

## Unit 2: Self-Management Skills – II

### Assignment Solutions

#### Multiple-Choice Questions (MCQs)

1. What kind of outcomes are expected from intrinsic motivation?
  - a. A reward in terms of money
  - b. A reward in terms of promotion in job
  - c. Enjoying the task one is doing
  - d. A reward of good grades in exam

Ans. c

2. Which of the following can be seen in a self-motivated person?
  - a. Doing something without the influence of others
  - b. Do not need someone to encourage them
  - c. Take problems as challenges
  - d. All of these

Ans. d

3. In ..... emotion, a person wants to insult or criticize someone.
 

a. Approach	b. Avoid
c. Attack	d. None of these

Ans. c

#### Long Answer Questions

1. What is the meaning of self-analysis? Explain in detail.

Ans. Self-analysis plays an important role in everyone's life. It is a process where we have to focus on ourselves completely. Self-analysis is an understanding of knowing our internal qualities, abilities, strengths and weaknesses. It is also an understanding of our positive and negative attributes. It also helps in converting weaknesses into strengths. To identify your strengths:

- Think about the areas in which you do well.
- Think about the areas in which you can do well.
- Point out the areas in which others appreciate you.

Since no one is perfect in this world; hence, there is no issue if you have some weaknesses but if you are able to identify your weaknesses and work on that, then you, will enhance your skills. To identify your weaknesses:

- Think about the areas of improvement.
- Think about the feedback received from others.
- Point out the areas in which you cannot do well.

2. What do you mean by self-awareness? Explain its types.

Ans. Individuals with self-awareness have an ability to observe themselves from an objective viewpoint. It is the individual's ability to recognize and understand his/her strengths, weaknesses, emotions and limitations in order to enhance the credibility and leadership qualities. The unique components of self-awareness are experiences, thoughts and abilities. These components create emotional intelligence in human beings. Hence, self-awareness is a key to emotional intelligence. To be aware about yourself, one has to dedicate himself to self-improvement. This is because when someone understands what he lacks only then can he can put efforts to improve.

#### Types of Self-Awareness

Self-awareness is the capacity of a person to examine his/her own thoughts or feelings. The process of examining own thoughts is called introspection. One can know various shades of his/her characteristics by being more aware about him/herself. In this way, a person can know about his/her personality defects and can overcome it. There are two types of self-awareness:

- Public self-awareness:** The kind of awareness that comes into being when people are at the center of attention, such as giving a presentation or speech at a public gathering. This kind of self-awareness often forces people to follow certain social norms.
- Private self-awareness:** The kind of awareness that comes into being when people become aware about themselves and their inner instincts, such as seeing your face in a mirror or introspecting on one's own conduct.

3. Explain the techniques used for managing stress.

Ans. The techniques for stress management are explained as follows:

- Deep breathing:** One of the simplest techniques of stress management is to take deep breaths. Being in stress, can lead to shallow breathing, which deprives our body from oxygen and may cause muscle tension. Taking deep breathes in times of stress can help us to better control our body's reaction to stress.
- Muscle relaxation:** Muscle relaxation technique focuses on our entire body. This technique is used to reduce stress by stretching muscles.
- Meditation:** In this stress-reducing technique, you need a peaceful place to sit for a few minutes.
- One has to try to get rid of his/her own thoughts to eliminate stress.
- Going on vacations:** Vacations or holidays with friends and family is also a stress-relieving technique.

A good vacation can help us to reconnect with ourselves as vacations help us to take some amount of time away from the

stress of daily life. After a vacation, you can return to your daily life refreshed.

- **Taking nature walks:** Walking helps us to relieve stress. For relief from stress, come out of your stressful environment, take deep breaths in the air and feel your body moving. Walking helps in releasing the body's natural happy drug called endorphins. To relieve yourself from stress and anxiety, one should spend time in nature. Walking in the lap of nature improves one's mood and boosts a feeling of happiness.

Natural scenery captures our attention and hence, calms our nerves.

- **Yoga or exercise:** Yoga or exercise not only makes an individual more fit, but also helps in reducing stress. It even helps in building stamina, which is helpful to avoid stress.
- **Spending time on social network:** By spending time on the social circle that comprises our relatives, friends, and colleagues you can reduce your stress.

**CHAPTER- 2**  
**ACIDS, BASES AND SALTS**  
**GIST OF THE LESSON**

- 1) Acids are sour in taste, turn blue litmus red, and dissolve in water to release  $H^+$  ions e.g. HCl,  $H_2SO_4$ ,  $HNO_3$  etc.
- 2) Bases are bitter in taste, have soapy touch, turn red litmus blue and give hydroxide ions in solution.  
  
e.g. NaOH, KOH etc.
- 3) A salt is a compound which is formed by neutralization reaction between an acid and base.  
e.g. sodium chloride.
- 3) **Indicators** – Indicators are substances which indicate the acidic or basic nature of the solution by their colour change.

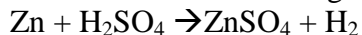
The colour of some acid – base indicators in acidic and basic medium are given below



Sr. No.	INDICATORS	COLOUR IN ACIDIC MEDIUM	COLOUR IN BASIC MEDIUM
1	Litmus solution	Red	Blue
2	Methyl Orange	Pink	Orange
3	Phenolphthalein	Colourless	Pink
4	Methyl red	Yellow	Red

### 5) Chemical properties of acids:

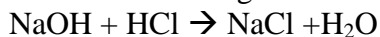
i) Acids react with active metals to give hydrogen gas.



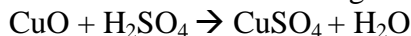
ii) Acids react with metal carbonate and metal hydrogen carbonate to give carbon dioxide.



iii) Acids react with bases to give salt and water. This reaction is called as neutralization reaction.



iv) Acids react with metals oxides to give salt and water.

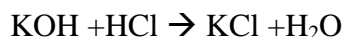


### 6) Chemical properties of Bases:

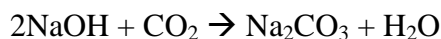
i) **Reaction with Metals** - Certain reactive metals such as Zinc, Aluminium, and Tin react with alkali solutions on heating and hydrogen gas is evolved.



ii) **Reaction with acids** - Bases react with acids to form salt and water.



iii) **Reaction with Non-metallic oxides** – These oxides are generally acidic in nature. They react with bases to form salt and water.



7) **PH Scale:** The concentration of hydrogen ion in solution is expressed in terms of pH. The pH of a solution is defined as the negative logarithm of hydrogen ion concentration in moles per liter.

$$\text{pH} = -\log [\text{H}^+]$$

For water or neutral solutions,  $\text{pH} = 7$ ; For acidic solutions,  $\text{pH} < 7$ ; For basic solutions,  $\text{pH} > 7$

### 8) Some Important Chemical Compounds:

#### a) Common Salt (NaCl)

Sodium chloride is known as common salt. Its main source is sea water. It also exists in the form of rocks and is called rock salt.

Common salt is an important component of our food. It is also used for preparing sodium hydroxide, baking soda, washing soda etc.

#### b) Sodium Hydroxide or Caustic Soda (NaOH)

It is prepared by passing electricity through an aqueous solution of sodium chloride also known as brine.



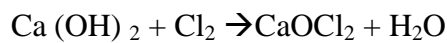
This process is known as chlor-alkali process.

#### Properties:

1. It is white translucent solid.
2. Crystals of sodium hydroxide are deliquescent.
3. It is readily soluble in water and gives strong alkaline solution.

**c) Bleaching Powder (CaOCl<sub>2</sub>)**

Its chemical name is calcium oxychloride. It is prepared by passing chlorine gas through dry slaked lime.



**Uses –**

1. For bleaching cotton and linen in textile industry and wood pulp in paper industry
2. For disinfecting drinking water.

**d) Baking Soda (NaHCO<sub>3</sub>)**

Chemical name is Sodium hydrogen carbonate.

It is prepared by passing CO<sub>2</sub> gas through brine solution saturated with ammonia.



**Properties:**

1. It is white crystalline solid and sparingly soluble in water at room temperature.
2. On heating it decomposes to give sodium carbonate and carbon dioxide.
3. It reacts with acids to give carbon dioxide gas.
4. Its aqueous solution is weakly alkaline due to hydrolysis.

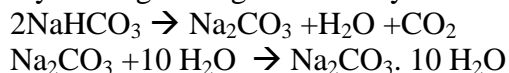
**Uses:**

1. It is used in soda – acid fire extinguisher.
2. It acts as a mild antiseptic and antacid.
3. It is used as a component of baking powder. In addition to sodium hydrogen carbonate, baking soda contains tartaric acid.

**e) Washing Soda (Na<sub>2</sub>CO<sub>3</sub>·10 H<sub>2</sub>O)**

Chemical name is sodium carbonate decahydrate.

It is prepared by heating baking soda. Recrystallisation of sodium carbonate gives washing soda.



**Uses:**

1. It is used for removing permanent hardness of water.
2. It is used in glass, soap and paper industries.
3. It can be used as a cleaning agent for domestic purposes.

**f) Plaster of Paris (CaSO<sub>4</sub>·1/2H<sub>2</sub>O)**

Its chemical name is calcium sulphate hemihydrate. It is obtained by heating Gypsum up to 373K.



On treatment with water it is again converted into gypsum and sets as a hard mass.

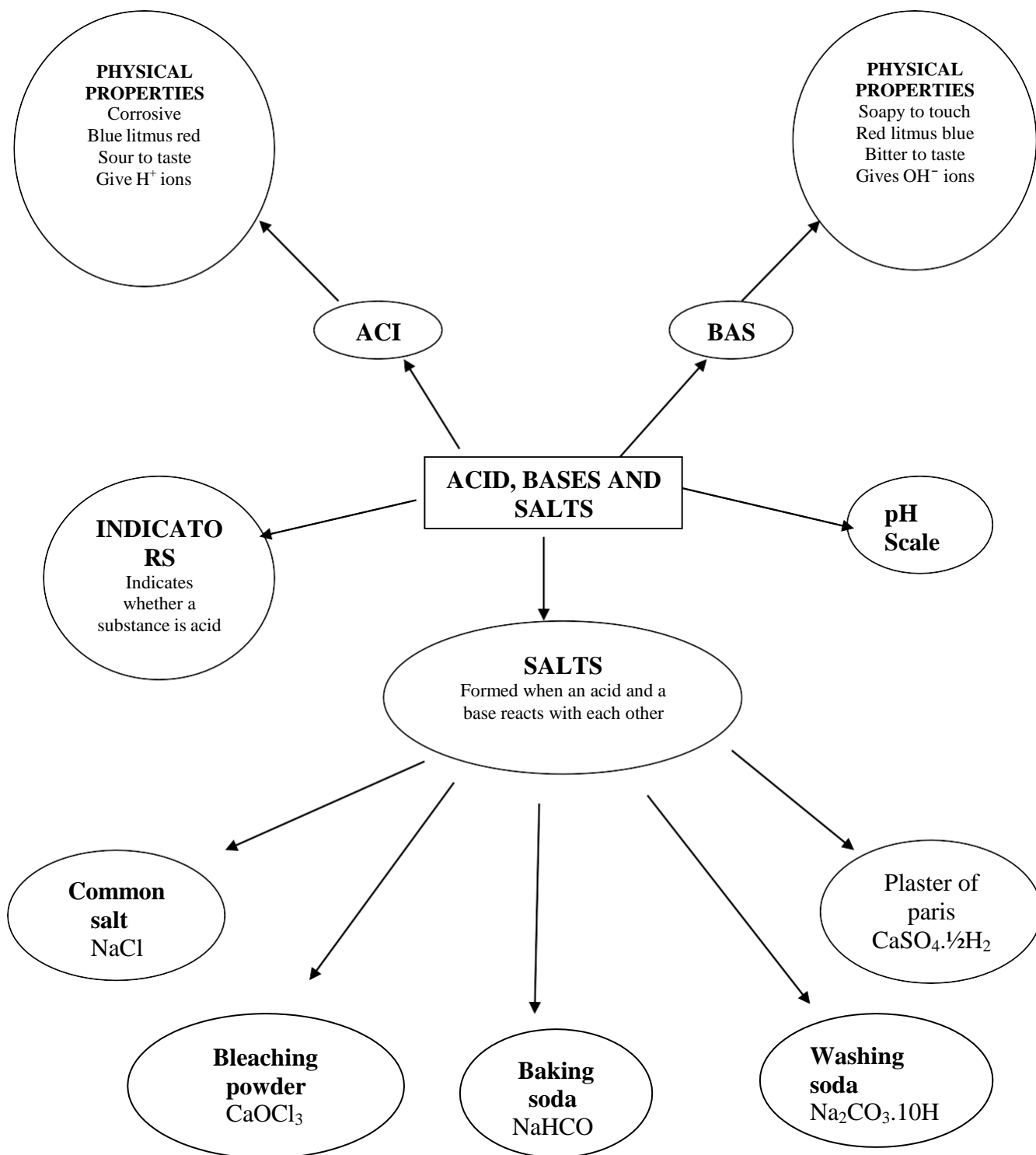


**Uses:-**

1. It is used by doctors for setting fractured bones.
2. It is used for making statues, models and other decorative materials.



## MIND MAP





**ACID, BASES AND SALTS**  
**FORMATIVE ASSESSMENT I**  
**O.PAPER**

MARKS-30

TIME- 70 MINUTES

Instructions:

- Questions : 1 to 5 – 1 Mark each
  - Questions : 6 to 9 – 2 Marks each
  - Questions : 10 to 13 – 3 Marks each
  - Question 14 – 5 Marks
- ii. Name the gas formed when sodium hydroxide reacts with zinc.
- iii. Write the chemical name of baking soda.
- iv. What happens when gypsum is heated at 373K?
- v. Which has a higher pH value 1M HCl or 1M NaOH solution?
- iv. Hydrogen ion concentration of an acid is  $1 \times 10^{-2}$  mol/l. what is its pH?
- ivi. What is meant by ‘Water of Crystallisation’ of a substance? Describe an activity to show that.
- ivii. Why does tooth decay start when the pH of mouth is lower than 5.5?
- iviii. What is baking powder? How does it make the cake soft and spongy?
- ix. Give Arrhenius definition of an acid and a base. Choose strong acid and strong base from the following:



- ix. What happens when nitric acid is added to egg shell? Give the chemical equation.
- ixi. A student prepared solutions of an acid and a base in two separate beakers. She forgot to label the solutions and litmus paper is not available in the laboratory. Since both the solutions are colourless, how will she distinguish between the two?
- ixii. Identify the compound ‘X’ on the basis of the reactions given below. Write the names and chemical formulae of A, B, C

Compound X	+ Zn	(A) + H <sub>2</sub> (g)
	+HCl	(B) + H <sub>2</sub> O
	+ CH <sub>3</sub> COOH	(C) + H <sub>2</sub> O

ixiii. How is plaster of Paris prepared? What is its chemical formula? Write its chemical name.

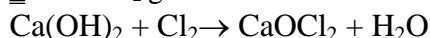
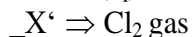
ixiv.

- a) Define strong acid and weak acid.
- b) A student working in the laboratory added some water to a syrupy liquid taken in tube. The tube immediately cracked and the liquid escaped out, that produced blisters on the skin of the student. Why?

### HOTS QUESTIONS

Q.1. In one of the industrial process used for manufacture of sodium hydroxide, a gas X is formed as by – product. The gas X reacts with lime water to give a compound Y which is used as a bleaching agent in chemical industry. Identify X and Y giving the chemical equation of the reaction.

Ans. In the manufacture of sodium hydroxide, hydrogen gas and chlorine gas (X) are formed as by products. When chlorine gas (X) reacts with lime water, it forms calcium oxy chloride (bleaching powder) Y.

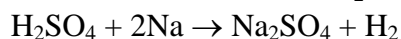
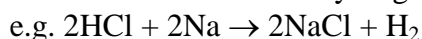


Q.2. Dry hydrogen chloride gas does not turn blue litmus, whereas hydrochloric acid does. Why?

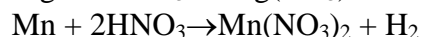
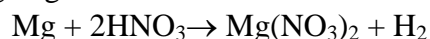
Ans. In the dry state, hydrogen chloride (HCl) does not release  $\text{H}^+$  ions. Therefore, it cannot behave as an acid. When dissolved in water, it forms hydrochloric acid. It dissociates to give  $\text{H}^+$  ions in solution and behaves as an acid.

Q.3. Acid when react with metals release hydrogen gas but there is one acid which when reacts with metals does not release hydrogen except for two metals. Prove this statement.

Ans. Acid + Metal  $\rightarrow$  Salt + Hydrogen



Because nitric acid is strong oxidising agent. Nitric acid reacts only with Mg and Mn to give hydrogen gas.



Q. 4 Name the properties responsible for the following uses of baling powder. (i) Baking industry (ii) As an antacid (ii) As soda-acid fire extinguisher.

Q. 5 What is meant by water of crystallisation of a substance? What is its importance?

Q. 6 What effect does an increase in concentration of  $\text{H}^+$  ions in a solution have on the pH of a solution

Q. 7 Fresh milk has a pH Of 6. When it changes to curd, will its pH value increase or decrease? Why?



- Q. 8 How does the flow of acid rain water into a river make the survival of aquatic life in a river difficult?
- Q. 9 Arrange in the increasing order of their pH values: NaOH solution, Blood, Lemon juice,
- Q. 10 Two solutions A and B have pH values of 5 and 8 respectively. Which solution will be basic in nature?
- Q. 11 Why does an aqueous solution of acid conduct electricity?
- Q. 12 How is alkali different from a base?

**FA II**  
**ACIDS, BASES AND SALTS**  
**ORAL QUESTIONS – (Conversation Type)**

1.
  - a) Acids are sour in taste. Is it a way to find whether a substance is an acid or a base?
  - b) What is other physical test?
  - c) Any test with solid acid?
  - d) Can you check the evolution of  $\text{CO}_2$  chemically?
2.
  - a) What are acids?
  - b) Can presence of  $\text{H}^+$  ion in water be estimated? How?
  - c) How is pH related to strength of an acid?
  - d) Name one strong acid and one weak acid.
3.
  - a) What are salts?
  - b) How many types of salts are formed?
  - c) What are neutral salts?
  - d) What do you mean by acidic salts?
  - e) Define basic salts.
  - f) Give the corresponding acid and base from which sodium carbonate is formed.
4.
  - a) What is common salt?
  - b) Why does common salt become moist in rainy season?
  - c) How is it used as a freezing mixture?
  - d) Name two important laboratory chemicals prepared from common salt on large scale.
5.
  - a) What is washing soda?

- b) Name the process by which sodium carbonate is manufacture.
  - c) What are the raw materials used in the preparation of washing soda?
  - d) Sodium carbonate is obtained from another carbonate on heating. Name it.
- 6.
- a) Name the substance used for bleaching cotton and wood pulp in textiles.
  - b) What is its chemical name?
  - c) How is it manufactured?
  - d) What is slaked lime?
  - e) Why does bleaching powder smell of chlorine?

### **ORAL QUESTIONS**

1. Name the acid present in lemon juice.
2. What is the chemical difference between washing soda and baking powder?
3. Name the acid present in ant sting.
4. What is the ideal pH of the soil for the healthy growth of a plant?
5. At what pH the mouth teeth start decaying?
6. How is pH of an acid solution affected when it is diluted?
7. Name the gas responsible for extinguishing fire in a soda – acid fire extinguisher.
8. Out of glucose and acetic acid which one will conduct electricity in water?
9. What is the pH of blood?
10. What is the chemical name of the compound which has the property of hardening when mixed with water?

### **QUIZ – WHO AM I**

1. I can roughly measure pH value from 0 – 14.
2. I am called antichlor and am used to remove excess chlorine from clothes when treated with bleaching powder.
3. I am a product of gypsum and am used to making chalks and fire proof materials.
4. I am a compound of calcium and can be used for disinfecting drinking water as well as for decolourisation.
5. I give different smell in acid and base solution.



6. I am an oxide capable of showing properties for both acids and bases.
7. I am a covalent compound and conducts electricity in aqueous medium.
8. I am a salt of potassium hydroxide and nitric acid.
9. I am the term used when a solid becomes liquid when exposed to moist air.
10. I am derived from tomato and turn blue litmus into red.

# BENGALI QUESTION BANK

## CLASS - X

### ● গদ্যাংশ

### \*জ্ঞানচক্ষু

- ১) “পৃথিবীতে এমন অলৌকিক ঘটনাও ঘটে”- ক) উদ্ধৃতিটি কার কোন রচনার অন্তর্গত?/উদ্ধৃতিটি কোথা থেকে গৃহীত হয়েছে? খ) উদ্ধৃতিটির প্রসঙ্গ উল্লেখ করো। গ) কোন ঘটনাকে অলৌকিক ঘটনা বলে উল্লেখ করা হয়েছে?/বক্তব্যটির অর্থ পরিস্ফুট করো।
- ২) “সত্যিই তপনের জীবনের সবচেয়ে সুখের দিন এলো আজ”- ক) কার কোন রচনার অন্তর্গত? খ) তপন কে? গ) কোন দিনটির কথা বলা হয়েছে? ঘ) উদ্ধৃতিটির প্রসঙ্গ উল্লেখ করো। ঙ) সুখের দিন বলার কারণ কি?
- ৩) “মনে হয় আজ যেন তার জীবনের সবচেয়ে সুখের দিন” - ক) আলোচ্য অংশটি কোথা থেকে গৃহীত? খ) ‘তার’ বলতে কার কথা বলা হয়েছে? গ) কোন দিনটিকে সবচেয়ে সুখের দিন বলা হয়েছে? কেন বলা হয়েছে?
- ৪) “বুকের রক্ত ছলকে ওঠে”- ক) উদ্ধৃতাংশটি কোন রচনা আর অন্তর্গত? খ) কার সম্পর্কে বলা হয়েছে? গ) বুকের রক্ত ছলকে ওঠা বলতে কী বোঝো? ঘ) আলোচ্য অংশটির প্রসঙ্গ উল্লেখ করো। ঙ) কার বুকের রক্ত কি কারণে ছলকে ওঠে?
- ৫) “বিকলে চায়ের টেবিলে উঠে কথাটা”- ক) কার কোন রচনায় অন্তর্গত? খ) চায়ের টেবিলে কোন কথাটা উঠে? গ) এব্যাপারে তপনের মেসো কী বলেন? ঘ) তপনের প্রতিক্রিয়া কি হয়?
- ৬) “রঞ্জের মূল্য জহরির কাছেই” - উদ্ধৃতির প্রসঙ্গ নির্দেশ করে তাৎপর্য ব্যাখ্যা কর।
- ৭) “আমাদের থাকলে আমরাও চেষ্টা করে দেখতাম”- ক) আলোচ্য অংশটি কার কোন রচনায় অন্তর্গত? খ) বক্তা কে? গ) আলোচ্য অংশটির প্রসঙ্গ উল্লেখ করো? ঘ) বক্তব্যটির তাৎপর্য ব্যাখ্যা করো?/ বক্তা কী বলতে চেয়েছেন?
- ৮) “তার চেয়ে দুঃখের কিছু নেই তার চেয়ে অপমানের”- ক) কার কোন গল্পের অন্তর্গত? খ) দুঃখের ও অপমানের এই অনুভূতি কার? গ) কোন ঘটনার পরিপ্রেক্ষিতে তার এই অনুভূতি হয়েছিল তা লিখ?/ তার দুঃখ ও অপমানের কারণ কী?
- ৯) “শুধু এই দুঃখের মুহূর্তে গভীরভাবে সংকল্প করে তপন”- ক) কার কোন রচনার অন্তর্গত? খ) কোন দুঃখের মুহূর্তের কথা এখানে বলা হয়েছে? গ) তপন কী সংকল্প করেছিল এবং কেন?

১০) “হঠাৎ একটা ভয়ানক উত্তেজনা অনুভব করে তপন”- ক) কার কোন রচনার অন্তর্গত? খ) তপন কে? গ) তার উত্তেজনার কারণ কী? ঘ) পরে সে কী করে?

১১) “গল্প ছাপা হলে যে ভয়ঙ্কর ভয়ঙ্কর আহ্লাদটা হবার কথা সে আহ্লাদটা খুঁজে পায়না”- ক) কার কোন গল্পের অন্তর্গত? খ) উদ্ধৃতিটির প্রসঙ্গ নির্দেশ করো। গ) আলোচ্য অংশটির বক্তব্য বিশ্লেষণ করো।/ আহ্লাদ খুঁজে না পাওয়ার কারণ কী?

### প্রশ্নগুলির উত্তর দাও (‘সঠিক উত্তর বাছাই’ ধরনের প্রশ্নের জন্য)( For MCQ)

**\*MCQ ধরনের প্রশ্ন উত্তর করার জন্য সম্পূর্ণ গল্পটি কয়েক বার ভাল করে পড়বে।( Read the story carefully)**

- ১) জ্ঞানচক্ষু গল্পটির রচয়িতা কে?
- ২) জ্ঞানচক্ষু একটি কি?
- ৩) সন্ধ্যাতারা কিসের নাম?
- ৪) তপনের মেসোমশাই একজন কি ছিলেন?
- ৫) তপনের লেখা গল্পের নাম কি?
- ৬) তপনের মাসি তপনের থেকে কত বছরের বড়?
- ৭) বাড়িতে কি হিসেবে তপনের পরিচিতি হয়ে গিয়েছিল?
- ৮) পত্রিকায় তপনের নাম কিভাবে লেখা ছিল?
- ৯) “বাবা, তোর পেটে এত!”- কথাটি কে বলেছিলেন?
- ১০) কাকে দেখে তপনের চোখ মার্বেল এর মত হয়ে গেল?
- ১১) তপন বিয়ে বাড়িতে কি নিয়ে এসেছিল?
- ১২) তপন কখন তার গল্পটি লিখেছিল?
- ১৩) তপনের চিরকালের বন্ধু কে ছিল?
- ১৪) “ছুটি ফুরিয়ে এসেছে”- এখানে কোন ছুটির কথা বলা হয়েছে?
- ১৫) ছোট মেসো কি নিয়ে তপনের বাড়িতে বেড়াতে এসেছিলেন?
- ১৬) দেদার ঘটাপটা কার বিয়ে হয়ে গেল?
- ১৭) নতুন মেসো কে দেখিয়ে তপনের কি খুলে গেল?
- ১৮) ছোট মাসি আত্মপ্রসাদের প্রসন্নতা নিয়ে বসে বসে কি খায়?
- ১৯) তপন খাতা-কলম নিয়ে কোথায় গেল?

২০) তপনের ছোট মাসি কার ঘুম ভাঙ্গিয়ে দিয়েছিল?

### **\*আলোবাবু**

১) “জীবন্ত কোন জিনিস পৌরসবার সামর্থ্য আমার নেই”- ক) কার কোন রচনা আর অন্তর্গত? খ) বক্তা কে? গ) উদ্ধৃত অংশটির প্রসঙ্গ উল্লেখ করো। ঘ) বক্তার বক্তব্য পরিস্ফুট করো।

২) “সেবা করতে বড় ভালোবাসে, বিশেষত সেবার পাত্র বা পাত্রী যদি অসহায় হয়”- ক) কার কোন রচনার অন্তর্গত? খ) কে সেবা করতে ভালোবাসে? গ) তার চরিত্রের কোন বৈশিষ্ট্য এখানে ফুটে উঠেছে?

৩) “চেহারা অবসর নামের উপযুক্ত নয়”- ক) কার কোন রচনায় অন্তর্গত? খ) কোন প্রসঙ্গে এই উক্তিটি করা হয়েছে? গ) তার চেহারা নামের উপযুক্ত না হওয়ার কারণ কী?

৪) “স্নেহের কাঙাল বেচারী জীবনে কিন্তু ভালোবাসার সুযোগ পাচ্ছে না কোথাও”- ক) কার কোন রচনায় অন্তর্গত? খ) বক্তা কে? বক্তা কাকি স্নেহের কাঙাল বলেছেন? গ) আলোচ্য অংশটির প্রসঙ্গ নির্দেশ করো। ঘ) তাকে স্নেহের কাঙাল বলার কারণ কী?

৫) “মাসখানেক পরে চাকরি গেল তার”- ক) কার কোন রচনার অন্তর্গত? খ) এখানে কার চাকরি যাওয়ার কথা বলা হয়েছে? গ) আলোচ্য অংশটির প্রসঙ্গ উল্লেখ করো। ঘ) সে কোথায় চাকরি করতো? ঙ) তার চাকরি যাওয়ার কারণ কী?

৬) “একটু বিরক্ত হলাম কিন্তু মুখে বিরক্তি প্রকাশ করতে পারলাম না”- ক) কার লেখা কোন রচনার অন্তর্গত? খ) বক্তা কে? বক্তা কেন বিরক্ত হলেন? গ) তিনি কেন কোন বিরক্তি প্রকাশ করলেন না?

৭) “আমায় ওরা সহ্য না কেউ,

আমার কাছে রইল না কেউ”- ক) কার কোন রচনায় অন্তর্গত? খ) বক্তা কে? গ) আলোচ্য অংশটির প্রসঙ্গ নির্দেশ করো? ঘ) বক্তার বক্তব্য পরিস্ফুট করো। ঙ) বক্তার এরূপ বলার কারণ কী?

৮) “অনুগ্রহ করে একটু সাহায্য করবেন আমাকে”- ক) কার কোন রচনার অন্তর্গত? খ) বক্তা কে? গ) বক্তার চেহারার বর্ণনা দাও। ঘ) বক্তা কার কাছে কি সাহায্য প্রার্থনা করেছিলেন?

৯) “সমাজের সঙ্গে নিজেকে তিনি খাপ খাওয়াতে পারলেন না কিছুতেই”- ক) কার কোন রচনার অন্তর্গত? খ) এখানে কার সম্পর্কে বলা হয়েছে? গ) তিনি নিজেকে সমাজের সঙ্গে খাপ খাওয়াতে পারলেন না কেন? ঘ) তার পরিণাম কি হয়?

### **প্রশ্নগুলির উত্তর দাও (‘সঠিক উত্তর বাছাই’ ধরনের প্রশ্নের জন্য)( For MCQ)**

**\*MCQ ধরনের প্রশ্ন উত্তর করার জন্য সম্পূর্ণ গল্পটি কয়েক বার ভাল করে পড়বে। (Read the story carefully)**

- ১) আলোবাবু গল্পটি কার লেখা?
- ২) বনফুল এর প্রকৃত নাম কি?
- ৩) আলোবাবু গল্পটির মূল গ্রন্থের নাম কি?
- ৪) হ্যালো বাবুর গায়ের রং কেমন ছিল?
- ৫) আলো বাবুর গলায় কি ছিল?
- ৬) আলোবাবু খলি থেকে কি বের করলেন?
- ৭) ছোঁড়াটা পাখির ছানা কে কিভাবে নিয়ে যাচ্ছিল?
- ৮) আলোবাবু কত দাম দিয়ে পাখির ছানাটা কিনেছিলেন?
- ৯) পাখিটার পায়ে কি ঔষধ লাগানো হয়েছিল?
- ১০) আলোবাবু কোথায় থাকেন?
- ১১) আলোবাবু কতদিন হলো অবিনাশবাবুর বাড়ীতে এসেছেন?
- ১২) অবিনাশবাবুর কয় ছেলে?
- ১৩) আলোবাবু হাসপাতালে কিসের চাকরি পেলেন?
- ১৪) অবিনাশবাবুর শিশুপুত্রটির নাম কি?
- ১৫) অবিনাশবাবুর বড় ছেলের নাম কি?
- ১৬) আলোবাবু কয়টার সময় ঘড়িতে দম দেন?
- ১৭) শেষে আলোবাবুর কোথায় ঠাই হলো?
- ১৮) আলোবাবু ঘরে ঢুকে কি খুললেন?
- ১৯) আলোবাবু কি বাজিয়ে গান করছিলেন?
- ২০) “সত্যিই অন্যায় কাজ করেছেন”- কে অন্যায় কাজ করেছেন?

## ● পদ্যাংশ

**\*আয় আরো বেঁধে বেঁধে থাকি**

১) “আমাদের ডান পাশে ধ্বস

আমাদের বাঁয়ে গিরিখাত”- ক) কার কোন রচনার অংশ? খ) আমাদের বলতে কাদের বোঝানো হয়েছে? গ) আলোচ্য অংশের তাৎপর্য বিশ্লেষণ করো।

২) “আমাদের চোখ মুখ ঢাকা

আমরা ভিখারি বারো মাস”- ক) উদ্ধৃতিটি কার কোন রচনা থেকে গৃহীত? খ) কোন প্রসঙ্গে এ উক্তি? গ) উদ্ধৃতাংশের তাৎপর্য বিশ্লেষণ কর।

৩) “আমাদের ইতিহাস নেই”- ক) কার কোন রচনার অংশ? খ) কবি কোন প্রসঙ্গে কথাগুলো বলেছেন? গ) আমাদের ইতিহাস নেই বলতে কবি কী বুঝিয়েছেন?

৪) “কিছুই কোথাও যদি নেই

তবুও তো কজন আছি বাকি”- ক) অংশটি কোথা থেকে নেওয়া হয়েছে? এর মূল গ্রন্থের নাম কি? খ) এখানে “কজন” বলতে কাদের বোঝানো হয়েছে? গ) উদ্ধৃতির মধ্য দিয়ে সমাজের কোন ছবি ফুটে উঠেছে?

৫) “আমাদের কথা কে-বা জানে।”- ক) কার কোন কবিতার অংশ? খ) আমাদের বলতে কাদের কথা বলা হয়েছে? গ) উদ্ধৃতাংশটিতে কবি কি বলতে চেয়েছেন?

### প্রসঙ্গ উল্লেখ করে ব্যাখ্যা করো

১) “আমাদের পথ নেই কোন”

২) “আমাদের ইতিহাস নেই”

৩) “তবু তো কজন আছি বাকি”

### \*তিন পাহাড়ের কোলে

১) “পুব আকাশে আন্তে-ধীরে আলোর ঘোমটা খোলে,

শান্ত সবুজ গাঁ ভেসেছে তিন পাহাড়ের কোলে”- ক) কার কোন কবিতার অন্তর্গত? খ) ‘আলোর ঘোমটা খোলে’ বলতে কি বোঝো? গ) আলোর ঘোমটা খুলতে ‘তিন পাহাড়ের কোলে’ কী পরিবর্তন লক্ষ করা যায়?

২) “সহজ করে বাঁচা কি আর খাঁচাতে সম্ভব?

তিন পাহাড়ের নকশিকাঁথায় শিশুর কলরব”-ক) কার কোন কবিতার অংশ? খ) ‘খাঁচাতে কি আর বাঁচা সম্ভব’ বলতে কী বোঝানো হয়েছে? গ) ‘নকশিকাঁথায় শিশুর কলরব’ বলতে কী বোঝো?

৩) “পথ হারিয়ে যায় যদি কৈ, সেদিকে পথ আছেই,



বর্ণা কদর শিলা পাথর বনভূমির কাছেই”- ক) কার কোন কবিতার অন্তর্গত? খ) ‘পথ হারিয়ে যায় যদিকে’ বলতে কি বোঝা? গ) ‘সেই দিকে পথ আছে বলতে কী বোঝানো হয়েছে?

৪) “অন্ধকারে তিনপাহাড়ে ট্রেনের থেকে নেমে

হাওয়াবিলাসী তিনজোড়া চোখ আটকে গেল ফ্রেমে।”- ক) কার কোন কবিতার অংশ? খ) ‘হাওয়াবিলাসী তিনজোড়া চোখ’ বলতে কী বোঝানো হয়েছে? গ) কেন ‘হাওয়াবিলাসী তিনজোড়া চোখ’ ফ্রেমে আটকে গেল?

### প্রসঙ্গ উল্লেখ করে ব্যাখ্যা করো

১) “এমন একটি দেশে আসলে সঙ্কলে পথ হারায়”

২) “বনভূমির ওপারে কোন বনভূমির দ’য়

ফুসুর ফাসুর ঘুসুর ঘাসুর স্বপ্নে কথা হয়।”

### **\*শিলাদিত্য**

১) “সেই কুন্ডের একধারে প্রকাণ্ড সূর্য মন্দিরে এক অতিবৃদ্ধ পুরোহিত বাস করতেন।”- ক) কার লেখা কোন রচনার অংশ? খ) সেই কুন্ডের বলতে এখানে কোন কুন্ডের কথা বলা হয়েছে? গ) বৃদ্ধ পুরোহিত সেই সূর্যমন্দিরে কি করতেন?

২) “সূর্যদেব ভক্তের মনোবাঞ্ছা পূর্ণ করলেন”- ক) কার কোন রচনা থেকে আলোচ্য উদ্ধৃতিটি গৃহীত হয়েছে? খ) ভক্তের মনোবাঞ্ছা কি ছিল? গ) সূর্যদেব কিভাবে ভক্তের মনোবাঞ্ছা পূর্ণ করেছিলেন?

৩) “পিতা, আজ সন্ধ্যার সময় এই প্রদীপে সূর্যদেবের আরতী করুন”- ক) বক্তা কে? খ) বক্তা কখন কথাগুলো বলেছিলেন? গ) বক্তা কেন কথাগুলো বলেছিলেন তা নিজের ভাষায় বর্ণনা করো।

৪) “সূর্যদেবের সমস্ত পৃথিবী অন্ধকার করে অন্ত গেলেন। সুভাগা একলা পড়লেন।”- ক) কোন দিনের কথা বলা হয়েছে? খ) সেদিন কি ঘটনা ঘটেছিল? গ) সুভাগা কিভাবে একলা হয়ে পড়েছিলেন তা সংক্ষেপে লেখ।

৫) “বৎসে, দেবতার বরে মৃত্যু হয়না, দেবতার অভিশাপে মৃত্যু হয়, তুমি বর প্রার্থনা করো।”- ক) বক্তা কে? খ) বক্তা কখন কথাগুলো বলেছিলেন? গ) তারপর কি ঘটেছিল তা সংক্ষেপে বর্ণনা করো।

৬) “এমন সময় ঝড়ের মতো গায়ের এসে পিতলের প্রদীপটা কেড়ে নিয়ে টান মেরে ফেলে দিলেন।”- ক) গায়ের কে? খ) কখন সে পিতলের প্রদীপটাকে নিয়ে টান মেরে ফেলে দিয়েছিল? গ) পিতলের প্রদীপ টান মেরে ফেলে দেওয়ার ফলে কি ঘটেছিল?

৭) “হে দরিদ্র, হে বন্ধুহীন, এই বালিকাকে তোমার বন্ধু কর, আশ্রয় দাও”- ক) কার লেখা কোন রচনার অন্তর্গত? খ) বক্তা কে? কাকে একথা বলা হয়েছে? গ) আলোচ্য অংশের তাৎপর্য কী?

৮) “আজ থেকে তোমার নাম শিলাদিত্য”- ক) কার কোন রচনার অন্তর্গত? খ) বক্তা কে? বক্তা কাকে একথা বললেন? গ) কোন দিন থেকে তার নাম শিলাদিত্য হয়?/ বক্তা কখন কথাগুলি বলেছিল? ঘ) বক্তা তারপর আর কি কি কথা বলেছিল?

### **প্রশ্নগুলির উত্তর দাও ( For very short answer type questions)**

**\*অতি সংক্ষিপ্ত প্রশ্নের উত্তর লেখার জন্য সম্পূর্ণ গল্পটি কয়েক বার ভাল করে পড়বে। (Read the story carefully)**

- ১) শিলাদিত্য কে?
- ২) বল্লভীপুর কী?
- ৩) সূর্য কুণ্ড কোথায় অবস্থিত?
- ৪) ব্রাহ্মণের কাছে আশ্রয়প্রার্থী কন্যাটির পরিচয় দাও?
- ৫) ব্রাহ্মণ কত বছর যাবত সূর্য মন্দিরে পূজা করেছিলেন?
- ৬) মন্দিরের সন্ধ্যা আরতির নিয়ম কি ছিল?
- ৭) সূর্য মন্ত্র এর বৈশিষ্ট্য কি ছিল?
- ৮) সুভাগা সূর্যদেবের কাছে কি প্রার্থনা করে?
- ৯) সুভাগা পুত্র ও কন্যা দুটির কি নাম রাখলেন?
- ১০) শিলাদিত্যের বংশ কি নামে পরিচিতি লাভ করে?
- ১১) সূর্যকুণ্ড থেকে উঠে আসা রথটির নাম কি?
- ১২) শিলাদিত্য সঙ্গে কার বিবাহ হয়?
- ১৩) সূর্যমন্দিরে সূর্য দেবের মূর্তির ওজন কত ছিল?
- ১৪) সূর্য কুণ্ডের জল অপবিত্র হলো কি করে?
- ১৫) সূর্য মন্দিরের প্রদীপটির ওজন কত ছিল?
- ১৬) কার আশীর্বাদে গায়েব ও গায়েবীর জন্ম হয়?
- ১৭) সূর্য মন্দিরের প্রদীপটি কিসের তৈরি ছিল?
- ১৮) নতুন প্রদীপের ওজন কত ছিল?
- ১৯) ব্রাহ্মণের জীবন-প্রদীপ কখন ধীরে ধীরে নিভে গিয়েছিল?
- ২০) আদিত্যশিলার বৈশিষ্ট্য কি ছিল?
- ২১) সুভাগা তার ছেলে মেয়ের নাম গায়েব গায়েবী দিয়েছিল কেন?
- ২২) ব্রাহ্মণ কন্যার আশ্রয়হীন হওয়ার কারণ কি?

২৩) সূর্য মন্দিরের ঘন্টাটিকে কিসের সাথে তুলনা করা হয়েছে?

২৪) শিলাদিত্যের সঙ্গে কে বিশ্বাসঘাতকতা করে?

২৫) শেষে কে বল্লভীপুর আক্রমণ করে?

## ✓ প্রবন্ধ রচনা করো ( Paragraph)

### (For Half yearly Exam)

১) শিষ্টাচার ও সৌজন্যবোধ

২) কম্পিউটার

৩) বিশ্ব উষ্ণায়ন

৪) একটি বর্ষগমুখর দিন

৫) মাতৃভাষার মাধ্যমে শিক্ষা

৬) আমার প্রিয় কবি/ লেখক/ সাহিত্যিক/ ঔপন্যাসিক।

## ✓ পত্র রচনা ( Letter writing)

### (For Half yearly Exam)

১) এবার পূজোতে দক্ষিণ ভারতে বেড়াতে যাবার আমন্ত্রণ জানিয়ে বন্ধুকে একটি পত্র লেখ।

২) কোন ঐতিহাসিক জায়গায় বেড়াতে গিয়ে তোমার মনে হয়েছে যে ইতিহাস যেন জীবন্ত হয়ে তোমার সামনে দাঁড়িয়েছে। এরকম সুন্দর অভিজ্ঞতার কথা চিঠির মাধ্যমে তোমার বন্ধুকে জানাও।

৩) তোমার দেখা একটি মর্মান্তিক ঘটনার বর্ণনা দিয়ে বন্ধুকে একটি চিঠি লেখ।

৪) তোমার বিদ্যালয়ে বার্ষিক ক্রীড়া প্রতিযোগিতার বিবরণ দিয়ে বন্ধুকে চিঠি লেখ।

৫) কোন একটি বই পড়ে তোমার খুব ভালো লেগেছে - সেই ভালো লাগার বিষয়টি জানিয়ে বন্ধুকে একটি চিঠি লেখ।

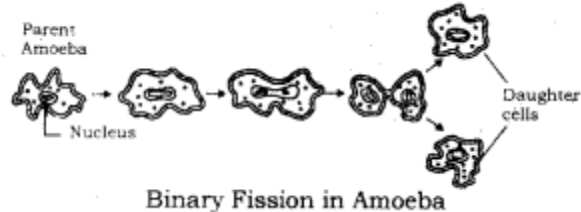
৬) বাংলার একটি গ্রাম পরিদর্শনের কথা জানিয়ে বন্ধুকে চিঠি লেখ।

## Asexual Reproduction

- It involves only one parent.
- There is no formation and fusion of gametes.
- The young ones formed are almost identical to each other as well as to the parent cell.
- Asexual reproduction generally occurs during favourable environmental conditions and when there is an abundance of food.
- It is a faster method of reproduction.

Types of Asexual Reproduction is Unicellular Organism

**(i) Binary Fission:** Seen in bacteria, protozoa like Amoeba, Paramecium. (In these first pseudopodia withdrawn (karyokinesis) the nucleus of the parent cell divides and then the cytoplasm divides (cytokinesis) resulting in the formation of two daughter cells). It occurs during highly favourable conditions. The cell division can occur in any plane as in case of Amoeba. However, organisms like Leishmania. (cause Kala-azar), which have a whip like flagella at one end, binary fission occurs in a definite orientation in relation to the flagellum.

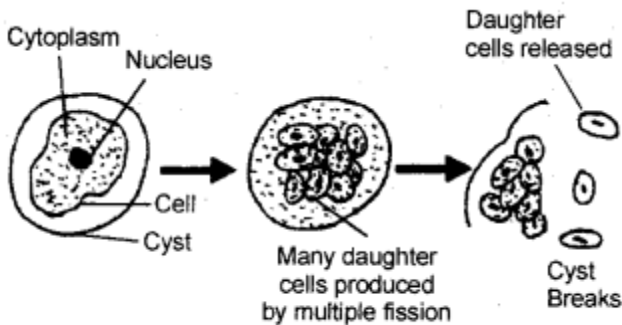


Binary Fission in Amoeba

Cytokinesis: Division of cytoplasm.

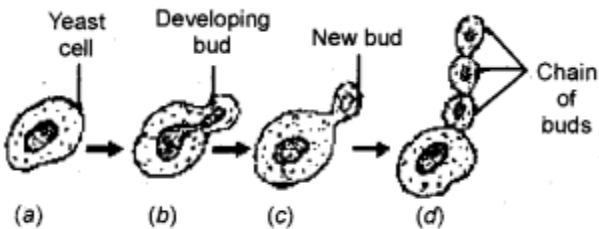
Karyokinesis: Division of Nucleus.

**(ii) Multiple Fission:** Seen in Plasmodium, (a malarial parasite). In this during unfavourable conditions, the parent cell develops a thick resistant wall around itself forming a cyst. Within the wall, the cytoplasm divides many times to form many plasmodia. When conditions become favourable, the cyst wall breaks and the Plasmodium are released.



Multiple Fission in Plasmodium

**(iii) Budding:** Seen in Yeast (a fungus). The parent yeast cell develops a protrusion or an outgrowth at its upper end. The nucleus of the parent cell divides and one of them moves into the outgrowth which grows bigger and finally separates from the parent cell to lead an independent existence. Very often if the conditions are highly favourable, a chain of buds is formed.

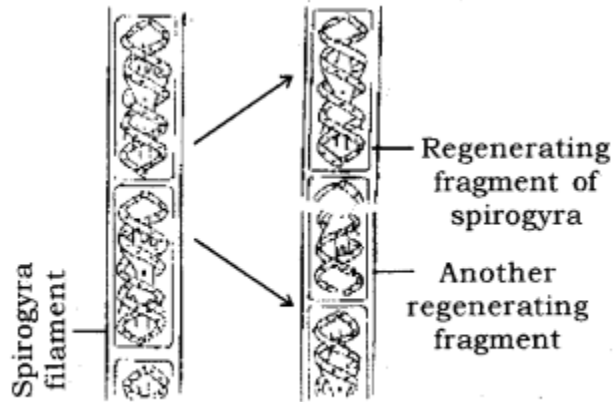


Budding in Yeast

Types of Asexual Reproduction in Multicellular Organisms :

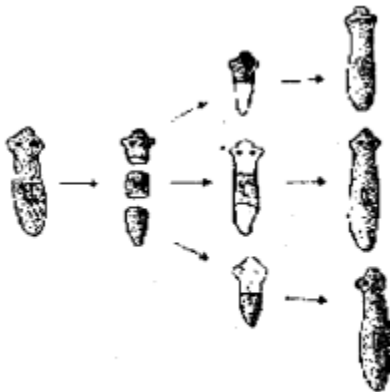
**(i) Fragmentation:** Seen in multicellular organisms which have a relatively simple body organisation like Spirogyra. Spirogyra has a filamentous body. (If it breaks into smaller pieces or fragments). Each fragment has the capacity to form a new individual.

However, all multicellular organisms cannot show cell-by-cell division as cells from tissues which form organs. These organs are placed at definite positions in the body. Hence, they need to use more complex methods of reproduction.



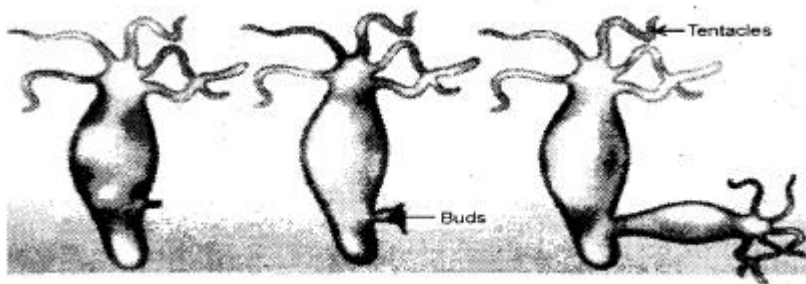
**Fragmentation in Spirogyra**

**(ii) Regeneration:** It is the ability of organisms to develop their lost parts. Some organisms show have high regenerative capacity it is also a means of reproduction for example; Planaria. (Regeneration is carried out by specialized cells which redivide to form a mass of cells from which different cells undergo changes to become different cell types and tissues. These changes occur in an organized sequence known as development).



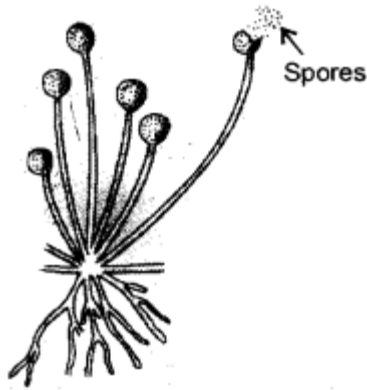
**Regeneration in Planaria.**

**(iii) Budding:** Seen in Hydra. Parent Hydra develops a bud at its lower end. This grows in size and finally breaks off to live independently.



**Budding in Hydra.**

**(iv) Spore Formation:** Seen in *Rhizopus* (a fungus). *Rhizopus* body is made up of thread-like structures called hyphae. The erect hyphae bear sporangia inside which reproductive structures called spores are formed. Spores are asexually reproducing bodies having a thick protective wall. They are produced during unfavourable times and help to tide over the unfavourable environmental conditions. When the spores fall on a suitable medium, each one forms a new individual.



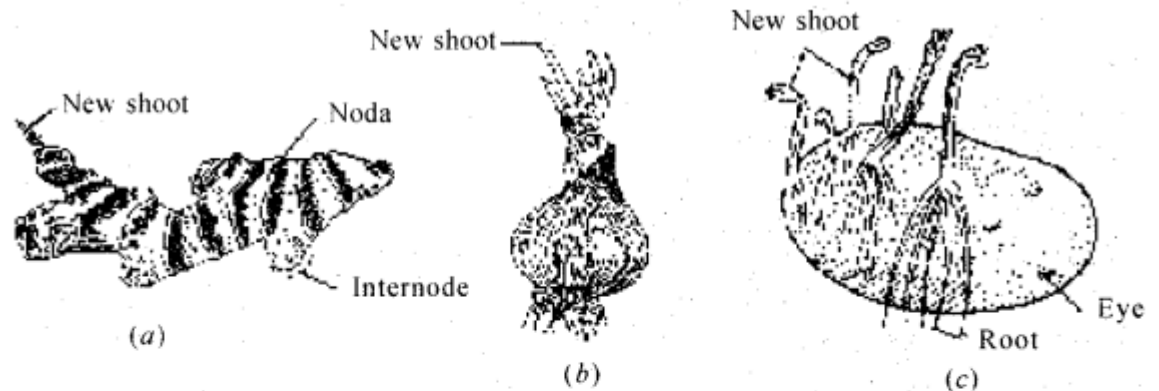
Spore formation  
in *Rhizopus*

**(v) Vegetative Propagation:** Method by which plants reproduce by their vegetative parts such as roots, stems, and leaves.

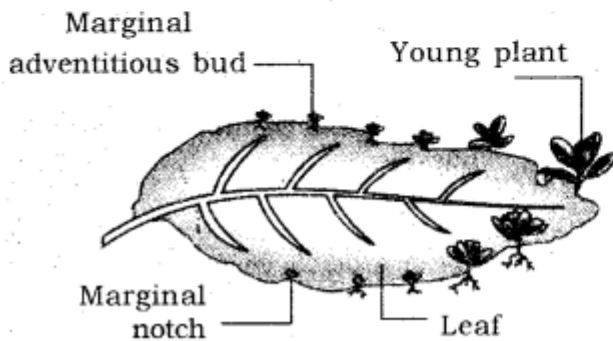
Types of Vegetative Propagation: It is two types

- Natural vegetative propagation.
- Artificial vegetative propagation (Tissue culture).

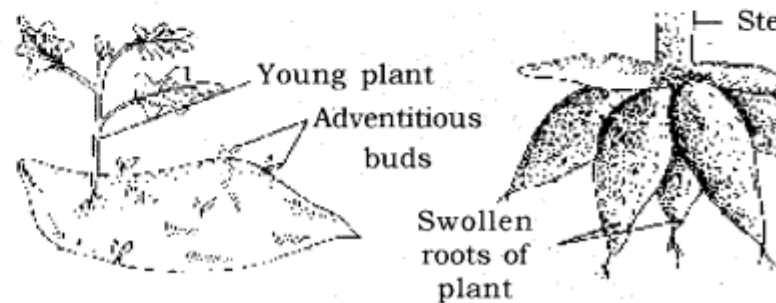
Mint reproduces naturally by roots. Sugarcane, jasmine by stems and Biyophyllum by leaves. In biyophyllum buds are produced in the notches along the leaf margins and when they fall on the soil, they develop into new plants.



Vegetative propagation by stem in— (a) ginger (rhizome) and (b) onion (bulb) and (c) potato (tuber)



Leaf of Bryophyllum with buds.



Vegetative propagation by roots in sweet potato

#### Importance of Vegetative Propagation

- Plants can bear flowers and fruits earlier.
- Plants which have lost the ability to produce viable seeds can also reproduce by vegetative propagation.
- All plants are genetically almost similar to the parent plant.
- Seedless varieties can be obtained.
- The property of vegetative propagation is used by horticulturists in developing methods like layering, grafting to grow many plants like sugarcane, roses, or grapes.

**Tissue Culture:** The technique of developing new plants from a cell or tissue in a nutrient medium under aseptic conditions. The cell or tissue is placed in a nutrient medium where it forms a mass of cells called callus. This callus is then transferred to another nutrient medium where it differentiates and forms a new plant.

**Sexual Reproduction:** Sexual reproduction in plants, Sexual reproduction in human beings. The mode of reproduction that takes place with the involvement of two individuals of two different sexes i.e. male and female. During sexual reproduction, male organism having male sex organs produces male gametes i.e. sperms which are small and motile and the female organism having female sex organs produces ova which are generally large and store food. Male and female gametes fuse to form a zygote that grows into a new organism.

#### Significance of Sexual Reproduction :

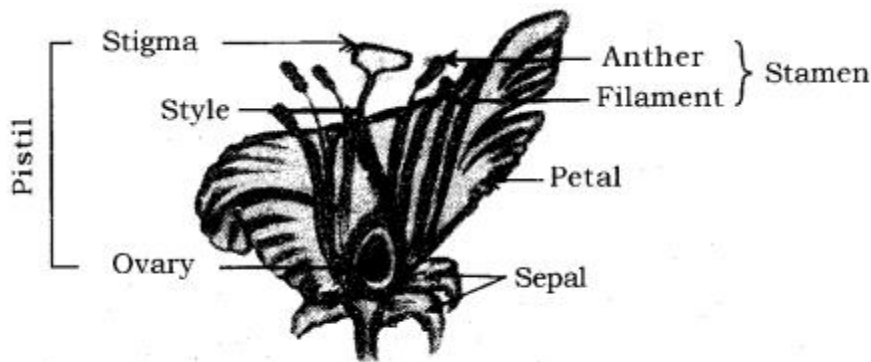
- Sexual reproduction involves DNA as well as cellular apparatus of two different organisms which promotes diversity of characters in the offspring.

- Since gametes are derived from two different organisms, it results in a new combination of genes which increases the chances of genetic variations.
- Sexual reproduction results in the origin of. new species.
- Sexual reproduction involves division in the sex organs that reduces the DNA matter to half so that the zygote formed after fusion has the same amount of DNA as the parents it maintains DNA in a species.

**Limitation of Sexual Reproduction:** Sexual reproduction involves the process of combining DNA from two different organisms which may bring some undesirable features also.

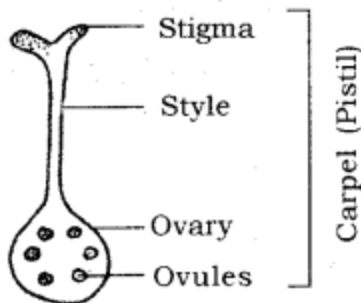
Sexual reproduction in flowering plants

- The reproductive parts are present in the flower.
- The parts of the flower are sepals, petals, stamens and carpels.
- Sepals are green structures that protect the inner parts when the flower is in bud stage.
- Petals are colourful and attract the insects for pollination.
- Stamens are male reproductive parts and produce pollen grains that contain male gametes. Each stamen has two parts—
- Filament i.e. stalk and Anther i.e. swollen top part which has large number of pollen grains.

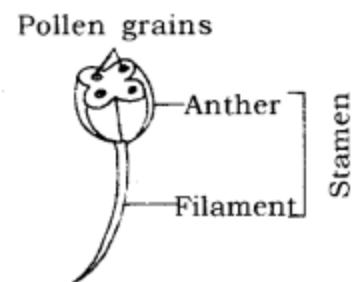


**Longitudinal section of flower.**

The carpel is the female reproductive part and produces ovules that contain female gametes. It has three parts— Stigma which is top sticky part and receives pollen grains during pollination. Style which is the middle long part and ovary which is the swollen part and contains ovules. Each ovule has an egg cell i.e. female gamete.



**Female reproductive organ of a plant (Carpel)**



**Male reproductive organ of a plant (Stamen)**

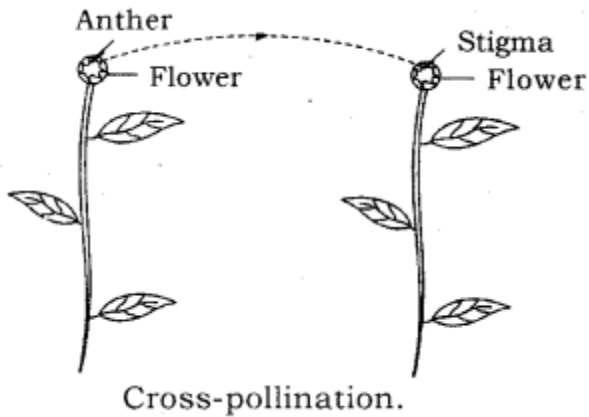
The flowers may be bisexual i.e. having both stamens and carpels for example; Mustard China Rose (Hibiscus). The flower may be unisexual i.e. having either stamens or carpels for example; Papaya, Watermelon.

**Pollination:** The process of transfer of pollen grains from an anther to the stigma of the flower is pollination. Two types of pollination are:

**(i) Self-pollination:** The transfer of pollen grains from the anther to the stigma of the same flower or another flower of the same plant.



**(ii) Cross-pollination:** The transfer of pollen grains from the anther to the stigma of another flower or another flower of a different plant of the same species. It generally takes place with the help of some agents like insects, birds, wind and water.



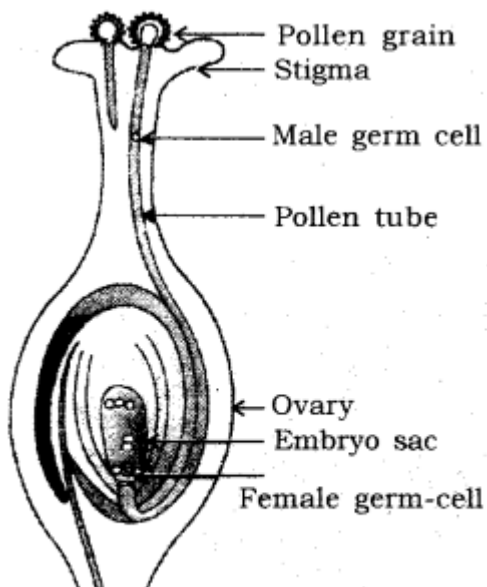
**Fertilization:** Fertilization is the process of fusion of male and female gamete to form a zygote during sexual reproduction. Pollination is followed by fertilisation in plants. The events are

Pollen grains land on the stigma of the ovary.

Pollen tubes grow out of the pollen grains, travel through the style and reach the ovary, through micro pyle.

Pollen tube has two male germ cells. Each ovule has two polar nuclei and a female germ cell (egg).

Pollen tube releases two male germ cells inside the ovule, one of them fuses with female germ cell and forms a zygote which grows into the baby plant i.e. embryo, the fusion is known as syngamy. The other male germ cell fuses with two polar nuclei, the process is known as triple fusion. So in flowering plants two fusions take place during fertilisation. It is called double fertilisation.



### **Fertilisation in flowering plant**

Post-fertilisation changes: After fertilisation the following changes takes place in the flower. Zygote divides several times and forms an embryo inside the ovule.

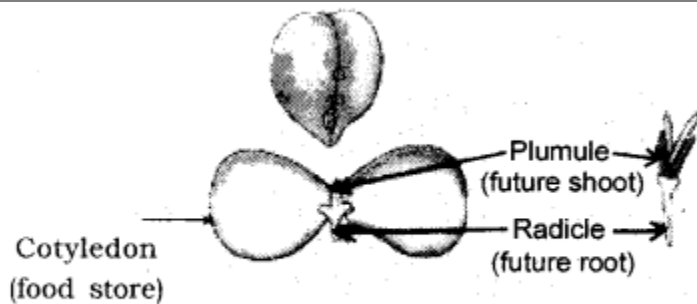
- The ovule develops a tough coat and changes into the seed.

- The ovary grows rapidly and ripens to form a fruit.
- Petals, sepals, stamens, style and stigma shrivel and fall off.

**Seed and its parts:** The advantage of seed is that it protects the future plant i.e. embryo.

**Seed has two parts:** Cotyledons and Embryo Cotyledons store food for the future plant.

**Embryo has two parts:** plumule and radicle. Plumule develops into shoot and radicle develops into root.  
The process of development of a seedling from the embryo under appropriate conditions is known as germination.



**Germination.**

**Reproduction in Human Being:** Human beings show sexual reproduction. Male parent produces male gametes called sperms. Female parent produces female gametes called ova. Sperms have tail and are therefore, motile. They are produced in large numbers in the testes. Ovum is bigger, non-motile and only one ovary produces one ovum in one month. There is no food stored in the sperms whereas ova contain stored food. Both the gametes are microscopic unicellular and have half the number of chromosomes as compared to the body cells.

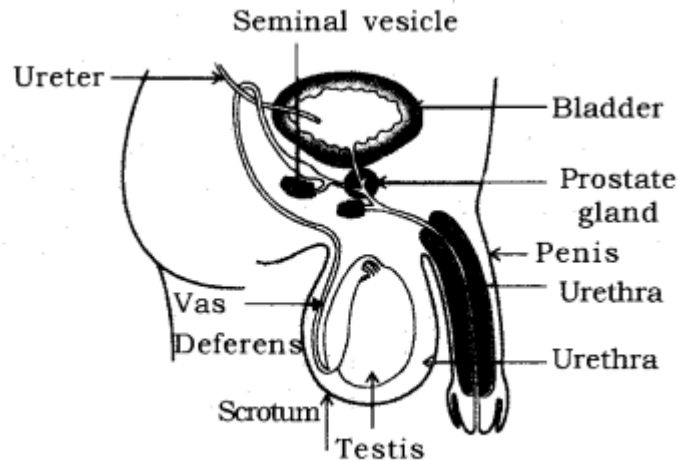
Human beings become reproductively active from the onset of puberty. Puberty is the period during adolescence when the rate of general body growth begins to slow down and reproductive tissues begin to mature. Onset of puberty in human males is between 11 to 13 yrs of age, while in human females is between 10 to 12 yrs. of age. Puberty is associated with many physical, mental, emotional and psychological changes in boys and girls which occur slowly over a period of time. These are called secondary sexual characters. For instance thick dark hair start growing in new parts of the body such as arm pits and genital area between the thighs. Thinner hair appear on legs, arms and face. Skin becomes oily and pimples may appear on the face. Individuals become more conscious of their bodies become more independent, more aggressive etc.

In case of boys beard and mustache start appearing, voice begins to crack, reproductive organs develop and start producing releasing sperms.

In case of girls, breast size begins to increase, skin of the nipples darkens, menstruation starts.

The act of mating between the male and female partner is termed as copulation.

**Male Reproductive System:** Male reproductive system consists of the following components



**Human male reproductive system.**

- 1 pair of testes
- A system of ducts
  - Epididymis
  - Vas deferens or the sperm duct
  - Urethra
- A system of glands
  - Seminal vesicles
  - Prostrate gland
  - Cowper's gland
- A copulatory organ called a penis.

One pair of testes are present in a bag-like structure called scrotum which lies outside the abdominal cavity, hence they are extra abdominal in position. This is so because the testes have to be maintained at 1-3 degree lesser temperature than the body in order to produce functional sperms.

#### Functions of testes

- To produce male gametes i.e. the sperms.
- To produce a male reproductive hormone called testosterone which is responsible for producing sperms as well as secondary sexual characteristics in males.

Attached to each testis is a highly coiled tube called epididymis. The sperms are stored here and they mature in the epididymis.

Each epididymis leads into the sperm duct or the vas-deferens. Each vas-deferens rises up and enters into the abdominal cavity. It unites with the duct coming from the urinary bladder to form a common duct called urethra which passes through the penis and opens to the outside. Along the way the ducts of the three glands also open and pour their secretions into the vas deferens.

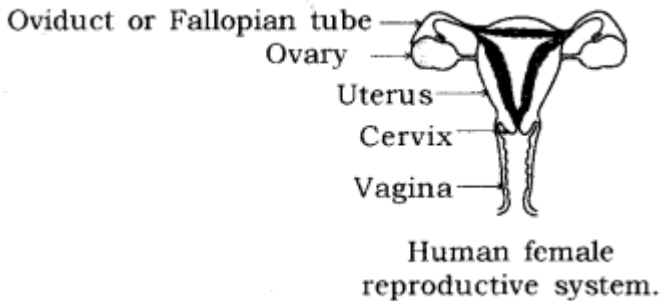
**Function of the vas-deferens:** It is meant for the passage of the sperms in the male body.

**Functions of the glands:** They produce different secretions which provide nutrition as well as medium for locomotion to the sperms.  
The secretions of the three glands along with the sperms is known as semen.

**Function of the urethra:** It is the common passage for both semen and urine from the body to. the outside.

**Penis:** It is the organ which is used to introduce semen into the female body. It is richly supplied with blood vessels.

**Female Reproductive System:** It consists of the following components



- 1 pair of ovaries
- 1 pair of fallopian tubes or oviducts
- A uterus/womb
- A vagina/birth canal.

Each ovary is almond shaped and present inside the abdominal cavity. At the time of birth each girl child already contains thousands of immature ova. These ova start maturing only from the time of puberty. Only one ovum is produced by one ovary in one month and each ovary releases an ovum in alternate months. The release of an ovum from the ovary into the abdominal cavity is known as ovulation.

Functions of ovary

- To produce and release ova
- To produce female reproductive hormones: estrogen and progesterone.

There are two fallopian tubes. The end lying close to the ovary has finger like structures called fimbriae. The two fallopian tubes unite to form an elastic bag like structure called uterus.

**Function of the fallopian tubes:** It is the site of fertilization between the male and the female gametes and formation of the zygote early embryo.

The inner lining of the uterus is richly supplied with blood vessels and is known as endometrium. The narrow end of the uterus is called cervix.

**Function of the uterus:** The embryo formed in the fallopian tube comes down and gets attached to the endometrium (implantation) and develops for the next nine months till the baby is delivered.

**Vagina:** The uterus opens into the vagina through the cervix. The vagina is a muscular tube through which the baby is delivered at the end of nine months. It also serves as the canal for receiving the semen at the time of copulation.

The semen is discharged into the vaginal tract during copulation. The sperms travel upwards and reach the fallopian tube where one sperm fuses with the ovum to form the zygote. The zygote divides and redivides as it descends into the uterus and the embryo gets implanted in the endometrium. The endometrium thickens so as to receive the embryo.

The embryo gets nutrition from the mother's blood with the help of a special tissue called placenta, which is a disk-like structure embeded in the uterine wall. It contains finger-like villi on the embryo side, while on the mother's side blood spaces surround the villi. Villi provides a large surface area for glucose and oxygen to pass from the mother to the developing embryo and the wastes to pass from the embryo to the mother through the placenta. When the embryo starts resembling a human is formed, it is termed as a foetus. The foetus continues to develop inside the uterus for almost nine months after which the baby is delivered as a result of rhythmic contractions of the uterine muscles.

**Menstruation:** It is the loss of blood, mucous along with the unfertilized ovum and the ruptured cells and tissues of the endometrium through the vagina of the female. It is a 28-day cycle which occurs in every reproductively active female (from puberty). The flow of blood continues for 2 to 8 days. If the ovum does not get fertilized, then the endometrium starts sloughing off and there is loss of blood and mucous etc. through the vagina. In case the ovum gets fertilized, then the endometrium becomes thick and spongy for nourishing the embryo and hence menstruation does not occur. A lady with a developing embryo in her womb is termed as pregnant. The beginning of menstruation at puberty is known as menarche. The stoppage of menstruation when the woman is 45-55 yrs of age is called menopause.

**Reproductive Health:** Sexually transmitted diseases and birth control.

A number of diseases occur as a result of sexual intercourse if one of the partners is infected. These are known as sexually transmitted diseases (STD's). They can be caused by bacteria for example; syphilis, gonorrhoea; or caused by a virus for example; HIV-AIDS, warts etc. The transmission of these diseases can be avoided by using birth control measures such as wearing a condom during the sexual act.

**Birth control measures:** They can be mechanical, chemical and surgical.

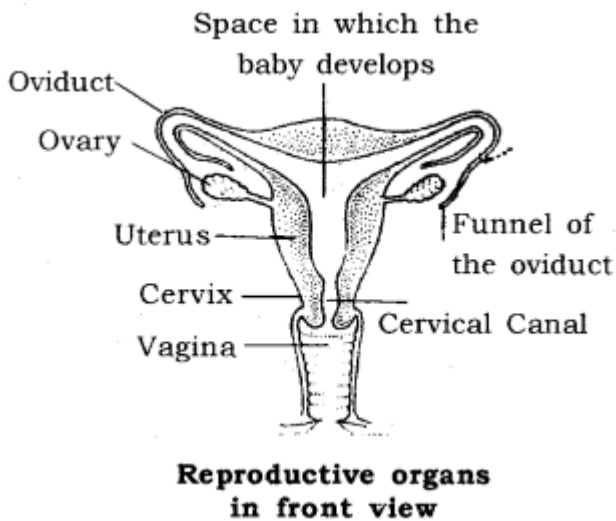
**Mechanical methods:** These are used to prevent the passage of semen to the fallopian tube :

(i) Use of condoms: Condoms are thin rubber tubes worn over the penis before sexual intercourse. The semen gets collected in this and is not discharged into the vagina.

(ii) Diaphragm: It is a thin rubber fixed over a flexible metal ring which is fitted over the cervix in a woman's body by a doctor.

(iii) Intra Uterine Contraceptive Device (IUCD) or loop: It is inserted in the uterus and its insertion causes certain secretion which prevents the implantation of the embryo in the uterine wall.

Both methods (ii) and (iii) cause side effects.



Chemical methods

- Use of spermicides: These are strong sperm-killing chemicals available in the form of creams, jellies etc. which are injected into the vagina just before copulation.
- Oral contraceptive pills: These are hormonal pills which prevent ovulation but do not stop menstruation.

Surgical methods

- Vasectomy: It involves cutting and ligating the vas deferens in males.
- Tubectomy: It involves cutting and ligating the fallopian tubes in females.
- Medical termination of pregnancy (MTP) or abortions is carried out to eliminate the developing embryo. This practice can, however, be misused to carry out female foeticide which involves the killing of the female foetus. It should be avoided at all cost as it disturbs the male-female ratio in a population.

**Reproduction:** It is the process by which living organisms produce new individuals similar to themselves.

- Reproduction ensured continuity of life on earth.
- It is a bridge to hereditary transmission.
- It involves a continuation of characters from the parents to daughter cells by copying of DNA (Deoxyribose Nucleic Acid) molecules present in the chromosomes of the cell.
- Copying of DNAs is also not a foolproof exercise, even minute changes bring about variation in the blue print of the offsprings.
- The useful variations are retained while the harmful ones do not go beyond.
- Actually, variations help the species to withstand drastic environmental changes, thus save the species from becoming extinct and promotes its survival for a longer time.
- This inbuilt tendency of variation is the "basis" for Evolution.

**Asexual Reproduction:** It is extremely useful as a means of rapid multiplication. It is common in lower plants and animals.

**Different forms of Asexual Reproduction:**

- **Fission:** The parent cell divides/splits into two daughter cells —Binary fission and splits into many cells — Multiple fission.
- **Budding:** A new organism is produced as an outgrowth of the parent body part.
- **Spore Formation:** Spores are small, the bulb-like structure which develops at the top of the erect hyphae of the fungus-plant, when released into the air germinate, into new individuals after landing into food or soil.
- **Fragmentation:** It is the accidental process when the broken pieces of an organism (fragments) grows into a complete organism. Example, fragmentation in Spirogyra.
- **Regeneration:** When simple animals like a hydra, planaria develop a new individual from their broken older part it is known as regeneration. It is carried out by specialised cells which grow large numbers of cells.

**Vegetative Propagation:** A mode of reproduction in which parts like the stem, root, leaves develop into new plants under favourable conditions.

**Benefits:**

- Plants can bear flowers, fruits more quickly than those produced from seeds.
- Growing banana, orange, rose, jasmine that have lost the capacity to produce seeds.
- The genetical similarity is maintained in the plants. Example, sugarcane, rose, grapes by layering or grafting.

**Sexual Reproduction:** When reproduction takes place as a result of the fusion between two gametes, one from each parent, it is called sexual reproduction.

- This process of fusion between two gametes is called fertilization.
- The formation of gametes involves an exchange of chromosomal (genetic) fragments between homologous chromosomes causing genetic recombination which leads to variation.

**Sexual Reproduction in Plants:** It occurs mostly in flowering plants.' In fact, flowers are the reproductive organ of plants.

- Pollen grains of a flower transfer to the stigma of the carpel of the same flower (Self-Pollination) or to the carpel of another flower (Cross-Pollination).
- This transfer of pollens is achieved by agents like wind, water or animals. After pollination, the pollen grains reach the egg cell in the form of a pollen tube.
- Fertilization. The fusion between the pollen grain and female egg cell. It occurs inside the ovary. The zygote is produced in this process.
- The zygote divides several times to form an embryo within the ovule. The ovule develops a rough coat and is converted into a seed.
- Ovary grows rapidly and ripens to form fruit, while the seed contains the future plant or embryo which develops into a seedling under suitable conditions. This process is known as Germination.

## **Reproduction in Human Beings:**

- Humans use a sexual mode of reproduction.
- It needs sexual maturation which includes the creation of the germ cells, i.e., egg (ova) in the female and sperm in the male partner and this period of sexual maturation is called Puberty.
- Human beings have a well-developed male and female reproductive system.
- The formation of the male germ cell (sperms) takes place in the testes (male reproductive organ). Actually, a pair of testes are located inside scrotum situated outside the abdominal cavity. It is meant to keep a relatively low temperature needed for the production of sperms by testes. Testes release a male sex hormone called testosterone whose function is to:
  - regulate the production of sperms;
  - brings about changes in appearance seen in boys at the time of puberty; and
  - the sperms along with the secretion of the prostate gland and seminal vesicle, together constitute semen, which is released and made to enter into the female genital tract during Copulation.

## **Female Reproduction System:**

- The female germ cells or eggs are made in the ovaries, a pair of which is located in both sides of the abdomen.
- When a girl is born, the ovaries already contain thousands of immature eggs. At the time of puberty, some of these eggs start maturing. One egg is produced every month by one of the ovaries.
- The egg is carried from the ovary to the womb through a fallopian tube. These two fallopian tubes unite into an elastic bag like structure known as the uterus.
- The uterus opens into the vagina through the cervix.
- Fertilization occurs in the fallopian tube of the female genital tract.
- The fertilized egg also called zygote gets implanted in the lining of the uterus, and starts dividing. The uterus is richly supplied with blood to nourish the growing embryo.
- If the zygote is not formed, the inner wall of uterus breaks which causes bleeding through vagina. This process is called Menstruation. It occurs at a regular interval of 28 days.
- The embryo gets nutrition from the mother's blood with the help of a special tissue called Placenta.
- Placenta provides a large surface area for glucose and oxygen to pass from the mother to the embryo. Similarly the wastes from developing embryo are removed to mother's blood through placenta.
- The child is born as a result of rhythmic contractions of the muscles in the uterus after nine months (36 weeks) of development inside the mother's womb, called Gestation Period.
- The sexual cycle in a woman continues upto the age of 45 to 50 years. After that the ovaries do not release eggs. This stage is called Menopause. It also marks the end of menstruation in the woman.

**Reproductive Health:** Reproductive health means total well-being in all aspects of reproduction, z.e., physical, emotional, social and behavioural.

**Contraception:** It is the avoidance of pregnancy through different methods—Natural methods, Barrier method, Oral contraceptives, Surgical methods.

**Advantages of contraception:** Help in birth control, prevent sexually transmitted diseases, prevent unwanted pregnancies, keep population explosion in check.

**1. Reproduction** is the process by which a living organism is able to produce new individuals of its own kind. Unlike other life processes such as nutrition, respiration, etc., it is not essential to, maintain the life of an individual organism. But it is important for the existence and continuity of the species.

**2.** Reproduction involves the creation of DNA copy and additional cellular apparatus by the cell involved in the process.

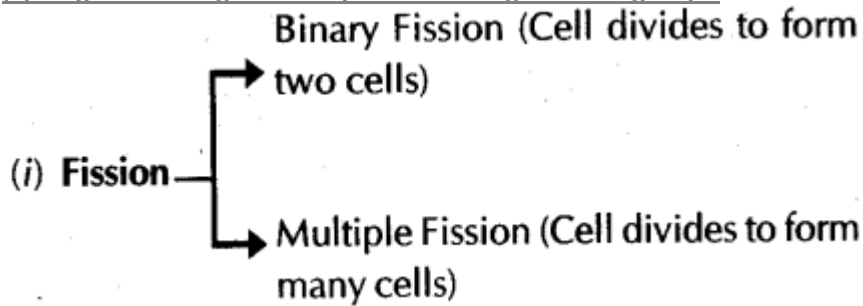
**3.** The process of DNA copying leads to variations. This inbuilt tendency for variations during reproduction is the basis for evolution.

4. Living organisms' reproduce mainly through :

- Asexual reproduction
- Sexual reproduction

### 5. ASEXUAL REPRODUCTION

(a) Single celled organisms reproduce through following ways:



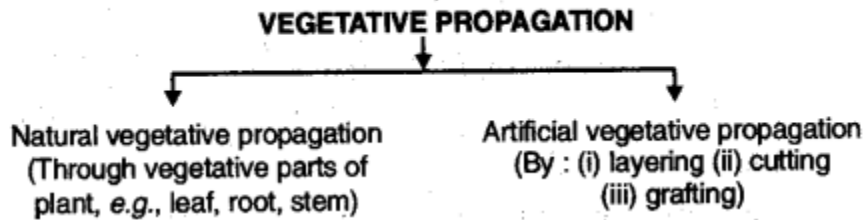
(ii) Budding (also by multicellular organisms)

(iii) Spore formation (also by multicellular organisms)

(b) Asexual reproduction by multicellular organisms:

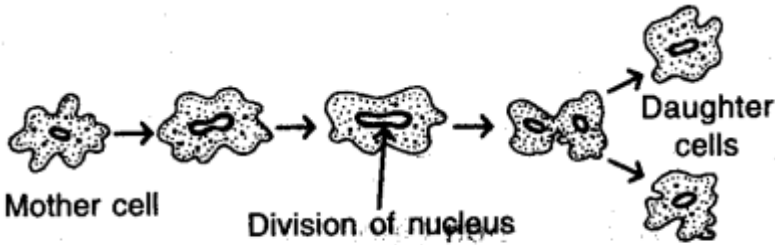
(i) Fragmentation and Regeneration

(ii)

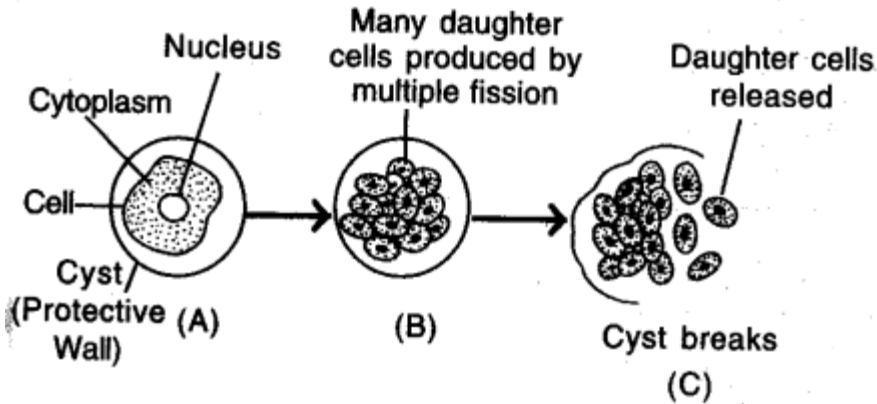


6. Fission: In unicellular organisms when cell becomes fully mature, it splits into two or more parts. It is called the fission. In organisms such as Amoeba, splitting can take place in any plane. But in organisms like Leishmania, having whip like structure at one end of the cell, binary fission occurs in a definite orientation in relation to these structures.





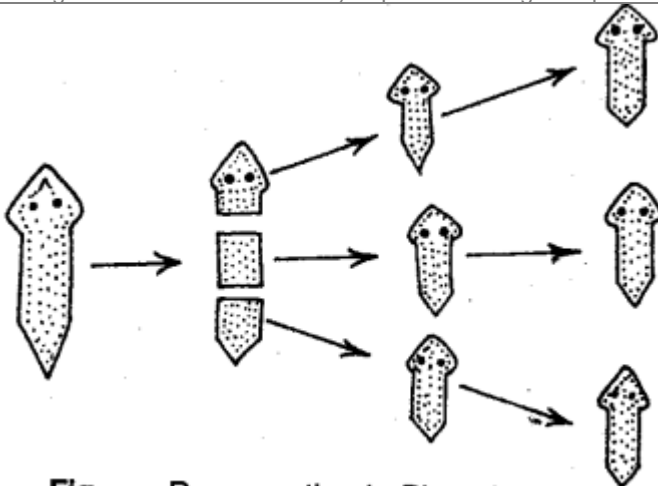
**Fig.** Binary fission in Amoeba.



**Fig.** Multiple fission in Plasmodium.

7. **Regeneration** : It is the ability to give rise to new organism. When the individual is cut or broken up into many pieces. It can be seen in Hydra and Planaria and is known as regeneration.

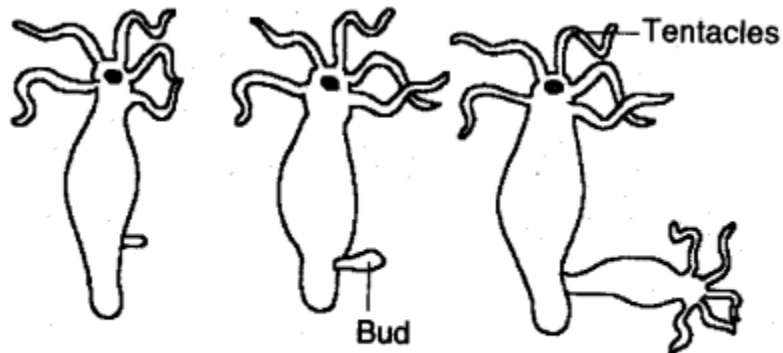
Regeneration is carried out by specialised cells. These cells proliferate and produce large numbers of cells. From this mass of cells, different cells undergo changes to become various cell types and tissues. These changes take place in an organised sequence referred to as " development. However, regeneration is not the same as reproduction, since most organisms would not normally depend on being cut up to be able to reproduce.



**Fig.** Regeneration in Planaria.

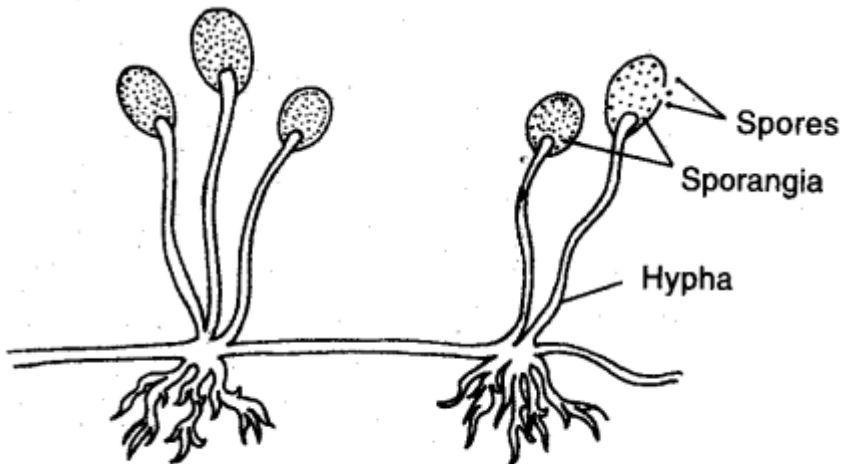
8. **Budding**: Organisms such as Hydra use regenerative cells for reproduction in the process of budding. In Hydra, a bud develops as an outgrowth due to repeated cell division at one specific site. These buds develop into tiny

individuals and when fully mature, detach from the parent body and become new independent individuals.



**Fig. Budding in Hydra.**

**9. Spore Formation (Sporulation):** Some bacteria and lower organisms make spores. During spore formation, knob like structure called sporangium develops from the fungal hypha. Sporangia contain spores that eventually develop into new individual. The spores are covered by thick walls that protect them until they come in contact with moist surface or substratum and can begin to grow.



**Fig. Spore formation in Rhizopus.**

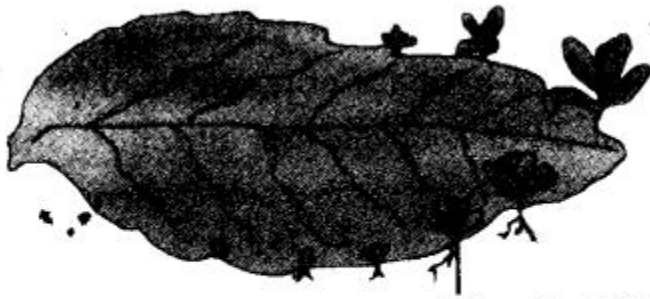
**10. Fragmentation :** It can be seen in Spirogyra. During this process filament of spirogyra simply breaks up into smaller pieces upon maturation. These pieces or fragments grow into new individuals. This process occurs under favourable conditions of moisture, temperature, light and nutrient availability.

**11. Vegetative propagation:** It is the simplest method of reproduction in some higher plants in which new plant is produced from any vegetative part of the plant such as root, stem, leaf, etc.

**Advantages of vegetative propagation :** Vegetative propagation is useful for plants those have lost the capacity to produce seeds, e.g. banana, rose, jasmine. Moreover, all plants produced are genetically similar to the parent plant.

**Natural Vegetative Propagation:** In some plants like guava, sweet potato, dahlia, roots sprout and grow into new plants during favourable conditions. In some other stems grow horizontally and develop root below and leaves above the ground. Many other common examples of vegetatively propagating plants are onion, banana, garlic, ginger, turmeric, bryophyllum and water hyacinth.

**12. Vegetative propagation in Bryophyllum:** Bryophyllum reproduces by the vegetative propagation method. During this method, buds produced in the notches along the leaf margin of bryophyllum fall on the soil and develop into new plants.

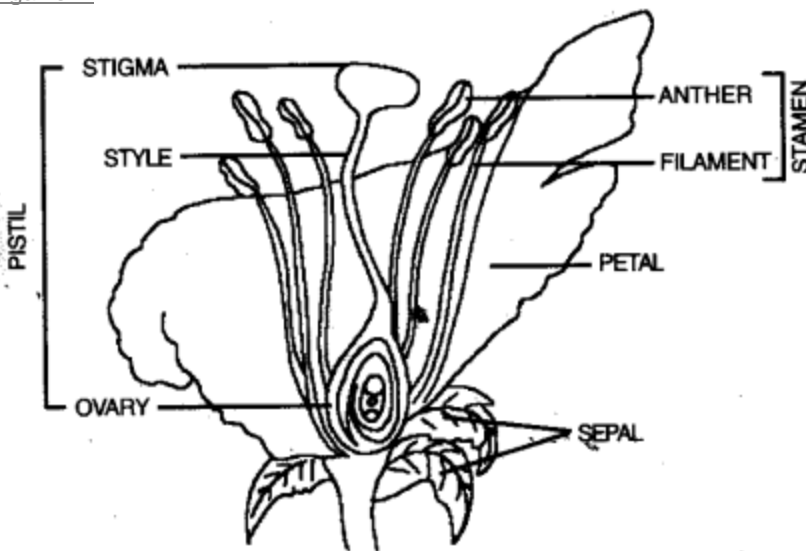


Fall on the soil and  
develops into new plant

**Fig.** Leaf of Bryophyllum with buds.

### 13. SEXUAL REPRODUCTION :

Sexual reproduction involves two individuals for producing a new individual. Sexual reproduction begins with fertilization, which is defined as the union of two different gametes. The motile germ-cell (sperm) is called the male gamete and germ-cell containing stored food (egg or ovum) is called the female gamete. The process of fusion of two gametes is called fertilization. After fertilization, a zygote is formed, which develops into a new organism.



**Fig.**

**14. Sexual reproduction in Plants :** The flowering plants or angiosperms bear special reproductive parts located in the flower. Various parts of flower are: sepals, petals, stamens and carpels.

Most flowers have both male and female reproductive organs. The flower may be unisexual (papaya, watermelon) when it contains either stamen or carpel or bisexual (Hibiscus, Mustard) when it contains both stamens and carpels. It has male reproductive part called stamen and a female reproductive part called carpel. Carpel is made of three parts. The swollen bottom part is the ovary, middle elongated part is the style and the terminal part which may be sticky is the stigma.

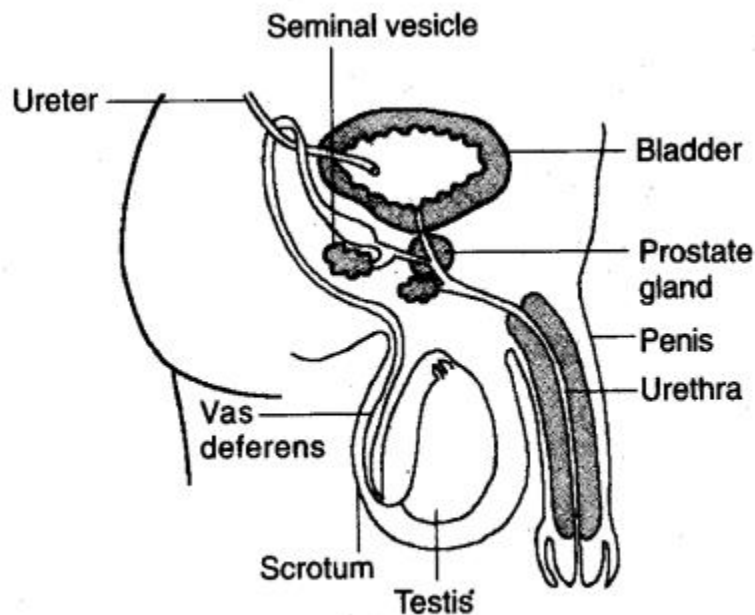
The ovary contains ovules and each ovule has an egg cell. Each stamen consists of stalk called filament, and a flattened fertile top called anther. The anthers produce the pollen grains. The pollen grains produce male gametes which fuse with (egg cell) female gamete present in the ovule. This fusion of the germ-cells or fertilization gives zygote which grows into a new plant. Pollination: It is the process of transfer of pollen grains from the anther to the stigma of flower. If this transfer of pollen occurs in the same flower, it is referred to as self-pollination, whereas if the pollen is transferred from one flower to another, it is known as cross-pollination. This transfer is carried out by different agencies like wind, water, insects or animals.

**Fertilization:** A tube grows out of pollen grain and travels through the style to reach the female germ-cells present in ovule in the ovary. Out of two male gametes present in pollen tube one fuses with egg to form zygote. This fusion is called fertilization. After fertilization, the zygote divides several times to form an embryo within the ovule. The ovule develops a tough coat and gradually turns into a seed. The ovary grows rapidly and ripens to form a fruit. Meanwhile the petals, sepals, stamens, style and stigma may shrivel and fall off.

**15. Reproduction in human beings :** The reproductive organs of human beings are called gonads. These are testes in male and ovaries in female. The male gonad produces sperms and female gonad produces ova (eggs) at the age of puberty (after attainment of sexual maturity). Various changes occur in girls and boys at this age.

**16. Male Reproductive System consists of the following organs:**

**Testes:** A pair of testes are situated in scrotum that lie outside the abdominal cavity and behind the penis. Testes produce sperms and hormone, Testosterone hormone. Testosterone brings about changes in appearance of boys at the time of puberty.



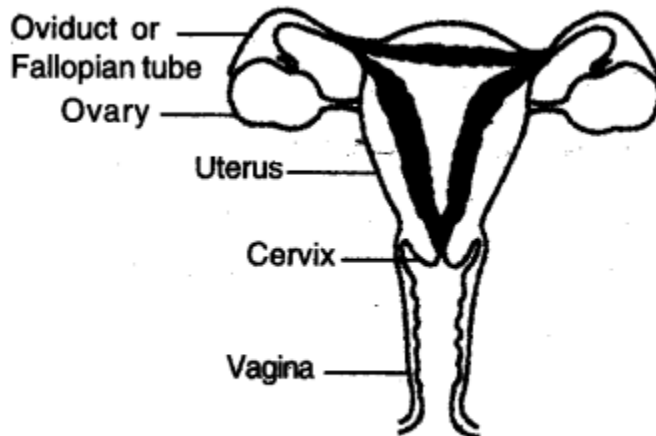
**Fig. Diagram of a male reproductive system.**

**VAS deferens:** From each testis, a duct arises which is known as vas deferens which unites with a tube coming from urinary bladder. It brings sperms from testis.

**Urethra:** Vas deferens tube opens into a common tube called urethra. It runs through a muscular organ called Penis. Penis is male copulatory organ.

**Accessory Glands:** Glands like prostate and seminal vesicles and Cowper's gland add their secretions which make transport of sperms easier and this fluid also provides nutrition.

**17. Female Reproductive System:** It consists of the following organs:



**Fig. Diagram of a female reproductive system.**

**Ovaries:** Paired ovaries are located in the abdominal cavity near the kidney. Ovaries produce female gamete (ovum or egg) and secrete female hormones (estrogen and progesterone). One egg is produced every month alternately by one of the ovaries.

**Fallopian Tube:** The egg is carried from the ovary to womb/uterus through a thin oviduct or fallopian tube.

**Uterus:** The two oviducts unite into an elastic bag like structure known as the uterus.

**Vagina:** Uterus opens into the vagina. It is a female copulatory organ.

**18. Sexual Cycle in female:** After puberty, only one egg is produced alternately from one ovary after a period of 28 days. Egg in fallopian tube encounter sperms which enter through the vaginal passage during sexual intercourse. This fertilized egg (zygote) gets implanted in the lining of uterus which later forms embryo. Embryo gets nutrition from the mother's blood with the help of special tissue called placenta.

If the egg is not fertilized, it lives for about one day since the ovary releases one egg every month, the uterus prepares itself every month to receive the fertilized egg. Thus, its lining becomes thick and spongy. If it does not get zygote, the developed lining slowly breaks down and comes out through the vagina as blood and mucus. This cycle takes place roughly every month and is known as menstruation. It usually lasts for about 2-5 days.

**19. Reproductive Health:** Reproductive organs need a lot of care and hygiene. Otherwise, they are susceptible to many infections or diseases. The diseases which spread through sexual routes are known as sexually transmitted diseases e.g., bacterial infections like syphilis, gonorrhoea and viral infections such as warts and HIV- AIDS. A condom helps to prevent transmission of many of these infections to some extent.

Frequent pregnancy causes many health problems and also adds to an already exploding population. Many ways have been devised to avoid pregnancy. Contraception can be achieved by:

- Mechanical barrier method (use of condoms).
- Chemical methods (use of pills).
- Use of contraceptive devices (copper-T).
- Surgical methods (vasectomy in males and tubectomy in females)

**Question 1:**

What is the difference between a reflex action and walking?

Answer:

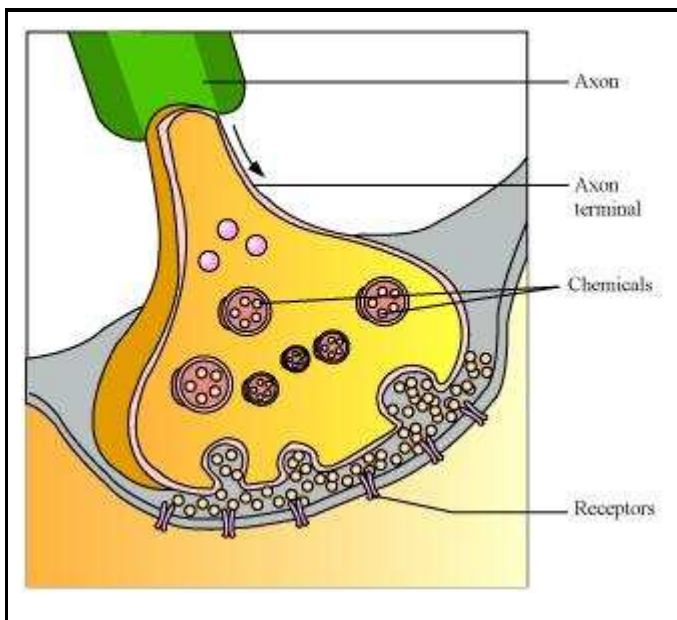
A reflex action is a rapid, automatic response to a stimulus. It does not involve any thinking. For example, we close our eyes immediately when the bright light is focused. Walking, on the other hand, is a voluntary action. It is under our conscious control.

**Question 2:**

What happens at the synapse between two neurons?

Answer:

A very small gap that occurs between the last portion of axon of one neuron and the dendron of the other neuron is known as a synapse. It acts as a one way valve to transmit impulses in one direction only. This uni-direction transfer of impulses occurs as the chemicals are produced in only one side of the neuron i.e., the axon's side. From axon, the impulses travel across the synapse to the dendron of the other neuron.

**A synapse or neuromuscular junction****Question 3:**

Which part of the brain maintains posture and equilibrium of the body?

Answer:

Cerebellum, a part of hindbrain is responsible for maintaining posture and equilibrium of the body.

**Question 4:**

How do we detect the smell of an *agarbatti* (incense stick)?

Answer:

The thinking part of our brain is the forebrain. It has separate areas that are specialized for hearing, smelling, sight, taste, touch, etc. The forebrain also has regions that collect information or impulses from the various receptors. When the smell of an incense stick reaches us, our forebrain detects it. Then, the forebrain interprets it by putting it together with the information received from other receptors and also with the information already stored in the brain.

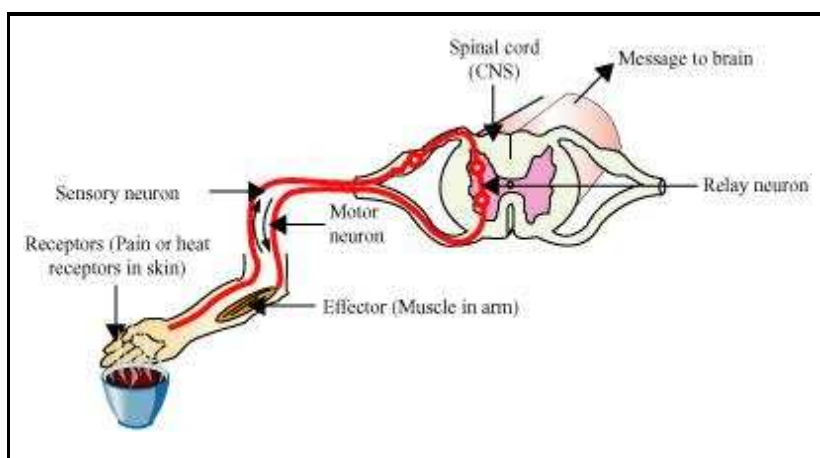
**Question 5:**

What is the role of the brain in reflex action?

Answer:

Reflex actions are sudden responses, which do not involve any thinking. For example, when we touch a hot object, we withdraw our hand immediately without thinking as thinking may take time which would be enough to get us burnt.

The sensory nerves that detect the heat are connected to the nerves that move the muscles of the hand. Such a connection of detecting the signal from the nerves (input) and responding to it quickly (output) is called a reflex arc. The reflex arcs –connections present between the input and output nerves – meet in a bundle in the spinal cord.

**Reflex arc**

Reflex arcs are formed in the spinal cord and the information (input) reaches the brain. The brain is only aware of the signal and the response that has taken place. However, the brain has no role to play in the creation of the response.

**Question 1:**

What are plant hormones?

Answer:

Plant hormones or phytohormones are naturally-occurring organic substances. These are synthesized in one part of the plant body (in minute quantities) and are translocated to other parts when required. The five major types of phytohormones are auxins, gibberellins, cytokinins, abscisic acid, and ethylene.

**Question 2:**

How is the movement of leaves of the sensitive plant different from the movement of a shoot towards light?

Answer:

The movement of leaves of the sensitive plant, *Mimosa pudica* or “touch me not”, occurs in response to touch or contact stimuli. This movement is independent of growth. The movement of shoot towards light is known as phototropism. This type of movement is directional and is growth dependent.

**Question 3:**

Give an example of a plant hormone that promotes growth.

Answer:

Auxin is an example of growth-promoting plant hormone.

**Question 4:**

How do auxins promote the growth of a tendril around a support?

Answer:

Auxin is synthesized at the shoot tip. It helps the cell grow longer. When a tendril comes in contact with a support, auxin stimulates faster growth of the cells on the opposite side, so that the tendril forms a coil around the support. This makes the tendrils appear as a watch spring.

**Question 5:**

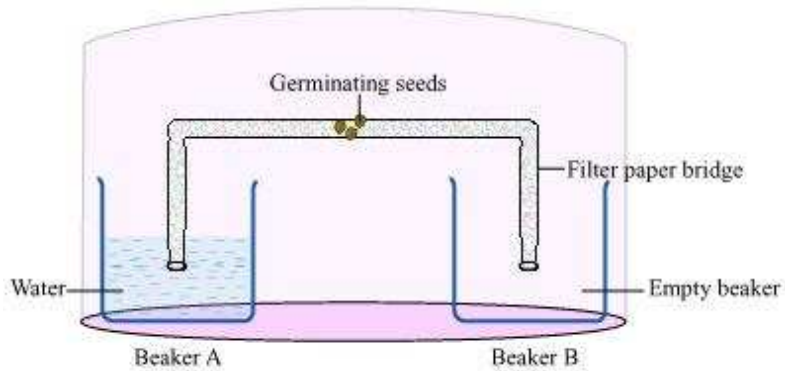
Design an experiment to demonstrate hydrotropism.

Answer:

Take two small beakers and label them as A and B. Fill beaker A with water. Now make a cylindrical-shaped roll from a filter paper and keep it as a bridge between beaker A and beaker B, as shown in the figure. Attach few germinating seeds in the middle of the filter

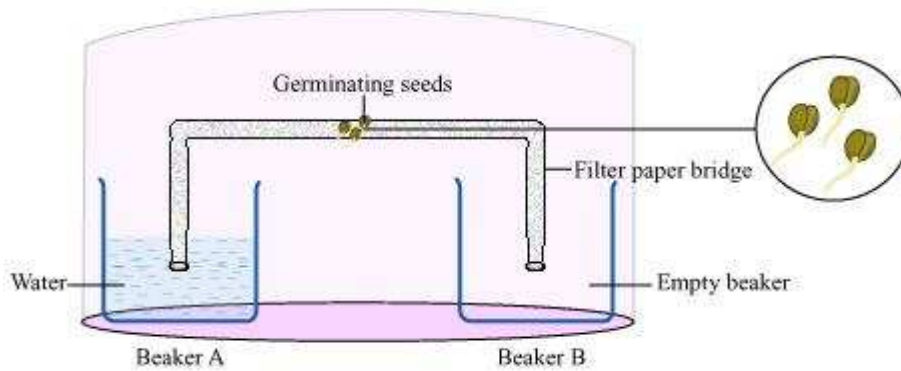


paper bridge. Now, cover the entire set-up with a transparent plastic container so that the moisture is retained.



Observation:

The roots of the germinating seeds will grow towards beaker A.



This experiment demonstrates the phenomenon of hydrotropism.

**Question 1:**

How does chemical coordination take place in animals?

Answer:

Chemical coordination takes place in animals with the help of hormones. Hormone is the chemical messenger that regulates the physiological processes in living organisms. It is secreted by glands. The regulation of physiological processes, and control and coordination by hormones comes under the endocrine system. The nervous system along with the endocrine system in our body controls and coordinates the physiological processes.

**Question 2:**

Why is the use of iodised salt advisable?

Answer:

Iodine stimulates the thyroid gland to produce thyroxin hormone. It regulates carbohydrate, fat, and protein metabolism in our body. Deficiency of this hormone results in the enlargement of the thyroid gland. This can lead to goitre, a disease characterized by swollen neck. Therefore, iodised salt is advised for normal functioning of the thyroid gland.

**Question 3:**

How does our body respond when adrenaline is secreted into the blood?

Answer:

Adrenalin is a hormone secreted by the adrenal glands in case of any danger or emergency or any kinds of stress. It is secreted directly into the blood and is transported to different parts of the body.

When secreted in large amounts, it speeds up the heartbeat and hence supplies more oxygen to the muscles. The breathing rate also increases due to contractions of diaphragm and rib muscles. It also increases the blood pressure. All these responses enable the body to deal with any stress or emergency.

**Question 4:**

Why are some patients of diabetes treated by giving injections of insulin?

Answer:

Diabetes is a disease in which the level of sugar in the blood is too high. Insulin, a hormone secreted by the pancreas, helps in regulating the blood sugar levels. This is the reason why diabetic patients are treated by giving injections of insulin.

**Question 1:**

Which of the following is a plant hormone?

- (a) Insulin
- (b) Thyroxin
- (c) Oestrogen
- (d) Cytokinin

Answer:

(d) Cytokinin is a plant hormone.

**Question 2:**

The gap between two neurons is called a

- (a) dendrite.
- (b) synapse.
- (c) axon.
- (d) impulse.

Answer:

(b) The gap between two neurons is called a synapse.

**Question 3:**

The brain is responsible for

- (a) thinking.
- (b) regulating the heart beat.
- (c) balancing the body.
- (d) all of the above.

Answer:

(d) The brain is responsible for thinking, regulating the heart beat and balancing the body.

**Question 4:**

What is the function of receptors in our body? Think of situations where receptors do not work properly. What problems are likely to arise?

Answer:

Receptors are sensory structures (organs/tissues or cells) present all over the body. The receptors are either grouped in case of eye or ear, or scattered in case of skin.

Functions of receptors:

- (i) They sense the external stimuli such as heat or pain.

(ii) They also trigger an impulse in the sensory neuron which sends message to the spinal cord.

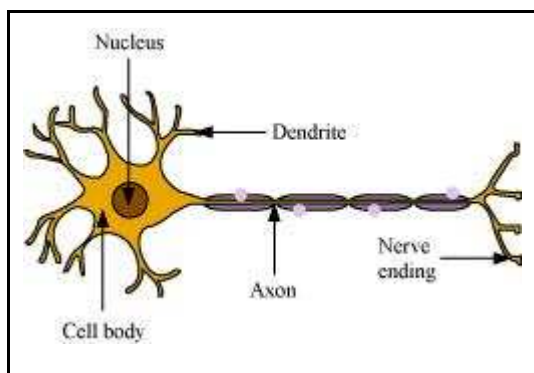
When the receptors are damaged, the external stimuli transferring signals to the brain are not felt. For example, in the case of damaged receptors, if we accidentally touch any hot object, then our hands might get burnt as damaged receptors cannot perceive the external stimuli of heat and pain.

#### Question 5:

Draw the structure of a neuron and explain its function.

Answer:

Neurons are the functional units of the nervous system. The three main parts of a neuron are axon, dendrite, and cell body.



#### Structure of a neuron

#### Functions of the three parts of a neuron:

**Axon:** It conducts messages away from the cell body.

**Dendrite:** It receives information from axon of another cell and conducts the messages towards the cell body.

**Cell body:** It contains nucleus, mitochondria, and other organelles. It is mainly concerned with the maintenance and growth.

#### Question 3:

What are the changes seen in girls at the time of puberty?

Answer:

#### Secondary sexual characteristics in girls:

- Increase in breast size and darkening of skin of the nipples present at the tips of the breasts.
- Appearance of hair in the genital area.

- Appearance of hair in other areas of skin like underarms, face, hands, and legs.
- Increase in the size of uterus and ovary.
- Beginning of menstrual cycle.
- More secretion of oil from the skin, which results in the appearance of pimples.

**Question 7:**

Which signals will get disrupted in case of a spinal cord injury?

Answer:

The reflex arc connections between the input and output nerves meet in a bundle in the spinal cord. In fact, nerves from all over the body meet in a bundle in the spinal cord on their way to the brain. In case of any injury to the spinal cord, the signals coming from the nerves as well as the signals coming to the receptors will be disrupted.

**Question 8:**

How does chemical coordination occur in plants?

Answer:

In animals, control and coordination occur with the help of nervous system. However, plants do not have a nervous system.

Plants respond to stimuli by showing movements. The growth, development, and responses to the environment in plants is controlled and coordinated by a special class of chemical substances known as hormones. These hormones are produced in one part of the plant body and are translocated to other needy parts. For example, a hormone produced in roots is translocated to other parts when required. The five major types of phytohormone are auxins, gibberellins, cytokinins, abscisic acid, and ethylene. These phytohormones are either growth promoters (such as auxins, gibberellins, cytokinins, and ethylene) or growth inhibitors such as abscisic acid.

**Question 9:**

What is the need for a system of control and coordination in an organism?

Answer:

The maintenance of the body functions in response to changes in the body by working together of various integrated body systems is known as coordination. All the movements that occur in response to stimuli are carefully coordinated and controlled. In animals, the control and coordination movements are provided by nervous and muscular systems. The nervous system sends messages to and away from the brain. The spinal cord plays an important role in the relay of messages. In the absence of this system of

control and coordination, our body will not be able to function properly. For example, when we accidentally touch a hot utensil, we immediately withdraw our hand. In the absence of nerve transmission, we will not withdraw our hand and may get burnt.

**Question 10:**

How are involuntary actions and reflex actions different from each other?

Answer:

Involuntary actions cannot be consciously controlled. For example, we cannot consciously control the movement of food in the alimentary canal. These actions are however directly under the control of the brain. On the other hand, the reflex actions such as closing of eyes immediately when bright light is focused show sudden response and do not involve any thinking. This means that unlike involuntary actions, the reflex actions are not under the control of brain.

**Question 11:**

Compare and contrast nervous and hormonal mechanisms for control and coordination in animals.

Answer:

	<b>Nervous system mechanism</b>		<b>Hormonal system mechanism</b>
1.	The information is conveyed in the form of electric impulse.	1.	The information is conveyed in the form of chemical messengers.
2.	The axons and dendrites transmit the information through a coordinated effort.	2.	The information is transmitted or transported through blood.
3.	The flow of information is rapid and the response is quick.	3.	The information travels slowly and the response is slow.
4.	Its effects are short lived.	4.	It has prolonged effects.

**Question 12:**

What is the difference between the manner in which movement takes place in a sensitive plant and the movement in our legs?

Answer:

	<b>Movement in sensitive plants</b>		<b>Movement in our legs</b>
1.	The movement that takes place in a sensitive plant such as <i>Mimosa pudica</i> occurs in response to touch (stimulus).	1.	Movement in our legs is an example of voluntary actions.
2.	For this movement, the information is transmitted from cell to cell by electro-chemical signals as plants do not have any specialised tissue for conduction of impulses.	2.	The signal or messages for these actions are passed to the brain and hence are consciously controlled.
3.	For this movement to occur, the plant cells change shape by changing the amount of water in them.	3.	In animal muscle cells, some proteins are found which allow the movement to occur.

कक्षा - 10

विषय - हिंदी साहित्य ब

पाठ - 11

स्पर्श - डायरी का पन्ना

प्रश्न अभ्यास

मौखिक

निम्नलिखित प्रश्नों के उत्तर एक-दो पंक्तियों में दीजिए -

1. कलकत्ता वासियों के लिए 26 जनवरी 1931 का दिन क्यों महत्वपूर्ण था?

उत्तर- 26 जनवरी 1930 को गुलाम भारत में पहला स्वतंत्रता दिवस मनाया गया था जिसमें कलकत्ता वासियों की भागीदारी साधरण थी। 26 जनवरी 1931 को उसकी पुनरावृत्ति थी परन्तु इस बार कलकत्ता में इसकी तैयारियाँ ज़ोरों पर थीं। इसीलिए कलकत्ता वासियों के लिए यह दिन महत्वपूर्ण था।

2. सुभाष बाबू के जुलूस का भार किस पर था?

उत्तर- सुभाष बाबू के जुलूस का भार पूर्णोदास पर था।

3. विद्यार्थी संघ के मंत्री अविनाश बाबू के झंडा गाड़ने पर क्या प्रतिक्रिया हुई?



उत्तर- बंगाल प्रांतीय विद्यार्थी संघ के मंत्री अविनाश बाबू ने जैसे ही झंडा गाड़ा, पुलिस ने उन्हें पकड़ लिया और लोगों पर लाठियाँ चलाई।

**4. लोग अपने-अपने मकानों व सार्वजनिक स्थलों पर राष्ट्रीय झंडा फहराकर किस बात का संकेत देना चाहते थे?**

उत्तर- लोग अपने-अपने मकानों व सार्वजनिक स्थलों पर राष्ट्रीय झंडा फहराकर बताना चाहते थे कि वे अपने को आज़ाद समझ कर आज़ादी मना रहे हैं। उनमें जोश और उत्साह है।

**5. पुलिस ने बड़े-बड़े पार्कों और मैदानों को क्यों घेर लिया था?**

उत्तर- आज़ादी मनाने के लिए पूरे कलकत्ता शहर में जनसभाओं और झंडारोहण उत्सवों का आयोजन किया गया। इसलिए पार्कों और मैदानों को घेर लिया था।

**लिखित**

**(क) निम्नलिखित प्रश्नों के उत्तर (25-30 शब्दों में) दीजिए -**

**1. 26 जनवरी 1931 के दिन को अमर बनाने के लिए क्या-क्या तैयारियाँ की गईं ?**

उत्तर- 26 जनवरी 1931 के दिन को अमर बनाने के लिए काफी तैयारियाँ की गईं थीं। केवल प्रचार पर दो हजार रुपए खर्च किए गए थे। कार्यकर्ताओं को उनका कार्य घर घर जाकर समझाया गया था। कलकत्ता शहर में जगह-जगह झंडे लगाए गए थे। कई स्थानों पर जुलूस निकाले

गए तथा झंडा फहराया गया था। टोलियाँ बनाकर भीड़ उस स्थान पर जुटने लगी जहाँ सुभाष बाबू का जुलूस पहुँचना था।

**2. 'आज जो बात थी वह निराली थी'- किस बात से पता चल रहा था कि आज का दिन अपने आप में निराला है? स्पष्ट कीजिए।**

उत्तर- आज का दिन निराला इसलिए था क्योंकि स्वतंत्रता दिवस मनाने की प्रथम पुनरावृत्ति थी। पुलिस ने सभा करने को गैरकानूनी कहा था किंतु सुभाष बाबू के आह्वान पर पूरे कलकत्ता में अनेक संगठनों के माध्यम से जुलूस व सभाओं की जोशीली तैयारी थी। पूरा शहर झंडों से सजा था तथा कौंसिल ने मोनुमेंट के नीचे झंडा फहराने और स्वतंत्रता की प्रतिज्ञा पढ़ने का सरकार को खुला चैलेंज दिया हुआ था। पुलिस भरपूर तैयारी के बाद भी कामयाब नहीं हो पाई।

**3. पुलिस कमिश्नर के नोटिस और कौंसिल के नोटिस में क्या अंतर था?**

उत्तर- पुलिस कमिश्नर ने नोटिस निकाला था कि कोई भी जनसभा करना या जुलूस निकालना कानून के खिलाफ होगा। सभाओं में भाग लेने वालों को दोषी माना जाएगा। कौंसिल ने नोटिस निकाला था कि मोनुमेंट के नीचे चार बजकर चौबीस मिनट पर झंडा फहराया जाएगा तथा स्वतंत्रता की प्रतिज्ञा पढ़ी जाएगी। इस प्रकार ये दोनों नोटिस एक दुसरे के खिलाफ थे।

**4. धर्मतल्ले के मोड़ पर आकर जुलूस क्यों टूट गया?**

उत्तर- जब सुभाष बाबू को पकड़ लिया गया तो स्त्रियाँ जुलूस बनाकर चलीं परन्तु पुलिस ने लाठी चार्ज से उन्हें रोकना चाहा जिससे कुछ लोग वहीं बैठ गए, कुछ घायल हो गए और कुछ पुलिस द्वारा गिरफ्तार कर लिए गए इसलिए जुलूस टूट गया।

5. डॉ. दासगुप्ता जुलूस में घायल लोगों की देख-रेख तो कर रहे थे, उनके फ़ोटो भी उतरवा रहे थे। उन लोगों के फ़ोटो खींचने की क्या वजह हो सकती थी? स्पष्ट कीजिए।

उत्तर- डॉ. दास गुप्ता लोगों की फ़ोटो खिचवा रहे थे। इससे अंग्रेजों के जुल्म का पर्दाफ़ाश किया जा सकता था, दूसरा यह भी पता चल सकता था कि बंगाल में स्वतंत्रता की लड़ाई में बहुत काम हो रहा है।

(ख) निम्नलिखित प्रश्नों के उत्तर (50-60 शब्दों में) दीजिए -

1. सुभाष बाबू के जुलूस में स्त्री समाज की क्या भूमिका थी?

उत्तर- सुभाष बाबू के जुलूस में स्त्री समाज की महत्वपूर्ण भूमिका रही थी। भारी पुलिस व्यवस्था के बाद भी जगह-जगह स्त्री जुलूस के लिए टोलियाँ बन गई थीं। मोनुमेंट पर भी स्त्रियों ने निडर होकर झंडा फहराया, अपनी गिरफ्तारियाँ करवाई तथा उनपर लाठियाँ बरसाईं। इसके बाद भी स्त्रियाँ लाल बाज़ार तक आगे बढ़ती गईं।

2. जुलूस के लाल बाज़ार आने पर लोगों की क्या दशा हुई?

उत्तर- जुलूस के लाल बाज़ार आने पर भीड़ बेकाबू हो गई। पुलिस डंडे बरसा रही थी, लोगों को लॉकअप में भेज रही थी। स्त्रियाँ भी अपनी

गिरफ्तारी दे रही थीं। दल के दल नारे लगा रहे थे। लोगों का जोश बढ़ता ही जा रहा था। लाठी चार्ज से लोग घायल हो गए थे। खून बह रहा था। चीख पुकार मची थी फिर भी उत्साह बना हुआ था।

3. 'जब से कानून भंग का काम शुरू हुआ है तब से आज तक इतनी बड़ी सभा ऐसे मैदान में नहीं की गई थी और यह सभा तो कहना चाहिए कि ओपन लड़ाई थी।' यहाँ पर कौन से और किसके द्वारा लागू किए गए कानून को भंग करने की बात कही गई है? क्या कानून भंग करना उचित था? पाठ के संदर्भ में अपने विचार प्रकट कीजिए।

उत्तर- यहाँ पर अंग्रेजी राज्य द्वारा सभा न करने के कानून को भंग करने की बात कही गई है। वात्सव में यह कानून भारतवासियों की स्वाधीनता को दमन करने का कानून था इसलिए इसे भंग करना उचित था। इस समय देश की आज़ादी के लिए हर व्यक्ति अपना सर्वस्व लुटाने को तैयार था। अंग्रेजों ने कानून बनाकर आन्दोलन, जुलूसों को गैर कानूनी घोषित किया हुआ था परन्तु लोगों पर इसका कोई असर नहीं था। वे आज़ादी के लिए अपना प्रदर्शन करते रहे, गुलामी की जंजीरों को तोड़ने का प्रयास करते रहे थे।

4. बहुत से लोग घायल हुए, बहुतों को लॉकअप में रखा गया, बहुत-सी स्त्रियाँ जेल गईं, फिर भी इस दिन को अपूर्व बताया गया है। आपके विचार में यह सब अपूर्व क्यों है? अपने शब्दों में लिखिए।

उत्तर- सुभाष चन्द्र बोस के नेतृत्व में कलकत्ता वासियों ने स्वतंत्रता दिवस मनाने की तैयारी जोर-शोर से की थी। पुलिस की सख्ती, लाठी चार्ज, गिरफ्तारियाँ, इन सब के बाद भी लोगों में जोश बना रहा। लोग

झंडे फहराते, वंदे मातरम बोलते हुए, खून बहाते हुए भी जुलूस निकालने को तत्पर थे। जुलूस टूटता फिर बन जाता। कलकत्ता के इतिहास में इतने प्रचंड रूप में लोगों को पहले कभी नहीं देखा गया था।

**(ग) निम्नलिखित का आशय स्पष्ट कीजिए -**

1. आज तो जो कुछ हुआ वह अपूर्व हुआ है। बंगाल के नाम या कलकत्ता के नाम पर कलंक था कि यहाँ काम नहीं हो रहा है वह आज बहुत अंश में धुल गया।

**उत्तर**

हजारों स्त्री पुरुषों ने जुलूस में भाग लिया, आज़ादी की सालगिरह मनाने के लिए बिना किसी डर के प्रदर्शन किया। पुलिस के बनाए कानून कि, जुलूस आदि गैर कानूनी कार्य, आदि की भी परवाह नहीं की। पुलिस की लाठी चार्ज होने पर लोग घायल हो गए। खून बहने लगे परन्तु लोगों में जोश की कोई कमी नहीं थी। बंगाल के लिए कहा जाता था कि स्वतंत्रता के लिए बहुत ज़्यादा योगदान नहीं दिया जा रहा है। आज की स्थिति को देखकर उन पर से यह कलंक मिट गया।

2. खुला चैलेंज देकर ऐसी सभा पहले नहीं की गई थी।

उत्तर- पुलिस ने कोई प्रदर्शन न हो इसके लिए कानून निकाला कि कोई जुलूस आदि आयोजित नहीं होगा परन्तु सुभाष बाबू की अध्यक्षता में कौंसिल ने नोटिस निकाला था कि मोनुमेंट के नीचे झंडा फहराया जाएगा और स्वतंत्रता की प्रतिक्षा पढ़ी जाएगी। सभी को इसके लिए

आमंत्रित किया गया, खूब प्रचार भी हुआ। सारे कलकत्ते में झंडे फहराए गए थे। सरकार और आम जनता में खुली लड़ाई थी।

## भाषा अध्ययन

### 1. निम्नलिखित वाक्यों को सरल वाक्यों में बदलिए -

(क) दो सौ आदमियों का जुलूस लालबाजार गया और वहाँ पर गिरफ्तार हो गया।

(ख) मैदान में हजारों आदमियों की भीड़ होने लगी और लोग टोलियाँ बना-बनाकर मैदान में घूमने लगे।

(ग) सुभाष बाबू को पकड़ लिया गया और गाड़ी में बैठाकर लालबाजार लॉकअप भेज दिया गया।

‘बड़े भाई साहब’ पाठ में से भी दो-दो सरल, संयुक्त और मिश्र वाक्य छाँटकर लिखिए।

### उत्तर-

(क) दो सौ आदमियों का जुलूस लालबाजार पहुँच कर गिरफ्तार हो गया।

(ख) हजारों लोगों की भीड़ मैदान में टोलियाँ बनाकर घूमने लगी।

(ग) सुभाष बाबू को पकड़कर गाड़ी में लाल बाजार लॉकअप भेज दिया गया।

### सरल वाक्य -

(क) वह स्वभाव से बड़े अध्ययनशील थे।

(ख) उनकी रचनाओं को समझना छोटे मुँह बड़ी बात है।

संयुक्त वाक्य -

(क) अभिमान किया और दीन दुनिया दोनों से गया।

(ख) मुझे अपने ऊपर कुछ अभिमान हुआ और आत्मसम्मान भी बढ़ा।

मिश्र वाक्य -

(क) मैंने बहुत चेष्टा की कि इस पहेली का कोई अर्थ निकालूँ लेकिन असफल रहा।

(ख) मैं कह देता कि मुझे अपना अपराध स्वीकार है।

2. नीचे दिए गए शब्दों की संधि कीजिए -

श्रद्धा + आनंद = .....

प्रति + एक = .....

पुरुष + उत्तम = .....

झंडा + उत्सव = .....

पुनः + आवृत्ति = .....

ज्योतिः + मय = .....

उत्तर

श्रद्धा	+	आनंद	=	श्रद्धानंद
प्रति	+	एक	=	प्रत्येक
पुरुष	+	उत्तम	=	पुरुषोत्तम
झंडा	+	उत्सव	=	झंडोत्सव
पुनः	+	आवृत्ति	=	पुनरावृत्ति
ज्योतिः	+	मय	=	ज्योतिर्मय

## योग्यता विस्तार

- 1- भौतिक रूप से दबे हुए होने पर भी अंग्रेजों के समय में ही हमारा मन आजाद हो चुका था। अतः दिसंबर सन् 1929 में लाहौर में कांग्रेस का एक बड़ा अधिवेशन हुआ, इसके सभापति जवाहरलाल नेहरू जी थे। इस अधिवेशन में यह अधिवेशन पास किया गया कि अब हम 'पूर्ण स्वराज' से कुछ भी कम स्वीकार नहीं करेंगे। 26 जनवरी 1930 को देशवासियों ने 'पूर्ण स्वतंत्रता' के लिए हर प्रकार से बलिदान की प्रतिज्ञा की। उसके बाद आजादी प्राप्त होने तक प्रतिवर्ष 26 जनवरी को स्वाधीनता दिवस के रूप में मनाया जाता रहा। आजादी मिलने के बाद 26 जनवरी गणतंत्र दिवस के रूप में मनाया जाने लगा।

उत्तर- विद्यार्थी इसे आत्मसात करें।



2- डायरी- यह गद्य की एक विधा है। इसमें दैनिक जीवन में होने वाली घटनाओं, अनुभवों को वर्णित किया जाता है। आप भी अपनी दैनिक जीवन से सम्बंधित घटनाओं को डायरी में लिखने का अभ्यास करें।

संभावित उत्तर-

10 अप्रैल 2017

मंगलवार

समय : शाम 7 बजे

शाम का समय है। आज जल्दी सोना चाहती हूँ। दिनभर पढाई में बीता। रात को उठकर फिर एकांत में पढ़ना ठीक रहेगा। हमारी कॉलोनी में कोई स्थानीय चुनाव होने वाले हैं। बाहर ज़ोर-ज़ोर से देशभक्ति के गीत बजाए जा रहे हैं, शायद किसी नेता के आने और भाषण देने का कार्यक्रम है। कल मेरी गणित की परीक्षा है। इन थोथे नेताओं को कैसे बताएँ कि हमारा कितना नुकसान हो रहा है!

3- जमना लाल बजाज महात्मा गांधी के पाँचवें पुत्र के रूप में जाने जाते हैं, क्यों? अध्यापक से जानकारी प्राप्त करें।

उत्तर- जमना लाल बजाज राजस्थान के प्रसिद्ध व्यापारी थे। इन्हें व्यवसाय और प्रशासन की कुशलता के कारण अंग्रेजों ने राय बहादुर की उपाधि से सम्मानित किया। जब वे महात्मा गांधी के संपर्क में आए तो उनके भक्त बन गए । उन्होंने अंग्रेजों की दी हुई उपाधि लौटा दी और महात्मा गांधी के अनुयायी बन गए। उन्होंने वर्धा में सेवा संघ की स्थापना की और गांधी जी के अहिंसा के सिद्धांत का अनुगमन किया। इनकी समर्पण की भावना को देखकर गांधी जी इन्हें अपने पुत्र की तरह मानने थे।

4- ढाई लाख का जानकी देवी पुरस्कार जमला लाल बजाज

फाउंडेशन द्वारा पूरे भारत में सराहनीय कार्य करने वाली महिलाओं को दिया जाता है। यहाँ ऐसी कुछ महिलाओं के नाम दिए जा रहे हैं-

श्रीमती अनुताई लिमये **1993** महाराष्ट्र; सरस्वती गोरा **1996** आंध्र प्रदेश;  
मीना अग्रवाल **1998** असम; सिस्टर मैथिलि **1999** केरल; कुंतला  
कुमारी आचार्य **2001** उड़ीसा।

इनमें से इसी एक के बारे में विस्तृत जानकारी प्राप्त कीजिए।

उत्तर- विद्यार्थी स्वयं करें।

परियोजना कार्य

1- स्वतंत्रता आंदोलन में निम्नलिखित महिलाओं ने जो योगदान दिया, उसके बारे में संक्षिप्त जानकारी प्राप्त करके लिखिए।

क- सरोजनी नायडू

ख- अरुणा आसफ अली

ग- कस्तूरबा गांधी

उत्तर-

क- सरोजनी नायडू

भारत कोकिला सरोजिनी नायडू सिर्फ स्वतंत्रता संग्राम सेनानी ही नहीं, बल्कि बहुत अच्छी कवियत्री भी थीं। 1914 में इंग्लैण्ड में वे पहली बार गांधीजी से मिली और उनके विचारों से प्रभावित होकर देश के लिए समर्पित हो गईं। एक कुशल सेनानी की भाँति उन्होंने अपनी प्रतिभा का परिचय हर क्षेत्र (सत्याग्रहों या संगठन की बात) में दिया। उन्होंने अनेक राष्ट्रीय आन्दोलनों का नेतृत्व किया और जेल भी गईं। सरोजिनी नायडू ने खिलाफत आंदोलन की बागडोर संभाली और अग्रेजों को भारत से निकालने में अहम योगदान दिया।

ख- अरुणा आसफ अली

अरुणा जी भारतीय स्वतंत्रता सेनानी थीं। उनका जन्म का नाम अरुणा गांगुली था। उन्हें 1942 में भारत छोड़ो आंदोलन के दौरान,

मुंबई के गोवालीया मैदान में कांग्रेस का झंडा फहराने के लिए हमेशा याद किया जाता है। इनपर जयप्रकाश नारायण, डॉ. राम मनोहर लोहिया, अच्युत पटवर्धन जैसे समाजवादियों के विचारों का अधिक प्रभाव था। इसी कारण **1942** ई. के 'भारत छोड़ो आन्दोलन' में अरुणा जी ने अंग्रेजों की जेल में बन्द होने के बदले भूमिगत रहकर अपने अन्य साथियों के साथ आन्दोलन का नेतृत्व करना उचित समझा। गांधी जी आदि नेताओं की गिरफ्तारी के तुरन्त बाद मुंबई में विरोध सभा आयोजित करके विदेशी सरकार को खुली चुनौती देने वाली वे प्रमुख महिला थीं। फिर गुप्त रूप से उन कांग्रेस जनों का पथ-प्रदर्शन किया, जो जेल से बाहर रह सके थे। मुंबई, कोलकाता, दिल्ली आदि में घूम-घूमकर, पर पुलिस की पकड़ से बचकर लोगों में नव जागृति लाने का प्रयत्न किया। लेकिन **1942** से **1946** तक देश भर में सक्रिय रहकर भी वे पुलिस की पकड़ में नहीं आईं। **1946** में जब उनके नाम का वारंट रद्द हुआ, तभी वे प्रकट हुईं। सारी सम्पत्ति जब्त करने पर भी उन्होंने आत्मसमर्पण नहीं किया।

### ग- कस्तूरबा गांधी

कस्तूरबा गांधी हमारे राष्ट्रपिता महात्मा गांधी जी की पत्नी हैं जिन्हें भारत में बा के नाम से जाना जाता है। **1913** में दक्षिण अफ्रीका में एक ऐसा कानून पास हुआ जिसके अनुसार ईसाई मत के अनुसार किए गए और विवाह विभाग के अधिकारी के यहाँ दर्ज किए गए विवाह के

अतिरिक्त अन्य विवाहों की मान्यता अग्राह्य की गई थी। बापू ने इस कानून को रद्द कराने का बहुत प्रयास किया। पर जब वे सफल न हुए तब उन्होंने सत्याग्रह करने का निश्चय किया और उसमें सम्मिलित होने के लिए स्त्रियों का भी आह्वान किया। पर इस बात की चर्चा उन्होंने अन्य स्त्रियों से तो की किंतु बा से नहीं की। वे नहीं चाहते थे कि बा उनके कहने से सत्याग्रहियों में जायँ और फिर बाद में कठिनाइयों में पड़कर विषम परिस्थिति उपस्थित करें। वे चाहते थे कि वे स्वेच्छया जायँ और जायँ तो दृढ़ रहें। जब बा ने देखा कि बापू ने उनसे सत्याग्रह में भाग लेने की कोई चर्चा नहीं की तो बड़ी दुःखी हुई और बापू को उपालंभ दिया। फिर स्वेच्छा सत्याग्रह में सम्मिलित हुई और तीन अन्य महिलाओं के साथ जेल गई। **1922** में जब बापू गिरफ्तार किए गए और उन्हें छह साल की सजा हुई उस समय उन्होंने जो वक्तव्य दिया वह उन्हें वीरांगना के रूप में प्रतिष्ठित करता है। उन्होंने गांधी जी के गिरफ्तारी के विरोध में विदेशी कपड़ों के त्याग के लिए लोगों का आह्वान किया। बापू का संदेश सुनाने नौजवानों की तरह गुजरात के गाँवों में घूमती फिरीं। **1930** में दांडी कूच और धरासणा के धावे के दिनों में बापू के जेल जाने पर बा एक प्रकार से बापू के अभाव की पूर्ति करती रहीं। वे पुलिस के अत्याचारों से पीड़ित जनता की सहायता करती, धैर्य बँधाती रहीं।

2- इस पाठ के माध्यम से स्वतंत्रता संग्राम में कलकत्ता (कोलकाता) के योगदान का चित्र स्पष्ट होता है। आज़ादी के आंदोलन में आपके क्षेत्र का भी किसी न किसी प्रकार का योगदान रहा होगा। पुस्तकालय, अपने परिचितों या फिर किसी दूसरे स्रोत से इस संबंध में जानकारी हासिल कर लिखिए।  
उत्तर- विद्यार्थी स्वयं जानकारी प्राप्त करें।

3- 'केवल प्रचार में दो हजार रुपया खर्च किया गया था।' तत्कालीन समय को मद्दे नज़र रखते हुए अनुमान लगाइए कि प्रचार-प्रसार के लिए इन माध्यमों का उपयोग किया गया होगा?

4- आपको अपने विद्यालय में लगने वाले पल्स पोलियो केन्द्र की सूचना पूरे मोहल्ले को देनी है। आप इस बात का प्रचार बिना पैसे के कैसे कर पाएँगे? उदाहरण के साथ लिखिए।

## Class X, Bengali (রাজকাহিনী)

### শিলাদিত্য

#### অবনীন্দ্রনাথ ঠাকুর

১) “সেই কুন্ডের একধারে প্রকাণ্ড সূর্য মন্দিরে এক অতিবৃদ্ধ পুরোহিত বাস করতেন।”- ক) কার লেখা কোন বচনার অংশ? খ) সেই কুন্ডের বলতে এখানে কোন কুন্ডের কথা বলা হয়েছে? গ) বৃদ্ধ পুরোহিত সেই সূর্যমন্দিরে কি করতেন?

**উত্তর:** ক) প্রখ্যাত শিশুসাহিত্যিক অবনীন্দ্রনাথ ঠাকুর রচিত “শিলাদিত্য” গল্পে আলোচ্য উক্তিটির বক্তা হলেন স্বয়ং সূর্যদেব।

খ) শিলাদিত্যের জন্মের আগে বল্লভীপুরে রাজা কনকসেনের বংশের শেষ রাজা রাজত্ব করছিলেন। তাঁর রাজত্বকালে বল্লভীপুরে সূর্যকুন্ড নামে এক অতি পবিত্র কুন্ড ছিল। আলোচ্য অংশে “সেই কুণ্ড” বলতে বল্লভীপুরের পবিত্র সূর্যকুন্ডের কথা বলা হয়েছে।

গ) বল্লভীপুরের সূর্যকুন্ডের একাধারে প্রকাণ্ড সূর্যমন্দিরের একজন অতি বৃদ্ধ পুরোহিত বাস করতেন। তার কোনো পুত্র কন্যা বা বন্ধু-বান্ধব কেউ ছিলনা। অনন্ত আকাশের সূর্য দেবের মতোই বৃদ্ধ ব্রাহ্মণ একাকী নিঃসঙ্গ ছিলেন। মন্দিরে প্রদীপ জ্বালানো, ঘন্টা বাজানো, উদয়-অস্ত দুই সন্ধ্যা আরতী সমস্ত কিছু কাজের ভার তাঁর উপরই ছিল। তাঁর কোনো ভৃত্য, অনুচর বা শিষ্য ছিল না। বৃদ্ধ পুরোহিত প্রতিদিন একাই ত্রিশ সের ওজনের পিতলের প্রদীপে সূর্যদেবের আরতি ঐকরতেন। প্রতিদিন জীর্ণ শরীরে শীর্ণ হাতে রাক্ষস রাজার রাজমুকুটের মতো মন্দিরের প্রকাণ্ড ঘন্টা বাজাতেন। এই সমস্ত কাজ করতে করতে তিনি মনে মনে ভাবতেন, একজন সঙ্গী পেলে তিনি বৃদ্ধ বয়সে তার হাতে মন্দিরের যাবতীয় ভার দিয়ে নিশ্চিন্ত হতে পারেন।

২) “সূর্যদেব ভক্তের মনোবাঞ্ছা পূর্ণ করলেন”- ক) কার কোন বচনা থেকে আলোচ্য উদ্ধৃতিটি গৃহীত হয়েছে? খ) ভক্তের মনোবাঞ্ছা কি ছিল? গ) সূর্যদেব কিভাবে ভক্তের মনোবাঞ্ছা পূর্ণ করেছিলেন?

**উত্তর:** ক) প্রখ্যাত শিশুসাহিত্যিক অবনীন্দ্রনাথ ঠাকুর রচিত রাজকাহিনী গ্রন্থের অন্তর্গত শিলাদিত্য গল্প থেকে আলোচ্য উক্তিটি সংকলিত হয়েছে।

খ) বল্লভীপুরের প্রকাণ্ড সূর্যমন্দিরের অতিবৃদ্ধ পুরোহিতকে ভক্ত বলা হয়েছে। তিনি ছিলেন একেবারে একাকী- কারণ তার কোন ভৃত্য, অনুচর, শিষ্য ছিল না। মন্দিরে প্রদীপ জ্বালানো, ঘন্টা বাজানো, উদয়-অস্ত দুই সন্ধ্যা আরতী সমস্ত কিছু কাজের ভার তাঁর উপরই ছিল। বৃদ্ধ পুরোহিত প্রতিদিন একাই ত্রিশ সের ওজনের পিতলের প্রদীপে সূর্যদেবের আরতি করতেন। প্রতিদিন জীর্ণ শরীরে শীর্ণ হাতে রাক্ষস রাজার রাজমুকুটের মতো মন্দিরের প্রকাণ্ড ঘন্টা বাজাতেন। এই সমস্ত কাজ করতে করতে তিনি মনে মনে ভাবতেন, একজন সঙ্গী পেলে তিনি বৃদ্ধ বয়সে তার হাতে মন্দিরের যাবতীয় ভার দিয়ে নিশ্চিন্ত হতে পারেন। এই ছিল ভক্তের মনোবাঞ্ছা।

গ) সূর্যদেব তাঁর ভক্তের মনোবাঞ্ছা পূর্ণ করেছিলেন। একদিন পৌষ মাসের প্রথমে ঘন কুম্বাশায় চারিদিকে অন্ধকার ছিল, সূর্যদেব অস্ত গেছেন, বৃদ্ধ পুরোহিতের সন্ধ্যারতি শেষে মন্দিরের প্রকাণ্ড লোহার কপাট বহুকষ্টে বন্ধ করেছেন, এমন সময়ে ম্লান মুখে এক ব্রাহ্মণকন্যা তার সামনে উপস্থিত হয়েছিল। ব্রাহ্মণকন্যার পরনে ছিলবাস, কিন্তু অপরূপা সুন্দরী। ব্রাহ্মণকন্যা হাতজোড় করে বৃদ্ধ ব্রাহ্মণের কাছে আশ্রয় প্রার্থনা করল। সে জানাল, সে বিয়ের রাতে বিধবা হওয়ায় দেশের লোক তাকে দুর্ভাগী বলে দেশের বাইরে বের করে দিয়েছে। সে আশ্রয়হীন, মাতৃহীন, তাই সে আশ্রয় চায়। ব্রাহ্মণ প্রথমাবস্থায় রাজি না হলেও পরে সম্মত হয়েছিলেন। সেই নির্জন মন্দিরে তখন আশ্রয় পেল সুভাগা নামের মেয়েটি। এভাবে সূর্যদেব ভক্ত ব্রাহ্মণের মনোবাঞ্ছা পূর্ণ করেছিলেন।

**৩) “পিতা, আজ সন্ধ্যার সময় এই প্রদীপে সূর্যদেবের আরতী করুন”- ক) বক্তা কে? খ) বক্তা কখন কথাগুলো বলেছিলেন? গ) বক্তা কেন কথাগুলো বলেছিলেন তা নিজের ভাষায় বর্ণনা করো।**

**উত্তর:** ক) প্রখ্যাত শিশুসাহিত্যিক অবনীন্দ্রনাথ ঠাকুর রচিত “শিলাদিত্য” গল্পে আলোচ্য উক্তিটির বক্তা সূর্যমন্দিরের আশ্রিতা সুভাগা।

খ) বল্লভীপুরের প্রকাণ্ড সূর্য মন্দিরের সুভাগা বৃদ্ধ ব্রাহ্মণের কাছে আশ্রয় পেয়েছিলেন। সেখানে আশ্রয় পাওয়ার পর অনেকদিন কেটে গেল, সুভাগা সমস্ত কাজই শিখে ফেলেছিলেন। কেবল মাত্র ত্রিশ সের ওজনের আরতির প্রদীপটা তুলে ধরে আরতি করতে পারতেন না। আরতির কাজটা তাই বৃদ্ধ ব্রাহ্মণকেই করতে হতো। একদিন সুভাগা দেখেছিলেন, বৃদ্ধের জীর্ণ শরীরটা যেন ভেঙে পড়েছে। আরতীর প্রদীপটা শীর্ণ হাতে টলে পড়ছে। সেই দিনই সুভাগা বল্লভীপুরের বাজার থেকে এক সের ওজনের একটি প্রদীপ কিনে এনে বৃদ্ধ ব্রাহ্মণকে আলোচ্য কথাগুলি বলেছিলেন।

গ) বল্লভীপুরের সূর্যমন্দিরের বৃদ্ধ ব্রাহ্মণ পুরোহিত প্রতিদিন সকাল সন্ধ্যায় ত্রিশ সের ওজনের পিতলের প্রদীপে আরতী করতেন। কিন্তু বয়স হওয়ার জন্য সেই প্রদীপে আরতী করা তার জীর্ণ শরীরে খুব কষ্টকর হয়ে পড়েছিল। দেবাদিত্য ব্রাহ্মণের কন্যা সুভাগা একদিন লক্ষ করেছিলেন বৃদ্ধ ব্রাহ্মণের জীর্ণ শরীর যেন একেবারে ভেঙে পড়েছে, আরতীর প্রদীপটা তাঁর শীর্ণ হাতে তোলে পড়ছে। সুভাগা সূর্যমন্দিরের সব কাজ করতে পারলেও ত্রিশ সের ওজনের পিতলের প্রদীপটা নিয়ে আরতী করতে পারতেন না। বৃদ্ধের এই অবস্থা দেখে তাঁর খুব কষ্ট হয়েছিল। সেই কষ্ট লাঘব করার জন্য তিনি বল্লভীপুর বাজার থেকে এক সের ওজনের পিতলের প্রদীপ কিনে এনে আলোচ্য কথাগুলো বলেছিলেন।

**৪) “সূর্যদেবের সমস্ত পৃথিবী অন্ধকার করে অস্ত গেলেন। সুভাগা একলা পড়লেন।”- ক) কোন দিনের কথা বলা হয়েছে? খ) সেদিন কি ঘটনা ঘটেছিল? গ) সুভাগা কিভাবে একলা হয়ে পড়েছিলেন তা সংক্ষেপে লেখ।**

**উত্তর:** ক) প্রখ্যাত শিশুসাহিত্যিক অবনীন্দ্রনাথ ঠাকুর রচিত “শিলাদিত্য” গল্পে বল্লভীপুরের সূর্য মন্দিরের পূজারী ব্রাহ্মণ যেদিন মারা যান সেই দিনের কথা এখানে বলা হয়েছে।

খ) সুভাগা সেইদিন ব্রাহ্মণকে বল্লভীপুর বাজার থেকে আনা এক সের ওজনের একটি ছোট প্রদীপ দিয়ে সূর্যদেবের আরতি করার অনুরোধ করেন। কিন্তু ব্রাহ্মণ জানান যে, সকালে যে প্রদীপে সূর্যদেবের আরতী হয়েছে সন্ধ্যায়ও সেই একই প্রদীপে দেবতার আরতী হওয়া চাই। তিনি নতুন দিনে নতুন প্রদীপে সূর্যদেবের আরতির কথা বলেছিলেন। সেদিন ব্রাহ্মণ দ্বিপ্রহরে সুভাগাকে সূর্য মন্ত্র দীক্ষা দিলেন, যে মন্ত্রের গুনে সূর্যদেব স্বয়ং এসে ভক্তকে দর্শন দেন, যে



মন্ত্র জীবনে একবার ছাড়া দুইবার উচ্চারণ করলে মৃত্যু নিশ্চিত। তারপর সন্ধিক্ষণে সন্ধ্যার অন্ধকারে আরতী শেষ হওয়ার পর নিভন্ত প্রদীপের মতো ব্রাহ্মণের জীবনপ্রদীপ ধীরে ধীরে নিভে গেল। সূর্যদেব সমস্ত পৃথিবী অন্ধকার করে অস্ত গেলেন।

গ) সূর্যদেব যেন সমস্ত পৃথিবী অন্ধকার করে অস্ত গেলেন। ব্রাহ্মণের মৃত্যুতে সেই প্রকাণ্ড সূর্য মন্দিরে সুভাগা একেবারে একাকী হয়ে পড়লেন। অনাথিনী দরিদ্র অসহায় সুভাগাকে ব্রাহ্মণ সূর্যমন্দিরে আশ্রয় দিয়েছিলেন। সেই বিরাট সূর্যমন্দিরে ব্রাহ্মণ ছাড়া সুমাইয়ার আর কেউ ছিল না। সেই কারণেই ব্রাহ্মণের অনুপস্থিতিতে সুভাগা একেবারে একলা হয়ে পড়েছিল।

৫) “বৎসে, দেবতার বরে মৃত্যু হয়না, দেবতার অভিশাপে মৃত্যু হয়, তুমি বর প্রার্থনা করো।”- ক) বক্তা কে? খ) বক্তা কখন কথাগুলো বলেছিলেন? গ) তারপর কি ঘটেছিল তা সংক্ষেপে বর্ণনা করো।

**উত্তর:** ক) প্রখ্যাত শিশুসাহিত্যিক অবনীন্দ্রনাথ ঠাকুর রচিত শিলাদিত্য গল্পে আলোচ্য উক্তিটির বক্তা হলেন স্বয়ং সূর্যদেব।

খ) একদিন সুভাগা সূর্য মন্দিরের সমস্ত দুয়ার বন্ধ করে প্রদীপ জ্বালিয়ে ঠাকুরের আরতি করার পর সূর্য মূর্তির সামনে বসেছিলেন সূর্যদেবকে উদ্দেশ্য করে সুভাগা বলেছিলেন তিনি পুত্রহীনার বিধবা অনাথিনী তাকে সূর্যদেব যেন এই বর দেন যে তাকে আর পৃথিবীতে না থাকতে হয় সমস্ত জ্বালা-যন্ত্রণা মুক্ত হয়ে সূর্য দেবের চরণতলে যেন তার মৃত্যু হয়। সুভাগার এই আকুল প্রার্থনা শোনার পরই সূর্যদেব আলোচ্য কথাগুলি বলেছিলেন।

গ) সূর্যদেবের আদেশেই সুভাগা তাঁর কাছে বর চেয়েছিলেন যে, সূর্যের মতো তেজস্বী একটি ছেলে ও চাঁদের কণার মতো সুন্দরী একটি মেয়ে উপহার দিতে। সুভাগার প্রার্থনা শুনে সূর্যদেব তথাস্ত বলে অন্তর্ধান হলেন। ধীরে ধীরে সুভাগার চোখে ঘুম এল, পাথরের উপর আঁচল পেতে তিনি শুয়ে পড়লেন। ক্রমে সকাল বেলায় সোনার আলো সুভাগার চোখে পড়ার পর তিনি তাড়াতাড়ি উঠে বসলেন, তাঁর আঁচলে টান পড়ল, তিনি চেয়ে দেখলেন কচি দুটো ছেলেমেয়ে তাঁর কোলের কাছে ঘুমিয়ে আছে। সূর্যদেবের বর সফল হল, সুভাগা দেবতার মত দুটো সুন্দর সন্তান কোলে তুলে নিলেন। মানুষের চোখের আড়ালে নির্জন মন্দিরে জন্ম হয়েছিল বলে সুভাগা সন্তান দুটির নাম দিলেন গায়েব ও গায়েবী।

৬) “এমন সময় ঝড়ের মতো গায়েব এসে পিতলের প্রদীপটা কেড়ে নিয়ে টান মেরে ফেলে দিলেন।”- ক) গায়েব কে? খ) কখন সে পিতলের প্রদীপটাকে নিয়ে টান মেরে ফেলে দিয়েছিল? গ) পিতলের প্রদীপ টান মেরে ফেলে দেওয়ার ফলে কি ঘটেছিল?

**উত্তর:** ক) প্রখ্যাত শিশুসাহিত্যিক অবনীন্দ্রনাথ ঠাকুর রচিত “রাজকাহিনী” গ্রন্থের অন্তর্গত “শিলাদিত্য” গল্পে সুমাইয়ার পুত্র হল গায়েব।

খ) গায়েব বড়ো হয়ে পাঠশালায় যাওয়া শুরু করেছিল। পাঠশালার বন্ধুরা খেলাচ্ছলে তাকে রাজা বানিয়ে ছিল এবং তারা প্রজা হয়েছিল। পাঠশালার বন্ধুরা তার বাবা-মায়ের নাম জিজ্ঞাসা করলে গায়েব মায়ের নাম বলতে পারলেও বাবার নাম বলতে পারেনি। সে জানত না তার বাবা হলেন স্বয়ং সূর্যদেব। বাবার নাম না বলতে পারার জন্য বন্ধুরা হো-হো করে হাততালি দেওয়াতে সে প্রচণ্ড অপমানিত হয়ে রাগে কাঁপতে কাঁপতে দেবমন্দিরে উপস্থিত হয়েছিল। সুভাগা তখন গায়েবকে সূর্যদেবের আরতী শিখিয়ে দিচ্ছিলেন। সেই মুহূর্তেই গায়েব ঝড়ের মত উপস্থিত হয়ে পিতলের প্রদীপটা কেড়ে নিয়ে টান মেরে ফেলে দিয়েছিল।

গ) গায়েব পিতলের প্রদীপটা টান মেরে ফেলে দেওয়ায় সেটি পাথরের দেওয়ালে লেগে ঝনঝন শব্দে চুরমার হয়ে গেল। সেই সঙ্গে সূর্য দেবের মূর্তি আঁকা একখানা কালো পাথর সেই দেওয়াল থেকে খসে পড়ল। সুভাগা বারবার ছেলেকে শাস্ত করার চেষ্টা করলেন কিন্তু গায়েব তাঁর মায়ের কাছে বারংবার পিতৃ পরিচয় জানতে চাইল। সুমাইয়া তখন গায়েবকে জানিয়ে ছিলেন সূর্যদেব তাঁর পিতা। কিন্তু গায়েবের বিশ্বাস না হওয়ায় সুভাগা যখনই সূর্যমন্ত্র উচ্চারণ



Prabal Sarkar

## Class -X, Bengali

### আয় আরো বেঁধে বেঁধে থাকি

#### কবি শঙ্খ ঘোষ

#### ১) আমাদের চোখ মুখ ঢাকা

আমরা ভিখারি বারো মাস – ক) কার কোন কবিতার অন্তর্গত? খ) কোন প্রসঙ্গে এই উক্তি? গ) উক্তিটির অর্থ পরিস্ফুট করো।

উত্তর: ক) আলোচ্য অংশটি কবি শঙ্খ ঘোষের 'আয় আরো বেঁধে বেঁধে থাকি' কবিতার অন্তর্গত।

খ) নিপীড়িত লাঞ্চিত অবহেলিত মানুষের কোনো ইতিহাস নেই এই প্রসঙ্গে কোভিদ এই উক্তি।

গ) শাসক ও ঋমতাসীন ব্যক্তিরাই বর্তমানের ইতিহাসের নিয়ামক। তাদের ইতিহাস হয় বিকৃত - পরিবর্তিত। কারণ তারা নিজেদের স্বার্থে ইতিহাসকে এমনভাবে বিকৃত করে যে, তাতে সাধারণ মানুষের কোন সংস্কৃতি ও সভ্যতার কথা থাকে না। তাদের চাপিয়ে দেওয়া ইতিহাসকেই সাধারণ মানুষ ইতিহাস বলে গ্রহণ করতে বাধ্য হয়। নিজেদের ইতিহাসের সন্ধান তারা করতে পারে না। নিজস্ব ইতিহাসের কোন অস্তিত্বও থাকে না।

#### ২) আমরাও তবে এইভাবে

এ-মুহুর্তে মরে যাব নাকি? - ক) কার কোন রচনায় অন্তর্গত? খ) কোন প্রসঙ্গে কবির এই উক্তি? গ) উক্তিটির অর্থ পরিস্ফুট কর।

উত্তর: ক) আলোচ্য অংশটি কবি শঙ্খ ঘোষের 'আয় আরো বেঁধে বেঁধে থাকি' কবিতার অন্তর্গত।

খ) চারিদিকের অরাজকতা, সাম্প্রদায়িক দাঙ্গা হাঙ্গামা, ধর্ম ও রাজনীতি ক্ষেত্রের অসহিষ্ণুতা, সীমাহীন লোভ মানুষের বেঁচে থাকাই অসম্ভব করে তুলেছে। প্রতিটি মুহূর্তে মানুষ শুনতে পাচ্ছে মৃত্যুর পদধ্বনি - এই প্রসঙ্গে কবির এই উক্তি।

গ) বর্তমান সমাজের অস্থিরতায় মানুষের জীবন হয়ে উঠেছে পদ্মপাতার টলমল করা এক বিন্দু জলের মত। যে কোন মুহূর্তে তা গড়িয়ে পড়তে পারে। বিশ্বব্যাপী যে মরণযজ্ঞ চলছে, তা থেকে শিশুরাও রেহায় পাচ্ছেনা। প্রতিটি মানুষের জীবন আজ চরম সংকটে আবর্তিত হচ্ছে। এ অবস্থায় বেঁচে থাকা যেন মৃত্যুর মতই যন্ত্রণাদায়ক।

**৩) “আমাদের পথ নেই কোন” - ক) কার কোন কবিতার অন্তর্গত? খ) কোন প্রসঙ্গে কবির এই উক্তি? গ) উক্তিটির অর্থ পরিস্ফুট কর।**

উত্তর: ক) আলোচ্য অংশটি কবি শঙ্খ ঘোষের আয় আরো বেঁধে বেঁধে থাকি কবিতার অন্তর্গত।

খ) বিশ্বব্যাপী এক চরম অস্থিরতার যুগ চলছে। কোথাও শান্তি নেই। আদর্শবাদের ভাঙ্গন স্পষ্ট থেকে স্পষ্টতর হচ্ছে - মানুষের চেতনা কোন পথে যাবে তা বোঝা যাচ্ছে না - এই প্রসঙ্গে কবির এই উক্তি।

গ) মানুষের জীবনের প্রতিটি পদক্ষেপে মৃত্যুর ফাঁদ পাতা। সবদিকেই জীবনহানির আশঙ্কা। তাই মানুষ প্রকৃত পথ খুঁজে পাচ্ছে না। কোন পথ ধরে কোন পথে গেলে সব অন্ধকার দূর হয়ে আলোর অভিসার ঘটবে - মানুষ তা বুঝে উঠতে পারছেনা। জীবনে চলার পথ প্রতিমুহূর্তে মরীচিকা হয়ে মানুষকে প্রতারিত করছে।

**৪) “আমাদের ডান পাশে ধ্বস**

**আমাদের বাঁয়ে গিরিখাদ” - ক) কার কোন কবিতার অন্তর্গত? খ) আমাদের বলতে কাদের বোঝানো হয়েছে? গ) আলোচ্য মন্তব্যের তাৎপর্য বিশ্লেষণ করো?**

উত্তর: ক) আলোচ্য অংশটি কবি শঙ্খ ঘোষের “আয় আরো বেঁধে বেঁধে থাকি” কবিতা থেকে চায়ন করা হয়েছে?

খ) আলোচ্য অংশে 'আমাদের' বলতে সমাজের তথাকথিত সাধারণ মানুষদের বোঝানো হয়েছে, যারা সর্বতোভাবে বঞ্চিত, লাঞ্চিত, নিপীড়িত।

গ) এক অস্থির সময়ে দাঁড়িয়ে কবি মানুষের বিপন্নতাকে ছোঁয়ার চেষ্টা করেছেন। বিংশ শতাব্দীর মাঝামাঝি সময়ে বিশ্বব্যাপি অনিবার্য রাষ্ট্রীয় সংকট ঘনীভূত হচ্ছিল। সমাজ ও রাষ্ট্রব্যবস্থায় নানা সংকট প্রকটিত হচ্ছিল। একুশ শতকের সূচনায় সেই সংকট আরো তীব্র আকার ধারণ করে। মধ্যযুগীয় বর্বরতা, ধর্মান্ধতা, হিমালীর বাঁধ চলার পথকে বারবার রুদ্ধ করেছে। ধর্মের দোহাই দিয়ে মানুষ মানুষের বিভাজন তৈরি করেছে স্বার্থান্বেষী মানুষের দল। সাম্প্রদায়িক দাঙ্গা হাঙ্গামায় বলি হচ্ছে সাধারণ মানুষ। সব মিলিয়ে মৃত্যুমিছিলে পূর্ণ হচ্ছে পৃথিবী। অস্তিত্ব সংকটে ভুগছে সাধারণ মানুষ। এই অবস্থায় প্রয়োজন ছিল আদর্শবাদের প্রতিষ্ঠা - যে পথে এগিয়ে নিয়ে যেতে পারবে সমাজের সাধারণ মানুষকে। কিন্তু দুর্ভাগ্যবশত সেখানেও কোন কবি দেখতে পাচ্ছেন না। কিন্তু দিশাহীন রাজনীতি ও রাষ্ট্রনীতি থেকে কবি কোন আলো খুঁজে পাচ্ছেন না যা সুনির্দিষ্ট একটি পথ দেখাতে পারে।

**৫) আমাদের ইতিহাস নেই কার কোন কবিতার অন্তর্গত? খ) আলোচ্য অংশটির বক্তাকে? গ) আমাদের ইতিহাস নেই কেন?**

উত্তর: ক) আলোচ্য অংশটি কবি শঙ্খ ঘোষের আয় আরো বেঁধে বেঁধে থাকি কবিতার অন্তর্গত।

খ) আলোচ্য অংশটির বক্তা কবি শঙ্খ ঘোষ নিজেই।

গ) ইতিহাস মানে শুধুমাত্র রাজা রাজ-রাজাদের যুদ্ধবিগ্রহ নয়। ইতিহাস মানে কোন জাতির আত্মবিকাশের কর্ম পর্যায় কাহিনী নয়। ইতিহাস মানে ঐতিহ্যের বিস্তার, ইতিহাস মানে সুদূর ভবিষ্যতের ইঙ্গিত।

কিন্তু দুৰ্ভাগ্যের বিষয় এই যে আমরা আমাদের প্রকৃত ইতিহাস থেকে বঞ্চিত হয়েছি। কবি শঙ্খ ঘোষ আসলে দেশ এবং জাতির শিকড় বিচ্ছিন্নতার দিকেই ইঙ্গিত করেছেন। শুধুমাত্র ইতিহাস না থাকা নয় বিকৃত ও ভ্রান্ত ইতিহাসের মধ্যে পড়ে দিকভ্রান্ত কবি এ কথা বলেছেন। যারাই যখন ঋমতায় এসেছে ইতিহাসকে তারা নিজেদের স্বার্থে পরিচালিত করেছে। তাই মানুষের যথার্থ ইতিহাস কোন মূল্য পায়নি। সেই ইতিহাসে তাই আমরা ভিখারি বারো মাস। এই কারণেই জঘন্য ইতিহাস সাধারণ মানুষকে ভুল পথে পরিচালিত করে। এই প্রথাগত ইতিহাস মানুষকে অন্ধ করে তোলে, নিজস্বতা হীন হয়ে জীবন্মৃত হয়ে বেঁচে থাকতে হয়। তাই শাসকশ্রেণীর চাপিয়ে দেওয়া ইতিহাসকেই নিজেদের ইতিহাস বলে মেনে নিতে হয়।

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**Prabal Sarkar**

# ENGLISH LANGUAGE & LITERATURE-X

## POETRY - DUST OF SNOW BY ROBERT FROST

-NORBERT JAMATIA

1. What is a dust of snow? What does the poet say has changed his mood? How has the poet's mood changed?

Ans- The dust of snow means the fine particles of snow.

The sudden shower in the form of the dust of snow changed the poet's mood.

The poet's mood changed from the state of sadness to happiness. He felt refresh and wanted to enjoy the rest of the day.

2. How does Frost present nature in this poem?

Ans- Frost is often called the poet of nature. Unlike wordsworth he does not glorify nature but takes on an objective view. He describes the positive and negative aspects of nature. In this poem Dust of snow Frost presents a positive view of nature. His depressed and sad mood is changed in a happy one when a simple event happened with him. A crow shook down the dust of snow on him and changed his mood.

3. What does the poet Robert Frost want to convey through the poem Dust of snow?

Ans- Through the poem Dust of snow Robert Frost wants to convey a message that even little things can bring huge changes in our lives. An ordinary event also holds a capacity to bring about a major change in our mood.

Also joys and sorrow always go hand in hand and we must never lose hope . In addition, the poet through the poem highlight the healing nature of the natural world.

4. How has the poet observed nature in the poem Dust of snow ?

Ans- The poet observed that nature has a healing power. Robert Frost is a nature lover. The crow and the hemlock tree are associated with bad omens or death and fear. But Frost has presented them very beautifully.

They bring cheer to him and are a source of joy. Through his poem he conveys that everything around us in nature is beautiful.

5. Comment on use of symbols in this poem. What is the purpose to use those symbols?

Ans- In the poem Dust of snow the poet has introduced three symbols i. e., the hemlock tree that crow and the dust of snow. Hemlock is a tree that contains poison so the hemlock tree is a symbol of death. Second the crow is considered to be the ugliest bird and is associated with bad omen. Another symbol dust of snow indicates natural joy and energy.

The poet uses two negative symbols to represent the negative aspect of mind. The falling of snow by the crow certainly improves his mood. Perhaps the poet is saying that even something that we generally associate with negativity can have a positive impact. So we can say that Frost use of symbols is very profound and meaningful.

6. Small things in life make significant changes in our life. Elaborate with reference to the poem Dust of snow.



**Ans-** It is truly said that little things in life can make huge changes in our life. Even the small incidents can have a huge impact in our lives. The poem Dust of snow beautifully states this fact. In the poem the poet's mood is transformed because of small event. While he was passing by the hemlock tree, the dust of snow falls on him. such an insignificant event changes his sad and depressed mood into a joyous one.

Just like the simple movement of the crow, the simple things that we do for others can make all the difference. Our random acts of kindness can brighten a person's day and sometimes change their future. Just like the poet who had wasted some part of the day in his sorrows, is enlightened by the event we also make our as well as others life happier. Noticing and appreciating the things of less importance can cause us to have a spirit that is willing to change and therefore succeed.

ENGLISH LITERATURE

# NATIONALISM IN EUROPE

SET- II

- NORBERT JAMATIA

1. What was the objective of Vienna?

Ans- The objective of Vienna were as follows :

- 1) To undo most of the changes that had come in Europe during the Napoleonic wars.
- 2) To Restore the power of the Bourbon dynasty.
- 3) A series of state were formed to prevent the expansion of France.

2. Why was the Napoleonic rule over other regions unpopular with some sections of Europe ?

Ans- Reasons of unpopular Napoleonic rule over other regions were —

- 1) Administrative reforms did not hand in- hand with political freedom. The newly annexed regions found themselves under the French rule.
- 2) The newly acquired territories had to face increased taxation and censorship.
- 3) The forced construction into French army to conquer other parts of Europe was not popular with the newly conquered people.

3. How did the Treaty of Vienna change the Map of Europe ?

Or How did the conservatives Establish their power after 1815 ?

Ans;-

- 1) The conservatives believed in modern army, an efficient bureaucracy and a dynamic economy.
- 2) In 1815 the European powers i. e. Britain , Russian , Prussian , and Austria , defeated Napoleon at Vienna (Austria) to draw up settlement of Europe.
- 3) The conference was hosted by Austrian chancellor Duke Metternich.
- 4) The treaty of Vienna of 1815 was signed to undo most changes that came about during Napoleonic war.
- 5) The deposed Bourbon dynasty was restored to power.
- 6) France lost its territories annexed under Napoleon.
- 7) To prevent further expansion a series of states were set up on the boundaries of France.
- 8) Kingdom of Netherlands, including Belgium was set up on the boundaries of France.
- 9) Genoa was added to piedmont(Italy) in south.

4. Who said when France sneezes the rest of Europe catches cold ?

Ans- Metternich

5. How did the Greek war of independence mobilize nationalist feelings among the educated elite across Europe ?

Ans-

- 1) Greece had been a part of the ottoman empire since 15<sup>th</sup> century.
- 2) The growth of revolution started in 1821.
- 3) The nationalist of Greeks got support from other Greeks living in other parts of Europe.
- 4) Poets and artist also support the nationalist and promote their ideas.
- 5) Finally the treaty of Constantinople of 1832 recognised Greece as an independent nation.

6. Write a short note on Frankfurt parliament.

Ans-

- 1) It is the name of the German National Assembly founded during the Revolution of 1848. It tried to unite Germany in a democratic way.
- 2) It constituted 831 elected members. It largely represented liberal middle class interests and it was convened in the church of St. Pauls in Frankfurt on 18<sup>th</sup> May 1848.
- 3) The Assembly drafted a constitution making Germany a constitutional monarchy.
- 4) The king of Prussia – Friedrich Wilhelm- IV rejected the Frankfurt parliament deputies offer of the crown. He joined other monarch to oppose the elected Assembly.
- 5) Though the Frankfurt parliament failed to achieve its purpose, but the important consequence was henceforth Prussia took on the leadership of the movement for national unification of Germany.

7. Who were Marianne and Germania? what was the importance of the way they were portrayed.

Ans- Marianne and Germania were female allegories invented by artists in the nineteenth century in France and Germany respectively to represent the abstract idea of the nation in concrete form. This was a way to personify a nation.

Marianne : Female figure in France was christened Marianne as a popular name. The underlying idea behind portraying Marianne with symbol of liberty and republic was to represent the French nation as people's nation. Statues of Marianne were erected in public places to remind the public of the national symbol of unity and to persuade them to identify with it. Marianne images were also marked on coins and stamps.

Germania : Germania was an allegory of the German nation. Germania of Germany was depicted by the artist Philip Veit in 1848. She was represented standing against a background where beams of sunlight shine through the national tricolor flag; wearing a crown of oak leaves and holding an unsheathed sword in her hand. The underlying idea was to symbolize the Germans as heroic.

8. What changes did Napoleon introduce to make the administrative system more efficient in the territories ruled by him?

Ans- Napoleon was a dictator and though a return to monarchy had destroyed democracy in France but the administrative system introduced by him in the territories ruled by France, made the system more rational and efficient. The Napoleonic code of 1804 was a major step in establishing the rule of law. This code was imposed in all regions under French control.

- 1) Napoleon reformed the French legal system and simplified the administrative divisions.
- 2) All privileges based on birth were taken away. Equality before law was established and right to property was secured.
- 3) In countries like the Dutch republic, Switzerland, Italy and Germany, feudal system was abolished and peasants freed from serfdom and manorial dues.
- 4) In towns, guild restrictions were removed.

SOCIAL SCIENCE

# NATIONALISM IN EUROPE

SET - 1

-NORBERT JAMATIA

1. Who was Frederic sorrieu?

Ans- Frederic sorrieu was a French artist who prepared a series of four prints in 1848 visualising his dream of a world made up of democratic and social Republics.

2. What is the idea behind Frederic sorrieu's painting?

Or

How did Frederic sorrieu visualize his dream of a world made up of democratic and social republic ?

Ans- a) The French artist Frederic Sorrieu visualized his dream of a world made up of democratic and social republic.

b) The first print of series shows the people of Europe and America, marching in a long train and offering homage to the statue of liberty as they pass by.

c) The people of the world are grouped as distinct nation, identified through their flags and national costume.

d) The procession was led by the United States and Switzerland which had become nation state at that time.

3. How did the French artist personify liberty ?

Ans- The French artist personified liberty as a female figure. The statue of Liberty having torch of enlightenment in one hand and charter of Rights of Man in the other hand.

4. What was the mission of French revolutionaries?

Ans- To liberate the people of Europe from despotism and to help other people of Europe to become nations.

5. What did the French revolutionaries aim for?

Ans- the French revolutionaries aimed for :

a) Creating a sense of collective responsibility

b) Establishing republic

c) Equal rights for all.

6. Which new name was given to 'The Estate General'?

Ans- 'The Estate General' was elected by the body of active citizens and renamed it as the National Assembly.

7. Who were the members of Jacobin club?

Ans- Students and Educated middle class people were the members of Jacobin club.

8. Which flag was chosen to unify a sense of collective identity ?

Ans- A New French flag, the tricolor was chosen to replace the former royal standard.

9. In which battle was Napoleon defeated in 1813?

Ans- The battle of Leipzig in 1813

10. Give reasons why the people in the conquered territories became hostile to the Napoleon's rule?

Ans- The people in the conquered became hostile to the Napoleon's rule because of

- a) Increased taxation
- b) Censorship
- c) Forced recruitment into the French armies.

11. What did Liberalism stands for new middle classes? How did liberalism stand in the economic sphere?

Ans- It meant freedom for the individual and equality of all before the law. It stood for the freedom of markets and the abolition of state imposed restrictions on the movement of goods and capital.

12. What major changes occurred in Europe due to French revolution ?

Ans- It was the first clear expression of nationalism. It led to the transfer of sovereignty from monarchy to a body of French citizen. The revolution proclaimed that the people make the nation and shape its identity.

13. What changes did Napoleon introduce to make the administration system more efficient? Or Explain any four provision of the Napoleonic code of 1804.

Or Explain any five social and administrative reform introduced by Napoleon in the region under his control?

Ans- The main features of Napoleonic code were as follows:

- i) He established equality before the law and introduced the right to property.
- ii) He abolished the feudal system and freed peasant from serfdom and manorial dues.
- iii) He removed guild restriction in the towns.
- iv) He improved the system of transport and communications.
- v) He introduced uniform laws, standardized weights and measures and a common national currency.

Other questions will continue in set- II .....

**CBSE Class 10 Science**  
**Revision Notes**  
**CHAPTER – 10**  
**LIGHT REFLECTION & REFRACTION**

Light is a form of energy, which gives us the power of vision.

In this chapter we will study the phenomena of reflection and refraction using the property of light i.e. straight line propagation (Light wave travel from one point to another, along a straight line).

Ray of light : It is a line in the direction of movement of light.

Beam of light : It is bunch of rays of light.

Parallel beam : All the rays are parallel.

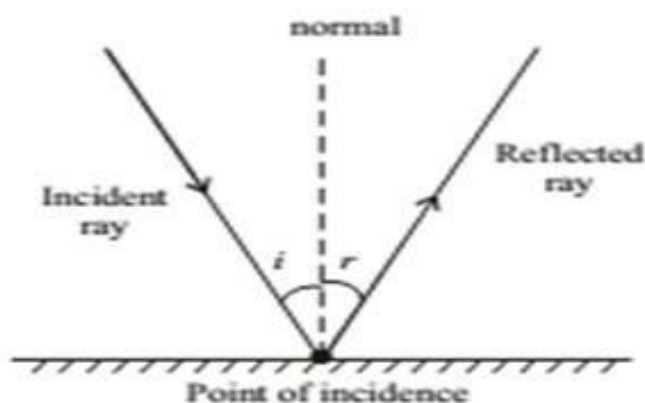
### Reflection of Light

When the light is allowed to fall on highly polished surface, such as mirror, most of the light gets reflected.

### Laws of Reflection

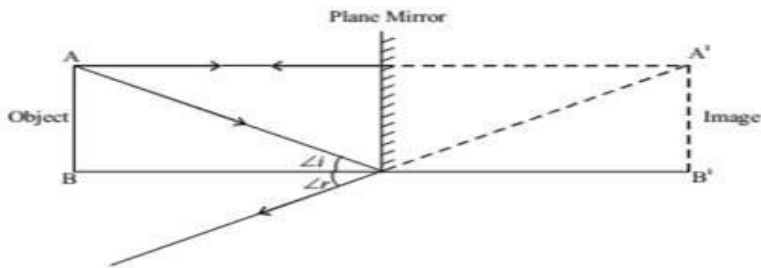
1. The angle of incidence is always equal to angle of reflection.

$$\angle i = \angle r$$



2. The incident ray, reflected ray and the normal to the reflecting surface at the point of incidence lie in the same plane.

### Image formed by Plane Mirror (Plane reflecting surface)

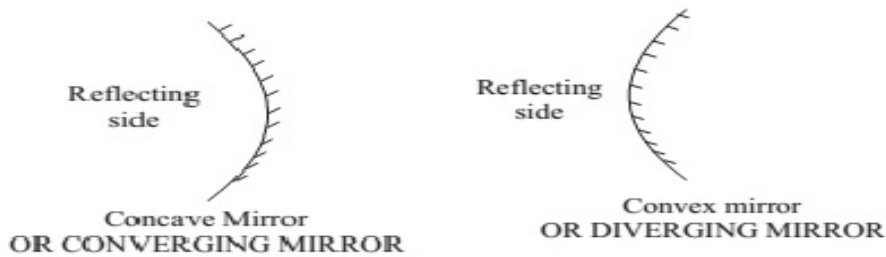


1. Virtual (imaginary) & Erect : The image that do not form on screen.  
Real images can be recorded on the screen.
2. Laterally inverted (The left side of object appear on right side of image)
3. The size of image is equal to that of object.
4. The image formed is as far behind the mirror as the object is in front of it.

### Reflection of light by spherical Mirrors

Mirrors, whose reflecting surface are curved inward or outward spherically are called spherical mirror.

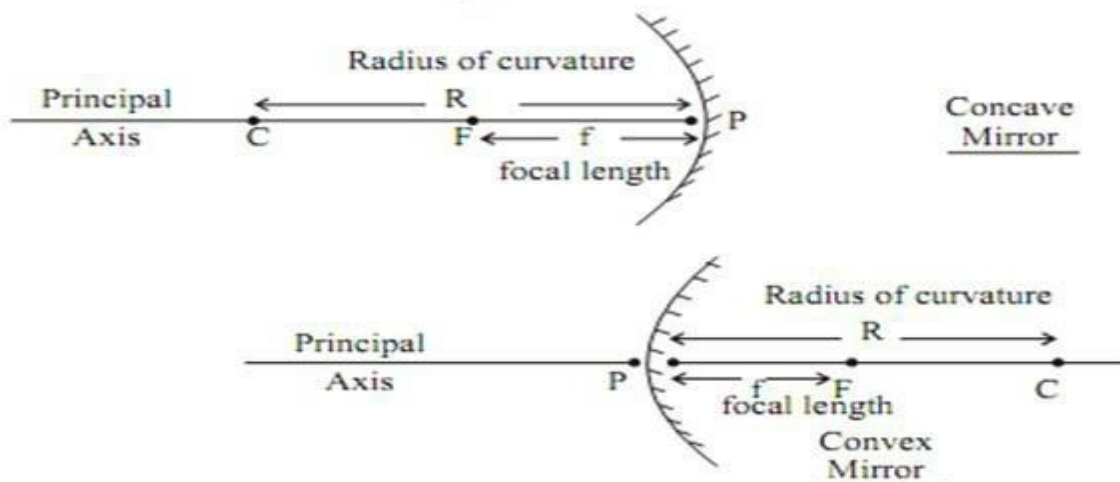
For example - Spoon → The curved surface of shinning spoon can be considered as curved mirror.



If it is curved inward → Act as concave mirror

If it is curved outward → Act as a convex mirror.

### Few Basic terms related to Spherial Mirror



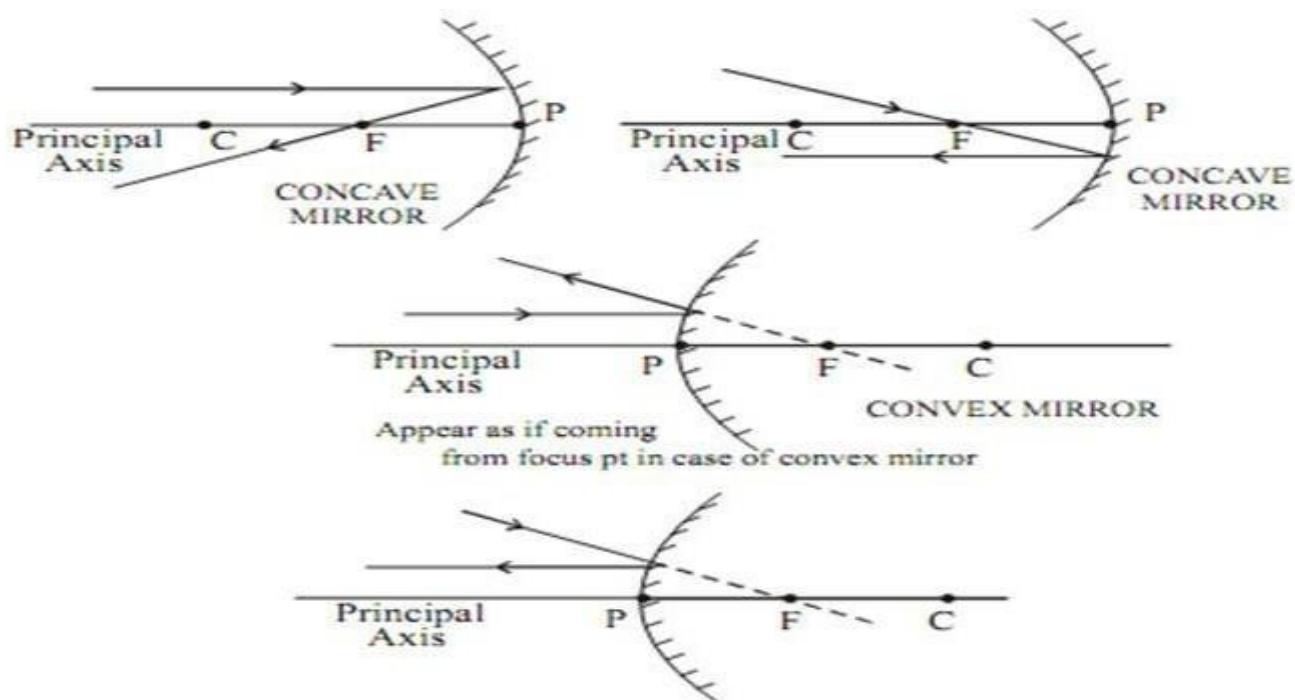


1. **Principal axis** : Line joining the pole and centre of curvature of the spherical mirror.
2. **Pole** : The geometrical central point of the reflecting spherical surface. (aperture), denoted by (P).
3. **Aperture** : The width of reflecting spherical surface.
4. **Centre of curvature** : The centre of the hollow glass sphere of which the spherical mirror is a part is called as centre of curvature.
5. **Radius of curvature** : The distance between the pole and the centre of curvature. i.e.  $PC = R$  or The radius of the hollow sphere of which the mirror is a part.
6. **Focus point** : The point on the principal axis, where all parallel rays meet after reflection is called as Principal Focus or Focus. It is denoted by letter 'F'.
7. **Focal length** : The distance between the pole and focus point i.e.  $PF = f$
8. Relationship between focal length and Radius of curvature.  $F = \frac{R}{2}$

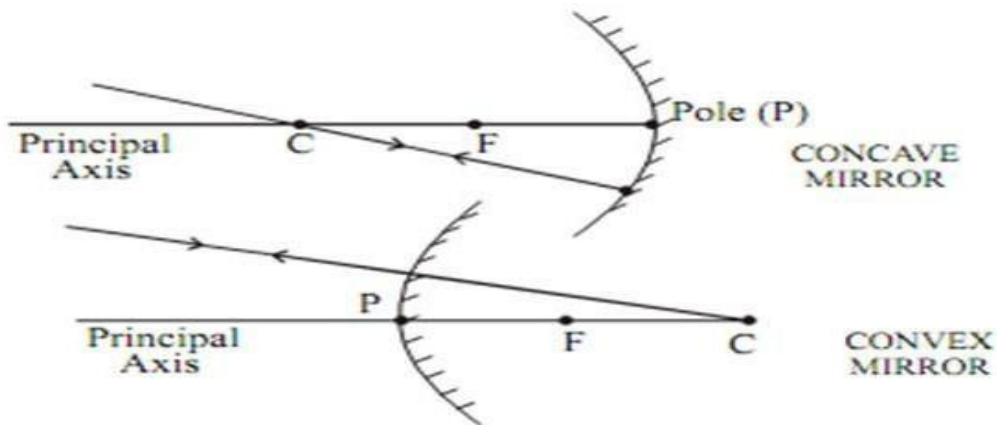
### Image Formation by Spherical Mirror

Before we learn the formation of image or ray diagram, let us go through few tips

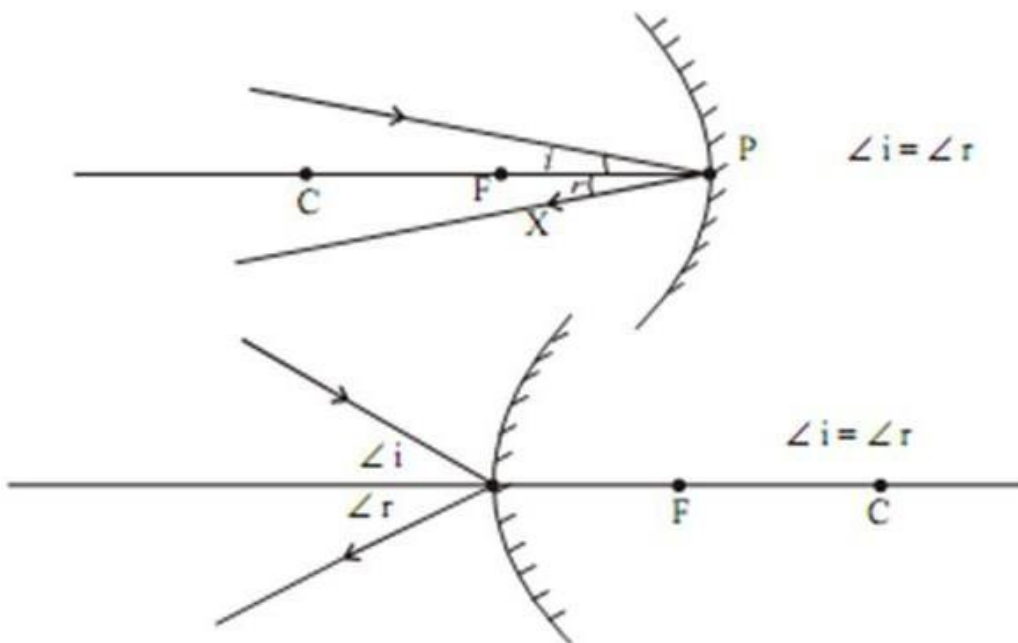
(a) Remember, a ray of light which is parallel to principle axis always pass through focus (meet at focus) or **vice-versa**.



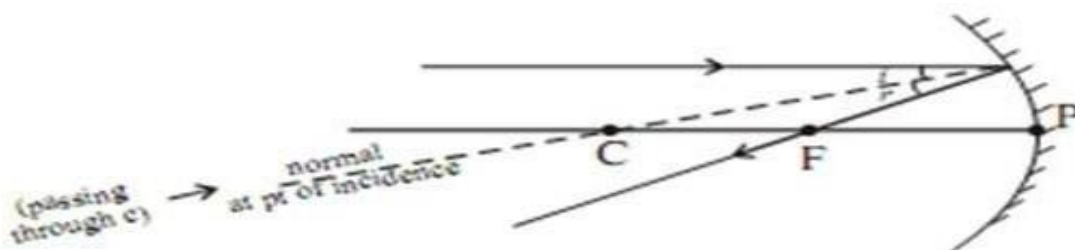
(b) A ray of light which passes through centre of curvature (it is also known as normal at the point of incidence on spherical mirror) will retrace their path after reflection.

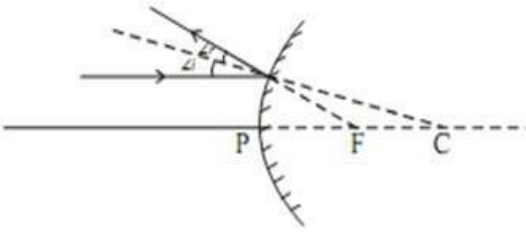


(c) A ray of light falling on pole get reflected at the same angle on the other side of principal axis.



**Note :** A ray of light passes through centre of curvature of reflecting spherical surface always act as normal at the point of incidence. If we know the normal we can draw angle of incidence and angle of reflection



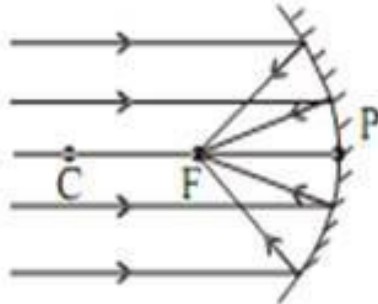


**Note 1 :** The image will only form when two or more rays meet at a point. Image formation by a concave mirror for different position of the object.

The ray diagrams given in NCERT Books are also good to be followed.

### Image Formation by Concave Mirror

1. Object  
At infinity

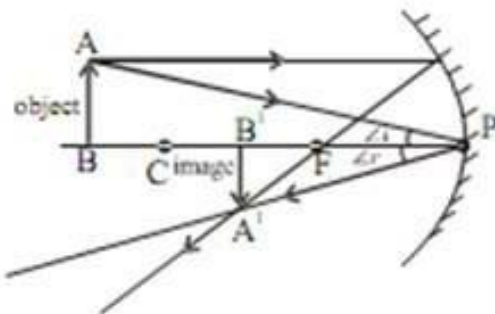


Position of Image  
At focus

Nature  
Real and  
Inverted

Size of Image  
Highly diminished  
(point size)

2. Object  
Beyond C

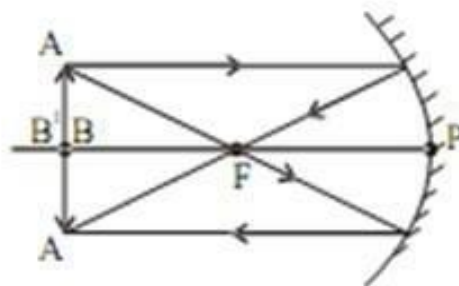


Position of Image  
Between F & C

Nature  
Real and  
Inverted

Size of Image  
Small

3. Object  
At C

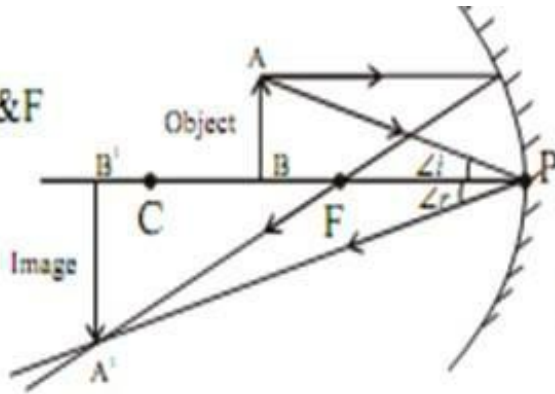


Position of Image  
At C

Nature  
Real and  
Inverted

Size of Image  
Same Size  
of object

4. Object  
Between C&F



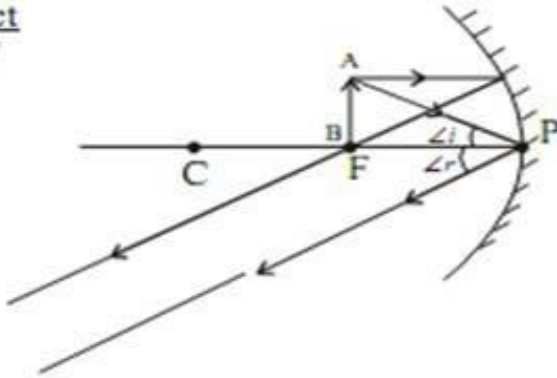
$$\angle i = \angle r$$

Position of Image  
Beyond C

Nature  
Real and Inverted

Size of Image  
Enlarged

5. Object  
At F



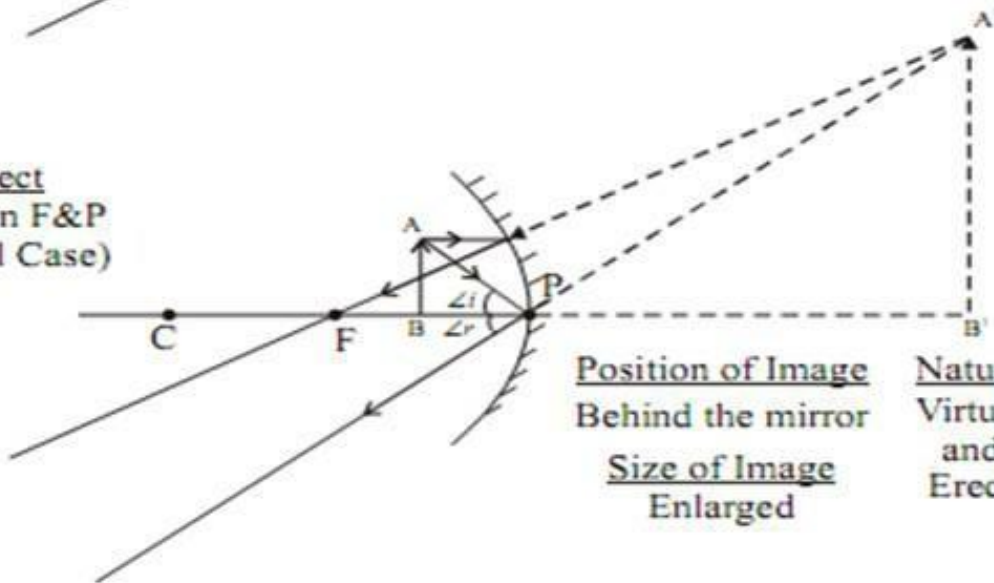
$$\angle i = \angle r$$

Position of Image  
At (infinity)

Nature  
Real and Inverted

Size of Image  
Highly enlarged

6. Object  
Between F&P  
(Special Case)

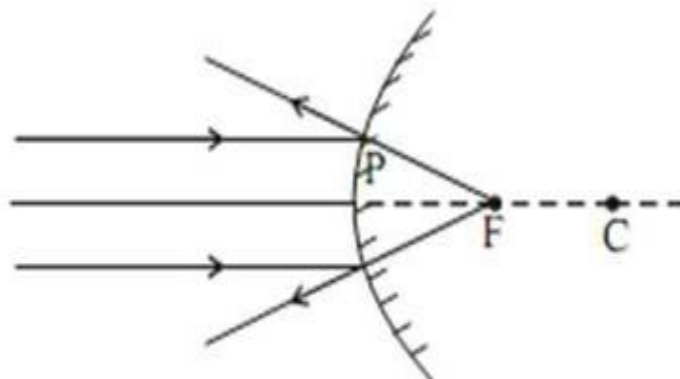


Position of Image  
Behind the mirror  
Size of Image  
Enlarged

Nature  
Virtual and Erect

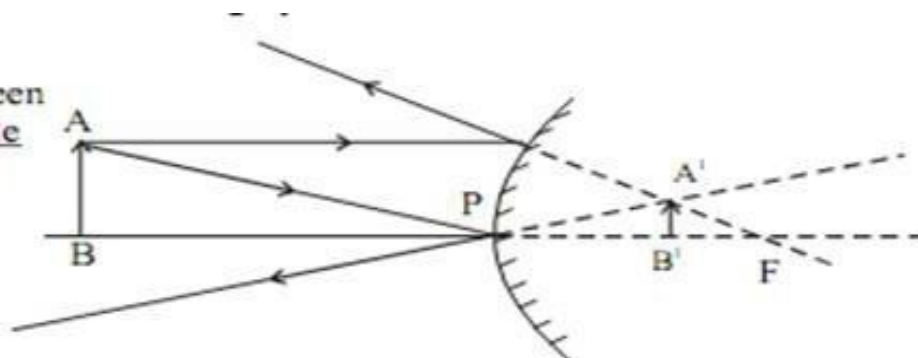
### Image formation by Convex Mirror

1. Object  
At infinity



<u>Position of Image</u>	<u>Size of Image</u>	<u>Nature</u>
At focus	Highly diminished	Virtual & erect

2. **Object**  
Anywhere between  
infinity and pole  
of the mirror



<u>Position of Image</u>	<u>Size of Image</u>	<u>Nature</u>
Between P & F	Very small	Virtual & erect

### Uses of Concave Mirror

1. Used in torches, search light and headlight of vehicle.
2. Used to see large image of face as shaving mirror
3. Used by dentist to see large images of the teeth
4. Large concave mirror used to focus sunlight (heat) in solar furnaces.

### Uses of Convex Mirror

Used as rear-view mirror in vehicles because it gives erect image. It also helps the driver to view large area.

### Sign Convention for Reflection by Spherical Mirror

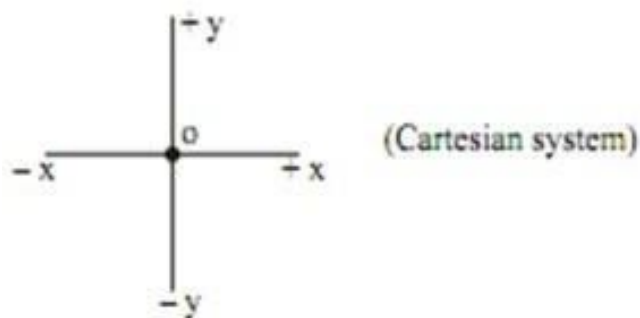
1. The object is always placed to the left side of mirror.
2. All distance should be measured from pole (P); parallel to principal axis.
3. Take 'P' as origin. Distances measured

Right of the origin (+x-Axis) are **taken positive**

Left of the origin (-x-Axis) are **taken negative**

Perpendicular to and above principal axis (+y-Axis) are **taken positive**

Perpendicular to and below principal axis (-y-Axis) are **taken negative**



### Mirror Formula

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$f \rightarrow$  distance between F and Pole

$v \rightarrow$  distance of image from Pole

$u \rightarrow$  distance of object from Pole

$R \rightarrow$  distance between centre of curvature and pole.

Where  $f = \frac{R}{2}$

### Magnification

It is expressed as the ratio of the height of the image to height of the object.

$$m = \frac{\text{height of image}}{\text{height of object}} = \frac{h^1}{h} \quad \text{--- (1)}$$

$$m = \frac{-v}{u} \quad \text{--- (2)}$$

$\therefore$  From 1 and 2 equation

$$m = \frac{h^1}{h} = \frac{-v}{u} \quad \text{When } h^1 \rightarrow \text{image height from principle axis.}$$

$h^1 \rightarrow$  Object height from principle axis

If magnification	$m > 1$	_____	Image is magnified
	$m = 1$	_____	Image is of same size
	$m < 1$	_____	Image is diminished.

Few tips to remember sign convention for Spherical mirror



	f	u	v
CONCAVE	-ve(real)	-ve(real)	-ve(real) +ve(virtual)
CONVEX	+ve	+ve	+ve

h – is always +ve

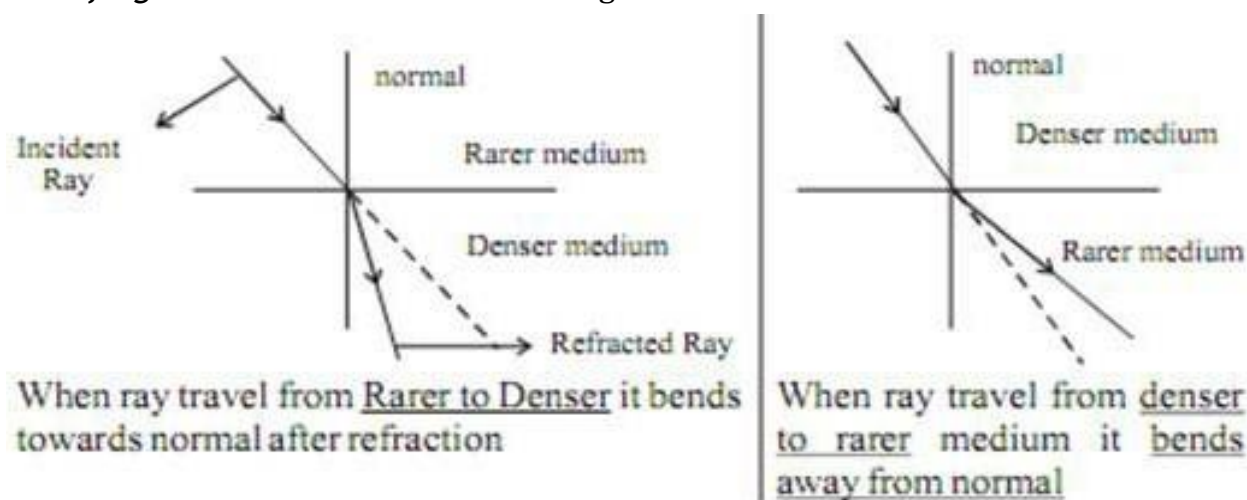
h' – is +ve for virtual , -ve for Real.

## Refraction of Light

**Refraction of Light :** Happens in Transparent medium when a light travels from one medium to another, refraction takes place.

A ray of light bends as it moves from one medium to another Refraction is due to change in the speed of light as it enters from one transparent medium to another.

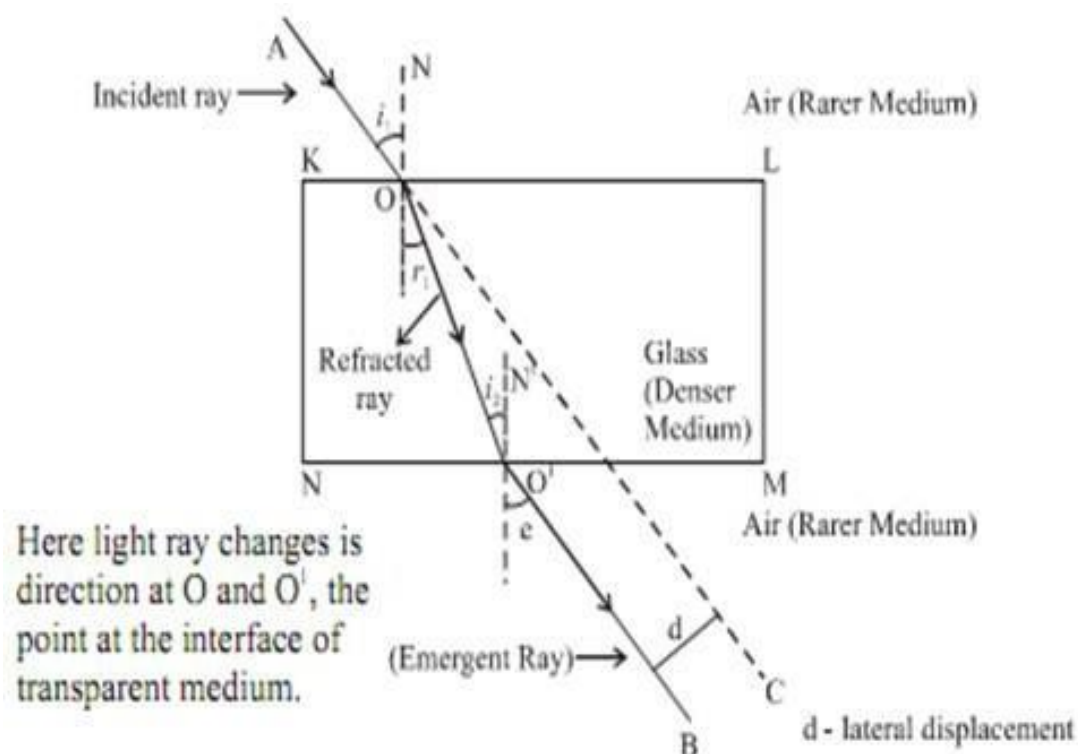
*Speed of light decreases* as the beam of light travel from rarer medium to the denser medium.



## Some Commonly observed phenomenon due to Refraction

- Your eyes.
- Rainbows.
- Light bending in a glass of water.
- Glasses.
- Camera lenses.
- Object dislocation in water.
- Binoculars..

## Refraction through a Rectangular Glass Slab



When an incident ray of light AO passes from a rarer medium (air) to a denser medium (glass) at point O on interface KL, it bends towards the normal. At point O', on interface NM, the light ray enters from the denser medium (glass) to the rarer medium (air); here the light ray bends away from the normal. OO' is a refracted ray, O'B is an emergent ray. If the incident ray is extended to C, we will observe that the emergent ray O'B is parallel to the incident ray. The ray will be slightly displaced laterally after refraction.

**Note :** When a ray of light is incident normally to the interface of two media, it will go straight, without any deviation.

### Laws of Refraction of Light

The incident ray, the refracted ray, and the normal to the interface of two transparent media at the point of incidence, all lie in the same plane.

- The ratio of the sine of the angle of incidence to the sine of the angle of refraction is a constant

i.e.

$$\frac{\sin i}{\sin r} = \text{constant } (r)$$

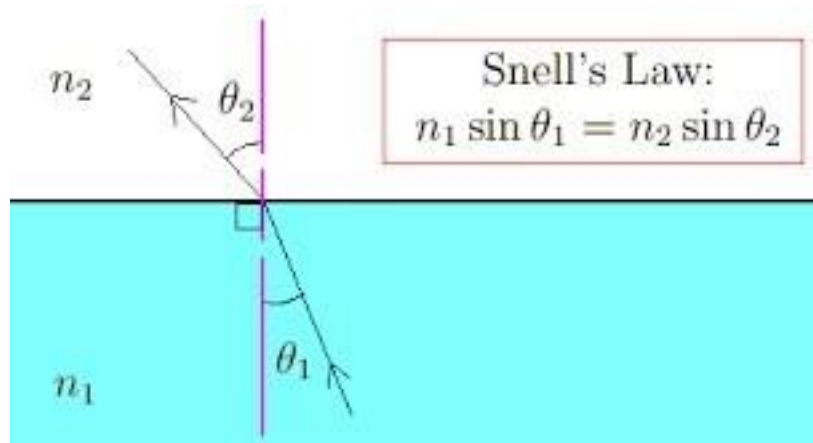


For given colour and pair of media, this law is also known as Snell's Law

**Constant  $n$**  is the refractive index for a given pair of medium. It is the refractive index of the second medium with respect to first medium.

$$\frac{\sin i}{\sin r} = \frac{n_2}{n_1} = n_{21}$$

Where 2 is for second medium and 1 is for first medium



### Refractive Index

The refractive index of glass with respect to air is given by ratio of speed of light in air to the speed of light in glass.

$$n_{ga} = \frac{\text{speed of light of air}}{\text{speed of light in glass}} = \frac{c}{v}$$

$c \rightarrow$  Speed of light in vacuum =  $3 \times 10^8 \text{ m/s}$  speed of light in air is marginally less, compared to that in vacuum.

Refractive index of air with respect to glass is given by

$$\left( \begin{array}{l} a \rightarrow \text{air} \\ g \rightarrow \text{glass} \end{array} \right) n_{ag} = \frac{\text{Speed of light in glass}}{\text{Speed of light in air}} = \frac{v}{c}$$

Refractive index of water ( $n_w$ ) = 1.33

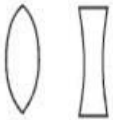
Refractive index of water ( $n_g$ ) = 1.52

### Spherical Lens

A transparent material bound by two surfaces, of which one or both surfaces are spherical, forms a lens.

**Convex lens Concave lens**

- 1. Bulging outwards 1. Bulging inwards.
- 2. Converging lens. 2. Diverging lens.



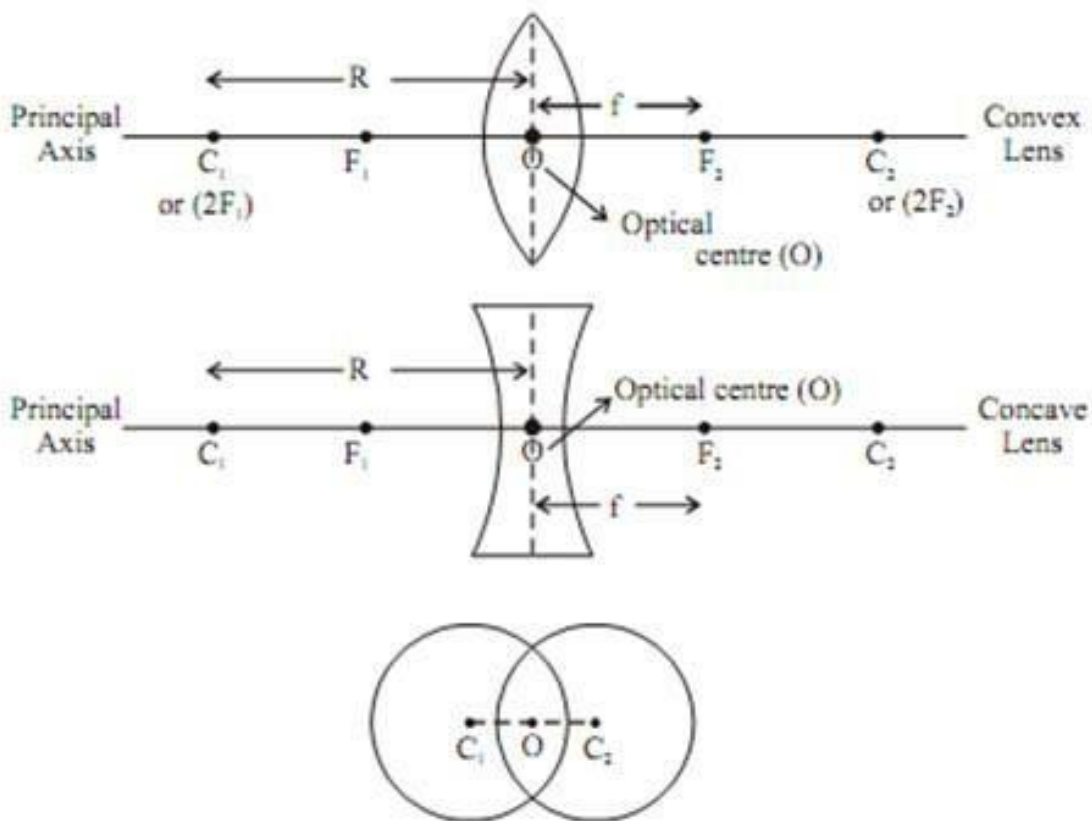
**Concave Lens**

A lens bounded by two spherical surfaces, curved inwards is known as double concave lens (or simply concave lens)

It is also known as diverging lens because it diverges the light.

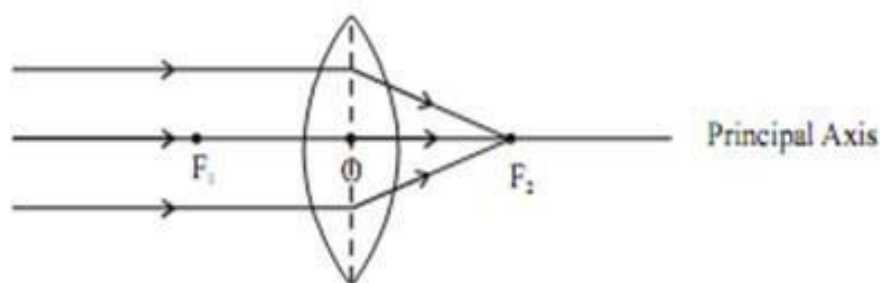


**Few Basic Terms Related to Spherical Lens**

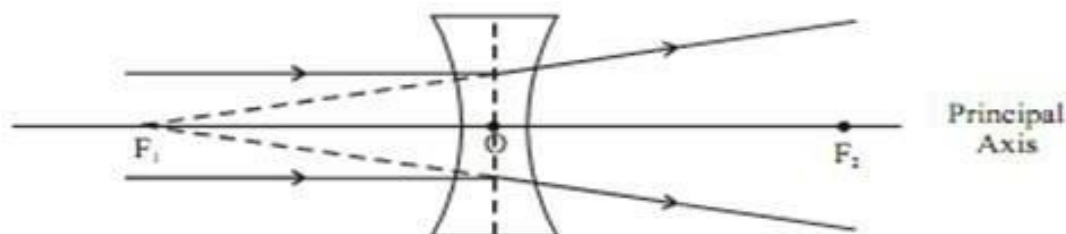


1. **Centre of curvature** : A lens, either a convex lens or a concave lens is combination of two spherical surfaces. Each of these surfaces form a part of sphere. The centre of these two spheres are called centre of curvature represented by C1 and C2.
2. **Principal axis** : Imaginary straight line passing through the two centres of curvature
3. **Optical Centre** : The central point of lens is its optical centre (O). A ray of light, when passes through 'O' it remains undeviated i.e. it goes straight.
4. **Aperture** : The effective diameter of the circular outline of a spherical lens.
5. **Focus of lens** : Beam of light parallel to principal axis, after refraction from

1. **Convex lens**, converge to the point on principal axis, denoted by F, known as Principal focus



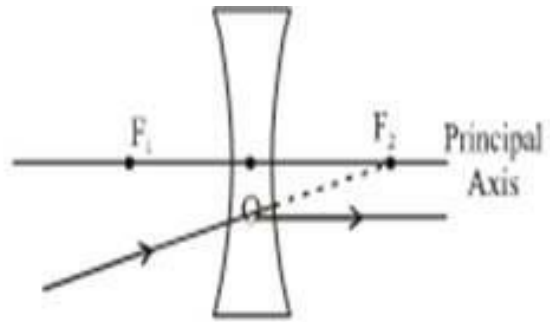
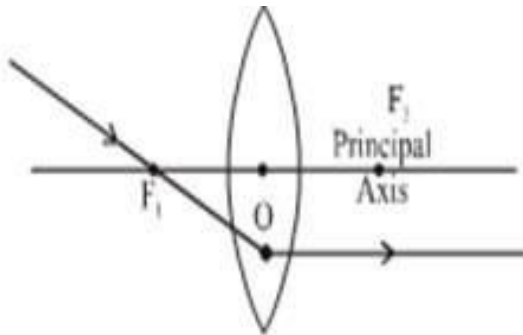
2. **Concave lens**, appear to diverge from a point on the principal axis known as principal focus.



The distance OF<sub>2</sub> and OF<sub>1</sub> is called as focal length

Tips for Drawaomg Ray Diagram

1. After refraction, a ray parallel to principal axis will pass through F.
2. A ray passes through F, after refraction will emerge parallel to principal axis



(c) A ray passes through optical centre 'O', passes without any deviation.

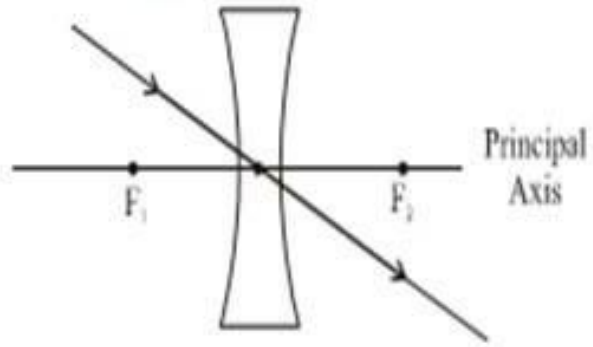
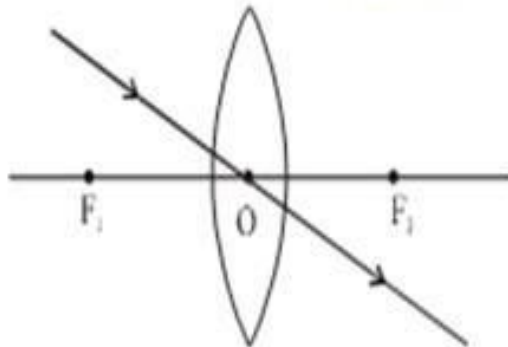
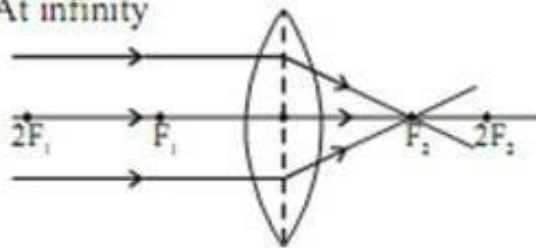


Image formation by a convex lens for various position of object

1. Object  
At infinity



Position of Image

At focus  
 $F_2$

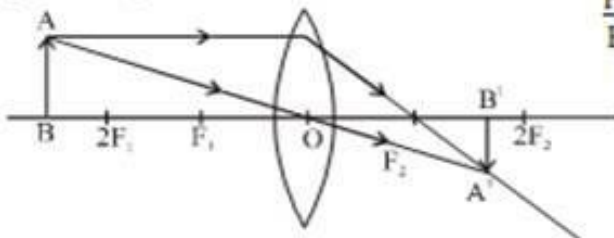
Nature

Real &  
inverted

Size of Image

Highly  
diminished  
(point size)

2. Object  
Beyond  $2F_1$



Position of Image  
Between  $F_2$  &  $2F_2$

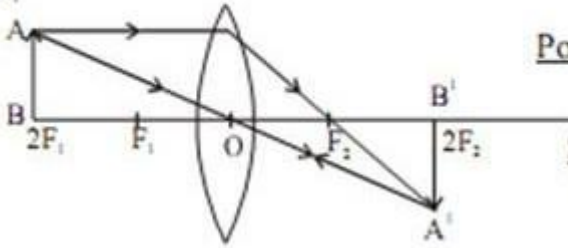
Nature

Real &  
inverted

Size of Image

Small

Object  
At  $2F_1$

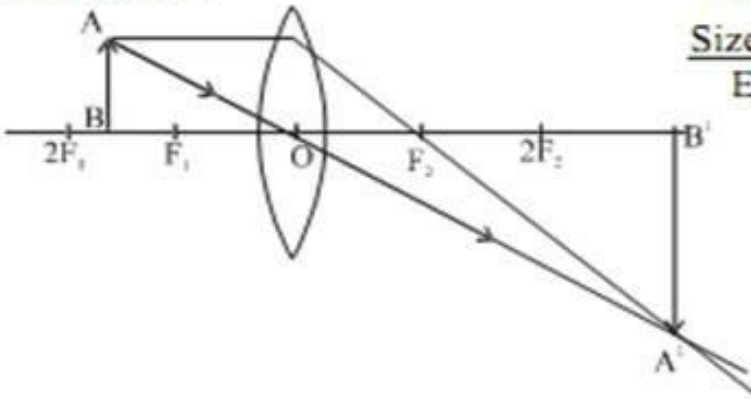


Position of Image  
At  $2F_2$

Nature  
Real &  
inverted

Size of Image  
Same size of  
object

Object  
Between  $F_1$  &  $2F_1$

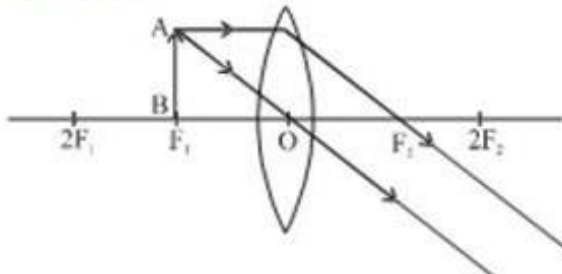


Position of Image  
Beyond  $2F_2$

Nature  
Real &  
inverted

Size of Image  
Enlarged

5. Object  
At focus  $F_1$

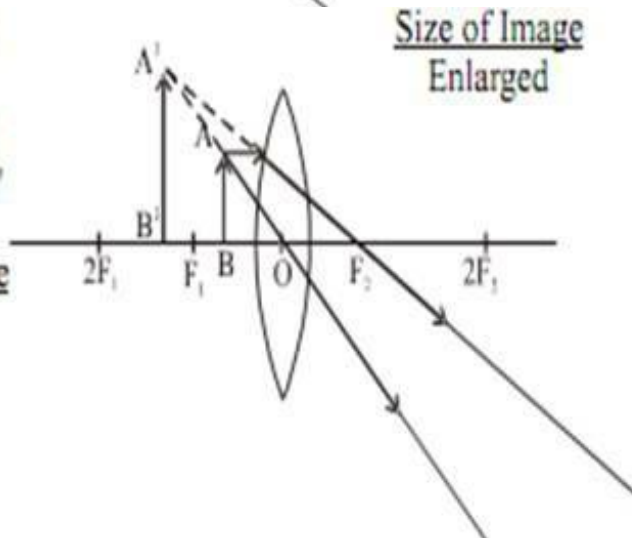


Position of Image  
at infinity

Nature  
Real &  
inverted

Size of Image  
Highly Enlarged

6. (Special Case)  
Object  
Between  $F_1$  and  
optical centre 'O'

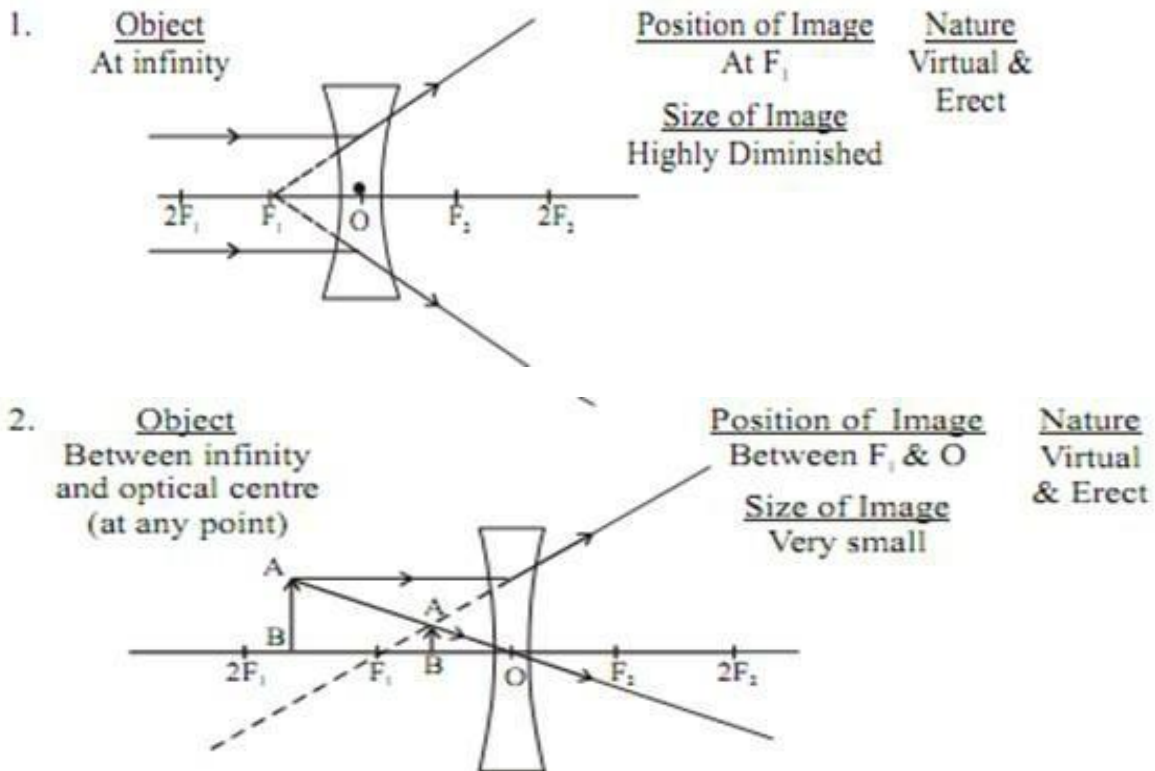


Size of Image  
Enlarged

Nature  
Virtual &  
Erect

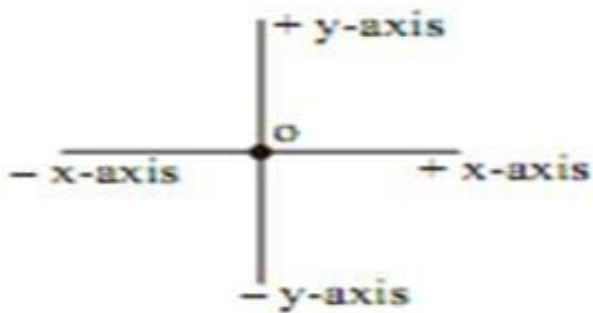
Position of Image  
On the same  
side of the  
object

## Image Formation by Concave Lens



## Sign Convention for Refraction by Spherical Lens

Similar to that of spherical mirror, only the difference is that all the measurement are made from optical centre 'O'



## Lens formula

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

'O' → optical centre

f • distance between F and 'O'

u • distance of object from 'O'

$$f = \frac{R}{2}$$

v • distance of image from 'O'

R • distance between centre of curvature & 'O'

## Magnification

It is defined as the ratio of the height of image to the height of object.

$$m = \frac{\text{height of image}}{\text{height of object}} = \frac{h^1}{h} = (1) \left\} \frac{h_1 - \text{image height from principal axis}}{h - \text{object height from principal axis}}\right.$$

It is also related to 'u' & 'v'

$$m = \frac{v}{u} \quad - (2)$$

From equation (1) & (2)

If magnification

m > 1, then image is magnified

m = 1, image is of same size

m < 1, image is diminished

## Few Tips to Remember Sign Convention for Spherical Lens

	f	u	v
CONCAVE	-ve	-ve	-ve (virtual image always)
CONVEX	+ve	-ve	+ve (real) -ve (virtual)

h is always +ve

h' -ve for Real and +ve for Virtual & Erect.

## Power of Lens

The degree of convergence or divergence of light ray achieved by a lens is known as power of a lens.

It is defined as the reciprocal of its focal length Represented by P.



If  $F$  is given in meter, then

$$P = \frac{1}{f}$$

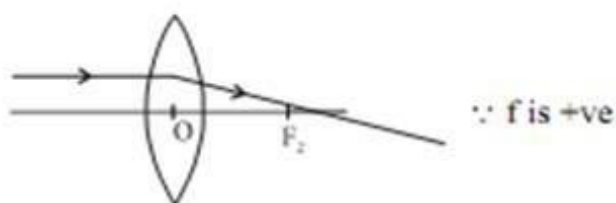
If  $F$  is given in cm, then

$$P = \frac{100}{f}$$

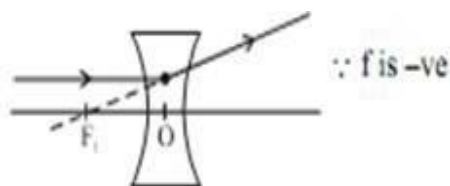
SI unit of power of a lens is “diopter” denoted by ‘D’

1 diopter or 1D  $\rightarrow$  It is the power of lens whose focal length is 1 m

$$1D = \frac{1}{1m} \quad \text{OR} \quad 1D = 1m^{-2}$$



Power of concave lens or diverging lens is always negative



If any optical instrument has many lens, then net power will be

$$P = P_1 + P_2 + P_3 \dots\dots\dots$$

### What you have learnt

- Light seems to travel in straight lines.
- Mirrors and lenses form images of objects. Images can be either real or virtual, depending on the position of the object.
- The reflecting surfaces, of all types, obey the laws of reflection. The refracting surfaces obey the laws of refraction.
- New Cartesian Sign Conventions are followed for spherical mirrors and lenses.
- Mirror formula,  $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$  gives the relationship between the object-distance ( $u$ ), image-distance ( $v$ ), and focal length ( $f$ ) of a spherical mirror.
- The focal length of a spherical mirror is equal to half its radius of curvature.



- The magnification produced by a spherical mirror is the ratio of the height of the image to the height of the object.
- A light ray travelling obliquely from a denser medium to a rarer medium bends away from the normal. A light ray bends towards the normal when it travels obliquely from a rarer to a denser medium.
- Light travels in vacuum with an enormous speed of  $3 \times 10^8 \text{ m s}^{-1}$ . The speed of light is different in different media.
- The refractive index of a transparent medium is the ratio of the speed of light in vacuum to that in the medium.
- In case of a rectangular glass slab, the refraction takes place at both air-glass interface and glass-air interface. The emergent ray is parallel to the direction of incident ray.
- Lens formula,  $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$  gives the relationship between the object-distance (u), image-distance (v), and the focal length (f) of a spherical lens.
- Power of a lens is the reciprocal of its focal length. The SI unit of power of a lens is diopetre.

Trigonometric Ratio full solve- prepared by surendra

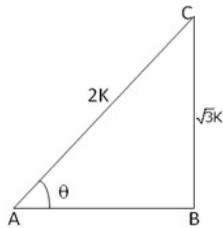
**Question 1.**

**Solution:**

Given:

$$\sin \theta = \frac{\sqrt{3}}{2}$$

Let us draw a  $\Delta ABC$  in which  $\angle B = 90^\circ$  and  $\angle BAC = \theta$



$$\text{Then, } \sin \theta = \frac{BC}{AC} = \frac{\sqrt{3}}{2}$$

Let  $BC = \sqrt{3}k$   
and  $AC = 2k$ ,  
where  $k$  is positive

By pythagoras theorem, we have

$$AC^2 = AB^2 + BC^2$$

$$\Rightarrow AB^2 = AC^2 - BC^2$$

$$AB^2 = \left[ (2k)^2 - (\sqrt{3}k)^2 \right]$$
$$= (4k^2 - 3k^2)$$

$$\Rightarrow AB = \sqrt{k^2} = k$$

$$\therefore \sin \theta = \frac{BC}{AC} = \frac{\sqrt{3}k}{2k} = \frac{\sqrt{3}}{2},$$

$$\cos \theta = \frac{AB}{AC} = \frac{k}{2k} = \frac{1}{2}$$

$$\tan \theta = \frac{\sin \theta}{\cos \theta} = \left( \frac{\sqrt{3}}{2} \times \frac{2}{1} \right) = \sqrt{3};$$

$$\operatorname{cosec} \theta = \frac{1}{\sin \theta} = \frac{2}{\sqrt{3}},$$

$$\sec \theta = \frac{1}{\cos \theta} = \frac{2}{1} = 2 \quad \text{and}$$

$$\cot \theta = \frac{1}{\tan \theta} = \frac{1}{\sqrt{3}}$$

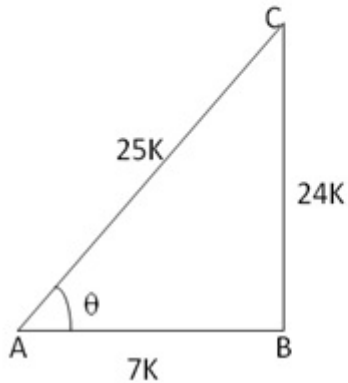
**Question 2.**

**Solution:**

$$\text{Given: } \cos \theta = \frac{7}{25}$$

Let  $AB = 7k$  and  $AC = 25k$ ,  
where  $k$  is positive

Let us draw a  $\triangle ABC$  in which  $\angle B = 90^\circ$  and  $\angle BAC = \theta$



By Pythagoras theorem, we have

$$AC^2 = AB^2 + BC^2$$

$$\Rightarrow BC^2 = AC^2 - AB^2$$

$$\begin{aligned} BC^2 &= [(25k)^2 - (7k)^2] \\ &= (625k^2 - 49k^2) \\ &= 576k^2 \end{aligned}$$

$$\Rightarrow BC = \sqrt{576k^2} = 24k$$

$$\therefore \sin \theta = \frac{BC}{AC} = \frac{24k}{25k} = \frac{24}{25}, \cos \theta = \frac{7}{25} \text{ (given)}$$

$$\tan \theta = \frac{\sin \theta}{\cos \theta} = \left( \frac{24}{25} \times \frac{25}{7} \right) = \frac{24}{7}$$

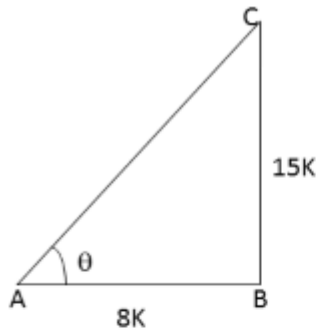
$$\operatorname{cosec} \theta = \frac{1}{\sin \theta} = \frac{25}{24}$$

$$\sec \theta = \frac{1}{\cos \theta} = \frac{25}{7}$$

$$\cot \theta = \frac{1}{\tan \theta} = \frac{7}{24}$$

### Question 3.

**Solution:**



$$\text{Given : } \tan A = \frac{BC}{AB} = \frac{15}{8}$$

Let  $BC = 15k$  and  $AB = 8k$ , where  $k$  is positive.

Let us draw a  $\triangle ABC$  in which  $\angle B = 90^\circ$  and  $\angle BAC = \theta$

By Pythagoras theorem, we have

$$AC^2 = AB^2 + BC^2 = (8k)^2 + (15k)^2 = 64k^2 + 225k^2 = 289k^2$$

$$\Rightarrow AC = 17k$$

Thus, we have

$$\sin \theta = \frac{BC}{AC} = \frac{15k}{17k} = \frac{15}{17}$$

$$\cos \theta = \frac{AB}{AC} = \frac{8k}{17k} = \frac{8}{17}$$

$$\tan \theta = \frac{15}{8} \text{ (given)}$$

$$\operatorname{cosec} \theta = \frac{1}{\sin \theta} = \frac{17}{15}$$

$$\sec \theta = \frac{1}{\cos \theta} = \frac{17}{8}$$

$$\cot \theta = \frac{1}{\tan \theta} = \frac{8}{15}$$

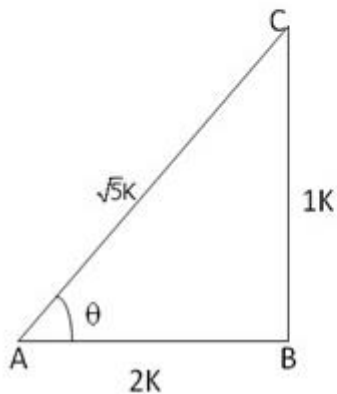
#### Question 4.

#### Solution:

$$\text{Given: } \cot\theta = \frac{AB}{BC} = \frac{2k}{1k}$$

Let  $AB = 2k$   
and  $BC = 1k$ , where  $k$  is positive

Let us draw a  $\triangle ABC$  in which  $\angle B = 90^\circ$  and  $\angle BAC = \theta$



By Pythagoras theorem, we have

$$\begin{aligned}(AC)^2 &= (AB)^2 + (BC)^2 = [(2k)^2 + (1k)^2] \\ &= (4k^2 + 1k^2) = 5k^2\end{aligned}$$

$$\therefore AC = \sqrt{5k^2} = \sqrt{5}k$$

$$\therefore \sin\theta = \frac{BC}{AC} = \frac{1k}{\sqrt{5}k} = \frac{1}{\sqrt{5}}$$

$$\cos\theta = \frac{AB}{AC} = \frac{2k}{\sqrt{5}k} = \frac{2}{\sqrt{5}}$$

$$\tan\theta = \frac{1}{\cot\theta} = \frac{1}{2}; \cot\theta = 2 \text{ (given)}$$

$$\operatorname{cosec}\theta = \frac{1}{\sin\theta} = \sqrt{5}$$

$$\sec\theta = \frac{1}{\cos\theta} = \frac{\sqrt{5}}{2}$$

#### Question 5.

#### Solution:

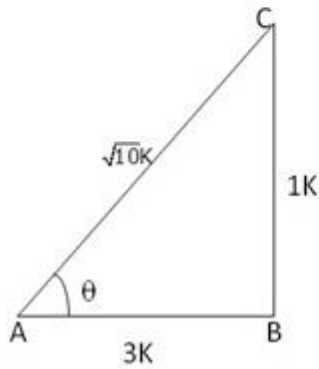
$$\text{Given: } \operatorname{cosec} \theta = \frac{AC}{BC} = \frac{\sqrt{10}}{1}$$

$$\text{Let } AC = \sqrt{10}k$$

$$\text{and } BC = 1k$$

where  $k$  is positive

Let us draw a  $\triangle ABC$  in which  $\angle B = 90^\circ$  and  $\angle BAC = \theta$



By pythagoras theorem, we have

$$\begin{aligned} (AC)^2 &= (AB)^2 + (BC)^2 \Rightarrow (AB)^2 = (AC)^2 - (BC)^2 \\ &= \left[ (\sqrt{10}k)^2 - (k)^2 \right] = (10k^2 - 1k^2) \end{aligned}$$

$$\Rightarrow (AB)^2 = 9k^2$$

$$\Rightarrow AB = \sqrt{9k^2} = 3k$$

$$\therefore \sin \theta = \frac{BC}{AC} = \frac{1}{\sqrt{10}}$$

$$\cos \theta = \frac{AB}{AC} = \frac{3k}{\sqrt{10}k} = \frac{3}{\sqrt{10}}$$

$$\operatorname{cosec} \theta = \sqrt{10} \text{ (given)}$$

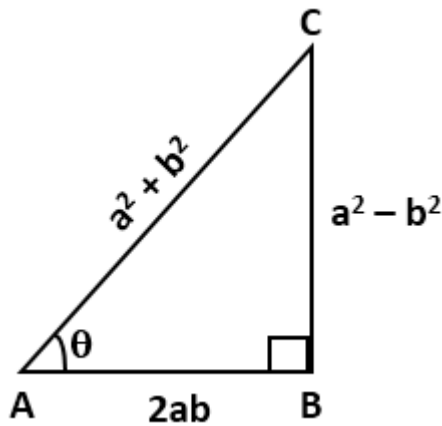
$$\sec \theta = \frac{1}{\cos \theta} = \frac{\sqrt{10}}{3}$$

$$\tan \theta = \frac{\sin \theta}{\cos \theta} = \left( \frac{1}{\sqrt{10}} \times \frac{\sqrt{10}}{3} \right) = \frac{1}{3}$$

$$\cot \theta = \frac{1}{\tan \theta} = 3$$

### Question 6.

**Solution:**



Consider  $\triangle ABC$  where  $\angle B = 90^\circ$ ,  $\angle A = \theta$

$$\text{Then, } \sin \theta = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{BC}{AC} = \frac{a^2 - b^2}{a^2 + b^2}$$

Let  $BC = a^2 - b^2$  and  $AC = a^2 + b^2$

Then, by Pythagoras theorem,

$$AC^2 = AB^2 + BC^2$$

$$\Rightarrow AB^2 = AC^2 - BC^2 = (a^2 + b^2)^2 - (a^2 - b^2)^2 = a^4 + b^4 + 2a^2b^2 - a^4 - b^4 + 2a^2b^2 = 4a^2b^2$$

$$\Rightarrow AB = 2ab$$

Now,

$$\cos \theta = \frac{\text{Base}}{\text{Hypotenuse}} = \frac{AB}{AC} = \frac{2ab}{a^2 + b^2}$$

$$\tan \theta = \frac{\text{Perpendicular}}{\text{Base}} = \frac{BC}{AB} = \frac{a^2 - b^2}{2ab}$$

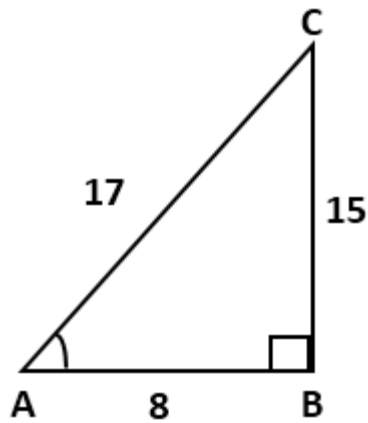
$$\cot \theta = \frac{1}{\tan \theta} = \frac{2ab}{a^2 - b^2}$$

$$\operatorname{cosec} \theta = \frac{1}{\sin \theta} = \frac{a^2 + b^2}{a^2 - b^2}$$

$$\sec \theta = \frac{1}{\cos \theta} = \frac{a^2 + b^2}{2ab}$$

### Question 7.

**Solution:**



$$15 \cot A = 8 \Rightarrow \cot A = \frac{8}{15}$$

Consider  $\triangle ABC$ , where  $\angle B = 90^\circ$

$$\text{Then, } \cot A = \frac{\text{Base}}{\text{Perpendicular}} = \frac{AB}{BC} = \frac{8}{15}$$

Let  $AB = 8$  and  $BC = 15$

Then, by Pythagoras theorem,

$$AC^2 = AB^2 + BC^2 = 8^2 + 15^2 = 64 + 225 = 289$$

$$\Rightarrow AC = 17$$

Now,

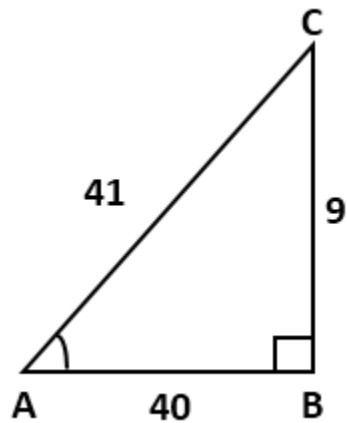
$$\sin A = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{BC}{AC} = \frac{15}{17}$$

$$\sec A = \frac{\text{Hypotenuse}}{\text{Base}} = \frac{AC}{AB} = \frac{17}{8}$$

### Question 8.

**Solution:**





Consider  $\triangle ABC$ , where  $\angle B = 90^\circ$

$$\text{Then, } \sin A = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{BC}{AC} = \frac{9}{41}$$

Let  $BC = 9$  and  $AC = 41$

Then, by Pythagoras theorem,

$$AC^2 = AB^2 + BC^2$$

$$\Rightarrow AB^2 = AC^2 - BC^2 = 41^2 - 9^2 = 1681 - 81 = 1600$$

$$\Rightarrow AB = 40$$

Now,

$$\cos A = \frac{\text{Base}}{\text{Hypotenuse}} = \frac{AB}{AC} = \frac{40}{41}$$

$$\tan A = \frac{\text{Perpendicular}}{\text{Base}} = \frac{BC}{AB} = \frac{9}{40}$$

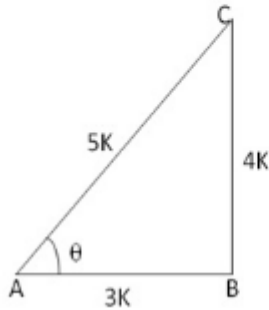
### Question 9.

**Solution:**

Given:

$$\cos \theta = 0.6 = \frac{6}{10} = \frac{3}{5}$$

Let us draw a triangle ABC in which  $\angle B = 90^\circ$  and  $\angle A = \theta$



$$\text{Then, } \cos \theta = \frac{AB}{AC} = \frac{3}{5}$$

let  $AB = 3k$

and  $AC = 5k$ ,

where  $k$  is positive

By Pythagoras theorem, we have

$$(AC)^2 = (AB)^2 + (BC)^2$$

$$\Rightarrow (BC)^2 = (AC)^2 - (AB)^2$$

$$= [(5k)^2 - (3k)^2] = 16k^2$$

$$\Rightarrow (BC)^2 = 16k^2$$

$$\Rightarrow BC = 4k$$

$$\sin \theta = \frac{BC}{AC} = \frac{4k}{5k} = \frac{4}{5}$$

$$\cos \theta = \frac{3}{5}$$

$$\tan \theta = \frac{\sin \theta}{\cos \theta} = \left( \frac{4}{5} \times \frac{5}{3} \right) = \frac{4}{3}$$

$$\Rightarrow (5 \sin \theta - 3 \tan \theta) = \left( 5 \times \frac{4}{5} - 3 \times \frac{4}{3} \right) = 0$$

$$\text{Hence, } (5 \sin \theta - 3 \tan \theta) = 0$$

### Question 10.

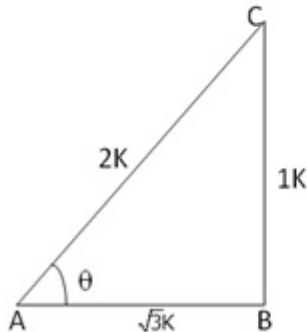
**Solution:**

$$\text{Given: } \operatorname{cosec} \theta = \frac{AC}{BC} = \frac{2}{1}$$

let  $BC = 1k$  and  $AC = 2k$

where  $k$  is positive

Let us draw a  $\triangle ABC$  in which  $\angle B = 90^\circ$  and  $\angle A = \theta$



By Pythagoras theorem, we have

$$AC^2 = (AB)^2 + (BC)^2$$

$$\Rightarrow (AB)^2 = (AC)^2 - (BC)^2$$

$$= [(2k)^2 - (1k)^2] = (4k^2 - 1k^2) = 3k^2$$

$$\Rightarrow (AB) = \sqrt{3}k$$

$$\sin \theta = \frac{BC}{AC} = \frac{1k}{2k} = \frac{1}{2}$$

$$\cos \theta = \frac{AB}{AC} = \frac{\sqrt{3}k}{2k} = \frac{\sqrt{3}}{2}$$

$$\cot \theta = \frac{\cos \theta}{\sin \theta} = \left( \frac{\sqrt{3}}{2} \times \frac{2}{1} \right) = \sqrt{3}$$

$$\begin{aligned} \Rightarrow \left[ \cot \theta + \frac{\sin \theta}{1 + \cos \theta} \right] &= \left[ \sqrt{3} + \frac{\frac{1}{2}}{1 + \frac{\sqrt{3}}{2}} \right] \\ &= \left( \sqrt{3} + \frac{1}{2 + \sqrt{3}} \right) = \left( \frac{2\sqrt{3} + 3 + 1}{2 + \sqrt{3}} \right) \\ &= \left( \frac{2\sqrt{3} + 4}{2 + \sqrt{3}} \right) = 2 \left( \frac{\sqrt{3} + 2}{2 + \sqrt{3}} \right) = 2 \end{aligned}$$

$$\text{Hence, } \left[ \cot \theta + \frac{\sin \theta}{1 + \cos \theta} \right] = 2$$

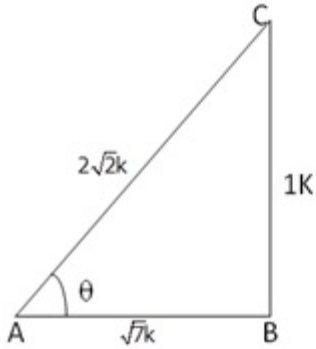
### Question 11.

**Solution:**

Given:  $\tan\theta = \frac{BC}{AB} = \frac{1}{\sqrt{7}}$

Let  $BC = 1k$  and  $AB = \sqrt{7}k$   
where  $k$  is positive

Let us draw a  $\triangle ABC$  in which  $\angle B = 90^\circ$  and  $\angle A = \theta$



By pythagoras theorem, we have

$$AC^2 = (AB^2 + BC^2)$$

$$\Rightarrow AC^2 = [(\sqrt{7}k)^2 + (1k)^2]$$

$$= 7k^2 + 1k^2 = 8k^2$$

$$\Rightarrow AC = 2\sqrt{2}k$$

$$\operatorname{cosec}\theta = \frac{AC}{BC} = \frac{2\sqrt{2}k}{1k} = 2\sqrt{2}$$

$$\sec\theta = \frac{AC}{AB} = \frac{2\sqrt{2}k}{\sqrt{7}k} = \frac{2\sqrt{2}}{\sqrt{7}}$$

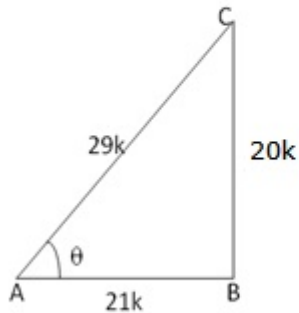
$$\begin{aligned} \Rightarrow \frac{(\operatorname{cosec}^2\theta - \sec^2\theta)}{(\operatorname{cosec}^2\theta + \sec^2\theta)} &= \frac{\left[ (2\sqrt{2})^2 - \left(\frac{2\sqrt{2}}{\sqrt{7}}\right)^2 \right]}{\left[ (2\sqrt{2})^2 + \left(\frac{2\sqrt{2}}{\sqrt{7}}\right)^2 \right]} \\ &= \frac{\left(8 - \frac{8}{7}\right)}{\left(8 + \frac{8}{7}\right)} = \frac{\left(\frac{48}{7}\right)}{\left(\frac{64}{7}\right)} = \frac{48}{64} = \frac{3}{4} \end{aligned}$$

Hence,  $\frac{(\operatorname{cosec}^2\theta - \sec^2\theta)}{(\operatorname{cosec}^2\theta + \sec^2\theta)} = \frac{3}{4}$

**Question 12.****Solution:**

Given:

$$\tan \theta = \frac{20}{21} = \frac{20k}{21k}$$

Let us draw a triangle ABC in which  $\angle B = 90^\circ$  and  $\angle A = \theta$ 

By Pythagoras theorem, we have

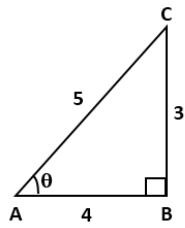
$$\begin{aligned} AC^2 &= AB^2 + BC^2 \\ &= (21k)^2 + (20k)^2 \\ &= 441k^2 + 400k^2 \\ &= 841k^2 \end{aligned}$$

$$\therefore AC = 29k$$

$$\sin \theta = \frac{BC}{AC} = \frac{20k}{29k} = \frac{20}{29}, \quad \cos \theta = \frac{AB}{AC} = \frac{21k}{29k} = \frac{21}{29}$$

$$\begin{aligned} \text{L.H.S.} &= \frac{1 - \sin \theta + \cos \theta}{1 + \sin \theta + \cos \theta} = \frac{1 - \frac{20}{29} + \frac{21}{29}}{1 + \frac{20}{29} + \frac{21}{29}} = \frac{\frac{29 - 20 + 21}{29}}{\frac{29 + 20 + 21}{29}} \\ &= \frac{30}{70} = \frac{3}{7} = \text{R.H.S} \end{aligned}$$

**Question 13.****Solution:**



$$\sec \theta = \frac{5}{4} \Rightarrow \cos \theta = \frac{4}{5}$$

Consider  $\triangle ABC$ , where  $\angle B = 90^\circ$  and  $\angle A = \theta$

$$\text{Then, } \cos \theta = \frac{\text{Base}}{\text{Hypotenuse}} = \frac{AB}{AC} = \frac{4}{5}$$

Let  $AB = 4$  and  $AC = 5$

Then, by Pythagoras theorem,

$$AC^2 = AB^2 + BC^2$$

$$\Rightarrow BC^2 = AC^2 - AB^2 = 5^2 - 4^2 = 25 - 16 = 9$$

$$\Rightarrow BC = 3$$

Now,

$$\sin \theta = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{BC}{AC} = \frac{3}{5}$$

$$\tan \theta = \frac{\text{Perpendicular}}{\text{Base}} = \frac{BC}{AB} = \frac{3}{4}$$

$$\cot \theta = \frac{1}{\tan \theta} = \frac{4}{3}$$

$$\therefore \text{L.H.S.} = \frac{(\sin \theta - 2\cos \theta)}{(\tan \theta - \cot \theta)}$$

$$= \frac{\frac{3}{5} - 2 \times \frac{4}{5}}$$

$$= \frac{\frac{3}{5} - \frac{8}{5}}$$

$$= \frac{3 - 8}{5}$$

$$= \frac{-5}{5}$$

$$= \frac{-1}{1}$$

$$= \frac{-7}{12}$$

$$= \frac{-1}{1}$$

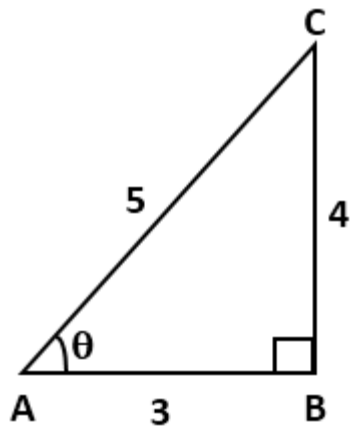
$$= \frac{-7}{12}$$

$$= \frac{12}{7}$$

$$= \text{R.H.S.}$$

#### Question 14.

**Solution:**



$$\cot \theta = \frac{3}{4}$$

Consider  $\triangle ABC$ , where  $\angle B = 90^\circ$  and  $\angle A = \theta$

$$\text{Then, } \cot \theta = \frac{\text{Base}}{\text{Perpendicular}} = \frac{AB}{BC} = \frac{3}{4}$$

Let  $AB = 3$  and  $BC = 4$

Then, by Pythagoras theorem,

$$AC^2 = AB^2 + BC^2 = 3^2 + 4^2 = 9 + 16 = 25$$

$$\Rightarrow AC = 5$$

Now,

$$\sec \theta = \frac{\text{Hypotenuse}}{\text{Base}} = \frac{AC}{AB} = \frac{5}{3}$$

$$\operatorname{cosec} \theta = \frac{\text{Hypotenuse}}{\text{Perpendicular}} = \frac{AC}{BC} = \frac{5}{4}$$

$$\therefore \text{L.H.S.} = \sqrt{\frac{\sec \theta - \operatorname{cosec} \theta}{\sec \theta + \operatorname{cosec} \theta}}$$

$$= \sqrt{\frac{\frac{5}{3} - \frac{5}{4}}{\frac{5}{3} + \frac{5}{4}}}$$

$$= \sqrt{\frac{\frac{20-15}{12}}{\frac{20+15}{12}}}$$

$$= \sqrt{\frac{5}{35}}$$

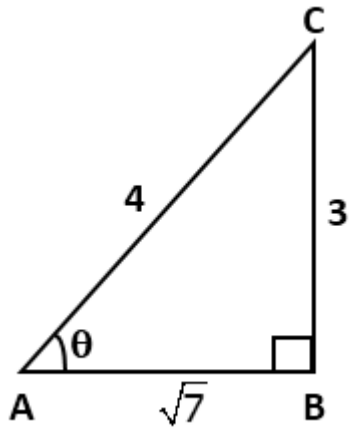
$$= \sqrt{\frac{1}{7}}$$

$$= \frac{1}{\sqrt{7}}$$

$$= \text{R.H.S.}$$

**Question 15.**

**Solution:**



$$\sin \theta = \frac{3}{4} \Rightarrow \operatorname{cosec} \theta = \frac{4}{3}$$

Consider  $\triangle ABC$ , where  $\angle B = 90^\circ$  and  $\angle A = \theta$

$$\text{Then, } \sin \theta = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{BC}{AC} = \frac{3}{4}$$

Let  $BC = 3$  and  $AC = 4$

Then, by Pythagoras theorem,

$$AB^2 = AC^2 - BC^2 = 4^2 - 3^2 = 16 - 9 = 7$$

$$\Rightarrow AB = \sqrt{7}$$

Now,

$$\cot \theta = \frac{\text{Base}}{\text{Perpendicular}} = \frac{AB}{BC} = \frac{\sqrt{7}}{3}$$

$$\sec \theta = \frac{\text{Hypotenuse}}{\text{Base}} = \frac{AC}{AB} = \frac{4}{\sqrt{7}}$$

$$\therefore \text{L.H.S.} = \sqrt{\frac{\operatorname{cosec}^2 \theta - \cot^2 \theta}{\sec^2 \theta - 1}}$$

$$= \sqrt{\frac{\left(\frac{4}{3}\right)^2 - \left(\frac{\sqrt{7}}{3}\right)^2}{\left(\frac{4}{\sqrt{7}}\right)^2 - 1}}$$

$$= \sqrt{\frac{\frac{16}{9} - \frac{7}{9}}{\frac{16}{7} - 1}}$$

$$= \sqrt{\frac{\frac{16-7}{9}}{\frac{16}{7} - 1}}$$

$$= \sqrt{\frac{\frac{9}{9}}{\frac{16}{7} - 1}}$$

$$= \sqrt{\frac{1}{\frac{9}{7}}}$$

$$= \sqrt{\frac{7}{9}}$$

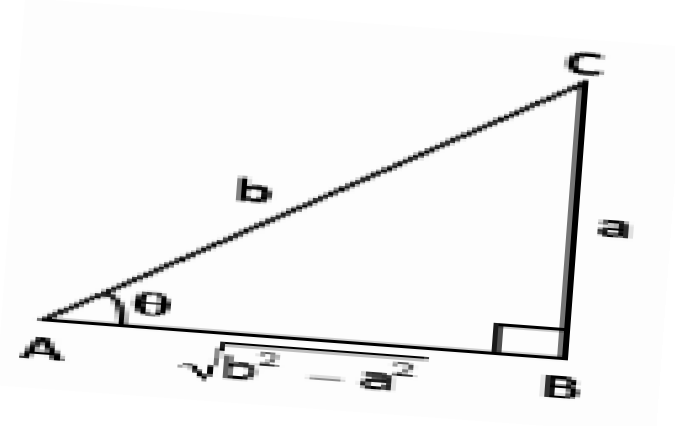
$$= \frac{\sqrt{7}}{3}$$

$$= \text{R.H.S.}$$

### Question 16.

**Solution:**





$$\sin \theta = \frac{a}{b}$$

Consider  $\triangle ABC$ , where  $\angle B = 90^\circ$  and  $\angle A = \theta$

$$\text{Then, } \sin \theta = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{BC}{AC} = \frac{a}{b}$$

Let  $BC = a$  and  $AC = b$

Then, by Pythagoras theorem,

$$AB^2 = AC^2 - BC^2 = b^2 - a^2$$

$$\Rightarrow AB = \sqrt{b^2 - a^2}$$

Now,

$$\sec \theta = \frac{\text{Hypotenuse}}{\text{Base}} = \frac{AC}{AB} = \frac{b}{\sqrt{b^2 - a^2}}$$

$$\tan \theta = \frac{\text{Perpendicular}}{\text{Base}} = \frac{BC}{AB} = \frac{a}{\sqrt{b^2 - a^2}}$$

$$\therefore \text{L.H.S.} = (\sec \theta + \tan \theta)$$

$$= \frac{b}{\sqrt{b^2 - a^2}} + \frac{a}{\sqrt{b^2 - a^2}}$$

$$= \frac{b + a}{\sqrt{b^2 - a^2}}$$

$$= \frac{b + a}{\sqrt{(b + a)(b - a)}}$$

$$= \frac{\sqrt{b + a} \times \sqrt{b + a}}{\sqrt{(b + a)} \times \sqrt{b - a}}$$

$$= \frac{\sqrt{b + a}}{\sqrt{b - a}}$$

$$= \text{R.H.S.}$$

**Question 17.****Solution:**

$$\cos \theta = \frac{3}{5} \Rightarrow \cos^2 \theta = \frac{9}{25}$$

$$\therefore \sin^2 \theta = 1 - \cos^2 \theta = 1 - \frac{9}{25} = \frac{25 - 9}{25} = \frac{16}{25}$$

$$\Rightarrow \sin \theta = \frac{4}{5}$$

$$\Rightarrow \tan \theta = \frac{\sin \theta}{\cos \theta} = \frac{\frac{4}{5}}{\frac{3}{5}} = \frac{4}{3}$$

$$\Rightarrow \cot \theta = \frac{1}{\tan \theta} = \frac{3}{4}$$

Thus,

$$\text{L.H.S.} = \frac{(\sin \theta - \cot \theta)}{2 \tan \theta}$$

$$= \frac{\frac{4}{5} - \frac{3}{4}}{2 \times \frac{4}{3}}$$

$$= \frac{16 - 15}{\frac{8}{3}}$$

$$= \frac{1}{20} \times \frac{3}{8}$$

$$= \frac{3}{160}$$

$$= \text{R.H.S.}$$

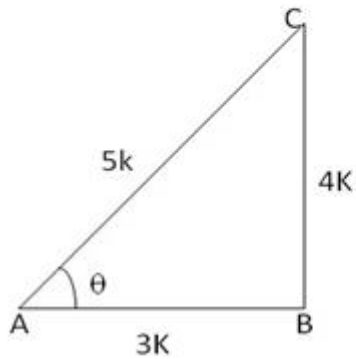
**Question 18.****Solution:**

$$\text{Given: } \tan\theta = \frac{BC}{AB} = \frac{4}{3}$$

Let  $BC = 4k$  and  $AB = 3k$

where  $k$  is positive

Let us draw a  $\triangle ABC$  in which  $\angle B = 90^\circ$  and  $\angle BAC = \theta$



By Pythagoras theorem, we get

$$(AC)^2 = (AB)^2 + (BC)^2$$

$$\Rightarrow (AC)^2 = [(3k)^2 + (4k)^2]$$

$$\Rightarrow (AC)^2 = (9k^2 + 16k^2) = 25k^2$$

$$\therefore AC = \sqrt{25k^2} = 5k$$

$$\sin\theta = \frac{4k}{5k} = \frac{4}{5}$$

$$\cos\theta = \frac{3k}{5k} = \frac{3}{5}$$

$$\Rightarrow (\sin\theta + \cos\theta) = \left(\frac{4}{5} + \frac{3}{5}\right) = \frac{7}{5}$$

$$\text{Hence, } (\sin\theta + \cos\theta) = \frac{7}{5}$$

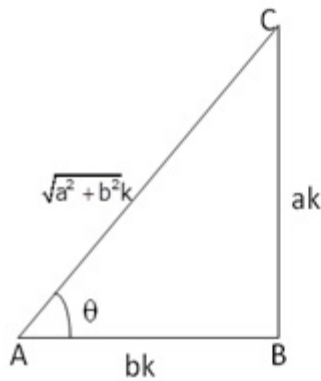
**Question 19.**

**Solution:**

Given:

$$\tan \theta = \frac{a}{b} = \frac{ak}{bk} = \frac{BC}{AB}$$

Let us draw a triangle ABC in which  $\angle B = 90^\circ$  and  $\angle A = \theta$



By Pythagoras theorem, we have

$$AC^2 = AB^2 + BC^2 = b^2k^2 + a^2k^2$$

$$\therefore AC = \sqrt{a^2 + b^2} k$$

$$\sin \theta = \frac{BC}{AC} = \frac{ak}{\sqrt{a^2 + b^2}k} = \frac{a}{\sqrt{a^2 + b^2}}$$

$$\cos \theta = \frac{AB}{AC} = \frac{bk}{\sqrt{a^2 + b^2}k} = \frac{b}{\sqrt{a^2 + b^2}}$$

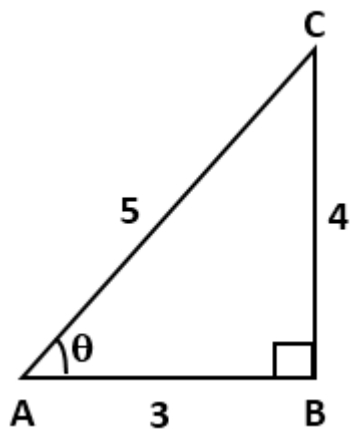
$$\text{L.H.S.} = \frac{a \sin \theta - b \cos \theta}{a \sin \theta + b \cos \theta}$$

$$\begin{aligned} &= \frac{a \frac{a}{\sqrt{a^2 + b^2}} - b \frac{b}{\sqrt{a^2 + b^2}}}{a \frac{a}{\sqrt{a^2 + b^2}} + b \frac{b}{\sqrt{a^2 + b^2}}} = \frac{\frac{a^2 - b^2}{\sqrt{a^2 + b^2}}}{\frac{a^2 + b^2}{\sqrt{a^2 + b^2}}} = \frac{a^2 - b^2}{a^2 + b^2} \end{aligned}$$

$$= \text{R.H.S.}$$

### Question 20.

**Solution:**



$$3 \tan \theta = 4 \Rightarrow \tan \theta = \frac{4}{3}$$

Consider  $\triangle ABC$ , where  $\angle B = 90^\circ$  and  $\angle A = \theta$

$$\text{Then, } \tan \theta = \frac{\text{Perpendicular}}{\text{Base}} = \frac{BC}{AB} = \frac{4}{3}$$

Let  $BC = 4$  and  $AB = 3$

Then, by Pythagoras theorem,

$$AC^2 = AB^2 + BC^2 = 3^2 + 4^2 = 9 + 16 = 25$$

$$\Rightarrow AC = 5$$

Now,

$$\sin \theta = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{BC}{AC} = \frac{4}{5}$$

$$\cos \theta = \frac{\text{Base}}{\text{Hypotenuse}} = \frac{AB}{AC} = \frac{3}{5}$$

$$\therefore \text{L.H.S.} = \frac{(4 \cos \theta - \sin \theta)}{(2 \cos \theta + \sin \theta)}$$

$$= \frac{4 \times \frac{3}{5} - \frac{4}{5}}{2 \times \frac{3}{5} + \frac{4}{5}}$$

$$= \frac{\frac{8}{5}}{\frac{10}{5}}$$

$$= \frac{8}{5} \times \frac{1}{2}$$

$$= \frac{4}{5}$$

$$= \text{R.H.S.}$$

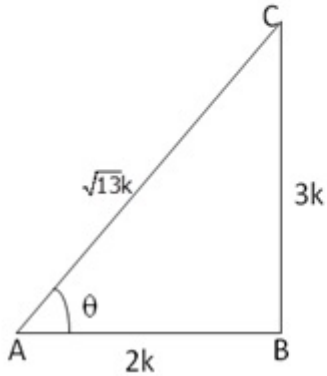
**Question 21.**

**Solution:**

Given:

$$\cot \theta = 2 \quad \therefore \cot \theta = \frac{2}{3} = \frac{2k}{3k}$$

Let us draw a triangle ABC in which  $\angle B = 90^\circ$  and  $\angle A = \theta$



By Pythagoras theorem, we have

$$\begin{aligned} AC^2 &= AB^2 + BC^2 \\ &= (2k)^2 + (3k)^2 \\ &= 4k^2 + 9k^2 = 13k^2 \end{aligned}$$

$$\Rightarrow AC = \sqrt{13}k$$

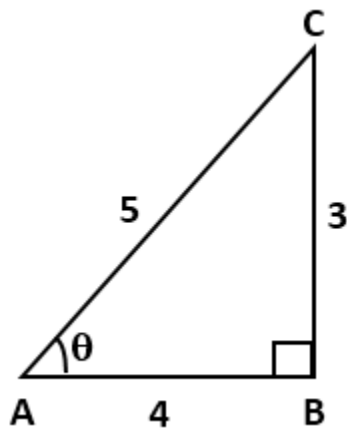
$$\therefore \sin \theta = \frac{3k}{\sqrt{13}k} = \frac{3}{\sqrt{13}}$$

$$\cos \theta = \frac{2k}{\sqrt{13}k} = \frac{2}{\sqrt{13}}$$

$$\begin{aligned} \text{L.H.S.} &= \frac{4\sin\theta - 3\cos\theta}{2\sin\theta + 6\cos\theta} \\ &= \frac{4 \times \frac{3}{\sqrt{13}} - 3 \times \frac{2}{\sqrt{13}}}{2 \times \frac{3}{\sqrt{13}} + 6 \times \frac{2}{\sqrt{13}}} \\ &= \frac{12 - 6}{6 + 12} \\ &= \frac{6}{18} = \frac{1}{3} = \text{R.H.S.} \end{aligned}$$

**Question 22.**

**Solution:**



$$3 \cot \theta = 4 \Rightarrow \cot \theta = \frac{4}{3} \Rightarrow \tan \theta = \frac{3}{4}$$

Consider  $\triangle ABC$ , where  $\angle B = 90^\circ$  and  $\angle A = \theta$

$$\text{Then, } \cot \theta = \frac{\text{Base}}{\text{Perpendicular}} = \frac{AB}{BC} = \frac{4}{3}$$

Let  $AB = 4$  and  $BC = 3$

Then, by Pythagoras theorem,

$$AC^2 = AB^2 + BC^2 = 4^2 + 3^2 = 16 + 9 = 25$$

$$\Rightarrow AC = 5$$

Now,

$$\sin \theta = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{BC}{AC} = \frac{3}{5}$$

$$\cos \theta = \frac{\text{Base}}{\text{Hypotenuse}} = \frac{AB}{AC} = \frac{4}{5}$$

$$\therefore \text{L.H.S.} = \frac{(1 - \tan^2 \theta)}{(1 + \tan^2 \theta)} = \frac{1 - \left(\frac{3}{4}\right)^2}{1 + \left(\frac{3}{4}\right)^2} = \frac{1 - \frac{9}{16}}{1 + \frac{9}{16}} = \frac{\frac{8}{16}}{\frac{25}{16}} = \frac{8}{25}$$

$$\text{R.H.S.} = \cos^2 \theta - \sin^2 \theta = \left(\frac{4}{5}\right)^2 - \left(\frac{3}{5}\right)^2 = \frac{16}{25} - \frac{9}{25} = \frac{8}{25}$$

$$\text{Hence, } \frac{(1 - \tan^2 \theta)}{(1 + \tan^2 \theta)} = (\cos^2 \theta - \sin^2 \theta)$$

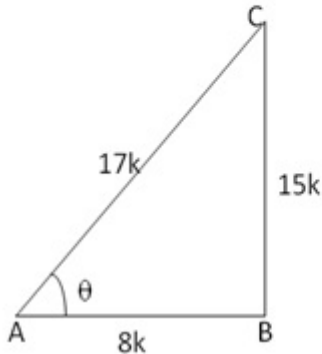
### Question 23.

**Solution:**

Given:

$$\sec \theta = \frac{17}{8} = \frac{17k}{8k}$$

Let us draw a triangle ABC in which  $\angle B = 90^\circ$  and  $\angle A = \theta$



By Pythagoras theorem, we have

$$AC^2 = AB^2 + BC^2$$

or  $BC^2 = AC^2 - AB^2$

$$\begin{aligned} \therefore BC^2 &= (17k)^2 - (8k)^2 \\ &= 289k^2 - 64k^2 = 225k^2 \end{aligned}$$

$$BC = 15k$$

$$\therefore \sin \theta = \frac{BC}{AC} = \frac{15k}{17k} = \frac{15}{17}$$

$$\cos \theta = \frac{AB}{AC} = \frac{8k}{17k} = \frac{8}{17}, \quad \tan \theta = \frac{BC}{AB} = \frac{15k}{8k} = \frac{15}{8}$$

$$\begin{aligned} \text{L.H.S.} &= \frac{3 - 4 \sin^2 \theta}{4 \cos^2 \theta - 3} = \frac{3 - 4 \times \left(\frac{15}{17}\right)^2}{4 \times \left(\frac{8}{17}\right)^2 - 3} = \frac{3 - \frac{4 \times 225}{289}}{4 \times \frac{64}{289} - 3} \\ &= \frac{\frac{3 \times 289 - 4 \times 225}{289}}{\frac{4 \times 64 - 3 \times 289}{289}} = \frac{867 - 900}{256 - 867} = \frac{-33}{-611} = \frac{33}{611} \end{aligned}$$

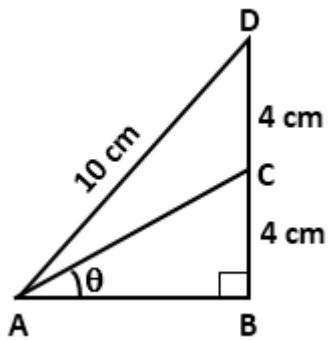
$$\begin{aligned} \text{R.H.S.} &= \frac{3 - \tan^2 \theta}{1 - 3 \tan^2 \theta} = \frac{3 - \left(\frac{15}{8}\right)^2}{1 - 3 \times \left(\frac{15}{8}\right)^2} = \frac{3 - \frac{225}{64}}{1 - 3 \times \frac{225}{64}} = \frac{\frac{3 \times 64 - 225}{64}}{\frac{64 - 3 \times 225}{64}} \\ &= \frac{192 - 225}{64 - 675} = \frac{-33}{-611} = \frac{33}{611} \end{aligned}$$

Hence, L.H.S. = R.H.S

### Question 24.

**Solution:**





In  $\triangle ABD$ ,  $\angle B = 90^\circ$

$AD = 10$  cm

$BD = BC + CD = 4 + 4 = 8$  cm

By Pythagoras theorem, we have

$$AB^2 = AD^2 - BD^2 = 10^2 - 8^2 = 100 - 64 = 36$$

$$\Rightarrow AB = 6$$
 cm

Now, in  $\triangle ABC$ ,  $\angle B = 90^\circ$ .

By Pythagoras theorem, we have

$$AC^2 = AB^2 + BC^2 = 6^2 + 4^2 = 36 + 16 = 52$$

$$\Rightarrow AC = 2\sqrt{13}$$
 cm

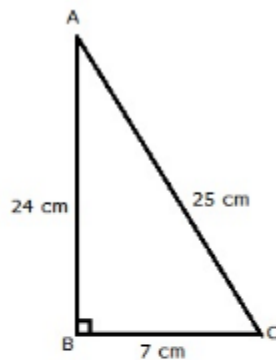
$$(i) \sin \theta = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{BC}{AC} = \frac{4}{2\sqrt{13}} = \frac{2}{\sqrt{13}} = \frac{2\sqrt{13}}{13}$$

$$(ii) \cos \theta = \frac{\text{Base}}{\text{Hypotenuse}} = \frac{AB}{AC} = \frac{6}{2\sqrt{13}} = \frac{3}{\sqrt{13}} = \frac{3\sqrt{13}}{13}$$

### Question 25.

**Solution:**

Given:  $\triangle ABC$  in which  $\angle B = 90^\circ$ ,  $AB = 24$  cm and  $BC = 7$  cm



By applying Pythagoras theorem

$$(AC)^2 = (AB)^2 + (BC)^2$$

$$\Rightarrow (AC)^2 = [(24)^2 + (7)^2] \text{ cm}^2$$

$$(AC)^2 = (576 + 49) \text{ cm}^2$$

$$(AC)^2 = 625 \text{ cm}^2$$

$$\Rightarrow AC = 25 \text{ cm}$$

(i) For T-ratio of  $\angle A$ , we have

Base  $AB = 24$  cm

Perpendicular  $BC = 7$  cm

Hypotenuse  $AC = 25$  cm

$$\cos A = \frac{AB}{AC} = \frac{24}{25}, \sin A = \frac{BC}{AC} = \frac{7}{25}$$

(ii) For T-ratio of  $\angle C$ , we have

Base  $BC = 7$  cm

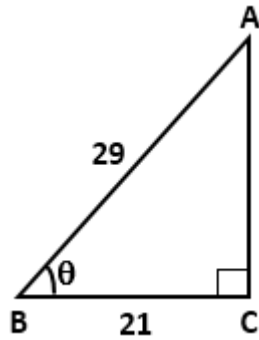
Perpendicular  $AB = 24$  cm

Hypotenuse  $AC = 25$  cm

$$\therefore \sin C = \frac{AB}{AC} = \frac{24}{25}, \cos C = \frac{BC}{AC} = \frac{7}{25}$$

### Question 26.

**Solution:**



In  $\triangle ABC$ ,  $\angle C = 90^\circ$

$AB = 29$  units and  $BC = 21$  units

By Pythagoras theorem, we have

$$AC^2 = AB^2 - BC^2 = 29^2 - 21^2 = 841 - 441 = 400$$

$$\Rightarrow AC = 20 \text{ units}$$

$$\therefore \sin \theta = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{AC}{AB} = \frac{20}{29}$$

$$\cos \theta = \frac{\text{Base}}{\text{Hypotenuse}} = \frac{BC}{AB} = \frac{21}{29}$$

$$\therefore \text{L.H.S.} = \cos^2 \theta - \sin^2 \theta$$

$$= \left(\frac{21}{29}\right)^2 - \left(\frac{20}{29}\right)^2$$

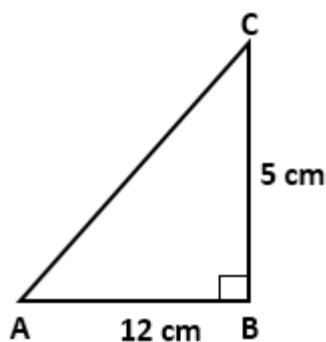
$$= \frac{441}{841} - \frac{400}{841}$$

$$= \frac{41}{841}$$

$$= \text{R.H.S.}$$

**Question 27.**

**Solution:**



In  $\triangle ABC$ ,  $\angle B = 90^\circ$

$AB = 12$  cm and  $BC = 5$  cm

By Pythagoras theorem, we have

$$AC^2 = AB^2 + BC^2 = 12^2 + 5^2 = 144 + 25 = 169$$

$$\Rightarrow AC = 13 \text{ cm}$$

$$(i) \cos A = \frac{\text{Base}}{\text{Hypotenuse}} = \frac{AB}{AC} = \frac{12}{13}$$

$$(ii) \operatorname{cosec} A = \frac{\text{Hypotenuse}}{\text{Perpendicular}} = \frac{AC}{BC} = \frac{13}{5}$$

$$(iii) \cos C = \frac{\text{Base}}{\text{Hypotenuse}} = \frac{BC}{AC} = \frac{5}{13}$$

$$(iv) \operatorname{cosec} C = \frac{\text{Hypotenuse}}{\text{Perpendicular}} = \frac{AC}{AB} = \frac{13}{12}$$

### Question 28.

**Solution:**

$$\sin \alpha = \frac{1}{2} \Rightarrow \sin^2 \alpha = \frac{1}{4}$$

$$\therefore \cos^2 \alpha = 1 - \sin^2 \alpha = 1 - \frac{1}{4} = \frac{3}{4}$$

$$\Rightarrow \cos \alpha = \frac{\sqrt{3}}{2}$$

$$\therefore \text{L.H.S.} = 3\cos \alpha - 4\cos^3 \alpha$$

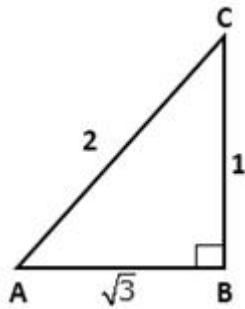
$$= 3 \times \frac{\sqrt{3}}{2} - 4 \left( \frac{\sqrt{3}}{2} \right)^3$$

$$= \frac{3\sqrt{3}}{2} - 4 \times \frac{3\sqrt{3}}{8}$$

$$= \frac{3\sqrt{3}}{2} - \frac{3\sqrt{3}}{2}$$

$$= 0$$

$$= \text{R.H.S.}$$

**Question 29.****Solution:**

$$\tan A = \frac{1}{\sqrt{3}}$$

Consider  $\triangle ABC$ , where  $\angle B = 90^\circ$

$$\text{Then, } \tan A = \frac{\text{Perpendicular}}{\text{Base}} = \frac{BC}{AB} = \frac{1}{\sqrt{3}}$$

Let  $BC = 1$  and  $AB = \sqrt{3}$

Then, by Pythagoras theorem,

$$AC^2 = AB^2 + BC^2 = (\sqrt{3})^2 + 1^2 = 3 + 1 = 4$$

$$\Rightarrow AC = 2$$

Now,

$$\sin A = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{BC}{AC} = \frac{1}{2} \text{ and } \cos A = \frac{\text{Base}}{\text{Hypotenuse}} = \frac{AB}{AC} = \frac{\sqrt{3}}{2}$$

$$\sin C = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{AB}{AC} = \frac{\sqrt{3}}{2} \text{ and } \cos C = \frac{\text{Base}}{\text{Hypotenuse}} = \frac{BC}{AC} = \frac{1}{2}$$

$$(i) \text{ L.H.S.} = \sin A \cdot \cos C + \cos A \cdot \sin C$$

$$= \frac{1}{2} \times \frac{1}{2} + \frac{\sqrt{3}}{2} \times \frac{\sqrt{3}}{2}$$

$$= \frac{1}{4} + \frac{3}{4}$$

$$= \frac{4}{4}$$

$$= 1$$

$$= \text{R.H.S.}$$

$$(ii) \text{ L.H.S.} = \cos A \cdot \cos C - \sin A \cdot \sin C$$

$$= \frac{\sqrt{3}}{2} \times \frac{1}{2} - \frac{1}{2} \times \frac{\sqrt{3}}{2}$$

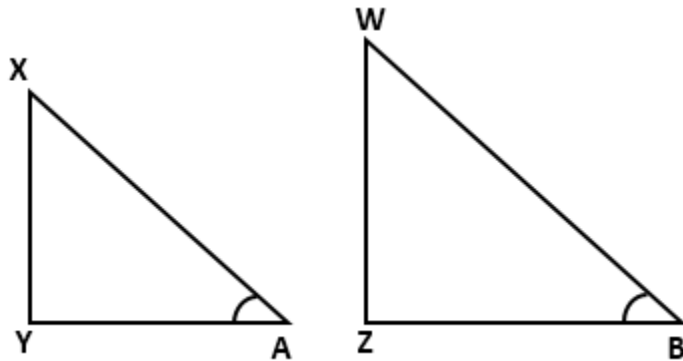
$$= \frac{\sqrt{3}}{4} - \frac{\sqrt{3}}{4}$$

$$= 0$$

$$= \text{R.H.S.}$$

**Question 30.****Solution:**

Consider two right triangles XAY and WBZ such that  $\sin A = \sin B$



We have,

$$\sin A = \frac{XY}{XA} \text{ and } \sin B = \frac{WZ}{WB}$$

Since  $\sin A = \sin B$

$$\Rightarrow \frac{XY}{XA} = \frac{WZ}{WB}$$

$$\Rightarrow \frac{XY}{WZ} = \frac{XA}{WB} = k \text{ (say) } \dots(i)$$

$$\Rightarrow XY = k \times WZ \text{ and } XA = k \times WB \dots(ii)$$

Using Pythagoras theorem in triangles XAY and WBZ, we have

$$XA^2 = XY^2 + AY^2 \text{ and } WB^2 = WZ^2 + BZ^2$$

$$\Rightarrow AY = \sqrt{XA^2 - XY^2} \text{ and } BZ = \sqrt{WB^2 - WZ^2}$$

$$\Rightarrow \frac{AY}{BZ} = \frac{\sqrt{XA^2 - XY^2}}{\sqrt{WB^2 - WZ^2}} = \frac{\sqrt{k^2 WB^2 - k^2 WZ^2}}{\sqrt{WB^2 - WZ^2}} = \frac{k\sqrt{WB^2 - WZ^2}}{\sqrt{WB^2 - WZ^2}}$$

$$\Rightarrow \frac{AY}{BZ} = k \dots(iii)$$

From (i), (ii) and (iii), we get

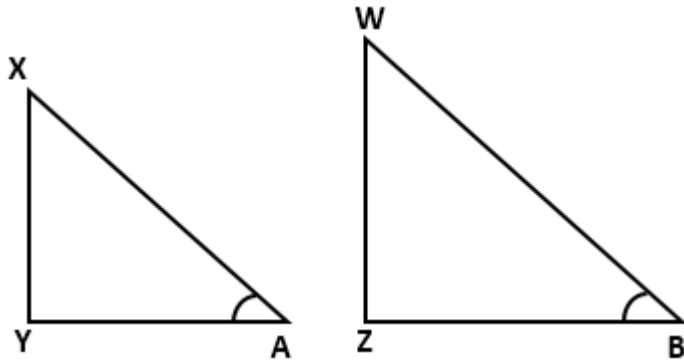
$$\frac{XY}{WZ} = \frac{XA}{WB} = \frac{AY}{BZ}$$

$$\Rightarrow \Delta XYA \sim \Delta WZB$$

$$\Rightarrow \angle A = \angle B$$

**Question 31.****Solution:**

Consider two right triangles XAY and WBZ such that  $\tan A = \tan B$



We have,

$$\tan A = \frac{XY}{AY} \text{ and } \tan B = \frac{WZ}{BZ}$$

Since  $\tan A = \tan B$

$$\Rightarrow \frac{XY}{AY} = \frac{WZ}{BZ}$$

$$\Rightarrow \frac{XY}{WZ} = \frac{AY}{BZ} = k \text{ (say) } \dots(i)$$

$$\Rightarrow XY = k \times WZ \text{ and } AY = k \times BZ \dots(ii)$$

Using Pythagoras theorem in triangles XAY and WBZ, we have

$$XA^2 = XY^2 + AY^2 \quad \text{and} \quad WB^2 = WZ^2 + BZ^2$$

$$\Rightarrow XA^2 = k^2 WZ^2 + k^2 BZ^2 \quad \text{and} \quad WB^2 = WZ^2 + BZ^2$$

$$\Rightarrow XA^2 = k^2(WZ^2 + BZ^2) \quad \text{and} \quad WB^2 = WZ^2 + BZ^2$$

$$\Rightarrow \frac{XA^2}{WB^2} = \frac{k^2(WZ^2 + BZ^2)}{(WZ^2 + BZ^2)} = k^2$$

$$\Rightarrow \frac{XA}{WB} = k \dots(iii)$$

From (i), (ii) and (iii), we get

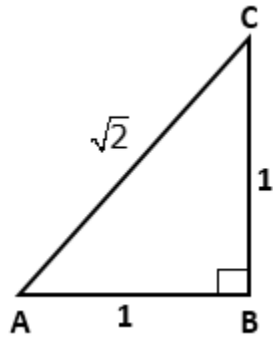
$$\frac{XY}{WZ} = \frac{AY}{BZ} = \frac{XA}{WB}$$

$$\Rightarrow \triangle AYX \sim \triangle BZW$$

$$\Rightarrow \angle A = \angle B$$

### Question 32.

**Solution:**



$$\tan A = 1$$

Consider  $\triangle ABC$ , where  $\angle B = 90^\circ$

$$\text{Then, } \tan A = \frac{\text{Perpendicular}}{\text{Base}} = \frac{BC}{AB} = \frac{1}{1}$$

Let  $BC = 1$  and  $AB = 1$

Then, by Pythagoras theorem,

$$AC^2 = AB^2 + BC^2 = 1^2 + 1^2 = 1 + 1 = 2$$

$$\Rightarrow AC = \sqrt{2}$$

Now,

$$\sin A = \frac{\text{Perpendicular}}{\text{Hypotenuse}} = \frac{BC}{AC} = \frac{1}{\sqrt{2}}$$

$$\cos A = \frac{\text{Base}}{\text{Hypotenuse}} = \frac{AB}{AC} = \frac{1}{\sqrt{2}}$$

$$\therefore \text{L.H.S.} = 2 \sin A \cdot \cos A$$

$$= 2 \times \frac{1}{\sqrt{2}} \times \frac{1}{\sqrt{2}}$$

$$= \frac{2}{2}$$

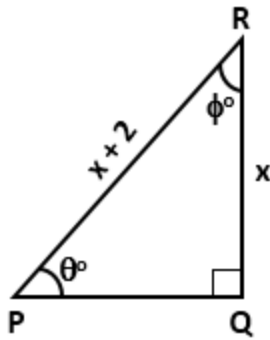
$$= 1$$

$$= \text{R.H.S.}$$

### Question 33.

**Solution:**





In  $\Delta PQR$ ,  $\angle Q = 90^\circ$ ,  $\angle P = \theta$  and  $\angle R = \phi$

By Pythagoras theorem, we have

$$PQ^2 = PR^2 - QR^2 = (x+2)^2 - x^2 = x^2 + 4x + 4 - x^2 = 4(x+1)$$

$$\Rightarrow PQ = 2\sqrt{x+1}$$

$$\text{Now, } \cot \phi = \frac{QR}{PQ} = \frac{x}{2\sqrt{x+1}} \text{ and } \tan \theta = \frac{QR}{PQ} = \frac{x}{2\sqrt{x+1}}$$

$$(i) (\sqrt{x+1}) \cot \phi = (\sqrt{x+1}) \times \frac{x}{2\sqrt{x+1}} = \frac{x}{2}$$

$$(ii) (\sqrt{x^3+x^2}) \tan \theta = (\sqrt{x^2(x+1)}) \tan \theta = x(\sqrt{x+1}) \times \frac{x}{2\sqrt{x+1}} = \frac{x^2}{2}$$

$$(iii) \cos \theta = \frac{PQ}{PR} = \frac{2\sqrt{x+1}}{x+2}$$

### Question 34.

#### Solution:

$$x = \operatorname{cosec} A + \cos A \text{ and } y = \operatorname{cosec} A - \cos A$$

Thus, we have

$$x + y = (\operatorname{cosec} A + \cos A) + (\operatorname{cosec} A - \cos A) = 2 \operatorname{cosec} A$$

$$x - y = (\operatorname{cosec} A + \cos A) - (\operatorname{cosec} A - \cos A) = 2 \cos A$$

$$\begin{aligned} \text{L.H.S.} &= \left(\frac{2}{x+y}\right)^2 + \left(\frac{x-y}{2}\right)^2 - 1 \\ &= \left(\frac{2}{2 \operatorname{cosec} A}\right)^2 + \left(\frac{2 \cos A}{2}\right)^2 - 1 \\ &= \left(\frac{1}{\operatorname{cosec} A}\right)^2 + (\cos A)^2 - 1 \\ &= (\sin A)^2 + (\cos A)^2 - 1 \\ &= \sin^2 A + \cos^2 A - 1 \\ &= 1 - 1 \\ &= 0 \\ &= \text{R.H.S.} \end{aligned}$$

**Question 35.****Solution:**

$$x = \cot A + \cos A \text{ and } y = \cot A - \cos A$$

Thus, we have

$$x + y = (\cot A + \cos A) + (\cot A - \cos A) = 2 \cot A$$

$$x - y = (\cot A + \cos A) - (\cot A - \cos A) = 2 \cos A$$

$$\begin{aligned} \text{L.H.S.} &= \left( \frac{x-y}{x+y} \right)^2 + \left( \frac{x-y}{2} \right)^2 \\ &= \left( \frac{2 \cos A}{2 \cot A} \right)^2 + \left( \frac{2 \cos A}{2} \right)^2 \\ &= \left( \frac{\cos A}{\cot A} \right)^2 + (\cos A)^2 \\ &= \left( \frac{\cos A}{\cancel{\cos A} / \sin A} \right)^2 + (\cos A)^2 \\ &= (\sin A)^2 + (\cos A)^2 \\ &= \sin^2 A + \cos^2 A \\ &= 1 \\ &= \text{R.H.S.} \end{aligned}$$

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