtyc>

GENE THERAPY :

Gene Therapy is a collection of methods that allows correction of gene defect .

- i) In this method , genes are inserted into the cells and tissues of an individual to correct certain hereditary diseases.
- ii) It involves the delivery of a normal gene into the individual or embryo to replace the defective mutant allele of the gene.
- iii) Viruses which attack the host and introduce their genetic material into the host are all used as vectors.
- iv) The first clinical gene therapy was given in 1990 to a four year old girl with adenosine deaminase (ADA) deficiency.



TREATMENT OF ADA DEFICIENCY

Traditional Method :- ADA deficiency can be cured by marrow transplantation in some children, but it is not completely curable.

Modern Method :-

- a) For gene therapy , lymphocytes were grown in a culture and functional ADA,c DNA is then introduced into these lymphocytes. These lymphocytes are then transferred into the body of the patient . The patient requires periodic infusion of such genetically engineered lymphocytes .
- b) If a functional gene is introduced into the bone marrow cells at early embryonic stage, it would be a permanent cure.

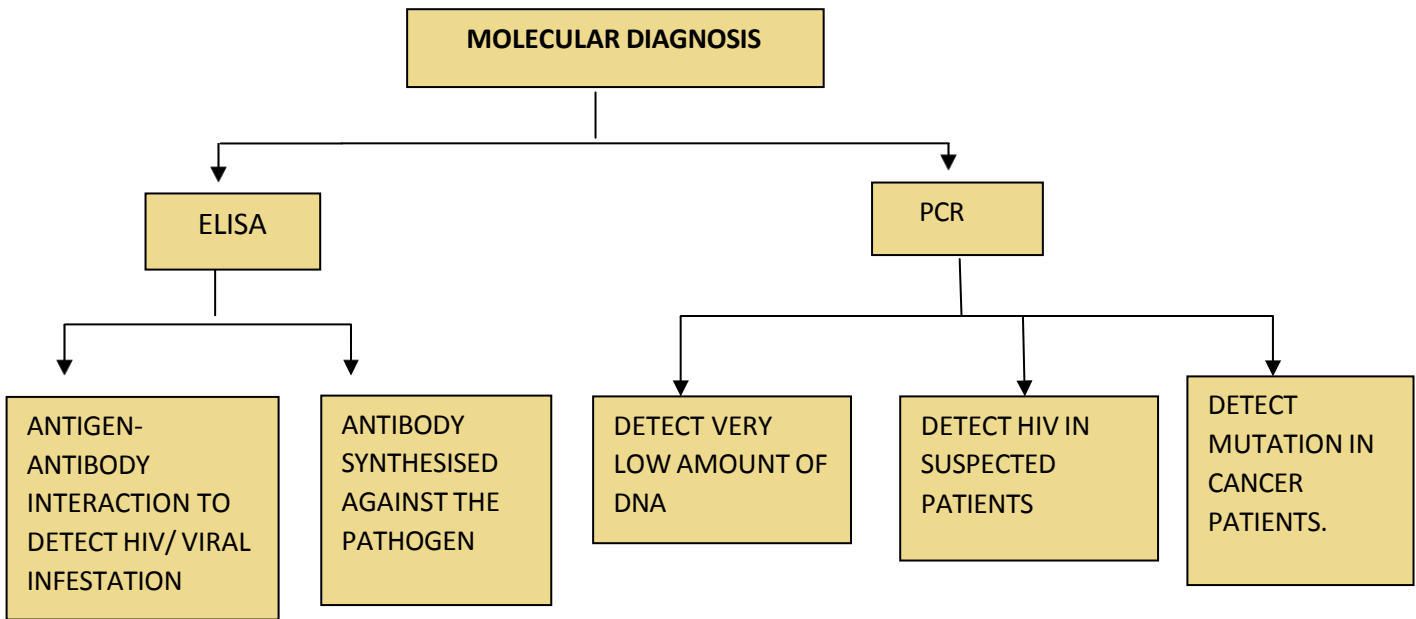
Molecular Diagnosis

- i) Recombinant DNA molecule and techniques like PCR are used for early diagnosis of disorders.
- ii) Cloned genes when expressed to produce recombinant proteins , help in developing sensitive diagnosis of techniques like ELISA.
- iii) The cloned genes are also used as probes to detect the presence of complementary DNA strand.

A probe is a piece of a single stranded DNA that is tagged with a radioactive molecule and it is used to find its complementary DNA by hybridisation. It is followed by detection of radioactivity by autoradiography.

- iv) Presence of normal or mutant gene can also be detected using such a method.

MOLECULAR DIAGNOSIS



TRANSGENIC ANIMALS

Transgenic animals are those animals that have had their DNA manipulated to possess and express a foreign gene.

Importance of Transgenic Animals :-

- i) Transgenic animals can be specifically designed to allow the study of how genes are regulated and how they affect the normal functions of the body and its developments. Eg. Information is obtained about the biological role of insulin like growth factors.

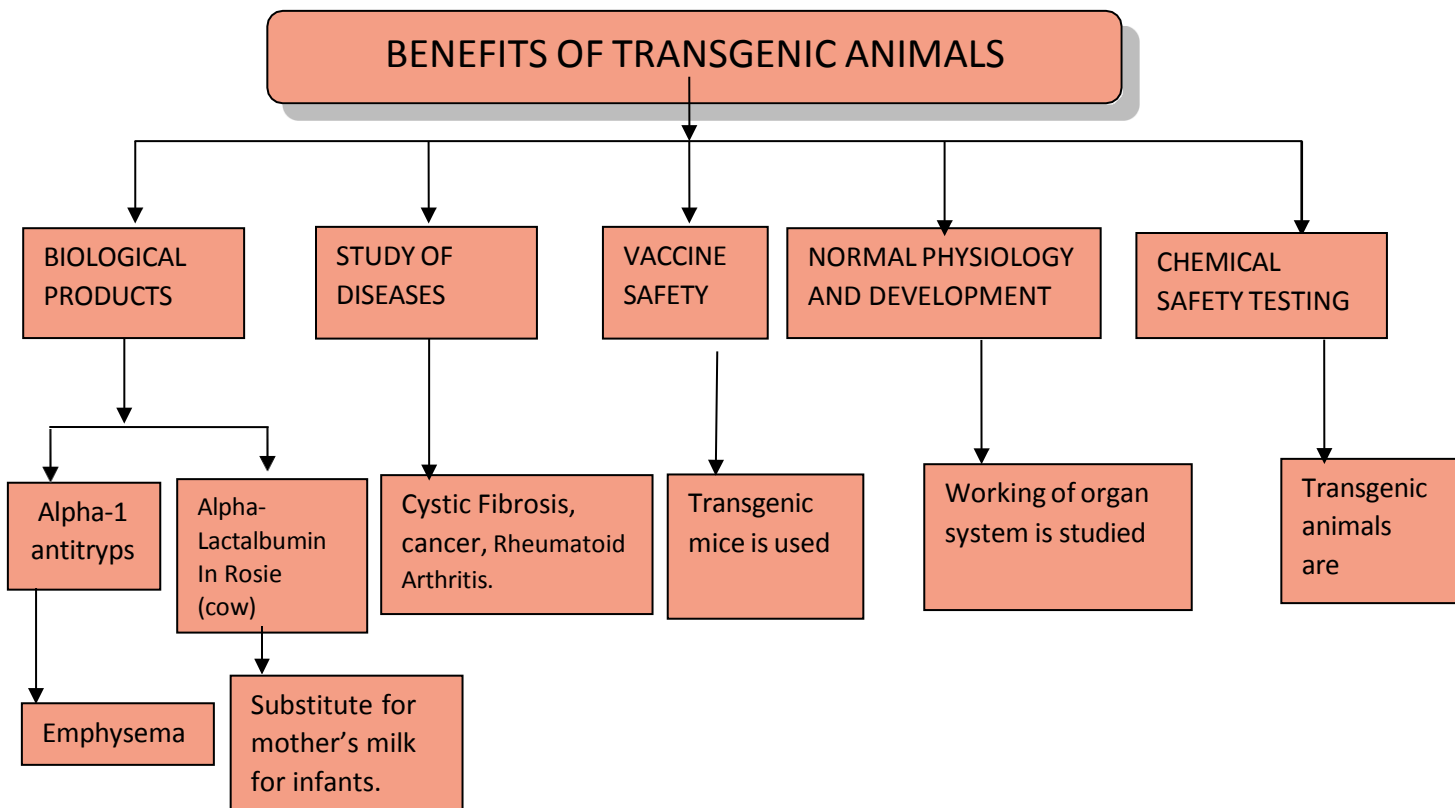
Transgenic animals are designed to increase our understanding of how genes contribute to the development of diseases. They are made to serve as models for human diseases.

- iii) Transgenic animals that produce useful biological compounds can be created by introducing a human protein used to treat emphysema.

eg. The first transgenic cow , Rosie ,produced the human protein enriched milk (2.4g/l).It also contained human alpha lactalbumin, a more nutritionally balanced product for human babies.

- iv) Transgenic are being developed for use in testing the safety of vaccines (e.g. polio vaccine)
- v) Transgenic animals with more sensitivity , to toxic substances are being developed to test the toxicity of drugs.

BENEFITS OF TRANSGENIC ANIMALS:



STEM CELL TECHNOLOGY

- * Definition :- Stem cells are the undifferentiated cells, which can divide (by mitosis) and differentiate into specialised cells.
- * Location :-
 - a) Embryonic stem cells are found in the inner cell mass of blastocyst and adult stem cells are found in the bone marrow , blood , adipose tissue etc.
 - b) Stems cells are also obtained from umbilical cord blood just after birth.

Properties of Stem Cells :-

- a) Self – renewal or ability to multiply.
- b) Potential to differentiate into specialised cells.

Example :- Bone marrow transplantation is an example of stem cell therapy.

ETHICAL ISSUES

- * Genetic modification of organisms can have unpredictable / undesirable effects, when such organisms are introduced into the ecosystem.
- * The modification and use of such organism for public service has also resulted in problems with the granting of patents.

GEAC (Genetic Engineering Approval Committee) :-

The Indian Govt. has set up GEAC which is authorised:-

- i) To make decisions regarding the validity of genetic modifications and
- ii) The safety of introducing genetically modified organisms for public services.

BIOPIRACY

Biopiracy refers to the use of bioresources by multinational companies and other organisations without proper authorisation from the countries and people concerned or without giving proper compensation to the people / countries concerned.

The industrialised / developed nations are rich financially , but poor in biodiversity and traditional knowledge, while the developing and underdeveloped countries are rich in bio resources and traditional knowledge. Such developed countries often indulge in Biopiracy.

Example :- The genome of Basmati Rice , Neem and Haldi was illegally patented by US Multinational companies illegally, however , these crops are of Indian Origin.

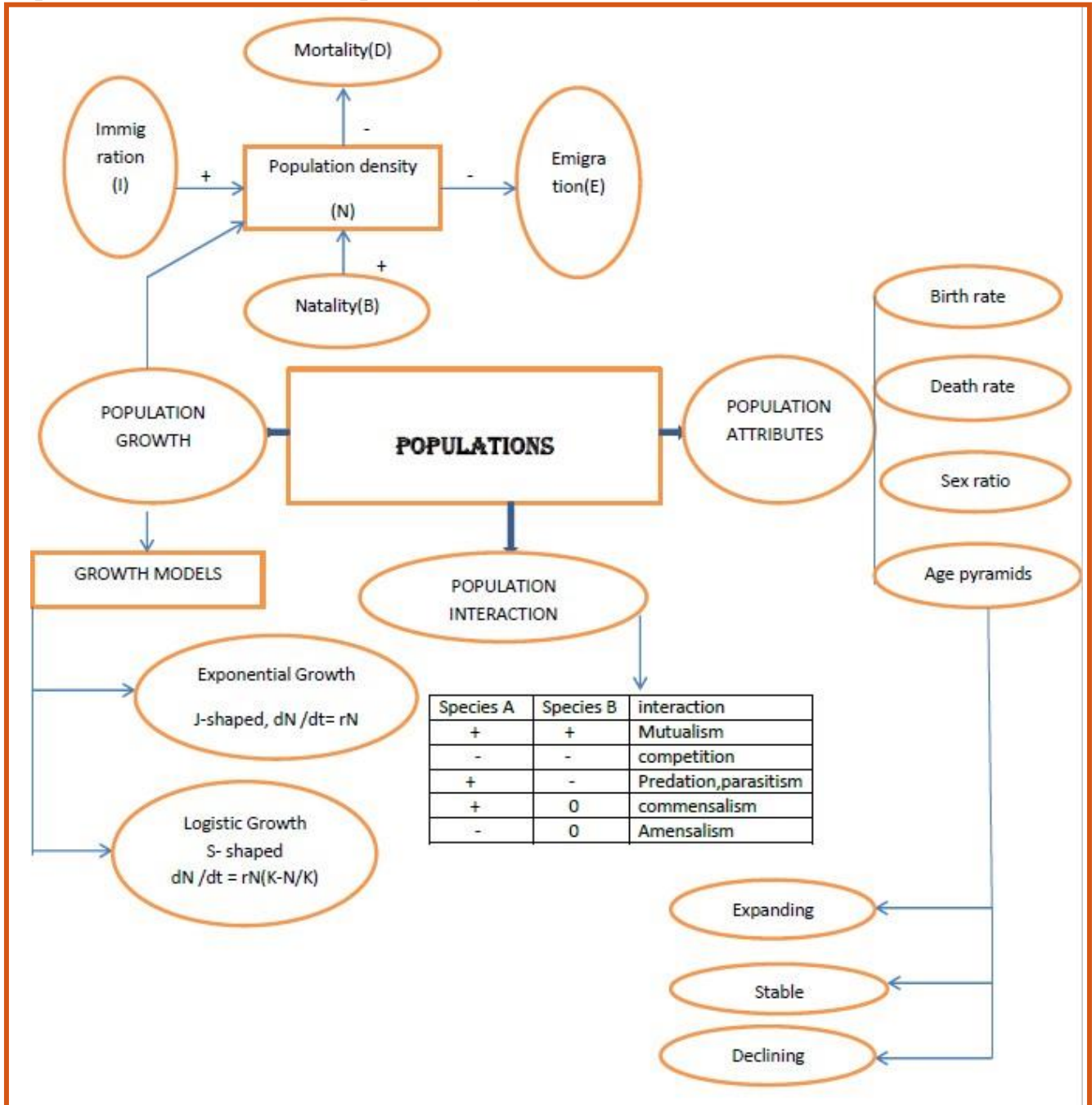
Unit 10 - ECOLOGY

Chapter 13 - ORGANISMS AND POPULATIONS

Ecology: Study of interactions among organisms between organisms and their physical environment.

Ecosystem: Biological community of interacting organisms and their physical environment.

Populations: A group of individual living in a well defined geographical area, share or compete for similar resources, potentially interbreed.



POPULATION:

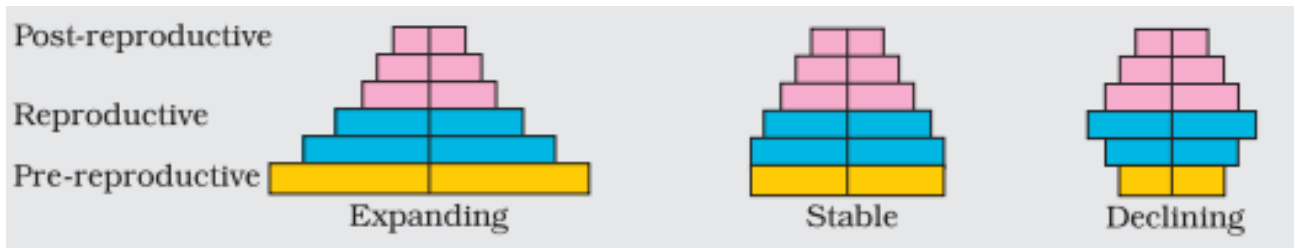
Population growth: Depends on the following factors.

Population size fluctuates due to changes in four basic processes, two of which (Natality and immigration) contribute an increase in population density and two (mortality and emigration) to a decrease.

Representation of age pyramids for human populations:

The geometrical diagrammatic representation of different age groups in a population of any organism is called Age of pyramids. These are of three types:-

- i) Expanding pyramid:- It is a broad base, triangular pyramid which represents a population containing large number of young people. It is rapidly expanding population with high birth rate.
- ii) Stable pyramid:- It represents a moderate proportion of young to old. As the rate of growth becomes slow & stable i.e.- pre-reproductive & reproductive age groups becomes more or less equal in size
- iii) Declining Pyramid:- The type of pyramid of population decreasing in size is characterised by a narrow base because there are fewer pre-reproductive individuals than in the other two age categories.



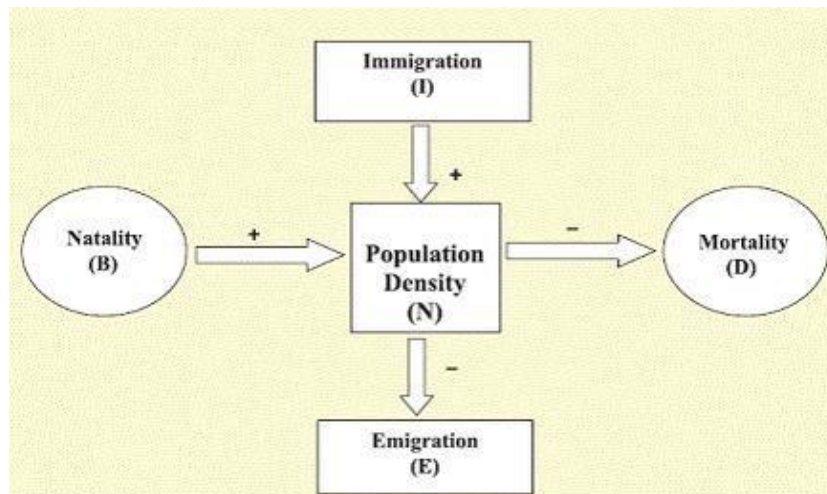
Natality: number of birth in given period in the population.

Mortality: number of deaths in the population in a given period of time.

Immigration: is the number of individuals of same species that have come into the habitat from elsewhere during a given period of time.

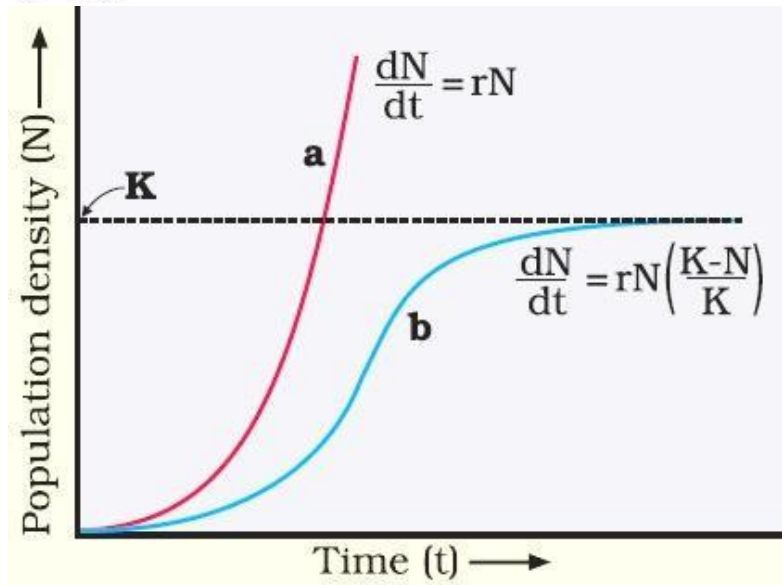
Emigration: number of individuals of the population who left the habitat and gone elsewhere during a given time period.

Population Density:



If 'N' is the population density at time 't', then its density at time t + 1 is :

$$N_{t+1} = N_t + [(B + I) - (D + E)]$$



Where B = the number of births

I = the number of immigrants

D = the number of deaths

E = the number of Emigrants.

N = Population Density

r = Intrinsic rate of natural increase

t = Time period

K= Carrying capacity (maximum population size that an environment can sustain)

Exponential growth:

- * The Exponential growth equation is $N_t = N_0 e^{rt}$
- * N_t = Population density after time t
- * N_0 = Population density at time zero
- * r = intrinsic rate of natural increase
- * e = the base of natural logarithms (2.71828)

Exponential growth ('J' shape curve is obtained).

- * When resources are not limiting the growth.
- * Any species growth exponentially under unlimited resources conditions can reach enormous population densities in a short time.
- * Growth is not so realistic.

Logistic growth model

- * Verhulst-Pearl Logistic Growth is described by the following equations
- * $dN/dt = rN (K-N / N)$
- * Where N = Population density at time t
- * r = Intrinsic rate of natural increase
- * K = Carrying capacity

Logistic Growth (Sigmoid curve is obtained)

- * When responses are limiting the Growth.
- * Resources for growth for most animal populations are finite and become limiting.
- * The logistic growth model is a more realistic one.

POPULATION DENSITY

Increase in population density (N) $\xrightarrow{\text{due to}}$ Natality (B) + Immigration (I)

Decrease in population density (N) $\xrightarrow{\text{Due to}}$ Mortality (D) + Emigration (E)

POPULATION GROWTH CURVE

INITIAL POPULATION $\xrightarrow{\text{In presence of unlimited resources}}$ Increases infinitely \rightarrow
Exponential growth.

Initial population $\xrightarrow{\text{in presence of limited resources (carrying capacity)}}$ increases till a limit and then stabilizes \rightarrow
Logistic growth

Population Interactions:

Species A	Species B	Name of Interaction
+	+	<i>Mutualism</i>
-	-	<i>Competition</i>
+	-	<i>Predation</i>
+	-	<i>Parasitism</i>
+	0	<i>Commensalism</i>
-	0	<i>Amensalism</i>

Predation is an interaction in which one organism, the predator, eats all or part of the body of another organism, the prey. For plants Herbivores are predators. is a form of predation in which the prey organism is a plant. Example American Pacific Coast the starfish *Pisaster* is a predator.

Competition

A process in which the fitness of one species (measured in terms of its 'r' the intrinsic rate of increase) is significantly lower in the presence of another species.

Eg. Abingdon tortoise in Galapagos Islands became extinct after goats were introduced on the island due to the greater browsing efficiency of the goats

Gause's 'Competitive Exclusion Principle' states that two closely related species competing for the same resources cannot co-exist indefinitely and the competitively inferior one will be eliminated eventually true if resources are limiting

Parasitism

Close relationship between species where one organism, the parasite, lives on or

inside another organism, the host causing it some harm, and adapted structurally to this way of life.
Eg. The human liver fluke (a trematode parasite) depends on two intermediate hosts (a snail and a fish) to complete its life cycle

Parasites that feed on the external surface of the host organism are called ectoparasites.

Example *Cuscuta*

Endoparasites are those that live inside the host body at different sites

Brood parasitism in which the parasitic bird (cuckoo) lays its eggs in the nest of its host (crow) and lets the host incubate them

Commensalism:

Type of interaction in which one species benefits and the other is neither harmed nor benefited

Example

- * An orchid growing as an epiphyte on a mango branch
- * Barnacles growing on the back of a whale
- * The cattle egret and grazing cattle
- * sea anemone that has stinging tentacles and the clown fish that lives among them

Mutualism

Interaction that benefits both the interacting species.

- * Lichens: relationship between a fungus and photosynthesising algae or cyanobacteria.
- * Mycorrhizae are associations between fungi and the roots of higher plants
- * Animals pollinating flowers and dispersing their seeds.
- * Fig trees and pollinator species of wasp

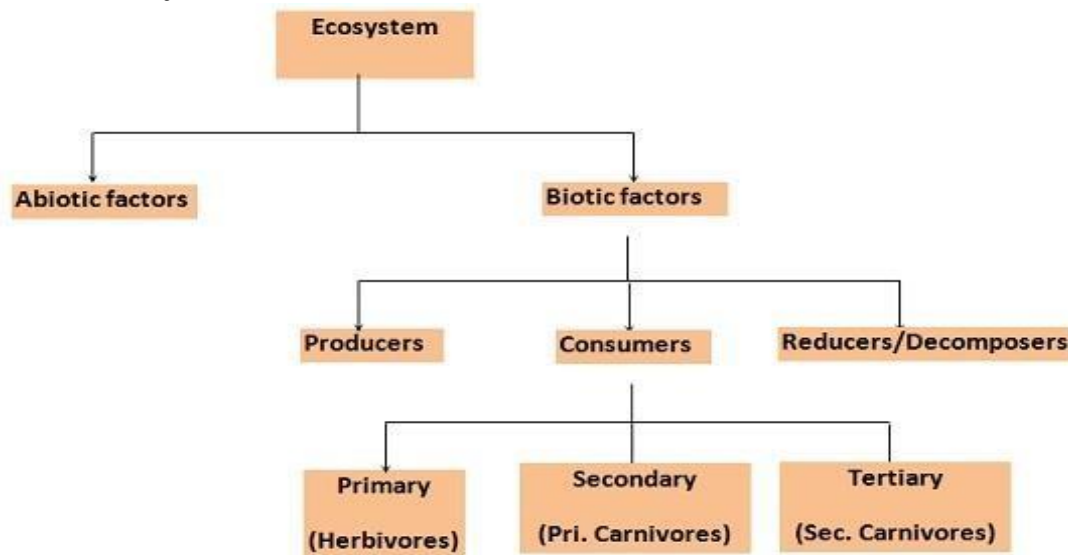
- * female wasp uses the fruit as an oviposition (egg-laying) site and for the developing seeds within the fruit for nourishing its larvae.
- * The Mediterranean orchid *Ophrys* employs 'sexual deceit' to get pollination done by a species of bee.

Link for Population interactions- Video:

<https://www.youtube.com/embed/uBSIz9mms8c>

Chapter 14 - ECOSYSTEMS

The interaction between the living organism and the non-living environment is called **ecosystem**.



ECOSYSTEM – STUCTURE AND FUNCTION:

The following components of the ecosystem functions as a unit:

- i) Productivity.
- ii) Decomposition.
- iii) Energy flow and
- iii) Nutrient cycle.

Link for Ecosystem Video

<https://www.youtube.com/embed/9MBdtbe5xDQ>

PRODUCTIVITY:

Primary productivity:

The amount of biomass or organic matter produced per unit area over a time period by plants during photosynthesis. The rate of biomass production is called **productivity**.

Gross primary productivity (GPP): The rate of production of organic matter during photosynthesis.

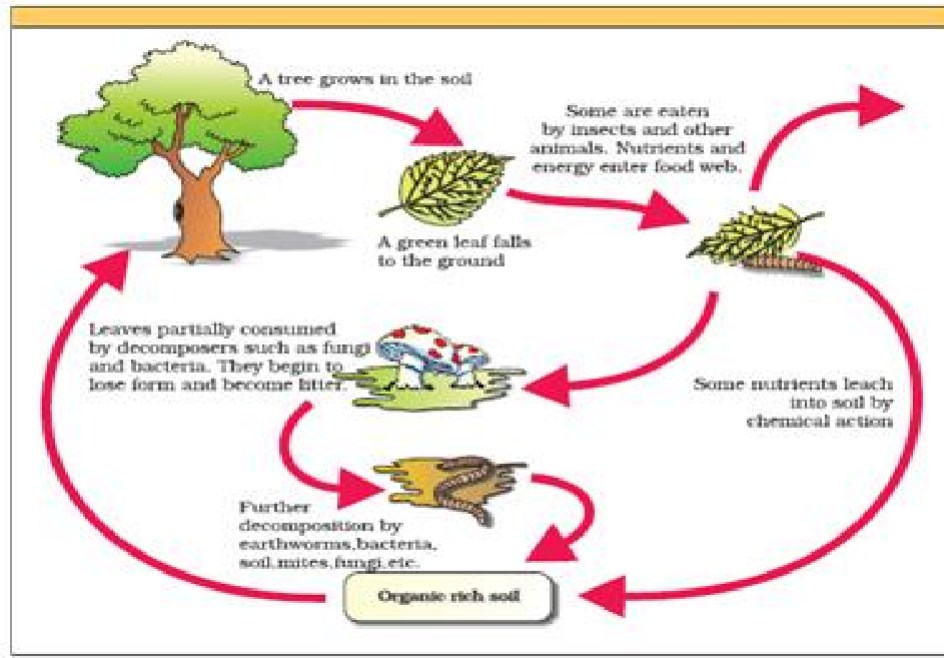
Net primary productivity:

A considerable amount of energy is utilized by plants in respiration. Gross primary productivity minus respiration losses (R) is the net primary productivity. $GPP - R = NPP$.

Net primary productivity is the available biomass for the consumption to heterotrophs (herbivore and decomposers).

Secondary productivity: The rate of formation of new organic matter by the consumer.

DECOMPOSITION:



The important steps in the process of decomposition:

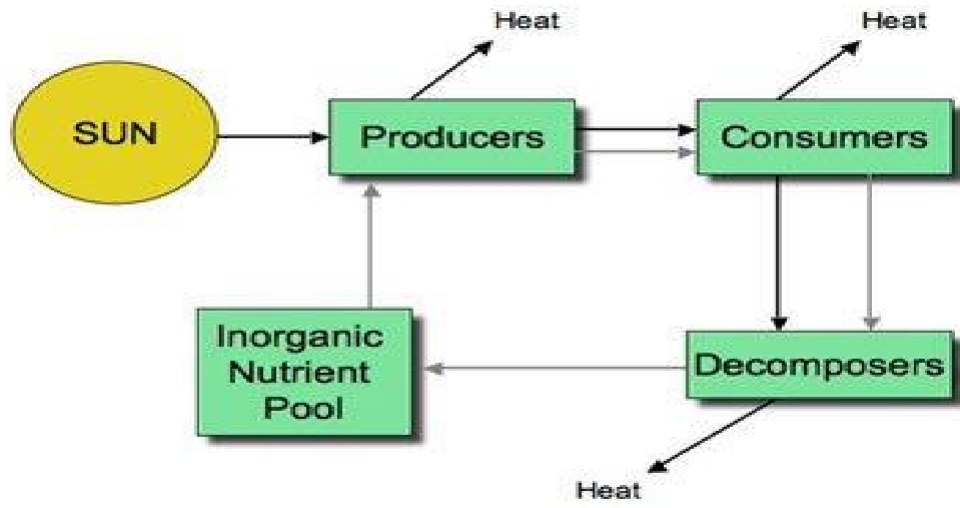
- i) **Fragmentation:** Detritivores (e.g., earthworm) break down detritus into smaller particles. This process is called fragmentation.
- ii) **Leaching:** Water soluble inorganic nutrients go down into the soil horizon and get precipitated as unavailable salts.
- iii) **Catabolism:** Bacterial and fungal enzymes degrade detritus into simpler inorganic substances. This process is called as catabolism.
- iv) **Humification:** leads to accumulation of a dark coloured amorphous substance called humus that is highly resistant to microbial action and undergoes decomposition at an extremely slow rate. Being colloidal in nature it serves as a reservoir of nutrients.
- v) **Mineralisation:** The humus is further degraded by some microbes and release of inorganic nutrients occur by the process known as mineralisation.

Factors affecting Decomposition:

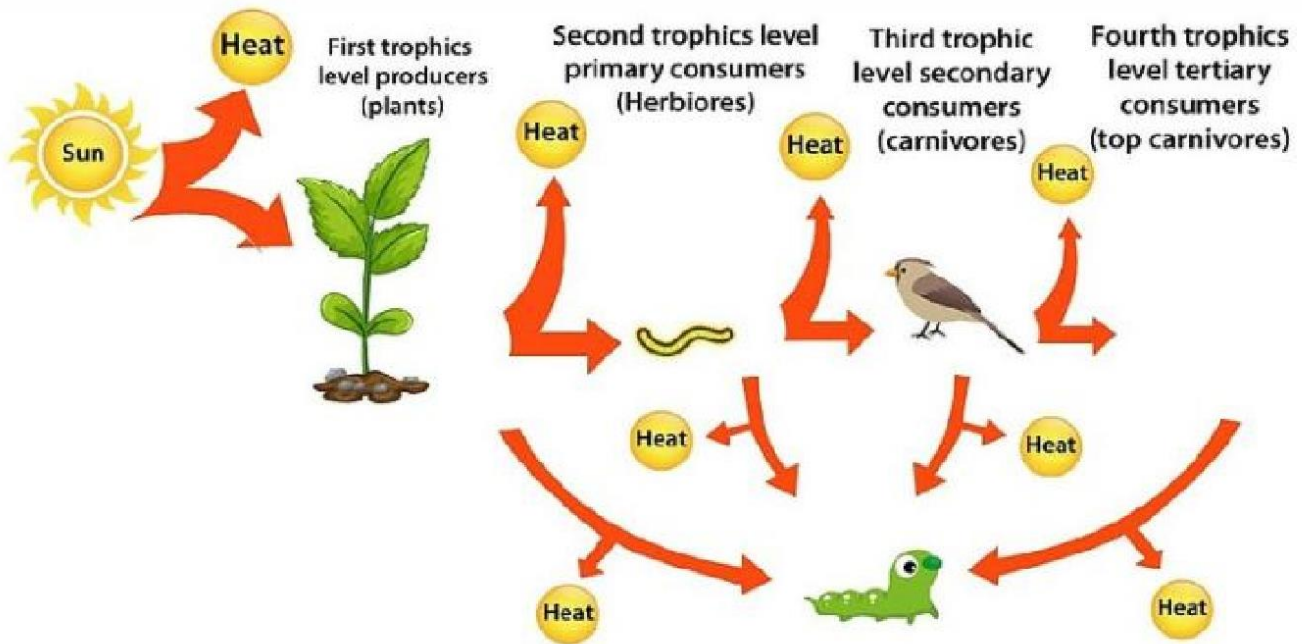
- i) The rate of decomposition is controlled by chemical composition of detritus and climatic factors.
- ii) In a particular climatic condition, decomposition rate is slower if detritus is rich in lignin and chitin, and quicker, if detritus is rich in nitrogen and water-soluble substances like sugars.
- iii) Temperature and soil moisture are the most important climatic factors that regulate decomposition through their effects on the activities of soil microbes.
- iv) Warm and moist environment favour decomposition whereas low temperature and anaerobiosis inhibit decomposition resulting in build-up of organic materials.

ENERGY FLOW

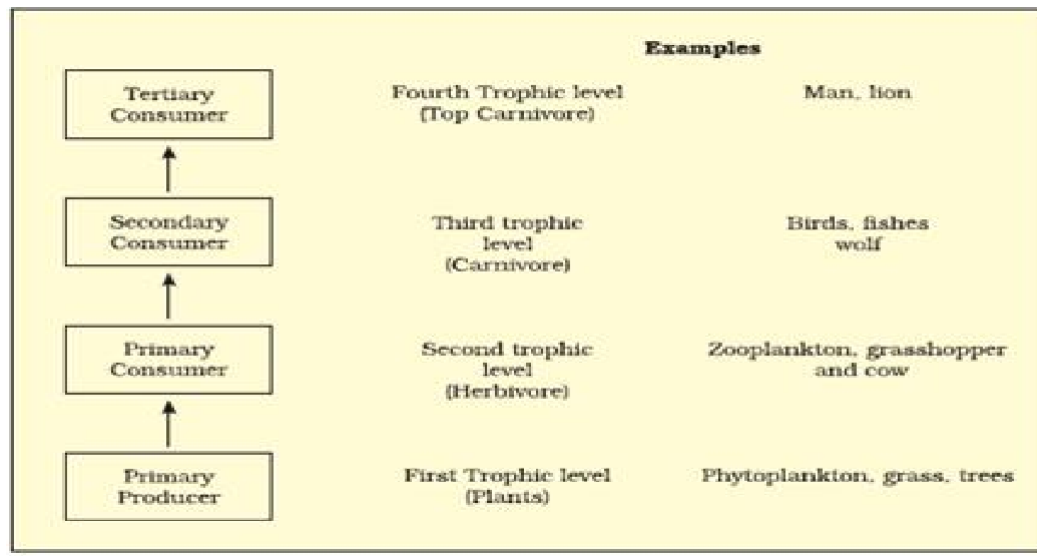
- * Flow of energy is unidirectional from the sun to producers and then to consumers.
- * The green plants in the ecosystem are called producers.
- * All organisms are dependent for their food on producers, either directly or indirectly.
- * In a terrestrial ecosystem, major producers are herbaceous and woody plants and in an aquatic ecosystem major producers are phytoplankton, algae and higher plants.
- * All animals depend on plants (directly or indirectly) for their food needs and they are called consumers.



Energy Flow through different Trophic Levels



Trophic levels in an ecosystem:



Food chain: The sequence of transfers of matter and energy in the form of food from organism to organism forms food chain.

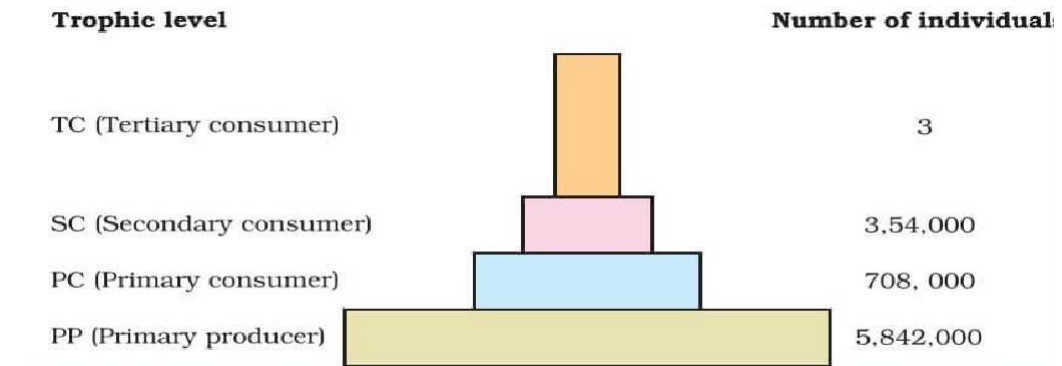
Food chain → **Grazing food chain** (starts from producers through herbivore to carnivore)
→ **Detritus food chain** (starts from dead organic matter (detritus) and pass through detritus feeding organism in soil to organisms feeding on detritus-feeders).

ECOLOGICAL PYRAMID:

- * The base of the pyramid is broad and it narrows down at the apex. The similar shape is obtained when food or energy relationship between organisms at different trophic level.
- * The relationship can be expressed in terms of number, energy or biomass.
- * The base of the pyramid represented by producer and apex is the top consumer; other trophic levels are in between.
- * In most ecosystems, all the pyramids, of number, of energy and biomass are upright.
- * The pyramid of **number** in a tree ecosystem is **inverted**.
- * The pyramid of **biomass** in sea also **inverted** because the biomass of fishes is far exceeds that of phytoplankton.

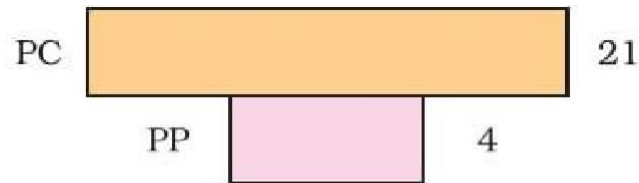
Pyramid of **energy** is **always upright**, can never be inverted, because when energy flows from a particular trophic level to the next, some energy is always lost as heat at each step.

Pyramid of numbers in a grass land ecosystem:



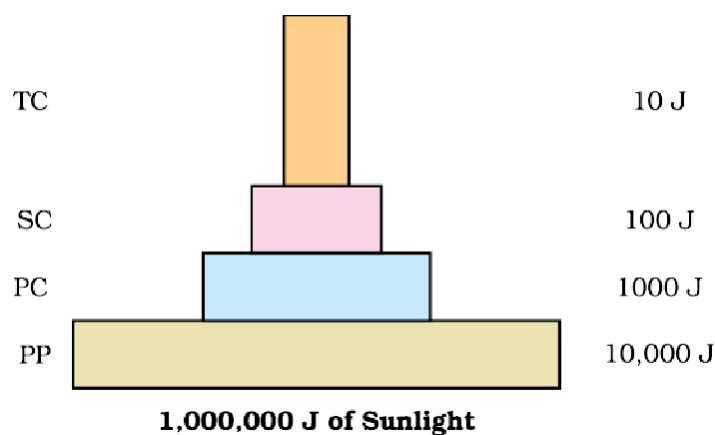
Pyramid of numbers in a grassland ecosystem. Only three top-carnivores are supported in an ecosystem based on production of nearly 6 millions plants

Inverted pyramid



Inverted pyramid of biomass-small standing crop of phytoplankton supports large standing crop of zooplankton

An ideal pyramid of energy



Ecological Succession:

The gradual and fairly predictable change in the species composition of a given area is called Ecological Succession.

All the changes lead finally to a community that is in near equilibrium with the environment and that is called **climax community**. The first community from which the ecological succession started is called **pioneer community**.

The entire sequences of communities that successively change in a given area are called **seres**.

The individual transitional communities are termed as **seral stages**.

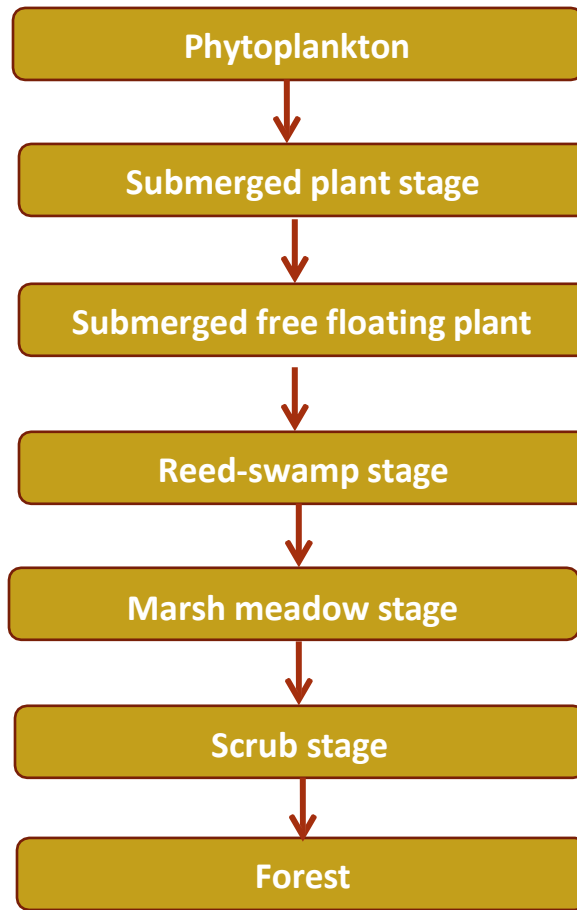
Video link for Ecological Succession:

<https://www.youtube.com/embed/ewJ96jjwHn0>

Differences between Primary & Secondary Succession

Properties	Primary Succession	Secondary Succession
Meaning	It is a type of succession that starts from barren or uninhabited land.	It is the type of succession which occurs in a habitat where life existed previously.
Occurs	It occurs in lifeless or barren areas.	It occurs in recently denuded or previously inhabited areas.
Time to complete	Takes around 1000 years, which may be more.	It takes place in 50 to 200 years.
Physical Conditions	Conditions are least suitable for the survival of life. Soil is devoid of nutrients or there is no soil at all.	As life once existed. There is the presence of soil and may also even some nutrients in the soil.
Humus	Humus is absent.	Humus is present due to the presence of previous inhabitants.
Seral community	There are several intermediary seral communities.	Few intermediary seral communities are present, compared to the primary succession.
Environment	It begins with an unfavourable environment.	The environment is more or less favourable right from the beginning.
Examples	Bare rock, ponds, desert, lava-filled lands, etc.	The areas that are affected by natural calamities, covered under deforestation, or devastated by human interactions, etc.

Primary succession:



Hydrarch succession is a form of plant succession that starts in a shallow water and eventually culminates in a forest.

Xerarch succession is a form of plant succession, which starts from a very dry place and eventually culminates in the mature forest.

Differences between Hydrarch succession and Xerarch succession

Hydrarch succession	Xerarch succession
1.This succession begins in the water first and then results into a forest.	1.This succession begins in a dry area and then results into a forest.
2.This progresses from hydric to mesic condition.	2.This progresses from xeric to mesic condition..
3.It begins from the phytoplankton stage.	3.It begins from bare rocks.
4.Usually they start growing on shallow ponds, lakes and other water bodies.	4.It usually start growing on rock deserts and sand dunes.

NUTRIENT CYCLING:

The movement of nutrient elements through the various component of an ecosystem is called nutrient cycling or biogeochemical cycle.

Standing state: The amount nutrients such as carbon, nitrogen, phosphorus, calcium etc. present in soil at any given time.

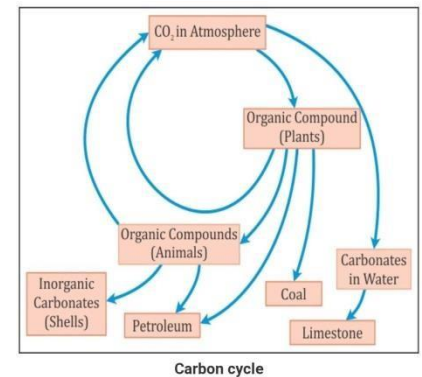
Nutrient cycles are of two types: **Gaseous cycle and Sedimentary cycle.**

The reservoir for gaseous type of nutrient cycle (nitrogen, carbon) exists in the atmosphere.

The reservoir for sedimentary cycle (sulphur, phosphorus) is Earth's crust.

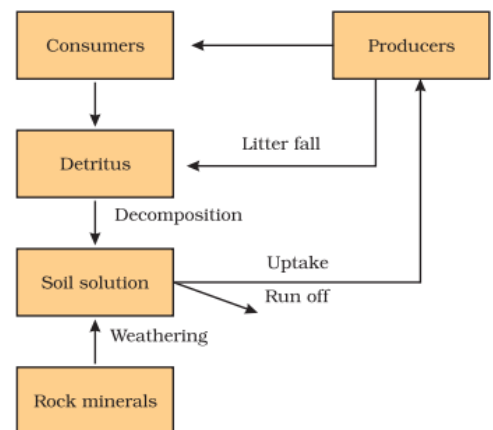
Carbon cycle:

- * Carbon constitutes **49 percent** of dry weight of organism.
- * Large amount of carbon returned to the atmosphere as CO₂ through respiration of producers and consumers.
- * Decomposers also return CO₂ to reservoir during decomposition process.
- * Some amount of Carbon is lost to sediments and removed from circulation.
- * Burning wood, forest fire, combustion of organic matter, fossil fuel, volcanic activities are additional sources for releasing CO₂ to atmosphere.



Phosphorus cycle:

- * Phosphorus is a major constituent of biological membranes, nucleic acids and cellular energy transfer system(ATP)
- * Animals need phosphorus to make shell, bones and teeth.
- * Reservoir pool of phosphorus is the rock, which contain phosphorus in the form of **phosphates**.
- * During weathering of rock small amount of phosphates dissolved in soil solution and are absorbed by the roots of the plants.
- * Herbivore and other animals obtain organic form of phosphorus from plants.
- * The waste product and dead organisms are decomposed by phosphate-solubilising bacteria releasing phosphorus.



Differences between phosphorus cycle and carbon cycle

- * There is no respiratory release of phosphorus into atmosphere.
- * Atmospheric inputs of phosphorus through rainfall are much smaller.
- * Gaseous exchange of phosphorus between organism and environment are negligible.

ECOSYSTEM SERVICES:

- * The products of ecosystem processes are named as **ecosystem services**.
- * Healthy forest ecosystems purify air and water.
- * Mitigate droughts and flood.
- * Cycle nutrients and generates fertile soil.
- * Provide wildlife habitat, maintain biodiversity and pollinate crops.
- * Provide storage site for carbon
- * Provides aesthetic, cultural and spiritual values

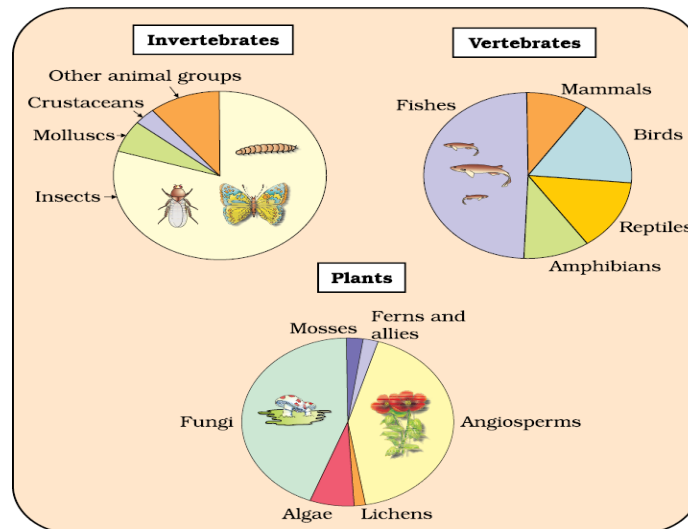
Chapter 15 - BIODIVERSITY AND CONSERVATION

Biodiversity: the term biodiversity refers to the totality of genes, species, and ecosystems of a region.

Types of biodiversity described by **Edward Wilson:**

Genetic diversity	Species diversity	Ecological diversity
<p>A single species might show high diversity at the genetic level over its distributional range. Eg. Medicinal plant <i>Rauwolfia vomitoria</i> of Himalayan range produces active chemical reserpine shows genetic variation. India has more than 50000 different strain of rice. 1000 varieties of mango.</p>	<p>The diversity at the species level. Eg. The Western Ghats have a greater amphibian species diversity than Eastern Ghats.</p>	<p>Diversity in the ecosystem level like desert, rain forest, mangroves, coral reef, wetlands, estuaries etc.</p>

Global Biodiversity: Proportionate number of species of major taxa of plants, invertebrates and vertebrates.



Pattern of Biodiversity:

Latitudinal gradients:

- * Species diversity decreases as we move away from the equator towards the pole.
- * Tropic (23.5° N to 23.5° S) harbors more species than temperate and pole
- * The largely tropical Amazonian rain forest in South America has the greatest biodiversity on earth:
- * 40,000 species of plants, 3000 species of fishes, 1300 of birds, 427 amphibians, 378 reptiles and more than 1,25,000 invertebrates.

- * Unlike temperate regions subjected to frequent glaciations in the past, tropical latitudes have remained relatively undisturbed for millions of years and thus, had a long evolutionary time for species diversification.
- * Tropical environments. Unlike temperate ones, are less seasonal, relatively more constant and predictable, promotes niche specialization and lead to greater species diversity.
- * There is more solar energy available in the tropics, which contribute to higher productivity.

Species area relationship:

- * ALEXANDER VON HUMBOLDT observed within a region species richness increased with increasing explored area but only up to a limit.
- * The relation between species richness and area for a wide variety of taxa turns out to be a rectangular hyperbola.
- * On a logarithmic scale the relationship is a straight line describe by the equation $\text{LogS} = \text{logC} + \text{Z log A}$

Where S= species richness, A = Area, Z = slope of the line (regression coefficient), C = Y- intercept.

Species area relationship:

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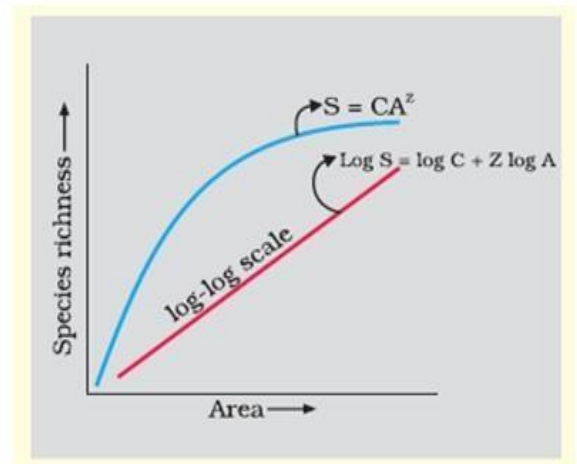
The relation between species richness and area for a wide variety of taxa turns out to be a rectangular hyperbola.

On a logarithmic scale the relationship is a straight line describe by the equation

$$\text{LogS} = \text{logC} + \text{Z log A}$$

Where S= species richness, A = Area, Z = slope of the line (regression coefficient), C = Y- intercept.

It has been noted that regardless of the taxonomic group or region the slope of the regression line are amazingly similar. However, for a very large area like the entire continent the slope of the line is steeper.



David Tillman's long-term field experiment finds that:

- * Plots with more species showed less year to year variation in biomass
- * Increased diversity contributed to higher productivity.

The rivet popper hypothesis:

- * In an airplane (ecosystem) all parts are joined together by thousands of rivets (species).
- * If every passenger starts popping a rivet to take home (species extinct), it may not affect flight safety initially but as more and more rivets are removed the plane becomes dangerously weak.
- * Further more which rivet is removed may also be critical.
- * Loss of rivets on the wings (key species) is obviously a more serious threat to flight safety than loss of a few rivets on the seats or windows inside the plane.

Loss of Biodiversity:

- * The IUCN Red List (2004) documents the extinction of 784 species.
- * Recent extinction includes: Dodo (Mauritius), Quake (Africa), Thylacine (Australia), Stiller's cow (Russia), Three subspecies of tiger (Bali, Java, Caspian).

- * Since the origin and diversification of life on earth there were **five episodes** of **mass extinction** of species.

The sixth mass Extinctions in progress now.

The Sixth Extinction is different from the previous five extinctions because the current extinction rate is 100 to 1000 times faster due to this one is anthropogenic influence.

Effects of biodiversity loss:

- * Decline in plant production.
- * Lowered resistance to environmental perturbations such as drought.
- * Increased variability in certain ecosystem processes such as plant productivity, water use, and pest and disease cycle.

Causes of biodiversity loss:

The present loss is all due to human activity (anthropogenic)

There are four major causes known as “**The Evil Quartet**” are as follows:

- * **Habitat loss and fragmentation:**

- * **Over-exploitation:**

- * **Alien species invasion:**

Eg. i) Nile perch introduced into Lake Victoria in east Africa led to extinction of 200 species of **cichlid fish** in the lake.

ii) *Parthenium*, (carrot grass), ***Lantana***, and water hyacinth (***Eichornia***) posed a threat to indigenous species.

iii) African cat fish *Clarias gariepinus* for aquaculture purposed is posing a threat to indigenous catfishes in our rivers.

Co-extinction:

When a species becomes extinct, the plant and animal species associated with it an obligatory way also become extinct. Extinction of **Host species** leads to extinction of the **parasite** also. Co-evolved **plant-pollinator** mutualism where extinction of one invariably lead to the extinction of the other.

Conservation of Biodiversity:

Reason for conservation biodiversity is grouped into three categories.

i) Narrowly utilitarian.

ii) Broadly utilitarian

iii) Ethical

Narrowly utilitarian:

- * Human derive countless direct economic benefits from nature-
- * Food (cereals, pulses, fruits), firewood, fiber, construction material.
- * Industrial products (tannins, lubricants, dyes, resins, perfumes)
- * Products of medicinal importance.
- * **Bioprospecting:** exploring molecular genetic and species-level diversity for products of economic importance.

Broadly Utilitarian

- * Amazonian forest along produce 20% of oxygen during photosynthesis.
- * **Pollinator layer:** bees, bumblebees, birds and bat that pollinate the plant without which seed cannot be produced by plants.
- * Aesthetic pleasure we get from the biodiversity.

Two types of conservation of biodiversity: In situ and Ex situ conservation.

In situ conservation:

- * When we conserve and protect the whole ecosystem, its biodiversity at all level is protected – we save the entire forest to save the tiger. This approach is called **in situ** (on site) conservation.
- * **Biodiversity hot spot:** regions with very high levels of species richness and high degree of **endemism**.(species confined to that region and not found anywhere else)
- * Hot spot in biodiversity is also regions of accelerated habitat loss.
- * Out of 34 hot spot in the world, three hot spot located in India:
 - Western Ghats and Srilanka.
 - Indo-Burma.
 - Himalaya.
- * Other protected area under in situ conservations are:
 - 14 biosphere reserve
 - 90 national park
 - 448 wild life sanctuary
- * **Sacred groves:** tract of forest were set aside, and all the trees and wildlife within were venerated and given total protection.

Ex situ conservation: threatened animals and plants are taken out from their natural habitat and placed in special setting where they can be protected and given special care.

- * Zoological Park.
- * Botanical garden
- * Wildlife safari.
- * Conservation of gamete by **cryopreservation**.
- * Genetic strains are preserved in **seed bank**.
- * **Convention on Biodiversity:**
- * **“The earth Summit”** held in Rio de Janeiro in 1992 called upon all nations to take appropriate measures for conservation of biodiversity and sustainable utilization of its benefits.
- * **World Summit** on Sustainable development held in 2002 in Johannesburg, South Africa, 190 countries pledged their commitment to achieve by 2010 a significant reduction in the current rate of biodiversity loss at global, regional and local level.



KENDRIYA VIDYALAYA SANGATHAN, ZIET GWALIOR

Interactive Study Material

CLASS - XII (2022-23)


ECONOMICS

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Unit: 1- NATIONAL INCOME AND RELATED AGGREGATES

GIST OF THE LESSON:

CONCEPTS OF STOCK AND FLOW

BASIS	STOCK	FLOW
Meaning	It refers to that variable which is measured at a particular point of time	It refers to that variable which is measured over a period of time
Time dimension	It does not have time dimension	It has time dimension as its magnitude can be measured over a period of time.(a week, a month, a year)
Concept	Static concept	Dynamic concept
Examples	<ul style="list-style-type: none">• Money supply• National wealth• Capital stock• Quantity of wheat stored• Total population as on 31.03.2019• Total number of houses as on 31.03.2019	<ul style="list-style-type: none">• Transaction in money• National income• Investment• Quantity of wheat produced• Number of births in the year 2018• Total number of houses constructed

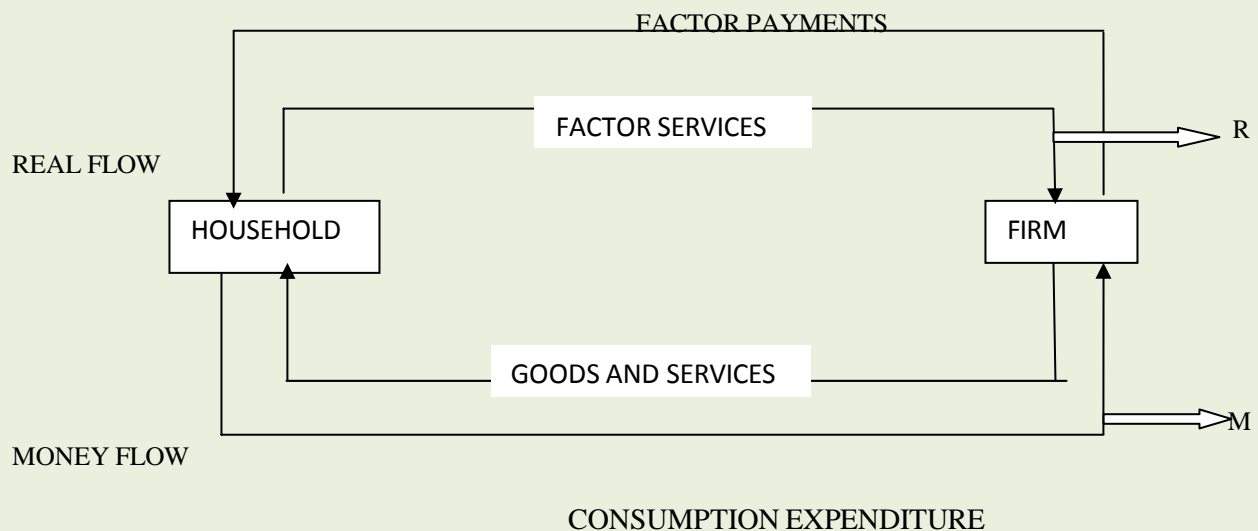
TYPES OF CIRCULAR FLOW

Real flow

- It refers to flow of factor services from households to firms and the corresponding flow of goods and services from firms to households
- The household provides factor services to the firms which in turn provide goods and services to them as reward for their productive services.
- It determines the magnitude of growth process in an economy

Money flow

- It refers to flow of factor payments from firms to households for the factor services rendered by households and the corresponding flow of consumption expenditure from households to firms for the purchase of goods and services
- It involves exchange of money
- It is known as Nominal flow



BASIC CONCEPTS

1. **Normal Resident** – it refers to an individual or an institution who **resides in a country for more than one year** and whose **economic interest** lies in that country

Following are not included in “Normal resident”:

- a. Foreign tourists who visit for recreation, holiday, medical treatment, study
- b. Foreign staff of embassies, diplomats and members of armed forces of a foreign country located in the given country etc
- c. International organisations like UNO, WHO.- they are treated as residents of international area
- d. Employees of international organisation are considered as residents of the countries to which they belong and not of the international area. But if the employees work for more than one year in such international institutions, then they become the normal residents of the country in which such institutions are located.
- e. Crew members of foreign vessels provided their stay is less than one year
- f. Border workers who live near international border and cross the border on a regular basis to work in the other country. They are treated as normal resident of the country where they live.

2. Factor Income and Transfer Income

Factor Income/ Factor payments	Transfer Income / Transfer payments
It refers to income earned by the factors of production for rendering factor services	It refers to income received without rendering any productive services
It is included in National and Domestic income	It is not included in National and domestic income
It is bilateral	It is unilateral transfers
It is received by factors of production	It is received by household, firm and government sector
Rent, interest, wages, profits	Scholarships, unemployment allowance, Old age pension, subsidy, taxes

3. Final Goods and Intermediate goods

Final Goods	Intermediate goods
These are those goods which are used for final consumption or for investment	These are those goods which are either used for resale or for further production in the same year
Included in National and domestic income	Not Included in National and domestic income
They cross the production boundary	They are within the production boundary
Ready to use by their final users and no value has to be added to final goods	Not ready for use by their final users and value has to be added to intermediate goods
Milk purchased by households	Milk used in sweets shop for preparation of sweets

4. Consumption goods and Capital goods

Consumption goods	Capital goods
These goods satisfy human wants directly	These goods satisfy human wants indirectly
They have direct demand	They have derived demand
They do not raise production capacity	They raise production capacity

Most consumption goods (except durable goods) has limited life

Capital goods) has expected limited life of more than one year.

5. Gross investment, Net investment and Depreciation

- a. Gross Investment – addition to stock of capital before making allowance for capital.

(Gross investment = Expenditure on purchase of fixed assets + Unsold stock)

- b. Net investment – actual addition made to the capital stock during a given period of time.

(Net investment = Gross investment – Depreciation)

- c. Depreciation – Fall in the value of fixed assets due to normal wear and tear, passage of time or expected obsolescence (change in technology)

6. Net Factor Income from Abroad (NFIA) = Factor income Received from Abroad minus

Factor income Paid to Abroad

NATIONAL INCOME FORMULAE

1. **GROSS DOMESTIC PRODUCT at market price** – it is the money value of all final goods and services produced within the domestic territory by residents and non-residents during a given period of time including depreciation
2. **GROSS DOMESTIC PRODUCT at factor cost** – it is the sum of all factor income earned by the factors of production within the domestic territory by residents and non-residents during a given period of time including depreciation

GDP fc = GDP mp – Net Indirect Tax

3. **NET DOMESTIC PRODUCT at market price** – it is the money value of all final goods and services produced within the domestic territory by residents and non-residents during a given period of time excluding depreciation
NDP mp = GDP mp - depreciation

4. **NET DOMESTIC PRODUCT at factor cost** – it is the sum of all factor income earned by the factors of production within the domestic territory by residents and non-residents during a given period of time excluding depreciation

NDP fc = GDP mp - depreciation– Net Indirect Tax

Domestic factor income (NDP fc) = Compensation of Employees (wages and salary + employer's contribution to social security+ bonus + pension of retired person)

+ Operating Surplus (rent + interest + royalty+ profit)

+ Mixed income of self employed

5. **GROSS NATIONAL PRODUCT at market price** – it is the money value of all final goods and services produced by residents within the domestic territory and abroad during a given period of time including depreciation

GNP mp = GDP mp + Net factor income from abroad

6. **GROSS NATIONAL PRODUCT at factor cost** – it is the sum of all factor income earned by the factors of production by residents within the domestic territory and abroad during a given period of time including depreciation

GNP fc = GDP mp + Net factor income from abroad – Net indirect tax

OR

GNP fc = GNP mp - Net indirect tax

7. **NET NATIONAL PRODUCT at market price** – it is the money value of all final goods and services produced within the domestic territory and abroad by residents during a given period of time excluding depreciation

8. **NET NATIONAL PRODUCT at factor cost** – it is the sum of all factor income earned by the factors of production within the domestic territory and abroad by residents during a given period of time excluding depreciation

NNP fc = GDP mp - depreciation– Net Indirect Tax +Net factor income from abroad

OR

NNP fc = NDP fc (DFI) +Net factor income from abroad

Methods of Measuring National Income

I. INCOME METHOD

Step 1 - Classification of Production Units into primary, secondary and Tertiary sectors.

Step 2. Calculation of Domestic Factor Income (NDP at FC)

NDPfc = Compensation of Employees (wages and salary+ employer's contribution to social security schemes + pension of retired person)

+ Operating Surplus (rent + interest + royalty+ profit)

+ Mixed income of self employed

Step 3. $NDP_{fc} + NFIA = NNP_{fc}$ (National Income)

II. VALUE ADDED METHOD

Step 1 - Classification of Production Sectors-

All the production units will be classified into primary, secondary and tertiary sectors

Step 2- Calculation of Net Value Added at FC=

(NDP at FC)

= Value of output (Sales + change in stock) – intermediate consumption– depreciation – Net indirect tax.

Step 3- Adding NFIA to get NNP at FC

$NDP_{at\ FC} + NFIA = NNP_{at\ FC}$

III. EXPENDITURE METHOD

Step 1 – Classification of Sectors Incurring Expenditure on GDP- Household Sector, Investment Sector (Production Sector), Government Sector, Foreign Sector (Rest of the World Sector).

Step 2- Calculation of expenditure from all the Four sectors of the economy

GDP mp = Private final consumption expenditure

+ government final consumption expenditure

+ gross domestic capital formation (gross domestic fixed capital formation + change in stock)

+ Net Exports (Export – Import)

Step 3 – Calculation of National Income

GDP mp – depreciation – Net indirect tax + NFIA = NNP fc

E-Material

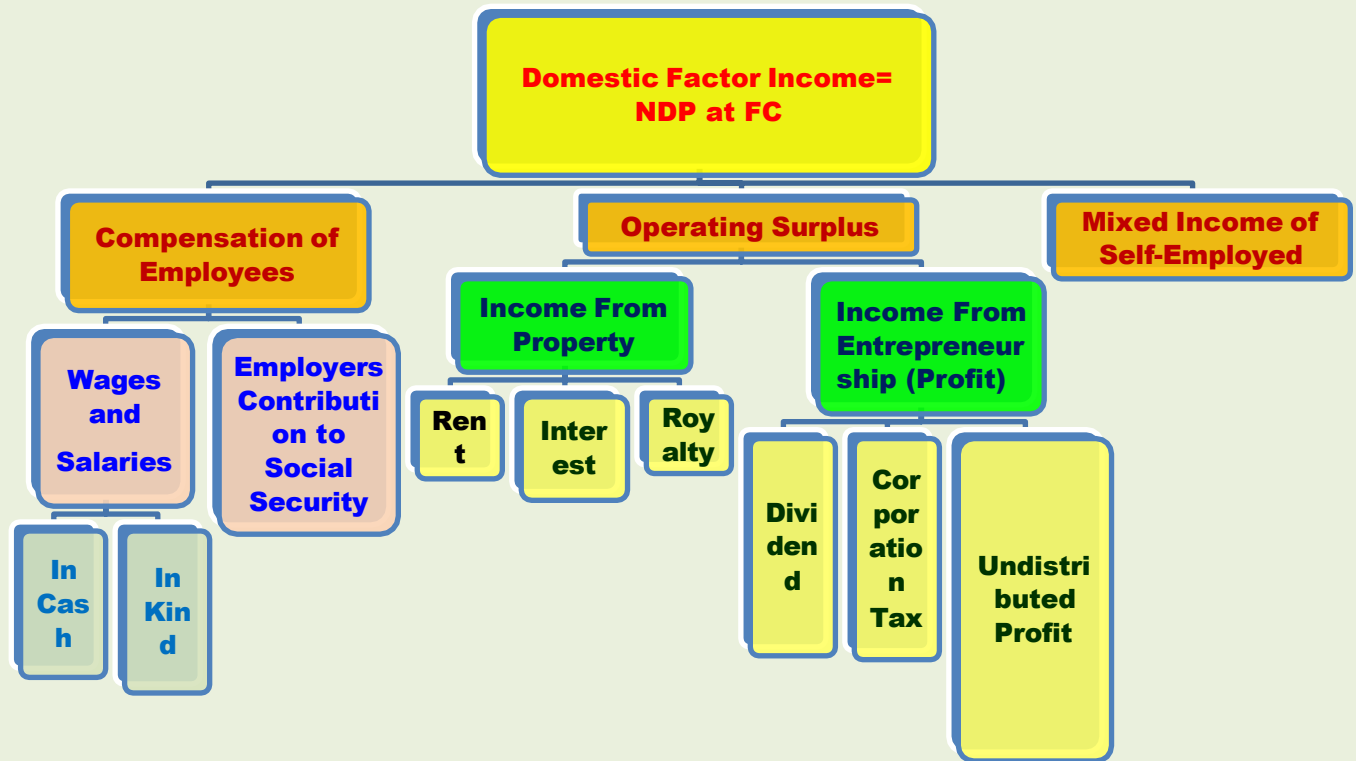
1. Basic Concepts of National Income Accounting (pdf):

https://drive.google.com/file/d/1HqYbBd3gOLtXgABtyQitpV5YtDNLh4Pd/view?usp=share_link

3. National Income - Income Method (Video Lesson):

https://www.youtube.com/watch?v=tQ0sHBg_W_M&t=21s

COMPONENTS OF DOMESTIC FACTOR INCOME



4. Value Added Method (Video Lesson):

https://drive.google.com/file/d/1Dq35J_UrG37G96dEXVCJAglxvl6M34u/view?usp=sharing

7. National Income- Expenditure method:

(Video Lesson):

<https://drive.google.com/file/d/10Vmm5oEX2JvRJ8EmNVBxY7B7Ijusij9c/view?usp=sharing>

8. GDP and Welfare: (Audio Explanation)-

<https://drive.google.com/file/d/1URkrx726SHuzhtOpDfz5TwZ6QTKRwcWp/view?usp=sharing>

Unit-2: MONEY AND BANKING

GIST OF THE LESSON:

Barter Exchange: **Direct exchange of goods for goods without use of money. For example exchanging rice for wheat.**

Difficulties involved in the Barter Exchange:

1. Lack of a common measure of value.
2. Lack of double coincidence of wants
3. Difficulty in store of value.
- 4 Lack of divisibility

Money: Money is anything which is generally acceptable as a medium of exchange and at the same time acts as a measure of value, store of value and standard of deferred payment.

Functions of Money:

1. Primary Functions

- a. Medium of exchange
- b. Common measure of value or unit of account

2. Secondary Functions

- a. Standard of deferred payment
- b. Store of value
- c. Transfer of value

Supply of Money: Total stock of money (currency notes, coins and demand deposit of banks) in circulation are held by the public at a given point of time.

Measures of Money Supply

$$M_1 = C + DD + OD$$

C = Currency and coins with the public

DD = Demand deposits of the public with the banks

OD = Other deposits

$$M_2 = M_1 + \text{Post office savings deposits}$$

$$M_3 = M_1 + \text{Time deposits of commercial banks}$$

$$M_4 = M_3 + \text{Total deposits with the post office saving organisation excluding NSC}$$

Banking :

Commercial Banks: Commercial Banks are financial institutions which accept deposits from the public and provide loans facilities for investment with the aim of earning profit.

Functions of Commercial Banks

- (a) Accepting deposits
- (b) Advancing loans
- (c) Discounting bill of exchange.
- (d) Transfer of fund
- (e) Collection of funds
- (f) Purchase and sale of shares and securities on behalf of the customers

MONEY CREATION OR CREDIT CREATION BY COMMERCIAL BANKS

CREDIT is defined as finance made available by one party to another party on a certain rate of exchange.

“Commercial Banks are not only dealers of money, but manufacturers of money and credit also”. The capacity of banks to create money or credit depends on (i) Amount of primary deposits and (ii) Legal reserve ratio(LRR).

Total credit created = Credit Multiplier x Primary deposits

Credit Multiplier = $1 / \text{LRR}$

Central Banks: The central Bank is the apex institution of monetary and financial system of a country. It makes monetary policy of the country in public interest. It manages, supervises and facilitates the banking system of the country.

Functions of Central Banks

1. Bank of Issue
2. Banker , Agent and Advisor to the Government
3. Banker’s Bank
4. Controller of credit.
5. Lender of last resort

Credit Control Measures by Central Bank:-

I. Quantitative Measures:

1- **Bank Rate Policy:-** Rate charged by central bank from commercial banks for providing loans to them.

Repo rate : Repo rate is the rate at which the central bank of a country (Reserve Bank of India in case of India) lends money to commercial banks in the event of any shortfall of funds

Reverse repo rate : Reverse repo rate is the rate at which commercial banks can park their surplus funds with central bank

2. Open Market Operations: It means the purchase and sale of securities in the Open Market by Central Bank.

3- Legal Reserve Ratio(LRR):- is fixed by the central bank of a country and it is the sum of CRR and SLR.

(a) Cash Reserve Ratio(CRR):- It is a part of LRR which is to be kept with the central bank in the form of cash.

(b) Statutory Liquidity Ratio(SLR):- It is a part of LRR which is to be kept with the bank themselves in the form of liquid assets.

II. Qualitative Measures:

1. Moral Suasion:

2. Margin Requirements:

3. Credit Rationing (Selective Credit):

4. Direct Action:

E- MATERIAL

1. Money- Functions and Money Supply (Video Lesson):

https://drive.google.com/file/d/1JMwoPU_NXDGHw1LRCsKGFmVbZCBdZhZu/view?usp=sharing

2. Important Terms: (pdf)

https://drive.google.com/file/d/1fgzer0g2jgwnv8nxYN_e5zSxFGLZfUgz/view?usp=sharing

BANKING:

3. Credit/Money Creation and Functions of Central Bank (Video Lesson):

https://drive.google.com/file/d/1-kq1PbRpubAe3WOCBH7Xy_I667xSpmXg/view?usp=sharing

Unit 3: DETERMINATION OF INCOME AND EMPLOYMENT

GIST OF THE LESSON:

- **Determination of income, output and employment** is the core of the subject matter of macroeconomics.
- **AD and AS** together determine the level of income, output and employment.
- **Aggregate demand (AD)**: is the total demand of goods and service in the economy. AD represents the total expenditure on goods and services in an economy
- **The main components of AD** are-
 1. House hold consumption demand(C).
 2. Investment demand (I).
 3. Government demand (G).
 4. Net export (X-M).
$$AD = C + I + G + X - M$$
- **Household consumption expenditure (C)**, is the expenditure incurred by the household on the purchase of goods and services to satisfy their wants.
- **Investment expenditure (I)** refers to the expenditure incurred by the private firms and government on the purchase of capital goods such as plant, machinery and equipment.
- **Government consumption expenditure (G)** refers to the expenditure incurred by the general government on the purchase of goods and services, to provide to the people either freely or at a nominal price.
- **Net export (X-M)**, refers to the difference between export and import.

Hence, $AD = C + I + G + (X - M)$.

In a two sector economy $AD = C + I$.

- **Aggregate supply (AS)**: is the total supply of goods and services in the economy. It is also the value of total output available in an economy during a given period of time. It is the sum total of consumption expenditure and saving.
$$AS = C + S$$
Aggregate supply represents the national income of the country.
$$AS = Y \text{ (National Income)}$$

CONSUMPTION FUNCTION AND PROPENSITY TO CONSUME

- ❖ The relationship between consumption and income is called propensity to consume or consumption function.
 1. $C = f(Y)$.
- ❖ Consumption function may be represented by an equation $C = C_0 + b(Y)$
C = consumption, C_0 = consumption at zero level of income $b = MPC$ (slope of the consumption curve) $Y =$ income. The consumption equation shows the level of consumption for various level of income.
- ❖ Propensity to consume has two aspects:
 - A) Average propensity to consume (APC)
 - B) Marginal propensity to consume (MPC).
- ❖ $APC =$ ratio of total consumption to total income.
$$APC = C/Y.$$

- ❖ $MPC = \Delta C / \Delta Y$.
- ❖ Propensity to save indicates the tendency of the households to save at a given level of income. It shows the relation between saving and income.
- ❖ Propensity to save has two aspects:
 - A. Average propensity to save (APS) = S/Y .
 - B. Marginal propensity to save (MPS) = $\Delta S / \Delta Y$.
- ❖ Average propensity to save is the ratio of saving to income.
- ❖ Marginal propensity to save is the ratio of change in saving to change in income
 $MPS = \Delta S / \Delta Y$.
- ❖ There is relationship between APC and APS.
 $APC + APS = 1$
 $APC = 1 - APS$.
- ❖ There is relationship between MPC and MPS.
 $MPC + MPS = 1$
 $1 - MPC = MPS$.

Meaning of involuntary unemployment and full employment.

- ❖ Involuntary unemployment refers to a situation in which people are ready to work at prevailing wage rate, but do not find work.
- ❖ Full employment refers to a situation in which no one is unemployed i.e....there is no involuntary unemployment.
- ❖ According to Keynes, full employment signifies a level of employment where increase in aggregate demand does not lead to an increase in the level of output and employment. Increase in demand beyond full employment causes prices to go up.

DETERMINATION OF EQUILIBRIUM LEVEL OF INCOME AND EMPLOYMENT.

- ❖ The determination of income and employment in the Keynesian theory depends on the level of AD and AS.

Equilibrium level of income and output is determined where,

1) $AD = AS$ 2) Planned saving = planned investment ($S = I$).

- ❖ In a two sector economy $AD = C + I$, $AS = C + S$, $Y = C + I$.
- ❖ Suppose that $C = 40 + 0.75Y$ (CONSUMPTION FUNCTION) and $I = Rs.60$ (investment function), then the equilibrium level of income is obtained as:

$$Y = C + I$$

$$Y = 40 + 0.75Y + 60$$

$$0.75Y = 100$$

$$0.25Y = 100$$

$$Y = 10000 / 25$$

$$Y = 400 \text{ crores.}$$

- ❖ **Investment multipliers and its working.**

- ❖ Investment multiplier explains the relationship between increase in investment and the resultant increase in income.
- ❖ Investment multiplier is the ratio of change in income to change in investment.

Multiplier (k) = $\Delta y / \Delta I$.

- ❖ The value of multiplier depends on the value of marginal propensity to consume (MPC).
- ❖ There is direct relationship between k and MPC.
- ❖ Multiplier also depends on the marginal propensity to save
- ❖ There is inverse relationship between multiplier and MPS.

IMPORTANT FORMULAE.

- ❖ $AD = C + I$ (two sector economy).
 - ❖ $APC = C/Y$.
 - ❖ $APS = S/Y$.
 - ❖ $APC + APS = 1$
 - ❖ $MPC = \Delta C / \Delta Y$
 - ❖ $MPS = \Delta S / \Delta Y$
 - ❖ $MPS + MPC = 1$ AND $1 - MPC = MPS$
 - ❖ Multiplier $K = \Delta Y / \Delta I$ or $K = 1 / MPS$ or $K = 1 / 1 - MPC$
 - ❖ $C = C_0 + b(Y)$
 - ❖ $S = -C_0 + (1-b)Y$
- C_0 = autonomous consumption
b = MPC
- C_0 = negative saving
(1-b) = MPS

EXCESS DEMAND AND DEFICIENT DEMAND

- When AD is more than AS at full employment level, the situation is called excess demand. The difference between AD and AS at full employment level in a situation of excess demand is called **inflationary gap**.
- When AD is less than AS at full employment level, the situation is termed as deficient demand. The difference between AD and AS at full employment level in a situation of deficient demand is termed as **deflationary gap**.

E-MATERIAL

1. Determination of Income- AD=AS (Video Lesson):

<https://drive.google.com/file/d/1BUG4HxHkB1RO3SNXIIUt6iC1QQRQHoZ/view?usp=sharing>

2. Meaning of Excess Demand and Deficient Demand (Video Lesson):

<https://drive.google.com/file/d/1xYGhcNV5pTit-5iCNP-dII9m8-4SSgeC/view?usp=sharing>

3.

Measures to correct Excess Demand and Deficient Demand (Video Lesson):

<https://drive.google.com/file/d/18EWZIOoNz2XEAZ5LiyfokQd-HvfbuSLL/view?usp=sharing>

Unit 4: GOVERNMENT BUDGET AND THE ECONOMY

GIST OF THE LESSON:

BUDGET –

It is an annual financial statement containing an estimate of all anticipated (expected) revenue and proposed expenditure of the government for the coming financial year/Fiscal year.

Features of the budget-

- It is the statement of expected revenue and proposed expenditure for the coming financial year.
- There must be a sanctioning authority
- Has periodicity
- It shows procedure to collect revenue and administer expenditure.

Objectives of government budget-

1. Reallocation of resources –

Many a times the market forces are not able to reallocate the resources. The government has to reallocate resources based on social and economic aspect. For example consumption of harmful consumer goods can be discouraged by imposing high taxes and production of socially useful goods such as food grains, medicine, housing etc can be encouraged through subsidies and tax concessions.

2. Redistribution of income and wealth –

Government through its budget reduces the inequalities in income and wealth through use of various instruments of taxation and increasing expenditure on social welfare, subsidies, public works etc. Thus the government taxes the rich and the revenue received is used in the welfare of poor people like providing basic facilities of infrastructure, schools, health facility etc. The welfare programs include MNREGA, Mid Day Meal Scheme, AAY etc. This is done to ensure there is no concentration of wealth in the hands of few people. The gap between the rich and the poor can be narrowed down.

3. Economic stability-

The government budget is used to prevent economic fluctuations. Economics fluctuations refer to the situation of inflation and deflation. Inflation means continuous rise in prices. This happens when demand is more than supply. Deflation refers to situation when prices keep falling continuously. This happens when demand is less than supply. It uses various fiscal policy measures to reduce these fluctuations. Economic stability increases the rate of investment and in turn increases the rate of economic growth and development

4. Management of Public enterprises-

Government undertakes commercial activity through its public enterprise. The management and operation of these enterprises is the responsibility of the government as these enterprises promote social welfare. Example railways, electricity, oil exploration etc.

COMPONENETS OF BUDGET

A. BUDGET RECEPITS

Budget Receipts are Revenue Receipts and Capital receipts:

Revenue receipts	Capital receipts
<ul style="list-style-type: none"> • Does not create liability 	<ul style="list-style-type: none"> • Creates liability
<ul style="list-style-type: none"> • Does not cause reduction in assets 	<ul style="list-style-type: none"> • Cause reduction in assets
<ul style="list-style-type: none"> • These are – Tax revenue – (includes direct and indirect tax) Non- tax revenue – (commercial revenue and administrative revenue) 	<ul style="list-style-type: none"> • These include <ol style="list-style-type: none"> 1. Small savings(deposits in post office, NSC,saving accounts and public provident fund) 2. Loans taken by the government from public, RBI and other parties through sale of treasury bills 3. Loans taken by the government from foreign countries and IMF and world bank 4. Recoveries of loan 5. Disinvestment proceeds

B. BUDGET EXPENDITURES:

Budget expenditures are revenue expenditure and capital expenditure:

I. Revenue Expenditure:

- Expenditure incurred for the normal functioning of the government.
- Does not create any asset
- Does not cause reduction in liability of the government
- It is recurring type
- Also called non- development expenditure.
- Eg. Expenditure on Civil administration, defence, post and telegraph, salaries of administrators, judges etc.

II. Capital Expenditure:

- Expenditure on the acquisitions of the asset and increases productive capacity.
- Creates assets
- Cause reduction in liability

- It is non- recurring
- Also called development expenditure
- Construction of land and building, roads, loans and advances granted by central government to state government.

MEASURES OF BUDGET DEFICIT

1. **Revenue deficit** – it refers to excess of Revenue expenditure over Revenue receipts

$$\text{REVENUE DEFICIT} = \text{REVENUE EXPENDITURE} - \text{REVENUE RECEIPTS}$$

Implications / Significance

1. It indicates dissavings on government account
2. It gives information on what the government is borrowing for
3. Capital receipts are used by the government to finance its consumption expenditure which leads to inflation in the economy.
4. It leads to repayment burden in the future.

How to reduce Revenue deficit

1. Increase Revenue receipts
2. Decrease revenue expenditure

2. **Fiscal deficit** – it is the excess of total expenditure (revenue expenditure and capital expenditure) over total receipts (revenue receipts and capital receipts **excluding borrowings**)

$$\text{FISCAL DEFICIT} = \text{total expenditure (revenue expenditure + capital expenditure)} - \text{total receipts (revenue receipts and capital receipts excluding borrowings)}$$

$$\text{FISCAL DEFICIT} = \text{BORROWINGS}$$

Implications / Significance of Fiscal Deficit:

1. **Debt trap** – Borrowing creates problem of not only paying the interest but repayment of loans. As government borrowing increases, its future liability to repay the loan amount along with interest also increases. Increase in interest payments increases the revenue expenditure of the government, leading to high revenue deficit and the government has to borrow more to repay the past loans. Thus there is a cycle of debt trap.
2. **Inflation** – as government borrows from RBI, it results in printing of new currency notes and coins. If the loan is used by the government for unproductive purpose then it may result in inflation as the money supply increases due to increase in employment, hence demand increases without corresponding increase in output/ supply in the economy. Unproductive purpose means which does not result in the production of goods and services.

Foreign Dependence- if the government borrows money from other countries or financial institutions then these countries and institutions will try to interfere in the economic policies of the government

3. **Retards economic growth**- borrowings put a financial burden on the future generation to repay the past loan and its interest thereon. This retards the growth of the economy.

How to reduce Fiscal deficit

1. Reduce revenue expenditure like subsidies and government spending on unproductive purpose
2. Reduce non-development expenditure
3. Tax base must be broadened
4. Tax evasion must be reduced
5. Restructuring and sale of public sector shares.
6. Borrowings must be done from domestic sources only like commercial banks or deficit financing from RBI.

3. Primary Deficit – it is fiscal deficit minus interest payments on previous borrowings

$$\text{PRIMARY DEFICIT} = \text{FISCAL DEFICIT} - \text{INTEREST PAYMENTS}$$

Implications / Significance:

1. It shows how much government borrowing is able to meet other expenses other than the interest payments
2. If primary deficit is zero it means the whole borrowings is used to cover the interest payments of previous borrowings. It is not adding to the existing loans.

BALANCED BUDGET :- It is where estimated revenue equals estimated expenditure

BUDGETORY DEFICIT = TOTAL EXPENDITURE (revenue expenditure+ capital expenditure) - TOTAL RECEIPTS (revenue receipts+ capital receipts)

E-MATERIAL:

1. Video Lesson:

<https://www.youtube.com/watch?v=rL42cPr3HQw> (Video Lesson)

2. Gist of the Lesson (pdf):

<https://drive.google.com/file/d/1BwlwvE79E3ZpmGAt0YetKtMKs26Un57Z/view?usp=sharing>

UNIT-5: BALANCE OF PAYMENTS

Gist of the Lesson:

Balance of payments (BoP)

Balance of payments is a systematic record which shows all international transactions of a country with the rest of the world during a year.

Balance of payments takes into account the exchange of **both visible and invisible items**. Hence the balance of payment represents a better picture of a country's economic transactions with the rest of the world than the balance of trade.

Meaning of Balance of Trade (BoT)

Trade account of the balance of the payments includes exports and imports of only goods in a year. The difference between the value of exports of goods and value of imports of goods is called **balance of trade**.

Balance of payments accounting is an accounting system used to measure international flows of money and products (goods, services, and resources) during an accounting year.

Each exchange is assigned both a positive and a negative value:

Generally, a positive value (+) is assigned to exports—and that includes exports of money or other financial assets as well as exports of products.

Generally, a negative value (-) is assigned to imports—and that includes imports of money and other financial assets as well as imports of products

The actual accounting simply records the flows as they are measured over any specified time period.

The balance of trade is a part of balance of payment. Balance of trade simply deals with the export and import of goods. Balance of trade doesn't include any services (not even the import and export of services; we have a different name for that).

Balance of payment, on the other hand, is a much broader concept. It includes the balance of trade, the balance of services, balance of unilateral transfers, and balance of payment on capital account.

The idea behind the balance of payment is to see whether both sides match. In other words, we will see whether the total of both sides (debit and credit) will equal to zero (we will see the examples in later sections).

In this article, discuss head to head differences between balance of trade vs balance of payments.

Balance of Trade vs Balance of Payments Infographics

Balance of trade is just a smaller part of balance of payments. Let's look at the differences between balance of trade and balance of payments below –

Here are the key differences between balance of trade and balance of payments –

Balance of trade can be calculated by deducting the value of imports of goods from the value of exports of goods. Balance of payments, on the other hand, can be calculated by adding balance of payments at current account and balance of payments at capital account or by finding out the net balance between inflow of foreign exchange and outflow of foreign exchange.

Balance of trade portrays a partial picture of foreign exchange. Balance of payments, on the other hand, provides a holistic picture.

The net effect of balance of trade can be positive, negative, or zero. The net effect of balance of payments would always be zero.

Capital and unilateral transfers are not included in the balance of trade. Capital and unilateral transfers are major parts of balance of payments.

Balance of trade is a sub-set of balance of payments. Without computing balance of trade, we would not be able to see the net effect of export and import in the balance of payments.

Balance of Trade vs Balance of Payments:

Basis for Comparison between balance of trade vs balance of payments	Balance of Trade	Balance of Payments
Meaning	Balance of trade can be defined as the net balance of the export of goods and the import of goods in a given period of time.	Balance of payments is the sum total of balance of trade, balance of services, balance of unilateral transfers, and capital account
What it's all about?	Balance of trade helps a country look at the net profit or net loss incurred by the export and the import	Balance of payment helps to see whether everything is properly accounted for.

	of goods	
Difference	Balance of trade is the difference between exports of goods and imports of goods.	Balance of payments is the difference between inflow of foreign exchange and outflow of foreign exchange.
Net effect	The net effect of balance of trade is either positive, negative or zero	The net effect of balance of payments is always zero.
Type of transactions	The entries in balance of trade are related to goods.	Transactions related to goods, services, transfers are included in balance of payments.
Capital and unilateral transfers	Capital and unilateral transfers are not included in the balance of trade.	Capital and unilateral transfers are included in the balance of payments.
Holistic picture	Does only provide partial picture.	Provides the whole picture.

Structure (or components) of BOP

(A) CURRENT ACCOUNT

(B) CAPITAL ACCOUNT

(A) **CURRENT ACCOUNT**: Current account is that account of BOP which records imports and exports of goods and services and unilateral transfers. It , thus, records the following three items

- (i) Visible items of trade
- (ii) Invisible items and
- (iii) Unilateral transfers

Current account deals with currently produced goods and services. Current account transactions are called account by actual transactions, because all the items included in it are actually transacted.

Items of current account:

- (i) **Exports and Imports of Visible Items**: Exports and imports of goods are also called transactions of visible items or merchandise. Therefore balance of trade is also called **balance on visible**.

If exports are greater than imports of goods, the balance of trade account is said surplus.

Export of Goods > Imports of Goods = Surplus Balance of Trade

If exports are less than the imports of goods, the balance of trade account is said deficit.

Export of Goods < Imports of Goods = Deficit Balance of Trade

(ii) Balance on Account of Invisible :

Non-factor services are a part of invisible. This includes shipping, banking, insurance and consultancy services, foreign travels, investment, transfer payment etc.

(a) **Services-banking, insurance, shipping etc.:** When a country gets such services from other countries, it is called **import of services** for which payments in foreign currencies are made. Similarly when a country provides these services to the other countries it is called **exports of services** for which it gets payments in foreign currencies?

(b) **Foreign Travel (Tourism):** When foreign tourists visit a country, in receipts foreign currencies which they spend during their stay. Similarly when people of a country visit other countries, they require foreign currencies for their spending in those countries. This is outflow of foreign currencies.

(c) **Investment Income:** a country may receive interest on given loans to other countries. These receipts are also foreign currencies. Similarly payment of interest and dividends on loans and investment by people of other countries results in outflow of foreign currencies.

(iii) **Unilateral Transfers(Transfer Payment):** People of a country may receive gifts from friends and relatives living abroad, remittances sent by emigrants to relatives. Such transfer payment results in inflow and outflow of foreign currencies.

The difference between total receipts and total payments of foreign currencies on account of invisibles is called balance of **an account of invisibles**.

(B) CAPITAL ACCOUNT

The Capital Account records all international transactions that involve a resident of the domestic country changing his assets with a foreign resident or his liabilities to a foreign resident.

The various forms of capital account transactions are given below:

- (i) **Private Transactions:** These are transactions that are effecting assets or liabilities by individuals, businesses etc.
- (ii) **Official Transactions:** Transactions affecting assets and liabilities by the government and its agencies.
- (iii) **Direct Investment:** It is the act of purchasing an asset and at the same time acquiring control of it. An example is the acquisition of a firm in one country by a firm in another country.
Similarly transaction by individuals could be the purchase of a house abroad etc.
- (iv) **Portfolio Investment :** It is the acquisition of an asset that does not given the purchase control on the asset
Ex-such investment is the purchase of shares in a foreign company or bonds issued by a foreign government, or loans made to foreign forms or government. The capital outflow is awarded a negative sign and capital inflows are awarded a positive sign. The net value of the balances of direct and portfolio investment is called **the balance on capital account**.

Structure of balance of payment accounting:

The transactions are recorded in the balance of payments account in double-entry book keeping.

Each international transaction undertaken by the country will result in a credit entry and debit entry of equal size. As international transactions are recorded in double entry accounting, the BOP accounting must always balance: that is total amount of debits must equal total amount of credits. Of course, the balancing item. Errors and Omissions must be added to 'balance' the BOP accounts.

Transactions in BOP are classified into five major categories as given below :

- (1) Goods and Services account
- (2) Unilateral transfers account
- (3) Long-term capital account
- (4) Short-term private capital account
- (5) Short-term official capital account

Autonomous and Accommodating Items of BOP

Autonomous items in the BOP : Autonomous items or transactions in the BOP refer to international economic transactions that take place due to some economic motive such as profit maximization. These transactions are independent of the state of the country's balance of payments. These transactions take place both on current account and capital account.

Example; Export of tea to England, Imports of crude oil, Loan raised by Tata Motors from abroad

These items are often called **above the line items** in the BOP as first item before calculating surplus or deficit in BOP.

The balance of payments is in deficit if the autonomous receipts are less than autonomous payments. This means that the foreign country has some net claims against the foreign country.

Autonomous receipts > Autonomous payments = Surplus in BOP

Autonomous receipts < Autonomous payments = Deficit in BOP

Accommodating Items of BOP; Accommodating Items or transactions refer to those transactions which are done to cover the deficit or surplus in BOP. These items take place only in the capital account.

Example;-

Loan taken by India from IMF to cover BOP deficit.

Reducing foreign exchange reserves.

These transactions are related to establish BOP identity.

These items are also called **below the line items**' in the BOP as secondary item after calculating surplus or deficit in BOP.

Disequilibrium In Balance of Payments

There are number of factors that cause disequilibrium in the balance of payments showing either a surplus or a deficit.

Activity: all the students to be divided into groups and find out what reason can cause disequilibrium in BOP

After the activity, we all will find out that all factors can be categorized into 3 parts:

- (a) Economic factors
- (b) Political factors

(c) Social factors

(a) Economic Factors :

- Large scale development expenditure that may cause large imports
- Cyclical fluctuations in business can cause recession or depression
- High domestic prices may result in imports
- New sources of supply.
- New and better substitutes to existing products.
- Change in costs.
- Change in trade flows and hence change over a period of time.

(b) Political Factors

Political instability may cause large capital. Outflows and damper the inflows of foreign capital.

(c) Social Factors

Changes in tastes, preference and fashions may affect imports and exports.

BOP disequilibrium is a serious issue for policy makers. A chronic BOP deficit leads to downgrading the economy in the world community. Hence the monetary authority of the country of the country concerned and the IMF undertake certain corrective measures to deal with the disequilibrium in the BOP.

A country's balance of payment position is assessed by its balance on current account. In an accounting sense, the balance of payment account always balances which means that the total credits and total debits of the balance of payment account are always equal. The sum of the balances on current account and autonomous capital transactions measures the deficit or the surplus. The sum of the accommodating capital transactions will just equal to this deficit or surplus with reverse signs. The balancing factors are the accommodating capital transactions which includes external assistance, transactions with IMF and increase/ decrease in foreign exchange resources.

(1) Balance of Trade is calculated on the basis of exports and imports of goods only.

(2) If the value of exports > value of imports of goods, the balance of trade shows a surplus.

- (3) If the value of exports of goods < value of imports of goods, the balance of trade shows a deficit.
- (4) The balance of trade of our country has always been in deficit because our imports of goods have increased at a faster rate than the exports of goods.
- (5) The current account includes both trade account and invisible account. So the sum of trade balance and invisible balance is called balance on current account.
- (6) Capital account includes 2 types of transactions (i) accommodating (ii) autonomous.
- (7) Autonomous transactions are not undertaken on account of deficit or surplus in the BOP.
- (8) Accommodating transactions are taken on account of deficit or surplus in BOP.
- (9) Balance of payments always balances because total receipts are always equal to payments. It is made possible by the accommodating transactions.

Foreign Exchange Rate

Definition: Foreign exchange rate is the price of the domestic currency stated in terms of another currency. In other words, a foreign exchange rate compares one currency with another to show their relative values.

Foreign exchange rate is the rate at which one currency is exchanged for another. Thus, an exchange rate can be regarded as the price of one currency in terms of another. An exchange rate is a ratio between two monies. If 5 UK pounds or 5 US dollars buy Indian goods worth ₹ 400 and ₹ 250 then pound- rupee or dollar-rupee exchange rate becomes ₹ 80 = £1 or ₹ . 50 = \$1, respectively.

Exchange rate is usually quoted in terms of rupees per unit of foreign currencies. Thus, an exchange rate indicates external purchasing power of money. For example, **at present , Rs.82 = 1 US\$**

A fall in the external purchasing power or external value of rupee (i.e., a fall in exchange rate, say from ₹ 80 = £1 to ₹ 90 = £1) amounts to depreciation of the Indian rupee. Consequently, an appreciation of the Indian rupee occurs when there occurs an increase in the exchange rate from the existing level to ₹ 78 = £1.

In other words, external value of the rupee rises. This indicates strengthening of the Indian rupee. Conversely, the weakening of the Indian rupee occurs if external value of rupee in terms of pound falls. Remember that each currency has a rate of exchange with every other currency.

Not all exchange rates but about 150 currencies are quoted, since no significant foreign exchange market exists for all currencies. That is why exchange rate of these national currencies are quoted usually in terms of US dollars and euros.

2. Exchange Rate Determination:

Now two pertinent questions that usually arise in the foreign exchange market are to be answered now. Firstly, how is equilibrium exchange rate determined and, secondly, why exchange rate moves up and down?

There are two methods of foreign exchange rate determination. One method falls under the classical gold standard mechanism and another method falls under the classical paper currency system. Today, gold standard mechanism does not operate since no standard monetary unit is now exchanged for gold.

All countries now have paper currencies not convertible to gold. Under inconvertible paper currency system, there are two methods of exchange rate determination. The first is known as the purchasing power parity theory and the second is known as the demand-supply theory or balance of payments theory. Since today there is no believer of purchasing power parity theory, we consider only demand-supply approach to foreign exchange rate determination.

a) Demand-Supply Approach of Foreign Exchange, Or BOP Theory of Foreign Exchange:

Since the foreign exchange rate is a price, economists apply supply-demand conditions of price theory in the foreign exchange market. A simple explanation is that the rate of foreign exchange equals its supply. For simplicity, we assume that there are two countries: India and the USA. Let the domestic currency be rupee. US dollar stands for foreign exchange and the value of rupee in terms of dollar (or conversely value of dollar in terms of rupee) stands for foreign exchange rate. Now the value of one currency in terms of another currency depends upon demand for and supply of foreign exchange.

(i) Demand for foreign exchange:

Import of goods & services; investment in other countries; gifts & grants to abroad; direct purchase made in abroad; other payments involved in international transactions etc. The demand for foreign exchange is made for the purpose of payments of foreign loans, import of products, making investments & giving loans to other countries, tour & travel in abroad etc. The demand for foreign exchange is inversely related to the exchange rate.

When Indian people and business firms want to make payments to the US nationals for buying US goods and services or to make gifts to the US citizens or to buy assets there, the demand for foreign exchange (here dollar) is generated. In other words, Indians demand or buy dollars by paying rupee in the foreign exchange market.

A country releases its foreign currency for buying imports. Thus, what appears in the debit side of the BOP account is the sources of demand for foreign exchange. The larger the volume of imports the greater is the demand for foreign exchange.

The demand curve for foreign exchange is negative sloping. A fall in the price of foreign exchange or a fall in the price of dollar in terms of rupee (i.e., dollar depreciates) means that foreign goods are now more cheaper.

Thus, an Indian could buy more American goods at a low price. Consequently, imports from the USA would increase resulting in an increase in the demand for foreign exchange, i.e., dollar. Conversely, if the price of foreign exchange or price of dollar rises (i.e., dollar appreciates) then foreign goods will be expensive leading to a fall in import demand and, hence, fall in the demand for foreign exchange.

Since price of foreign exchange and demand for foreign exchange move in opposite direction, the importing country's demand curve for foreign exchange is downward sloping from left to right.

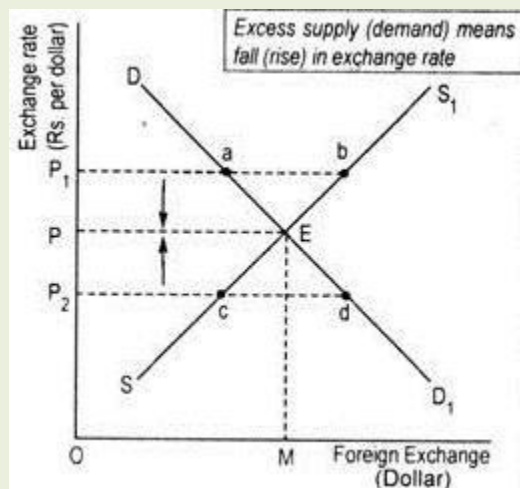


Fig. 1. Equilibrium Exchange Rate

In Fig. 1, DD_1 is the demand curve for foreign exchange. In this figure, we measure exchange rate expressed in terms of domestic currency that costs 1 unit of foreign currency (i.e., dollar per rupee) on the vertical axis. This makes demand curve for foreign exchange negative sloping.

(b) Supply of foreign exchange:

In a similar fashion, we can determine supply of foreign exchange. Supply of foreign currency comes from its receipts for its exports. If the foreign nationals and firms intend to purchase Indian goods or buy Indian assets or give grants to the Government of India, the supply of foreign exchange is generated.

In other words, what the Indian exports (both goods and invisibles) to the rest of the world is the source of foreign exchange. To be more specific, all the transactions that appear on the credit side of the BOP account are the sources of supply of foreign exchange.

A rise in the rupee-per-dollar exchange rate means that Indian goods are cheaper to foreigners in terms of dollars. This will induce India to export more. Foreigners will also find that investment is now more profitable. Thus, a high price or exchange rate ensures larger supply of foreign exchange. Conversely, a low exchange rate causes exchange rate to fall. Thus, the supply curve of foreign exchange, SS_1 , is positive sloping.

Now we can bring both demand and supply curves together to determine foreign exchange rate. The equilibrium exchange rate is determined at that point where demand for foreign exchange equals supply of foreign exchange. In Fig. 5.4, DD_1 and SS_1 curves intersect at point E. The foreign exchange rate thus determined is OP. At this rate, quantities of foreign exchange

demand (OM) equals quantity supplied (OM). The market is cleared and there is no incentive on the part of the players to change the rate determined.

Suppose that at the rate OP, ₹ 50 = \$1, demand for foreign exchange is matched by the supply of foreign exchange. If the current exchange rate OP₁ exceeds the equilibrium rate of exchange (OP) there occurs an excess supply of dollar by the amount 'ab'. Now the bank and other institutions dealing with foreign exchange—wishing to make money by exchanging currency—would lower the exchange rate to reduce excess supply.

Thus, exchange rate will tend to fall until OP is reached. Similarly, an excess demand for foreign exchange by the amount 'cd' arises if the exchange rate falls below OP, i.e., OP₂. Thus, banks would experience a shortage of dollars to meet the demand. Rate of foreign exchange will rise till demand equals supply.

The exchange rate that we have determined is called a floating or flexible exchange rate. (Under this exchange rate system, the government does not intervene in the foreign exchange market.) A floating exchange rate, by definition, results in an equilibrium rate of exchange that will move up and down according to a change in

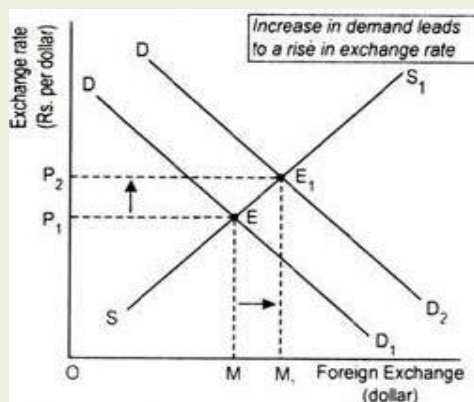


Fig. 2. Equilibrium Exchange Rate

demand and supply forces. The process by which currencies float up and down following a change in demand or change in supply forces is, thus, illustrated in Fig. 2.

Let us assume that national income rises. This results in an increase in the demand for imports of goods and services and, hence, demand for dollar rises. This results in a shift in the demand curve from DD₁ to DD₂. Consequently, exchange rate rises as from OP₁ to OP₂ determined by the intersection of new demand curve and supply curve. Note that dollar appreciates from ₹ 50 = \$1 to ₹ 53 = \$1, while rupee depreciates from \$1 = ₹ 50 to \$1 = ₹ 53.

Similarly, if supply curve shifts from SS₁ to SS₂, as shown in Fig. 3, new exchange rate thus determined would be OP₂. If Indian goods are exported more, following an increase in national income of the USA, the supply curve would then shift rightward. Consequently, dollar depreciates and rupee appreciates. New exchange rate is settled at that point where the new supply curve (SS₂) intersects the demand curve at E₂.

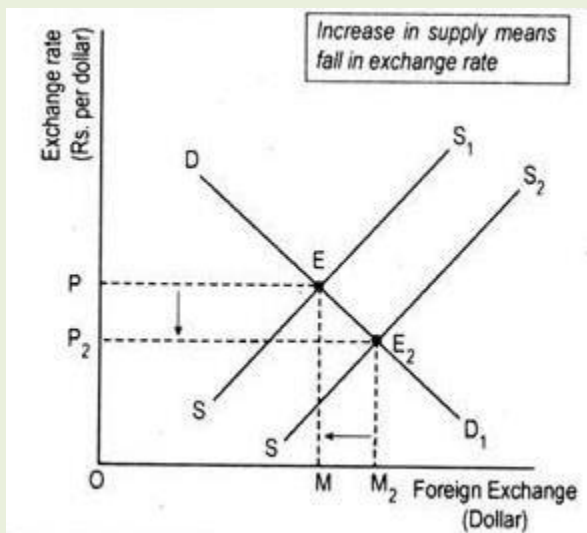


Fig. 3. Equilibrium Exchange Rate

This is the balance of payments theory of exchange rate determination. Wherever government does not intervene in the market, a floating or a flexible exchange rate prevails. Such system may not necessarily be ideal since frequent changes in demand and supply forces cause frequent as well as violent changes in exchange rate. Consequently, an air of uncertainty in trade and business would prevail.

Such uncertainty may be damaging for the smooth flow of trade. To prevent this situation, government intervenes in the foreign exchange rate. It may keep the exchange rate fixed. This exchange rate is called a fixed exchange rate system where both demand and supply forces are manipulated or calibrated by the central bank in such a way that the exchange rate is kept pegged at the old level.

Often managed exchange rate is suggested. Under this system, exchange rate, as usual, is determined by demand for and supply of foreign exchange. But the central bank intervenes in the foreign exchange market when the situation demands to stabilise or influence the rate of foreign exchange. If rupee depreciates in terms of dollar, the RBI would then sell dollars and buy rupee in order to reduce the downward pressure in the exchange rate.

Flexible & Fixed Exchange Rate System

There may be variety of exchange rate systems (types) in the foreign exchange market. Its two broad types or systems are Fixed Exchange Rate and Flexible Exchange Rate as explained below.

In between these two extreme rates, there are some hybrid systems like Crawling Peg, Managed Floating.

Broadly when government decides the conversion rate, it is called fixed exchange rate. On the other hand, when market forces determine the rate, it is called floating exchange rate.

(a) Fixed Exchange Rate System:

Fixed exchange rate is the rate which is officially fixed by the government or monetary authority and not determined by market forces. Only a very small deviation from this fixed value is possible. In this system, foreign central banks stand ready to buy and sell their currencies at a fixed price. A typical kind of this system was used under Gold Standard System in which each country committed itself to convert freely its currency into gold at a fixed price.

In other words, value of each currency was defined in terms of gold and, therefore, exchange rate was fixed according to the gold value of currencies that have to be exchanged. This was called mint par value of exchange. Later on Fixed Exchange Rate System prevailed in the world under an agreement reached in July 1994.

The advantages and disadvantages of this system are as under:

Merits:

(i) It ensures stability in exchange rate which encourages foreign trade, (ii) It contributes to the coordination of macro policies of countries in an interdependent world economy, (iii) Fixed exchange rate ensures that major economic disturbances in the member countries do not occur, (iv) It prevents capital outflow, (v) Fixed exchange rates are more conducive to expansion of world trade because it prevents risk and uncertainty in transactions, (vi) It prevents speculation in foreign exchange market.

Demerits:

(i) Fear of devaluation. In a situation of excess demand, central bank uses its reserves to maintain foreign exchange rate. But when reserves are exhausted and excess demand still persists, government is compelled to devalue domestic currency. If speculators believe that exchange rate cannot be held for long, they buy foreign exchange in massive amount causing deficit in balance of payment. This may lead to larger devaluation. This is the main flaw or demerit of fixed exchange rate system, (ii) Benefits of free markets are deprived; (iii) There is always possibility of under-valuation or over-valuation.

(b) Flexible (Floating) Exchange Rate System:

The system of exchange rate in which rate of exchange is determined by forces of demand and supply of foreign exchange market is called Flexible Exchange Rate System. Here, value of currency is allowed to fluctuate or adjust freely according to change in demand and supply of foreign exchange.

There is no official intervention in foreign exchange market. Under this system, the central bank, without intervention, allows the exchange rate to adjust so as to equate the supply and demand for foreign currency. In India, it is flexible exchange rate which is being determined. The foreign exchange market is busy at all times by changes in the exchange rate. Advantages and disadvantages of this system are listed below:

Merits:

(i) Deficit or surplus in BOP is automatically corrected, (ii) There is no need for government to hold any foreign exchange reserve, (iii) It helps in optimum resource allocation, (iv) It frees the government from problem of BOP

Demerits:

- (i) It encourages speculation leading to fluctuations in foreign exchange rate, (ii) Wide fluctuation in exchange rate hampers foreign trade and capital movement between countries, (iii) It generates inflationary pressure when prices of imports go up due to depreciation of currency.

Distinction between Fixed Exchange Rate and Flexible Exchange Rate

Fixed exchange rate is the rate which is officially fixed in terms of gold or any other currency by the government. It does not change with change in demand and supply of foreign currency. As against it, flexible exchange rate is the rate which, like price of a commodity, is determined by forces of demand and supply in the foreign exchange market. It changes according to change in demand and supply of foreign currency. There is no government intervention.

Managed Floating:

This refers to a system of gradual adjustments in the exchange rate deliberately made by a central bank to influence the value of its own currency in relation to other currencies. This is done to save its own currency from short-term volatility in exchange rate caused by economic shocks and speculation. Thus, central bank intervenes to smoothen out ups and downs in the exchange rate of home currency to its own advantage.

E-MATERIAL**FOREIGN EXCHANGE RATE (Video Lesson):**

<https://drive.google.com/file/d/1fVy0c77ThcAE4rnJO0KHSySmrDq0P2uL/view?usp=sharing>

SECTION- B

Unit 6: DEVELOPMENT EXPERIENCE (1950-1990) AND

ECONOMIC REFORMS SINCE 1991

Gist of the Lesson:

DEVELOPMENT EXPERIENCES (1947-1990)

KEY CONCEPTS:

1. **Economy:** Economy of a country includes all production, distribution or economic activities that relate with people and determines the standard of living.
2. **Indian Economy on the eve of independence:** On the eve of independence, Indian Economy was in a very bad condition due to the exploitative policies of British colonial rule.
3. **State/Features of Agriculture Sector:** Agriculture was the main source of livelihood for most of the people of India, and about 75% Of the country's population lived mostly in villages and derived livelihood directly or indirectly from agriculture.

Indian agriculture at the time of independence was marked with the following features

- (i) Low level of productivity
 - (ii) High degree of vulnerability
4. **State/Features of Industrial Sector:** Britishers followed a policy of systematic de-industrialisation by creating circumstances conducive to the decay of handicraft industry and not taking any steps to promote modern industry and reduced India to a mere exporter of raw material and importer of finished goods. The following points bring forward the state of the industrial sector at the eve of independence:
 - (i) Decay Of handicraft industry
 - (ii) Slow growth of modern industry
 5. **State/Features of Foreign Trade:** India has been an important trading nation, since ancient times. But when the restrictive policies of commodity production, trade and tariff were imposed by the colonial government, it adversely affected the structure, composition and volume of India's foreign trade.

Following were the reasons behind the poor growth of foreign trade

 - (i) Exporter of primary products and importer of finished goods.
 - (ii) Britain's monopoly control over foreign trade.
 6. **State of Occupational Structure:** During the colonial period, the occupational structure of India exhibited backwardness.

The agricultural sector accounted for the largest share of the workforce which remained at a high of 70-75% Of the workforce and the manufacturing and service sectors accounted for only 10 and 15-20%, respectively.

7. **State of Infrastructure:** Infrastructure comprises of such industries which help in the growth of other industries.

Under the colonial period, basic infrastructure such as railways, ports, water, air transport, post and telegraphs were developed.

8. **Demographic Condition:** Various details about the population of British India were first collected through a census in 1881. Before 1921, India was in the first stage of demographic transition. The second stage began after 1921.

9. **Positive contribution of British rule** – (i) Commercial Outlook of the Farmers (ii) Better means of transportation, (iii) Control on famines, (iv) Shift to monetary economy, and (v) Effective administration set up.

10. **Economic System:** It is defined as an arrangement by which the central problems of an economy are solved.

The three basic central problems of an economic system are

- (i) Choice of goods to be produced
- (ii) Choice of technology of production
- (iii) Distribution of goods and services

11. **Types of Economic Systems:**

(i) **Socialist Economy:** It is an economic system in which all economic decisions are taken by the government.

In this system, the government decides what goods are to be produced in accordance with the needs of society, how goods are to be produced and how they should be distributed. Socialist economy promotes equitable distribution of income. However, it also suffers from the drawbacks of a bureaucratic set-up in the form of red-tapism and corruption. In Cuba and China, most of the economic activities are governed by the socialistic principles.

(ii) **Capitalist Economy:** It depends upon the market forces of demand and supply.

In this type of economy, only those consumer goods will be produced that have good demand in the market and yield profit to the producers. In this economy, the goods and services produced are distributed among people not on the basis of what people need but on the basis of purchasing power.

Capitalist economy is also called *laissez faire* or free market economy. It exists in North America, Japan, Australia, Western Europe, etc.

(iii) **Mixed Economy:** It is an economic system in which public sector and private sector exist side by side. In this economy, the market will provide whatever goods and services it can produce well and the government will provide essential goods and services which the market fails to provide. India follows this economic system.

12. **Economic Planning:** It is a process by which a central authority of a country defines a set of goals to be achieved within a specified period, sets out a plan to achieve those goals, keeping in view the country's resources.

13. **Five Year Plans:** In India, planning was launched in 1951, as a five yearly exercise, therefore it came to be popularly known as 'five Year Plans'.

14. **Common Goals Of Five Year Plans:** All the Five Year Plans were formulated keeping the below objectives in mind:

- (i) Growth
- (ii) Modernisation
- (iii) Self-reliance
- (iv) Equity

15. **Agriculture:** Equity in agriculture called for (a) **land reforms** which primarily refer to change in the ownership of landholdings (b) **Land ceiling** which means fixing the maximum size of land which could be owned by an individual.

Green revolution refers to the large increase in production of food grains, resulting from the use of high yielding variety (HYV) seeds especially for wheat and rice. The spread of green revolution technology enabled India to achieve self-sufficiency in food grains, the price of food grains declined, shifts from subsistence to commercial farming, increase in crop productivity.

The portion of agricultural produce which is sold in the market by the farmers is called **marketed surplus**.

The Debate Over Subsidies:

Points in favour of agricultural subsidy:

- 1) It provides an incentive for adoption of the new HYV technology by farmers in general and small farmers in particular.
- 2) Eliminating subsidies will increase the inequality between rich and poor farmers.

16. **Need for public sector units:**

- 1) Indian industrialists did not have the capital to undertake investment in industrial ventures.
- 2) The market was not big enough to encourage industrialists to undertake major projects.
- 3) To develop the Indian economy on socialist lines led to the policy of the government controlling the commanding heights of the economy.

17. **Industrial Policy Resolution 1956 (IPR 1956):**

Main features:

Industries were classified into three categories:

The first category comprised industries which would be exclusively owned by the government; the **second category** consisted of industries in which the private sector could supplement the efforts of the public sector, the **third category** consisted of the remaining industries which were to be in the private sector.

The private sector was kept under state control through a system of licenses. This was to promote regional equality.

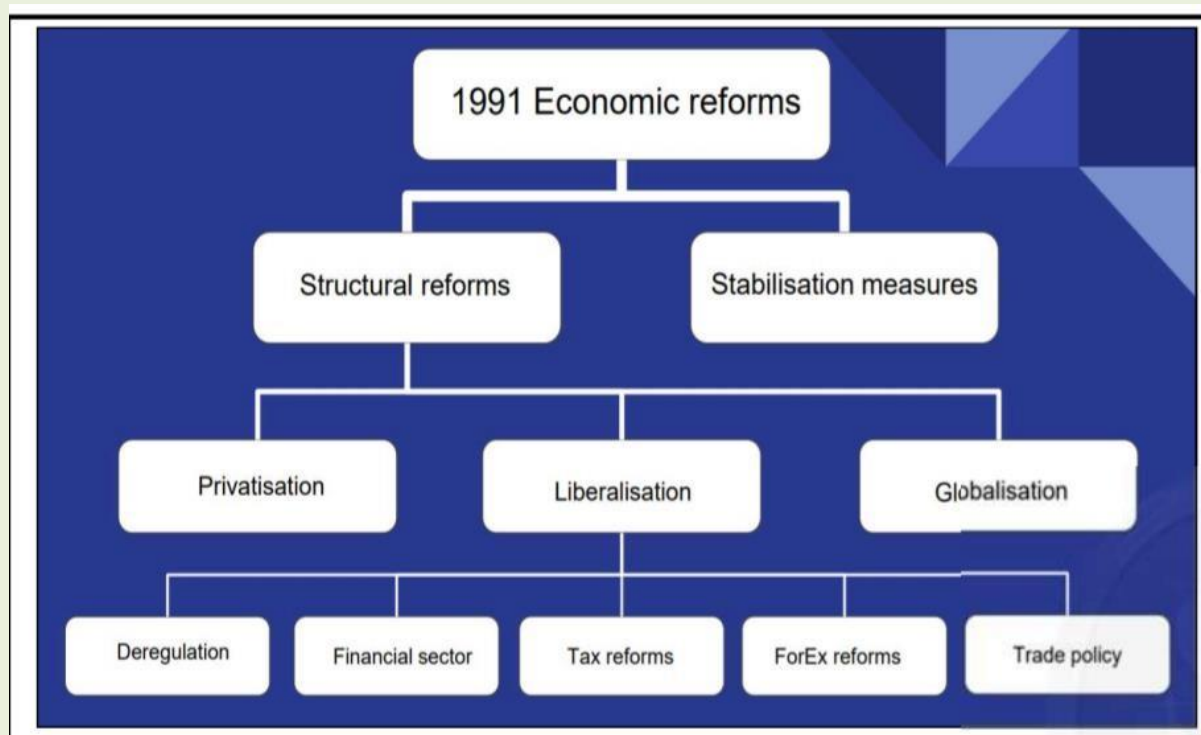
The production of a number of products was reserved for the small-scale industry

In 1955, the Village and Small-Scale Industries Committee, also called the Karve Committee, noted the possibility of using small-scale industries for promoting rural development. In 1950

a small -scale industrial unit was one which invested a maximum of rupees five lakh; at present the maximum investment allowed is rupees one crore.

Small-scale industries are more labour intensive, has locational flexibility, requires less investment.

ECONOMIC REFORMS SINCE 1991



Before 1991, the Indian economy and Indian companies were living **under a shelter** of protection that was created by the Indian government to protect the domestic companies from outside or international competition. The economy was not ready to step out in the international market and compete with big established companies and organisations. But, during 1991, the government agreed to the reforms that were advised by the foreign banks and hence announced New Economic Policy (NEP) in order to develop the Indian economy and also for its future growth. We can broadly categorise or classify the measures into two groups:

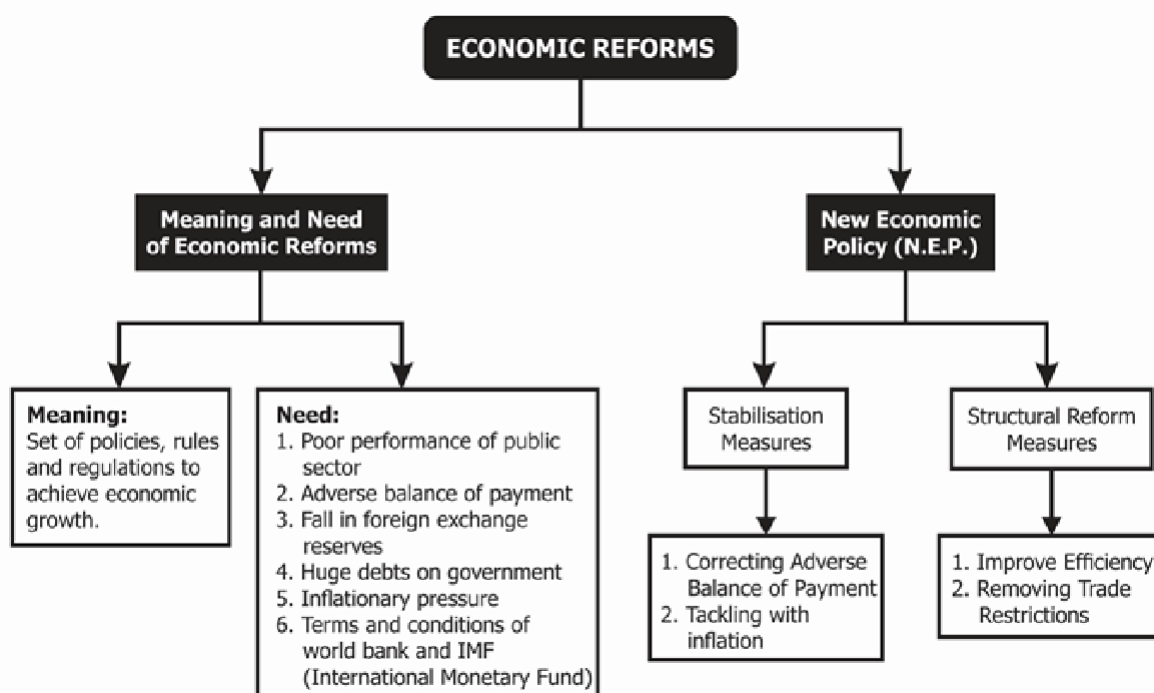
- Structural reforms
- Stabilization measures

Stabilization Measures

Stabilization measures were taken and accepted by the Indian government to revamp the Indian economy. These measures were undertaken in order to correct the inherent and **carried forward**

weaknesses that had been developed in BOPs (Balance of Payments) and also to control inflation. These were mainly **short term measures**, unlike the structural reforms.

Structural Reforms



From a long-term perspective and in order to strengthen international competitiveness, reforms have been put in place to eliminate rigidity in various segments of the Indian economy. Hence these are long term measures and policies. The **structural reforms** that were adopted by the Indian government were as follows:

- Liberalization
- Privatization
- Globalization

Factors Responsible for Economic Reforms Since 1991

The major factors that were responsible and let the government came up with the economic reforms since 1991 were:

1. A decrease in foreign exchange reserves: imports grew faster than exports

2. The unfavourable balance of payments gave rise to a repayment crisis
3. The budget deficit worsened as public expenditure increased faster than receipts
4. Prices increased, with a negative impact on investment
5. Failure of state-owned enterprises: – very small high return on investment
6. The Gulf crisis has led to a rise in crude oil prices, which has had a negative impact on the balance of payments.
7. High ratio of deficit funding
8. The collapse of the soviet block

I. Liberalization

Liberalization was one of the three structural reforms that were adopted by the Indian government. It was adopted to put an end to various restrictions and reforms which later on became a hindrance in the development and the growth of the Indian economy. The government decided to **loosen up** its influence and let private sector organisations and companies enter the Indian economy and start working without or with fewer government restrictions. This allowed the economy to become liberal and grow eventually.

Objectives Of Liberalization Policy

There were many reasons due to which the structural reform of liberalization was undertaken by the government. They are mentioned below.

- Increase competitiveness between domestic industries
- Encourage foreign trade with other countries whose imports or exports are regulated
- Foreign capital and technological improvements
- Expand the borders of the country's global marketplace
- A reduction in the country's debt burden

Major Economic Reforms Since 1991 Under Liberalisation

1. Industrial sector reforms- these included factors and reforms like:
 - Contraction off Public Sector
 - Abolition of Industrial Licensing
 - Freedom to Import capital goods
2. Financial sector reforms- these included factors and reforms like:
 - De-regulation of interest rates
 - Reducing various Ratios like SLR and CRR
 - Change in the role of the central bank or the RBI from the regulator to facilitator of the economy and banks.
2. Foreign exchange reforms- these included factors and reforms like:
 - Devaluation of rupee
3. Trade and investment reforms
4. Fiscal reforms

5. Tax reforms

II. Privatization

Moving further, Class 12 Economic Reform Since 1991 talks about Privatization. This was the second policy among the three policies of LPG that were adopted by the government.

Privatization policy has been used to **enhance the dominant role** of private sector enterprises and the diminished role of public sector enterprises. In other words, it's reducing the ownership of the management of a government-owned company. Now these State-owned enterprises can be turned into private enterprises in two ways:

- By disinvestment
- By withdrawal of governmental ownership or stakes from these public sector companies

Objectives Of Privatization

Class 12 Economic Reform Since 1991 also talks about the various objective of privatization as a policy. They are mentioned below.

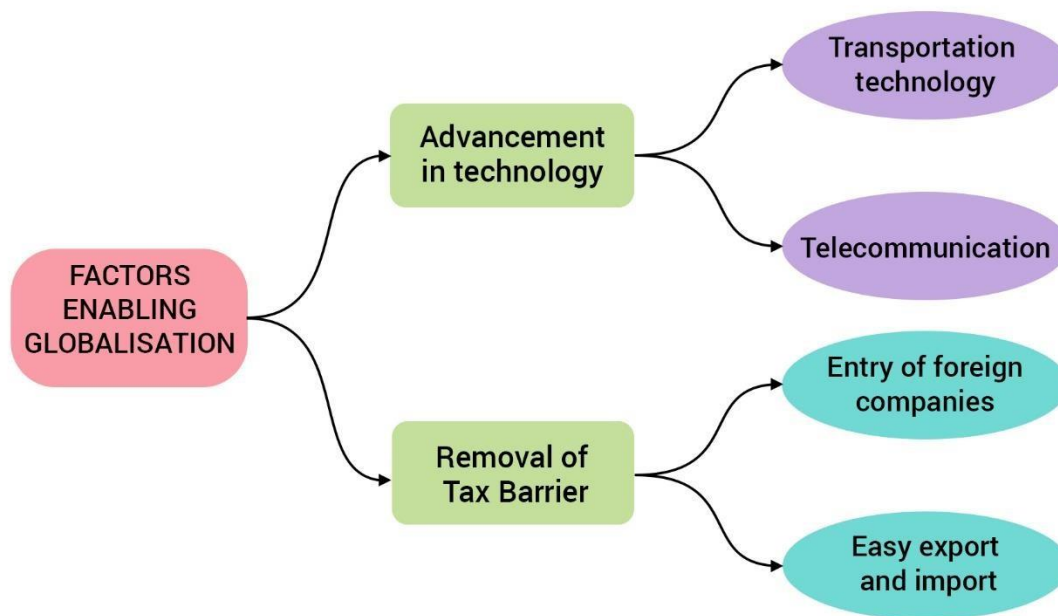
- Improve the government's fiscal situation.
- Reduce the workload on public sector firms.
- Raise capital through divestment.
- Increase the effectiveness of governmental agencies.
- Provide the consumer with higher quality and improved goods and services.
- Develop healthy competition in society.
- Encouragement of foreign direct investment (FDI) in India.

Policies Adopted for Privatisation

As per the unit of class 12 on Economic Reforms Since 1991, the policies that were adopted for privatisation by the government of India are as follows:

1. Contraction of the public sector
2. Abolishing the ownership of the Government in the management of public enterprises
3. Sale of shares of public enterprises

3. Globalization



Globalisation refers to the integration of the economy of the nation with the global economy. During globalization, the emphasis is placed on foreign trade and private and institutional foreign investment. It was the final LPG policy to be implemented in India. Having said that, globalization as a term is a very complicated phenomenon. The main objective is to transform the world into an independent and integrated world by defining various strategic policies. Globalisation tries to create a world without borders, where the needs of a country can come from all over the world and become a great economy.

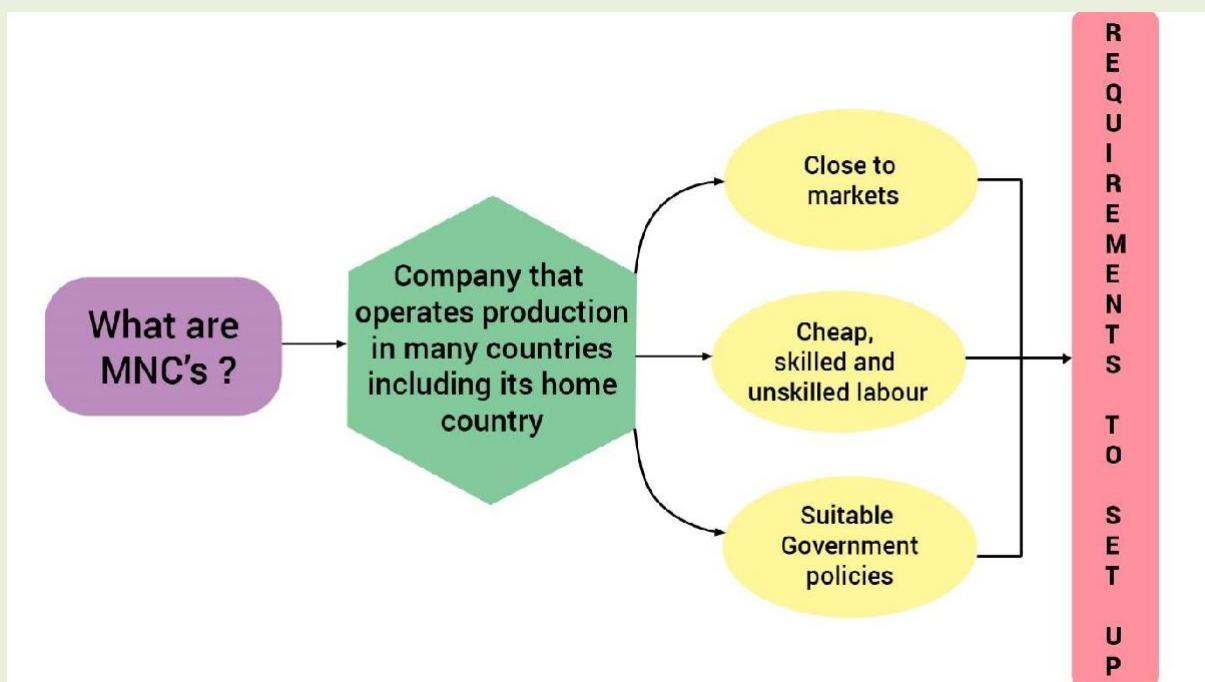
The most important outcome of globalisation in the Indian economy is the **concept of outsourcing model**. Outsourcing refers to when a company of a country hires professionals from other countries to get their work done at cheap prices. The best part about outsourcing is that the work can be done at a low cost and from the top source and human resources available throughout the world. Services such as legal advice, marketing, technical assistance, etc were being outsourced from companies based in the US, UK, and other parts of Europe. As information technology or IT was also developing in recent years, outsourcing of contract work from one country to another increased considerably due to globalisation. As a means of communication has broadened their reach, all economic activities have increased around the world.

Having said that, various business process outsourcing (BPOs) companies or call centers, which have their voice business process model, are being developed in India. Activities such as **accounting** and bookkeeping services, clinical counselling, banking or even education were being outsourced from developed countries to India.

Benefits Of Globalization

Towards the end, Class 11 Liberalization, Privatization and Globalisation talks about the many benefits of Globalization. You can have a look here:

- The biggest advantage of globalisation and its outcome outsourcing is that large multinational corporations or even small businesses can benefit from good services at a lower rate than their country's standards.
- The skill set and the availability of the human resource capital in abundance in India is regarded as the most dynamic and effective throughout the world.
- The professionals in India are the best at what they do.
- The low wage rate and highly skilled personnel have made India the most favourable global outsourcing destination in the subsequent phase of the reform.
- It has helped in the growth and development of the tertiary sector of the economy and creation of more jobs and employment for the people.



Policies Promoting Globalisation

As per the unit of Class 12 of Economic Reforms since 1991, the main policies that were adopted by the government of India to promote and implement globalisation were:

1. Increase in the equity limit for foreign investments
2. Partial convertibility
3. Long-term business and trade policy
4. Reduction of tariffs

Positive and Negative Impacts of LPG Policies

Positive Impacts

Increase in foreign investment and/or foreign direct

Negative Impacts

The agriculture sector of the Indian economy was so

investments in the Indian economy.	neglected in the economic reforms since 1991.
Increase in foreign exchange reserves	Jobless growth
A decrease in the Inflation rates	A rise in the income inequalities in the country
Increase in the national income	Adverse effects of the disinvestment policies could b see
Increase in the exports of the country	Spread of consumerism
Consumer sovereignty	Encouragement of economic colonialism
	Cultural erosion

World Trade Organisation

The last topic of the class 12 unit on Economic Reforms Since 1991 is about the World Trade Organisation. Also known as WTO, this institution or organisation was established in 1995. It successfully replaced the General Agreement on Trade and Tariffs (GATT) which was in place since 1946. The overarching goal of the World Trade Organization or WTO is to always contribute to smooth, free, fair and predictable trade. To meet this objective, they perform these functions:

1. Monitoring and revising domestic trade policies
2. Support the member in the development of trade policies through technical assistance and training programs.
3. Administration of World Trade Agreements
4. Serve as the forum for trade negotiations
5. Settlement and Management of Trade Disputes
6. Technical assistance and training for developing nations
7. Cooperation with other International Organizations

	Decentralisation	Liberalisation	Privatisation	Globalisation
Economic Planning	From central planning to local planning	From local planning to individual planning (full liberalisation)	Individual planning as a part of privatisation	Planning at the international level
Structure of the economy	From heavy industry, through light industry and agriculture to the service industry	Heavy industry: adjustment of production structure and technical advancement. Light industry, agriculture and service industry	TVEs, small and middle size SOEs are privatized; Large SOEs are limited	A new form: Foreign companies, joint ventures and wholly independent enterprises
Markets (including price setting)	Local government has the right to set prices	The price of the majority of products are set by the market	Private company's role and freedom to enter market	Integrating the Chinese market into the international market
Ownerships	From collective or state-owned enterprises to private and individual owned enterprises	Ownership is diverse based on free market	Privatizing TVEs or small and middle size SOEs	Multinational companies in China

8.

KEY CONCEPTS ECONOMIC REFORMS SINCE 1991

1. Economic crisis: A situation wherein the expenditures are much more than the revenues and there is no source (such as world Bank) to lend (as the borrower already has a large outstanding loan to repay with interest)

2. Public sector undertakings (PSU's): Government-owned enterprises that produce and sell various goods in the market, to earn profit.

3. Remittances: These are foreign currencies transferred by those working outside the country to their families and friends in their own countries.

4. Delicensing: Removal of controls, especially on industries.

5. Dereservation: Taking off certain industries from the sole domain of public sector by allowing Private capital investment, such as in coal, medicine etc.

6. Devaluation: It is the fall in the value of domestic currency with respect to foreign currency under the fixed exchange system (Presently, the synonymous term is depreciation-under flexible exchange system).

7. Outsourcing: Contracting another agency to conduct a process during production of services. Foreign. Contract for maintaining software, customer services etc.

8. Quantitative restrictions: Restrictions in the form of total quantities or quotas imposed on imports to reduce Balance of Payments (BoP) deficit and protect domestic industry.

9. Import Licensing: Permission required from the government to import goods into a country.

10. Foreign Direct Investment (FDI): refers to the investment of foreign assets into domestic structures, equipment and organizations. It does not include investment into the stock markets.

IMPORTANT POINTS: -

- **• Meaning:** Economic reforms refer to a set of economic policies directed to accelerate the pace of 'growth and development'
- **• Economic reforms or structural adjustment** is a long term multi-dimensional package of various policies (Liberalisation, privatisation, and globalisation) and programme for the speedy growth, efficiency in production and make a competitive environment. Economic reforms are adopted by Indian Govt. **in 1991.**
- **• Factors responsible or Need for Economic reforms:-**
 - Fall in foreign exchange reserve.
 - Adverse balance of payments
 - Mounting fiscal deficit.
 - Rise in prices
 - Failure of public enterprises.
 - Gulf crisis.
- **1. • Stabilization measures:** These are short run measures introduced by Govt. to control rise in price, adverse balance of payment and fall in foreign exchange reserve.
- **2. • Structural adjustment:** These are long-run policies the goal of structural reforms is to abolish controls, eliminate bureaucratic hurdles. and red tapism and make the decision-making process efficient and transparent.
 - In the new economic policy 1991, Structural reforms can be seen with respect to: 1. Liberalisation. 2. Privatisation 3. Globalisation.
- **I • Liberalization:** Liberalization means removing all unnecessary control and restriction like permits licenses. Protectionist duties, quotas etc.
- **• Economic reforms under liberalization:**
 - Industrial sector reforms
 - Financial sector reforms.
 - Fiscal reforms. Fiscal reforms relate to revenue and expenditure of the government. Tax reforms are the principal component of fiscal reforms.

Broadly, taxes are classified as: (a) direct taxes, and (b) indirect taxes. Direct taxes are those taxes, the burden of which cannot be shifted onto others. (Examples: Income tax, wealth tax.) Indirect taxes (levied on goods and services) are those taxes, the burden of which can be shifted onto others. [Examples: GST (Goods and Services Tax), custom duty.]

- Foreign exchange reforms: -External sector reforms include: (i) foreign exchange reforms, and (ii) foreign trade policy reforms.

- **II• Privatisation:** Privatisation is the general process of involving the private sector in the ownership or operation of state-owned enterprises.

- **• Policies adopted for privatization:**

- • Contraction of public sector.
- • Abolish the ownership of Govt. in the management of public enterprises.
- • Sale of shares of public enterprises.

- **III• Globalization:** Globalization may be defined as a process associated with increasing openness growing economic interdependence and deepening economic integration in the world economy.

- **Policy promoting globalization:**

- • Increase in equity limit of foreign investment.
- • Partial convertibility.
- • Long term trade policy.
- • Reduction in tariff.
- • An Appraisal of LPG Policies: - Positive Impact:
- • Increase in foreign investment
- • Increase in foreign exchange reserves

DEMONETISATION IN INDIA

“Demonetisation is the act of stripping a currency unit of its status as legal tender”.

The current form or forms of money is pulled from circulation and retired, and replaced with new notes or coins.

Objectives of Demonetisation:

1. To discourage cash system and promote digital transactions.
- 2. To combat corruption and thereby eliminate black money.
- 3. To eradicate counterfeit currency .
- 4. To reduce tax evasion.
- 5. To arrest the flow of money for terrorism, radical groups, and insurgency.
- 6. To expand the tax base.
- 7. To integrate the formal and informal economies of India.

- **Demonetisation on 08th November 2016:**

- Currency notes of Rs. 500 and Rs.1000 were demonetised.
- These notes accounted for 86% of the country’s currency supply
- The Specified Bank Notes (Cessation of Liabilities) Ordinance, 2016, was issued on 28 December 2016, ending the liability of the government for the demonetised banknotes.

- **Benefits of Demonetisation:**

- 1. Reduction of Black Money

- 2. Increase in Liquidity position of Banks.
- 3. Increase in cashless and digital transactions
- 4. More tax-revenue.

E-MATERIAL

1. Economic Reforms Since 1991 (Video Lesson):

https://drive.google.com/file/d/1yf1yrdkGW_XhSqHEbI4v2Tq7nXETqw8j/view?usp=sharing

2. Development Experience of India (1950-1990)- pdf:

<https://drive.google.com/file/d/1BIXW0S9qcGs0vL1LCzieq7AwO1p45uju/view?usp=sharing>

3. Economic Reforms since 1991 (pdf)

https://drive.google.com/file/d/1AcsJY0VryEfoWKDWxZ-rTJvM2cY2_R17/view?usp=sharing

4. Demonetisation in India (Video Lesson):

<https://drive.google.com/file/d/1wqXzJbuAyOEO18skOYcAv5PcUyaercXb/view?usp=sharing>

5. GST (Video Lesson):

<https://drive.google.com/file/d/1BnERUW1tLTJblet58IVf6zwmwTM-rQP5/view?usp=sharing>

Unit 7: CURRENT CHALLENGES FACING INDIAN ECONOMY

1. HUMAN CAPITAL FORMATION: Gist of the Lesson:

COMPARISON BETWEEN ‘PHYSICAL CAPITAL’ AND ‘HUMAN CAPITAL’.

Physical Capital	Human Capital
Physical capital is tangible and can be easily sold in the market.	Human capital is intangible and cannot be sold in the market.
It depreciates with the passage of time.	Depreciation in human capital (due to aging) can be reduced by making continuous investment in education & health.
It is more mobile between countries	Human capital is less mobile between countries as compared to physical capital.
Physical capital (like machinery) separated from its owners.	Human capital (like skills of a person) cannot be separated from the own.
Physical capital is the outcome of the conscious decision of the owner and is mainly an economic and technical process.	Formation of human capital is partly a social process by partly a conscious decision of the possessor of the human capital.

Human Capital formation: Human capital formation means the development of abilities and skills among the population of the country.

Sources of Human Capital Formation:

1. Expenditure on education:

(It is one of the most important sources of human capital formation) proper utility of man power depends on the system of education, training and industrial experience of the people. Spending on education by individuals is similar to spending on capital goods by companies with the objective of increasing future profits once a period of time. This increases the income of the people and their standard of living. Investment in education is not only highly productive but also it yields increasing return and accelerates economic growth of all the resources education receives most importance because it gives maximum contribution to the development of the country.

2. Expenditure on Health:

Health is an important input for a development of a nation. Expenditure on health is needed in the following areas.

A preventive medicine known as vaccination curative medicines, i.e., medical intervention during the time of illness is very important. Provision of clean drinking water and good sanitation is very important for improvement of health. Health expenditure directly

increases the physical capacity of human being and it raises the supply of healthy labor force.

3. On-the-job training:

Productivity of physical capital is substantially increased with the improvement in human capital. Due to this reason many firms provide on the job training to their workers. Such training has the advantage that it can be provided fast and without much cost. It increases the skill and efficiency of the workers and leads to an increase in production by productivity. Expenditure regarding on-the-job training is the source of human capital formation because it increases labor productivity than its cost.

4. Expenditure on migration: -

People migrate to one place to another that gives them higher salaries. Unemployment people from rural migrate to urban areas technically qualified people migrate to other countries for higher salaries. Though it results in cost of migration and higher cost of living due to migration in migrated place it enhances earning that their cost of migration. Hence it is a source of human capital formation.

5. Expenditure on Information: -

Expenditure is incurred to acquire information relating to labour market and other market. It involves amount spent on seeking information about educational institutions, education standard their educational needs and cost of education. This information is necessary to make decisions regarding investment in human capital as well as for efficient utilization of the acquired human capital stock.

Importance of Human capital formation

Human Capital formation is very important for the growth of an economy.

1.. Effective use of physical capital: Its growth and productivity depend on human capital formation. Human capital formation raises the productivity and production as knowledgeable and skilled worker makes the better (use of the resources). Increase in productivity and quality production depends on technical skill of the people which can be acquired only by education or training and maintaining health of the people.

Inventions, innovations and technological improvement are all due to the extra knowledge acquired during education which provides lot of innovations and inventions. The knowledgeable, skilled and physically fit people help in the human capital formation.

2.. Increases life expectancy: Formation of human capital raises life expectancy of the people. Health facilities and availability of nutritive food enable people to live a healthy and long life. This in turn, adds to the quality of life.

3.. Improves Quality of life: The quality of population depends upon the level of education health of a person and skill formation acquired by the people. Human capital formation not only makes people productive and creative but also transforms the lives of the people.

4. Control of population growth: It has been observed that educated persons have smaller families as compared to illiterate families, So, spread of education is necessary to control the population growth rate.

Reasons for poor Human Capital formations are:

1. Insufficient Resources: - The resources allocated to the formation of human capital have been much less than the resources required for meeting the educational & health needs of the country. Due to this reason, the facilities for the formation of human capital have remained grossly inadequate.

2.. Serious Inefficiencies: There are a lot of wastages of society's resources as capabilities

of educated people are either not made use of (in case of unemployment or are underutilized in case of unemployment). Massive literacy, non-education of many children, poor health facilities are other inefficiencies, which have not been attended to adequately & properly.

3.. High Growth of population: The continuous rise in population has adversely affected the quality of human capital.

4.. Lack of proper manpower planning: There is an imbalance between the demands for the supply of human resources of various categories, especially in case of highly skilled personnel. The absence of such balancing has resulted in the wastage of resources.

Human Capital & Human Development

1. Human Capital consider education & health as a means to increase labour productivity. Human Development is based on the Idea that education & health are integral to human well-being.

2. In Human capital, investment in education and health is considered to be unproductive, if it does not increase output of goods & services. In case of human development, investments in education and health are taken to be productive, even if it does not lead to higher output.

3. Human capital treats human beings as a means to an end; the end being the increase in productivity. In the human development perspective, human welfare should be increased through investment in education & health as every individual & health as every individual has a right to be literate & lead a healthy life

Growth of Education Sector in India

There has been considerable growth in the field of Education. The number of schools increased from 230.7 thousand (1950-51) to 1,215.8 thousand (2005-06). The no. of teachers in the same period increased from 751 thousand to 6010 thousands & no of students from 23,800 thousand to 2, 22,700 thousand.

Gross Enrollment Ratio

Gross Enrollment Ratio (GER) is the total enrolment of pupil in grade or cycle or level of education, regardless of age, expressed as percentage of the corresponding eligible official age group population in a given school year. GER in elementary education increased steadily from 82% in 1950-51 to 94.85% in 2005-06.

Literacy Rate

The literacy rate has increased from 18.33% in 1951 to 64.84% in 2001

Elementary Education in India

Elementary Education in India means eight years of schooling from the age of six i.e., primary & middle school education together, is called Elementary Education. Elementary Education, therefore is the foundation on which the development of every citizen and the nation as a whole hinge. The government has made elementary education compulsory and free. But, the goal of universal elementary education in India has been very difficult to achieve till now. In December 2002, the government of India made free and compulsory education, a fundamental right of all children in the age group of 6-14 years.

I. Primary Education Schemes

Government has made number of schemes to make “Education for all” The following are the few schemes

Sarva Shiksha Abhiyan (SSA):

It was launched in 2001 to universalize & improve the quality of Elementary Education in India through community ownership of Elementary Education. The SSA is being implemented in partnership with states to address the needs of children in age group of 6-14 years. The achievements under SSA up to September 30, 2007, include constructions of 7, 13,179 additional classrooms, 1, 72,381 drinking water facilities, construction of 2, 18,075 toilets. Supply of free textbooks of 6.64 crore children & appointment of 8.10 lakh teachers besides opening of 1, 86,985 (till 31.3.07) new schools.

National Programme for Education of Girls at Elementary Education (NPEGEL):

The programme is aimed at enhancing girl’s education by providing additional support for development of a model girl child friendly school. In every cluster with more intense community mobilization and supervision of girl’s enrolment in schools. Under NPEGEL, 35,252 models schools have been opened. In addition to supporting 25,537 Early Childhood Care & Education (ECCE) centers. Besides, 24,837 additional classrooms have been constructed and 18.75 lakh teachers have been given training on gender sensitization.

Kasturba Gandhi Balika Vidyalaya (KGBV)

The Kasturba Gandhi Balika Vidyalaya (KGBV) scheme was launched in July 2004 for setting up residential schools at upper primary level, for girls belonging predominantly to the SC, ST, OBC & minority community. The scheme ran as separate scheme for two years but was merged with Sarva Shiksha Abhiyan w.e.f April 1, 2007.

II. Secondary Education

Secondary Education, which starts with classes IX and X leads to senior secondary classes XI and XII aims to in cooperate basic skills & analytical abilities. It provides a stepping stone to higher professional and technical education.

III. Higher Education

The Higher Education System comprises both general and technical education. The higher education has undergone a manifold expansion since Independence. The no. of universities in the country has increased from 27 in 1950-51 to 350 in 2005-06 University Grants Commission (UGC) takes measures for promotion and coordination of university education and determination and maintenance of standards in teaching, examination and research in universities and allocation and disbursement of grants to them.

IV. Technical Education

Technical Education plays a vital role in human resources development of the country by creating skilled manpower, enhancing Industrial productivity and improving the quality of life. Since independence, there has been a phenomenal expansion of Technical Education Sector in the country. All India Council for Technical Education (AICTE) is the apex body in the field of Technical Education.

Weakness of the Education Sector

High Illiteracy: According to 2001 census, the literacy rate of 64.8 percent is still far off the 100 percent mark.

Gender Bias: Education in India is gender biased. The enrolment of girls in both primary and upper primary classes is much below the boys.

Low Quality Education: The quality of the education is fairly low.

Lack of Vocational and Technical Training: Too much emphasis on general education neglecting the Vocational and Technical Education.

Low Level of Government Expenditure: Actual level of expenditure is only 3.46% compared to the desired level of 6%

E-MATERIAL

1. Video Lesson:

<https://drive.google.com/file/d/1fCn-Tw61pDXtpZUp0pdNyL7yZ-HJb1o0/view?usp=sharing>

2. Gist of the Lesson (pdf):

<https://drive.google.com/file/d/11-jLl3QaBNd4HBNncuz48zjHqs4ccE6R/view?usp=sharing>

2. RURAL DEVELOPMENT

Rural Development: It is a continuous comprehensive socio-economic process, attempting to improve all aspects of rural life.

Rural Credit: Rural Credit means provision of loans especially in production for agriculture and non- agricultural sectors. Credit facilities in the rural areas have contributed a large increase in agricultural productivity and employment facilities in non-agricultural sectors. The loans have provided in rural areas to the frames in order to purchase machineries agricultural implements etc. The government had also provided long term loans which can be repaved in 15to 20 years for improvement of the land, digging tube well, purchase of tractors etc.

Unproductive Lone: There are some loans which are provided to farmers to celebrate religious ceremonies, marriages for settlements of old loans and to support the family in case of a crop failure. These loans are called as unproductive loans.

Sources of Rural Credit

Non-institution Sources: - These are the traditional sources of agricultural credit in India. They include money lenders, relatives, traders, commission agents and land lords.

Institutional Sources: - They are cooperative credit, land development banks, commercial banks, regional rural banks, govt., national bank for agricultural and rural development (NABARD) and also self-help groups.

Micro finance: is a credit scheme extended to the poor through Self Help Groups (SGHs)

The Self-Help Groups (SGHs) have been set up to promote thrift in small proportions by a minimum contribution from each member. From the pooled money, credit is given to the needy numbers to be repayable in small instalments at reasonable interest rates.

Agricultural Marketing System: Agricultural marketing is a process which involves assembling, storage, processing, transportation, packaging, grading and distribution of different agricultural commodities across the country.

Measures to Improve Agricultural Marketing

After Independent govt. has adopted various measures to improve of the system of agricultural marketing in the country. It has brought about following measures in order to regulate the markets.

Regulated Markets: - The first measure was regulation of markets, to create orderly and transparent marketing condition. This is organized in order to protect farmers from malpractices of sellers and brokers.

Cooperative Marketing: Marketing societies are formed by farmers to sell the output collectively and to take advantages of collective bargaining, for obtaining a better price. Cooperatives are not functioning properly in a recent past due to inadequate coverage of

farmer members and processing cooperatives and also inefficient management.

Infrastructural facilities: - Govt. had also provided infrastructural facilities like roads, railways, warehousing, old storage and processing units.

Standardization and Grading: - Grading And quality control helps farmers to get good price for quality products produced by them.

Minimum Support Price: - To safeguard the Interest of the farmers government fixes the minimum support price for agricultural products like wheat, rice, maize, cotton, sugarcane, pulses etc. the government willingly will buy any amount of grains from the farmers at a price higher than the market price in order to help them recover their loss. This is normally done by good cooperation of India & the Government in turn will supply these products in public distribution system against BPL & APL card.

Defects of Agricultural Market in India: The existing system of Agricultural marketing has no. of defects the following are some of the defects due to which the marketing system is not properly organized.

Lack of storage facility: Food grain and crops has damaged the products either by rats or insects or due to rain.

Distress Sale: Most Indian farmers are poor and they have no capacity to wait for better price. They sell the commodities at whatever the price available immediately. As a result, they go for distress sale of their output, to the village money lenders or traders at low price.

Lack of transportation: as a result, farmer cannot reach nearly mandis to sell their produce at a fair price.

Long chain of middleman: Intermediaries between the cultivator and the consumer will also reduce the profit of the farmers.

There are also other defects like lack of institutional finance, lack of guiding etc. This makes Indian marketing system disorganized.

Remedial measures for improvement of agricultural marketing

1. Extension of storage facilities at the farm level and storage and warehousing facilities in the markets and consumption centers.
2. Establishments of regulated markets.
3. Improvement of transport facilities between the village and the mandis.
4. Establishment of cooperation marketing societies.
5. Provision of cheap credit, especially from institutional sources.
6. Provision for grading of the produce to ensure good quality to the consumers and better prices for the producers.
7. Prompt supply of marketing information.

Diversification of Agricultural Activity: This means the excess of people in agriculture can be given gainful employment in some other allied activities in agriculture and non-farm activities. This is done in order to overcome poverty, improve employment and make rural agricultural people fully employed.

Diversification includes 2 aspects.

Diversification of crop production: - This involves shift from single cropping system to multiple cropping system. This also involves shifting cropping pattern from food grains to cash crops. The main aim is to promote shift from subsistence farming to commercial

farming.

Diversification of Productive Activities: - As agriculture is already overcrowded the major portion of the increasing labour force needs to find alternate employment opportunities in other non-farm sectors. This will provide alternate sustainable livelihood and would raise the level of income.

Some of the non-farm activities are animal husbandry, dairy farming, fisheries, horticulture, agro processing industries, food processing industries, leather industry, tourism etc. These sectors have the potential but they lack infrastructure and other financial support.

Operation flood is a system, whereby all the farmers can pool their milk produce according to different grading and the same is processed and marketed to urban centers through cooperatives.

The period of 1991-2003 is known as Golden Revolution because during this period, the planned investment in horticulture became highly productive and the sector emerged as a sustainable livelihood option.

Role of IT Industries in the development of agriculture

Information Technology has revolutionized many sectors in Indian economy. There is a broad agreement that IT will play a critical role in achieving sustainable development and food security in the 21st century. Through proper information and software tools, govt has been able to predict areas of food insecurity and vulnerability to prevent or reduce the likelihood of an emergency.

It also has a positive impact on the agricultural sector as it circulates information regarding technologies and its application prices, weather and soil condition for growing different crops.

This has increased the knowledge about agriculture.

The aim for increasing the role of information technology is to make every village a knowledge centre, where IT provides a sustainable option of employment and livelihood.

Sustainable Development: It is the development which aims to develop the present generation without affecting the quality of life of future generations.

Sustainable development does not prohibit the use of any resources, but aims to restrict their use in such a way it is left for the future generation.

Organic Farming

Organic farming is the process of producing food naturally.

This method avoids the use of synthetic chemical fertilizers and genetically modified organisms.

It is very eco-friendly and very essential for sustainable development. It has a zero impact on environment.

Advantages of Organic Farming

It substitutes costlier agricultural inputs such as HYV seed, chemical fertilizers, pesticides etc. locally produced organic inputs, which are cheaper and thereby generate good returns on investments.

It generates income through export as the demand for organically grown crops is on the rise.

It provides healthy food as organically grown food has more nutritional value than food grown through chemical farming.

It can provide more employment opportunities in India as it requires more laborer for production than chemically produced goods.

Organic food is a pesticide free and is produced in an environmentally sustainable way.

Disadvantages of Organic Farming

Organic farming needs to be popularized by creating awareness and willingness on the part of the farmers for adoption of new methods.

There is no proper infrastructure and marketing facilities for these products alone. An appropriate agricultural policy should be brought in for organic farming.

The fields from organic farming are less than modern agricultural farming in the initial years. Therefore, small and marginal farmers may find it difficult to adapt to large scale production.

E-Material

Video Lesson:

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<https://drive.google.com/file/d/11XEtNln579kyCVl0ncPEb8dP0D3Pe8w1/view?usp=sharing>

3. Employment:

Employment: Growth, Informalisation and Other Issues

Worker: A worker is an individual who is involved in some productive activities to earn a living.

People included in workers: It is not only people those who are paid workers also includes self-employed people like shopkeepers, barbers, cobblers etc. Workers include all those people who are engaged in work whether for others (paid workers or self-employed)

Labour Force: All persons, who are working (who have a job) and though not working, are seeking and are available for work, are dram to be in the labour force.

Work force: The number of persons, who are actually employed at a particular time are known as work force.

Worker – population ratio: Worker- population ration is the percentage of total population engaged in work.

$$WPR = \frac{\text{Total number of workers in India}}{\text{No. of work population In India}} \times 100$$

Labour force participation rate: The ratio of labour force to total participation is called labour force participation rate.

Informalisation of workforce: refers to a situation whereby the proportion of workforce in the informal sector to total workforce increases.

Characteristics of workforce:

- More rural women are found working because of their poor economic condition as compared to urban women.
- People in rural areas are engaged mostly in agriculture, which is a seasonal activity. So, rural workforce migrates to urban areas during some part of the year.
- Regular salaried employees are more in urban areas as considerable section of urban people are able to study in various educational institution and it enables them to look for an appropriate job to suit their qualifications and skills. However, in rural areas, most of the people are illiterate and lack skills, which are needed for regular employment.

Casual Wage Labourer: Workers who are not hired by their Employers on a regular or permanent basis (i.e., do not have job security) and do not get social security benefits, are termed as casual wage labour.

Jobless growth refers to a situation when the Economy is able to produce more goods and service without a proportionate increase in Employment opportunities.

Regular workers: Workers who are hired by their employers on a permanent basis and also get social security benefits (like pension, provident fund, etc.) are higher in regular workers.

Casualisation of work force: The process of moving from Self- Employment and regular salaried employment to casual wage work is known as Casualisation of Workforce.

Types of urban unemployment:

Industrial unemployment: It refers to the unemployment among the illiterates who wish to work in industrial establishment

Educated unemployment: Educated unemployment refers to the unemployment among the educated people.

Wage employment: An arrangement in which a worker sells his labour and earns wages in return

Types of rural unemployment:

Disguised unemployment: Disguised unemployment refers to a state in which more people are engaged in work than are really needed.

Seasonal unemployment: Unemployment that occurs at certain seasons of the year is known as Seasonal unemployment.

Full employment: Full employment refers to a situation in which all the workers who are capable of working and willing to work get an Employment in prevailing wage rates.

Self-employment: An arrangement in which a worker used his own resources, to make a living is known as self-employment.

Formal sector: All the public enterprises and private establishments, which Employ 10 or more hired workers are called formal sector establishments.

Informal sector: All those private enterprises which hire less than 10 workers are called Informal sectors.

Ex: Workers who work in farms, owners of Small Enterprises, Agriculture laborer. Here they do not get regular income. No protection or regulation by government can be dismissed at any time. Live in slums, use outdated technology and do not maintain accounts.

Frictional unemployment: Temporary unemployment, which exists during the period, wherein. Workers leave one role and join some other, are called frictional unemployment.

Labour Force: Number of people who are able and willing to work at the existing wage rate.

People those who are not working and are neither seeking nor available for work are considered to be outside the labour force.

Labour force = Person's working + Persons seeking & available for work.

- After 66 years & below 15 years not included labour force. A handicapped person not included. People those who are not interested not included. People are not available not included.
- Unemployed people = Labour force – Work force

E-Material:

Video Lesson:

https://drive.google.com/file/d/1NotYUAKLxp4_zVNzLRAS5HnFKzB1ZKAw/view?usp=sharing

(pdf):

<https://drive.google.com/file/d/1Vcww-ldVXGATage47azxR-Tf2SdWXtg1/view?usp=sharing>

4. SUSTAINABLE ECONOMIC DEVELOPMENT

Environment and Sustainable Economic Development

Environment: Environment is defined as the total planetary inheritance and the totality of all resources.

Functions of Environment

- 1. Supplier of raw-material:** Resources such as renewable and non- renewable are supplied by the environment.
- 2. Environment is the sink of wastage:** Environment assimilates wastes.
- 3. Life Support services:** It sustains life by providing essential elements like sun, soil, air, water etc.
- 4. Provider of aesthetic services:** It includes land, forest, water bodies, rainfall, mountain etc., with this people enjoy the beauty of hill station and to improve the quality of life.

Carrying Capacity of Environment

It includes two things-

- 1. Resources extraction should remain below the rate of resource generations.
- 2. Generation of wastes should remain within the absorption capacity of the environment. If these two conditions are not fulfilled, then environment fails to perform its vital functions of life sustenance and it leads to the situations of environmental crises.

Reason for Environmental Crises

- Population explosion and Industrial revolution has increased the demand for environmental resources, but their supply is limited due to misuse and overuse.
- The intensive and extensive extraction of both renewable and non-renewable resources has exhausted some of the vital resources.
- Extinction of many resources and continuous rising population has also resulted in environmental crisis.
- Due to affluent consumption and production standard of developed world, the waste generated is beyond the absorptive capacity of the environment.
- The development process has polluted environment, water and atmosphere and there is decline in air and water quality. It has resulted in increased incidence of respiratory and water borne diseases.
- The expenditure on health is also rising. Global environmental issues such as global warming. Ozone depletion also contributes to the increased financial commitments of government.

Pollution

- Pollution is the introduction of contaminants into an Environment that causes instability, disorder, harm and or discomfort in the ecosystem.
- Pollution is substances, chemicals or factors which cause adverse effect on natural quality of any constituent of environment.

STRATEGIES FOR SUSTAINABLE DEVELOPMENT

The following strategies should be adhered to, for sustainable development.

1. **Use of Non-conventional source of Energy** – India is mostly dependent on thermal and hydropower plants which have adverse environmental impact. Non-conventional sources like wind and solar says are cleaner and greener technologies, which can be effectively used to replace thermal and hydropower.
2. **Use of Cleaner fuels** – Use of Compressed Natural Gas (CNG) is being promoted to be used as fuel. In Delhi, the use of CNG as fuel in public transport system has lowered air pollution and the air has become cleaner. The use of LPG and Gobar Gas is being promoted which reduces air pollution.
3. **Establishment of Mini-Hydel plants** – Mountain regions and streams are used to generate electricity through mini-Hydel plants. These are environment friendly.
4. **Traditional Knowledge and Practices** – Traditionally all practices relating to agriculture system, health care system, housing, transport etc. used to be environment friendly. The shift from the traditional system has caused large scale damage to the environment as our social heritage.
5. **Use of Bio-Compost** – The use of chemical fertilizers to increase the Agricultural production has not only adversely affected the large areas of productive land but also contaminate the water bodies. Increases in demand for organic food demand for dung are in increased use which is an important fertilizer and soil conditioner.
6. **Use of bio pest**

Change in unsustainable patterns of consumption and production – India has taken large number of steps for sustainable development.

E-MATERIAL

Video Lesson:

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Unit 8: DEVELOPMENT EXPERIENCE OF INDIA- A COMPARISON

WITH NEIGHBOURS

GIST OF THE LESSON:

Development Path of India, China, and Pakistan:

- 1. India and Pakistan got independence in 1947 and, PRC was established in 1949.
- 2. India announced its Five Year Plan in 1951, China in 1953 and Pakistan in 1956.
- 3. India and Pakistan have made slow and irregular progress as compared to China, which has made a miraculous progress.

Development History of China

- 1. The Great Leap Forward campaign of 1958.
- 2. Great Proletarian Cultural Revolution of 1965.
- 3. Economic Reforms- 1978
- 4. Dual Pricing
- 5. Special Economic Zones
- 6. Socialist economic model.

Development History of Pakistan

- 1. Mixed economic system.
- 2. Protectionism of tariffs and quotas.
- 3. Green Revolution of 1960s .
- 4. Denationalisation and privatisation of industries in the late 1970s.
- 5. Economic Reforms- 1988

Per Capita Income of India and Pakistan:

With a per capita income of US \$ 1627 in nominal terms (2018), India is ahead of Pakistan whose per capita income was US \$ 1343 in nominal terms , in 2018. In PPP terms, India's PCI is US \$ 5855 and that of Pakistan is US \$ 4736 in 2018.

China's PCI in 2018-19 is US \$ 10,153 in nominal terms and US \$ 19,520 in PPP terms.

Comparison based on Economic Growth Rate (in %)

<u>Country</u>	<u>1980-1990</u>	<u>1991-2010</u>	<u>2011-2015</u>	<u>2016-2019</u>
INDIA	5.7	6.6	6.7	6.8
CHINA	10.3	7.2	7.9	6.6
PAKISTAN	6.3	4.7	4.0	5.5

Population

- India today is the second largest populous country (133.92 crores in 2017)in the world after China (142.06 crores).

Pakistan has a population of 21.70 crores people in 2017

Demographic Facts (2015)

Country	Annual Pop. Growth (%)	Pop. Density (Per Sq.km)	Sex Ratio	Fertility Rate
India	1.2	441	929	2.3
China	0.5	146	941	1.6
Pakistan	2.1	245	947	3.7

Sectoral Share of GDP and Employment (%) in 2014-15

Sector	Contribution to GDP			Distribution of Workforce		
	India	China	Pakistan	India	China	Pakistan
Primary	17	9	25	50	28	43
Secondary	30	43	21	21	29	23
Tertiary	53	48	54	29	43	34
Total	100	100	100	100	100	100

Human Development Indicators

No.	Items	Year	India	China	Pak.
1	HDI Value	2017	0.640	0.752	0.562
2	HDI Rank (Out of 189 countries)	2017	130	86	150
3	Literacy Rate (%)	2011	74.04	95.12	62.3
4	Life Expectancy at Birth (Years)	2011	68.3	76	66.4
5	Mean Years of Schooling (%)	2011	6.3	7.6	5.1
6	GDP Per Capita (US \$ PPP)	2018	5855	10,153	4736
7	Population BPL (%) - (US \$ 1.9 a day)	2011	37	32	44
8	IMR (per 1000 live births)	2017	33	08	61.2
9	MMR (per 1 Lakh births)	2017	130	19.6	178
10	Population with Improved Sanitation (%)	2015	39.6	76.5	63.5
11	Population with Improved Water (%)	2015	92.6	95.5	91
12	GER in Higher education (%)	2017	25.2	48	9.9

E-MATERIAL

1. Video Lesson:

https://drive.google.com/file/d/1essEZ5bpGIpoxl3kg993JqvGE-A_oAjh/view?usp=sharing

2. Gist of Chapter (pdf):

<https://drive.google.com/file/d/1RxeoPCI4P1e1PSH2dwezFticaDnlHWA5/view?usp=sharing>

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**ZONAL INSTITUTE OF EDUCATION AND
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**INTERACTIVE STUDY
MATERIAL**

HINDI

CLASS XII 2022-23

**Sh. Upendra Singh Tomar
Training Associate (Hindi)**



केंद्रीय विद्यालय संगठन

आंचलिक शिक्षा एवं प्रशिक्षण संस्थान, ग्वालियर

अध्ययन सामग्री 2022-23

कक्षा 12 (हिंदी केन्द्रिक)



1	आत्मपरिचय	(आरोह)	वीडिओ पाठ	कविता - सार	पीपीटी	पद्यांश आधारित प्रश्न	सब्जेक्टिव प्रश्न
1.1	एक गीत		वीडिओ पाठ	कविता - सार	पीपीटी	पद्यांश आधारित प्रश्न	सब्जेक्टिव प्रश्न
2	पतंग		वीडिओ पाठ	कविता - सार	पीपीटी	पद्यांश आधारित प्रश्न	सब्जेक्टिव प्रश्न
3	कविता के बहाने		वीडिओ पाठ	कविता - सार	पीपीटी	पद्यांश आधारित प्रश्न	सब्जेक्टिव प्रश्न
3.1	बात सीधी थी पर		वीडिओ पाठ	कविता - सार	पीपीटी	पद्यांश आधारित प्रश्न	सब्जेक्टिव प्रश्न
4	कैमरे में बंद अपाहिज		वीडिओ पाठ	कविता - सार	पीपीटी	पद्यांश आधारित प्रश्न	सब्जेक्टिव प्रश्न
6	उषा		वीडिओ पाठ	कविता - सार	पीपीटी	पद्यांश आधारित प्रश्न	सब्जेक्टिव प्रश्न
7	बादल राग		वीडिओ पाठ	कविता - सार	पीपीटी	पद्यांश आधारित प्रश्न	सब्जेक्टिव प्रश्न
8	कवितावली (उत्तर कांड से)		वीडिओ पाठ	कविता - सार	पीपीटी	पद्यांश आधारित प्रश्न	सब्जेक्टिव प्रश्न
8.1	लक्ष्मण मूर्च्छा और राम का विलाप		वीडिओ पाठ	कविता - सार	पीपीटी1 पीपीटी2	पद्यांश आधारित प्रश्न	सब्जेक्टिव प्रश्न
9	रूबाईयां		वीडिओ पाठ	कविता - सार	पीपीटी	पद्यांश आधारित प्रश्न	सब्जेक्टिव प्रश्न
10	छोटा मेरा खेत		वीडिओ पाठ	कविता - सार	पीपीटी	पद्यांश आधारित प्रश्न	सब्जेक्टिव प्रश्न
10.1	बगुलों के पंख		वीडिओ पाठ	कविता - सार	पीपीटी	पद्यांश आधारित प्रश्न	सब्जेक्टिव प्रश्न
11	भक्तिन		वीडिओ पाठ	पाठ - सार	पीपीटी	पद्यांश आधारित प्रश्न	सब्जेक्टिव प्रश्न
12	बाजार दर्शन		वीडिओ पाठ	पाठ - सार	पीपीटी	पद्यांश आधारित प्रश्न	सब्जेक्टिव प्रश्न
13	काले मेघा पानी दे		वीडिओ पाठ	पाठ - सार	पीपीटी	पद्यांश आधारित प्रश्न	सब्जेक्टिव प्रश्न
14	पहलवान की ढोलक		वीडिओ पाठ	पाठ - सार	पीपीटी	पद्यांश आधारित प्रश्न	सब्जेक्टिव प्रश्न
17	शिरीष के फूल		वीडिओ पाठ	पाठ - सार	पीपीटी	पद्यांश आधारित प्रश्न	सब्जेक्टिव प्रश्न
18	1.(श्रम विभाजन और जाति-प्रथा) 2.(मेरी कल्पना का आदर्श समाज)		वीडिओ पाठ 1 2	पाठ - सार	पीपीटी	पद्यांश आधारित प्रश्न	सब्जेक्टिव प्रश्न
1	सिल्वर वेडिंग	(वितान भाग 2)	वीडिओ पाठ	पाठ सार	पीपीटी	MCQs	
2	जूझ		वीडिओ पाठ	पाठ सार	पीपीटी	MCQs	
3	अतीत में दबे पाँव		वीडिओ पाठ	पाठ सार	पीपीटी	MCQs	
3	विभिन्न माध्यमों के लिए लेखन	(अभिव्यक्ति और माध्यम)	वीडिओ पाठ	पाठ नोट्स		MCQs	
4	पत्रकारीय लेखन के विभिन्न रूप और लेखन प्रक्रिया		वीडिओ पाठ	पाठ नोट्स		MCQs	
5	विशेष लेखन स्वरूप और प्रकार		वीडिओ पाठ	पाठ नोट्स / प्रश्न		MCQs	
11	कैसे करें कहानी का नाट्य रूपांतरण		वीडिओ पाठ	पाठ नोट्स / प्रश्न			
12	कैसे बनता है रेडियो नाटक		वीडिओ पाठ	पाठ नोट्स / प्रश्न			
13	नए और अप्रत्याशित विषयों पर लेखन		वीडिओ पाठ	पाठ नोट्स / प्रश्न			
1	CBSE			प्रश्न पत्र प्रारूप	हिंदी केन्द्रिक SQP	हिंदी केन्द्रिक MS	

