

**When a solution of potassium iodide is added to a solution of lead nitrate in a test tube, a reaction takes place.**

- a. What type of reaction is this?**
- b. Write the balanced chemical equation to represent the above reaction.**

**ICBSE 2011, 2010, 2008**

- a. It is precipitation as well as double displacement reaction.
- b.  $\text{Pb}(\text{NO}_3)_2(\text{aq}) + 2\text{KI}(\text{aq}) \longrightarrow \text{PbI}_2(\text{s}) + 2\text{KNO}_3(\text{aq})$

**What is sequence of steps in photosynthesis? How is it different in desert plants and those in temperate regions?**

**[All India 2018, Delhi 2017, Foreign 2015]**

**Chloroplast (chlorophyll), on exposure to light energy, becomes activated by absorbing light energy, and splits water (photolysis of water) to oxygen and hydrogen. Hydrogen reduces  $\text{CO}_2$ , and synthesizes glucose.**

**In plants of temperate regions, stomata open during day to take in  $\text{CO}_2$  and release  $\text{O}_2$ .**

**Desert plants open stomata at night to check excessive loss of water hence sequence of steps of photosynthesis are slightly different.**

**These plants take up carbon dioxide at night and prepare an intermediate which is acted upon by the energy absorbed by the chlorophyll during the day.**

**What is the fate of glucose molecule in**

- a. Anaerobic respiration in Yeast and *Lactobacillus* bacteria?**
- b. Aerobic respiration in human cells. Write chemical equation for each type.**

**[AI India 2010, 2013, 2015]**

## a. Anaerobic Respiration

1. In Yeast: Glucose is broken down into **ethanol**, **carbon dioxide**, and **energy**.

- Equation:



2. In Lactobacillus Bacteria: Glucose is broken down into **lactic acid** and **energy**.

- Equation:



## b. Aerobic Respiration in Human Cells

Glucose is completely broken down into **carbon dioxide**, **water**, and a large amount of **energy (ATP)**.

- Equation:



Name the reducing agent in the following reaction:



State which is more reactive, Mn or Al and Why?

**Ans :** [CBSE 2016, 2015]

Al is the reducing agent. Al is more reactive than Mn.

Reason: It is because Al is displacing Mn from  $\text{MnO}_2$ .

- a. Define excretion.
- b. Name the basic filtration unit present in the kidney.
- c. Draw excretory system in human beings and label the following organs of excretory system which perform following functions:
  - (i) form urine
  - (ii) is a long tube which collects urine from kidney.
  - (iii) store urine until it is passed out.

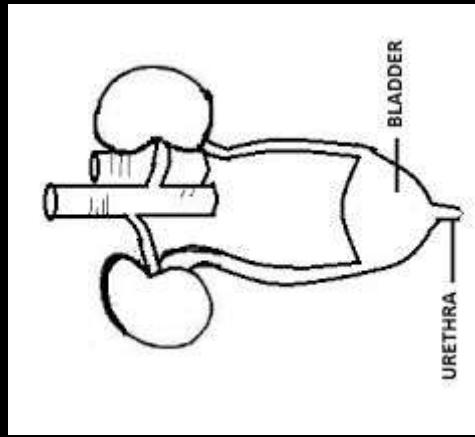
[All India 2018]

**a. Definition of Excretion**

Excretion is the biological process by which harmful metabolic waste products (like urea, carbon dioxide, and water) are removed from the body of an organism.

**b. Basic Filtration Unit in Kidney**

The basic filtration unit in the kidney is the nephron.



**c. Human Excretory System Diagram with Labels**

**Describe the mechanism of gaseous exchange in tissues and lungs.**  
[Delhi 2015]

**How is oxygen and carbon dioxide transported in human being?**  
[CBSE 2016]

**How is oxygen and carbon dioxide transported in human being?**  
**Explain clearly how the air is inhaled and exhaled during breathing in humans.** [All India 2009]

## Mechanism of Gaseous Exchange in Tissues and Lungs

### 1. Gaseous Exchange in Lungs:

#### Inhalation:

Air rich in oxygen is drawn into the lungs through the nose, trachea, and bronchi, filling the alveoli (air sacs).

#### Diffusion in Alveoli:

Oxygen from the alveoli diffuses into the blood capillaries because oxygen concentration is higher in alveoli than in blood.

Carbon dioxide, a waste product, diffuses from the blood into the alveoli for exhalation.

### Gaseous Exchange in Tissues:

Oxygen from the blood diffuses into the body tissues where oxygen concentration is low.

Carbon dioxide produced during cellular respiration diffuses from tissues into the blood to be transported back to the lungs.

**Oxygen Transport:** Oxygen binds to hemoglobin in red blood cells, forming oxyhemoglobin, which is transported to tissues.

**Carbon Dioxide Transport:** Bound to hemoglobin as carboxyhemoglobin.

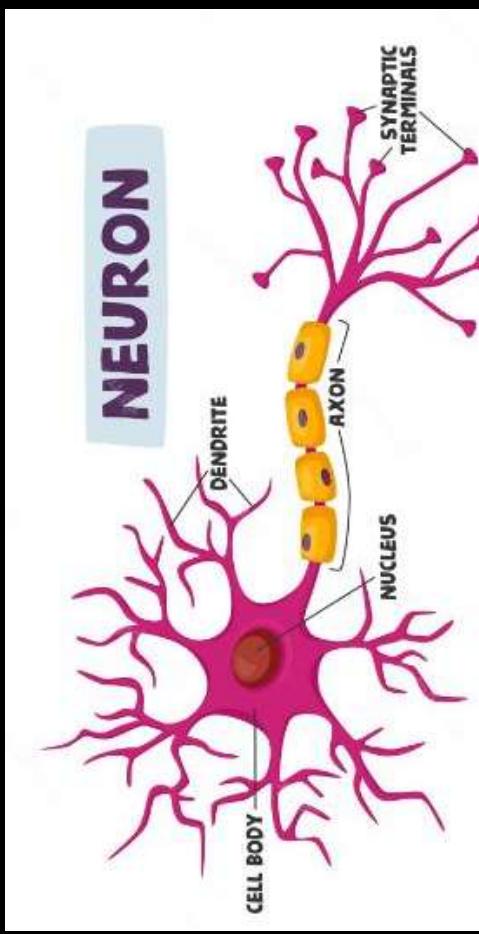
**(a) Draw the structure of a neuron and label the following on it:**

**Nucleus, Dendrite, Cell body and Axon.**

**(b) Name the part of neuron**

- (i) Where information is acquired.**
- (ii) Through which information travels as an electrical impulse.**

**[CBSE 2013, AI 2008]**



b. (i) Dendrite  
(ii) Axon.

**a. Name the diseases by which a person is likely to suffer due to the deficiency of:**

- (i) iodine
- (ii) insulin

**b. How the timing of secretion and amount of hormone secretion are regulated in human system. Explain with example.**

**[CBSE 2012,13]**

- a. (i) Goitre
- (ii) Diabetes.

- b. The timing and amount of hormone released are regulated by feedback mechanisms, e.g., if the sugar levels in blood rise, they are detected by the cells of the pancreas which respond by producing more insulin. As the blood sugar level falls, insulin secretion is reduced.

**Name the hormones secreted by the following endocrine glands and specify one function of each:**

- (a) Thyroid
- (b) Pituitary
- (c) Pancreas

**[All India 2018, CBSE 2017]**

- a. **Thyroid:** Secretes Thyroxine. It regulates metabolism of carbohydrates, fats and proteins.
- b. **Pituitary:** Secretes growth hormone. Growth hormone regulates growth and development of body.
- c. **Pancreas:** Secretes insulin. Insulin lowers blood sugar level.

(i) Solid calcium oxide was taken in a container and water was added slowly to it.

- (a) Write the observations.
- (b) Write the chemical formula of the product formed.

(ii) What happens when carbon dioxide is bubbled through lime water  
(a) in small amount  
(b) in excess?

[CBSE 2013, 2012, 2010]

(i) (a) The container becomes hot and hissing sound is produced.

(b)  $\text{Ca}(\text{OH})_2$  is the formula of the product formed.  
(ii) (a) Lime water turn milky when  $\text{CO}_2(\text{g})$  is passed through it:



(b) If excess of  $\text{CO}_2$  is passed milkiness disappears:  
 $\text{CaCO}_3(\text{s}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O(s)} \longrightarrow \text{Ca}(\text{HCO}_3)_2(\text{aq})$

**In the electrolysis of water:**

- a. Name the gas collected at the cathode and anode respectively.
- b. Why is volume of gas collected at one electrode double than that at the other? Name this gas.
- c. How will you test this gas?

[CBSE 2012, CBSE Sample Paper 2018]

## Gases Collected at Electrodes

- At the cathode: Hydrogen ( $H_2$ ) gas is collected.
  - At the anode: Oxygen ( $O_2$ ) gas is collected.
- b) It is because  $H_2O$  contains hydrogen and oxygen in the ratio 2 : 1.

## Hydrogen Test:

- Bring a burning splinter near the collected hydrogen gas.
- Observation:** It burns with a 'pop' sound, confirming the presence of hydrogen.

Balance the following reactions:

- a.  $\text{BaCl}_2 + \text{H}_2\text{SO}_4 \longrightarrow \text{BaSO}_4 + \text{HCl}$
- b.  $\text{Ca}(\text{OH})_2 + \text{HNO}_3 \longrightarrow \text{Ca}(\text{NO}_3)_2 + \text{H}_2\text{O}$
- c.  $\text{Pb}(\text{NO}_3)_2 \longrightarrow \text{PbO} + \text{NO}_2 + \text{O}_2$
- d.  $\text{MnO}_2 + \text{HCl} \longrightarrow \text{MnCl}_2 + \text{Cl}_2 + \text{H}_2\text{O}$

[CBSE 2011, 2009, 2008, 2008C]

- a.  $\text{BaCl}_2(\text{aq}) + \text{H}_2\text{SO}_4(\text{dil}) \longrightarrow \text{BaSO}_4(\text{s}) + 2\text{HCl}(\text{aq})$
- b.  $\text{Ca}(\text{OH})_2(\text{aq}) + 2\text{HNO}_3 \longrightarrow \text{Ca}(\text{NO}_3)_2(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$
- c.  $2\text{Pb}(\text{NO}_3)_2(\text{s}) \xrightarrow{\text{Heat}} 2\text{PbO}(\text{s}) + 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$
- d.  $\text{MnO}_2 + 4\text{HCl} \longrightarrow \text{MnCl}_2 + \text{Cl}_2 + 2\text{H}_2\text{O}$

A solution of potassium chloride when mixed with silver nitrate solution, an insoluble white substance is formed. Write the chemical reaction involved and also mention the type of reaction.

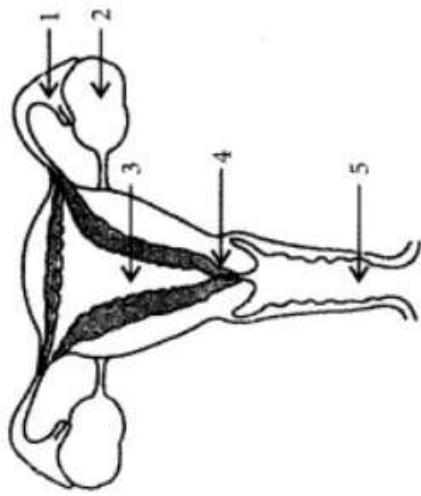
**Ans :**

[CBSE 2012, 2011, 2010]



It is a double displacement reaction.

(a) Identify the given diagram. Name the parts 1 to 5.



(b) What is contraception? List three advantages of adopting contraceptive measures. (Delhi 2019)

**Contraception is the avoidance of pregnancy. Methods of contraception:**

- **Barrier methods (condoms, diaphragm, etc.)**
- **Chemical methods (spermicide creams and jellies)**
- **Intrauterine Contraceptive Devices (IUCDs) (Lippes loop, CuT, etc.)**
- **Natural methods (rhythm method, coitus interruptus)**

**What are soaps and detergents chemically? Explain the action of cleaning by soaps. State the reason why we can wash our clothes even in hard water using detergents. (Foreign 2012)**

**What are detergents chemically? List two demerits of using detergents for cleansing. (AI 2012)**

**What is the difference between the chemical composition of soaps and detergents? State in brief the action of soaps in removing an oily spot from a shirt. Why are soaps not considered suitable for washing where water is hard? (Delhi 2012)**

**What is the difference between the molecules of soaps and detergents, chemically? Explain the cleansing action of soaps. (Delhi 2015)**

**Soaps and detergents are both, types of salts. State the difference between the two. Write the mechanism of the cleansing action of soaps. Why do soaps not form lather (foam) with hard water? Mention any two problems that arise due to the use of detergents instead of soaps. (Delhi 2017, AI 2015)**

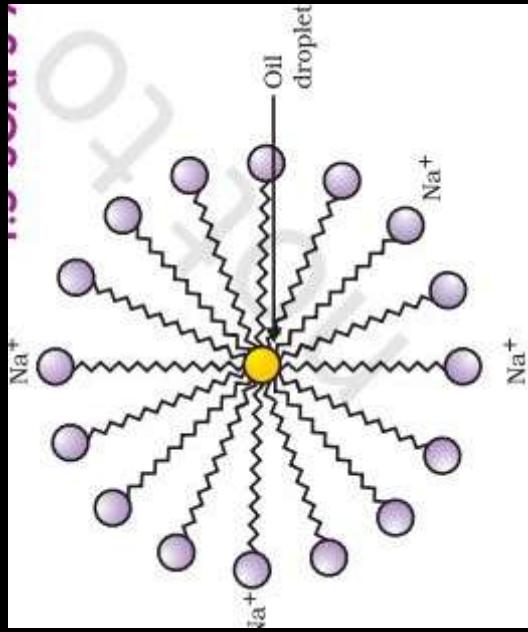
The molecules of soap are sodium or potassium salts of long-chain carboxylic acids.

### CLEANING EFFECT OF SOAPS:

Most dirt is oily in nature and oil does not dissolve in water. The **ionic-end of soap interacts with water** while the **carbon chain interacts with oil**.

The soap molecules, thus form structures called micelles where one end of the molecules is towards the oil droplet while the ionic-end faces outside.

This forms an emulsion in water. The soap micelle thus helps in pulling out the dirt in water and we can wash our clothes clean



The molecules of soap are **sodium or potassium salts of long-chain carboxylic acids**. Detergents are sodium long chains of sulphonated benzoic acid.

In hard water, soap does not form lather as hard water contains  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$  ions. Soap reacts with these ions to form insoluble calcium and magnesium salts of fatty acids.



Two problems which arise due to the use of detergents instead of soaps are :

- (i) Synthetic detergents are non-biodegradable and hence, cause water pollution.
- (ii) Synthetic detergents also cause skin related problems.

**What happens when**

- (a) Accidentally, **Planaria** gets cut into many pieces
- (b) **Bryophyllum** leaf falls on the wet soil
- (c) On maturation **sporangia** of **Rhizopus** bursts?

**(Delhi 2017, CBSE 2015)**

**Answer:**

- (a) When Planaria accidentally gets cut into many pieces then its each piece grows into a complete organism. This is known as regeneration.
- (b) When the Bryophyllum leaf falls on the wet soil, the buds present in the notches along the leaf margin develop into new plants. This is known as vegetative propagation.
- (c) The sporangia of Rhizopus contain cells or spores that can eventually develop into new Rhizopus individuals when it bursts on maturation.

**A white chemical compound becomes hard on mixing proper quantity of water. It is also used to maintain joints in fixed position. Name the chemical compound and write its chemical formula.**

**Write the chemical equation to show what happens when water is added to this compound in proper quantity.**

[CBSE Sample Paper 2018, CBSE 2016]

The compound is **Plaster of Paris (POP)**.

**Chemical Formula:**  $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$  (Calcium sulfate hemihydrate).

**Reaction with Water:**

When Plaster of Paris is mixed with water, it forms a hard mass of gypsum, which is used to fix joints and molds.

Chemical Equation:



**(a) What is puberty?**

**(b) Describe in brief the functions of the following parts in the human male reproductive system.**

- (i) Testes**
- (ii) Seminal vesicle**
- (iii) Vas deferens**
- (iv) Urethra**

**(c) Why are testes located outside the abdominal cavity?**

**(d) State how sperms move towards the female germ cell. (AI 2020, 2016)**

**Answer:**

- a) Puberty is the time when adolescent human beings reach sexual maturity and become capable of reproducing
- b) Functions of:
  - i) **Testes:** Production of sperms and testosterone
  - (ii) **Seminal vesicle:** Secretes a fluid rich in fructose to provide energy for sperm motility.

(iii) **Vas deferens**: Transports sperm from the testes to the urethra.

(iv) **Urethra**: Serves as a common passage for the excretion of urine and the ejaculation of semen.

- c) Testes are located outside the human body because they are the site of sperm production in human males, and sperm production requires 2-3 degrees less temperature than the normal human body temperature.
- d) The sperms present in the testes of man are introduced into the vagina of the woman through penis during copulation. They travel from here upward through the uterus at the top of fallopian tube within five minutes.

- (a) Three acidic solutions A, B and C have pH = 0, 3 and 5 respectively.
- (i) Which solution has highest concentration of H<sub>+</sub> ions?
- (ii) Which solution has the lowest concentration of H<sub>+</sub> ions?
- (b) How concentrated sulphuric acid can be diluted? Describe the process.

(Board Term I, 2014)

Answer:

- (a) (i) The solution having lower pH will have more hydrogen ion concentration. Hence, solution 'A' will have highest H<sub>+</sub> ion concentration.
- (ii) Solution C i.e., pH = 5 has the lowest concentration of H<sub>+</sub> ions.

(a) Three acidic solutions A, B and C have pH = 0, 3 and 5 respectively.

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(Board Term I, 2014)

(b) Mixing of an acid with water is called dilution. This process is highly exothermic and therefore, acid is always added to the water not water to acid. The process for diluting concentrated sulphuric acid is :

(i) Take about 10 mL of water in a beaker.

(ii) Add concentrated sulphuric acid dropwise to water and swirl the beaker slowly.

**Write one main difference between asexual and sexual mode of reproduction.**

**Which species is likely to have comparatively better chances of survival**  
– the one reproducing asexually or the one reproducing sexually?  
Justify your answer.

**(Foreign 2015, AI 2014)**

A key difference between asexual and sexual reproduction is that asexual reproduction involves a single parent and produces genetically identical offspring, while sexual reproduction involves two parents and results in offspring with genetic variation.

Species reproducing sexually have better chances of survival compared to those reproducing asexually.

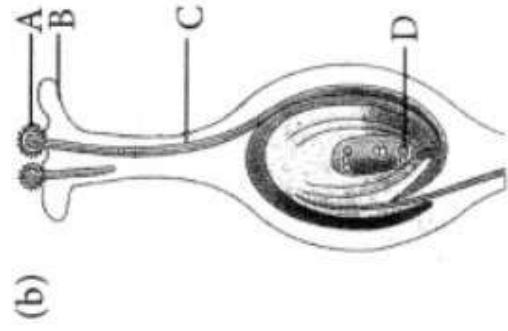
This is because genetic variation introduced through sexual reproduction enhances the ability of a species to adapt to changing environmental conditions and provides resilience against diseases, ensuring long-term survival and evolution.

# What is placenta? Explain its function in humans (Foreign 2015, AI 2014)

Placenta is an intimate connection between fetus and uterine wall of the mother to exchange the materials. It is a disc shaped structure embedded in the uterine wall.

## Placenta performs the following functions:

- All nutritive elements from maternal blood pass into the fetus through it.
- Placental helps in respiration, i.e., supply of oxygen and removal of CO<sub>2</sub> from fetus to maternal blood.
- Fetal excretory products diffuse out into maternal blood through placenta and are excreted by mother



- Name the part marked A in the diagram.
- How does A reaches part B?
- State the importance of the part C.
- What happens to the part marked D after fertilisation is over? (AI 2016)

29. (a) Create a food chain of the following organisms. Insect, Hawk, Grass, Snake, Frog

- (b) Name the organism at the third trophic level of the created food chain.
- (c) Which organism of this food chain will have the highest concentration of non-biodegradable chemicals?
- (d) Name the phenomenon associated with it.
- (e) If 10,000 Joules of energy is available to frogs, how much energy will be available to snakes in this food chain? (NCERT Exemplar, 2020)

37. "Energy flow in food chains is always unidirectional." Justify this statement. Explain how the pesticides enter a food chain and subsequently get into our body. (NCERT Exemplar, Foreign 2015, AI 2014)

Energy flow in an ecosystem is **unidirectional** because:

1. **Energy is Lost at Each Trophic Level:**
  - During energy transfer from one trophic level to the next, a major portion (about 90%) is lost as heat, leaving only 10% available for the next level.
2. **Energy Cannot be Recycled:**
  - Once energy is used by organisms for metabolic activities or lost as heat, it cannot return to the previous trophic level or the Sun.
3. **Producers Depend on the Sun:**
  - Producers (plants) can only capture energy from the Sun, and energy does not flow backward from consumers to producers or from decomposers to plants.

37. "Energy flow in food chains is always unidirectional." Justify this statement. Explain how the pesticides enter a food chain and subsequently get into our body. (NCERT Exemplar, Foreign 2015, AI 2014)

Pesticides enter food chains when they are sprayed on crops and absorbed by plants or settle on soil and water. Small organisms like insects or aquatic life ingest these chemicals, which then pass through the food chain as larger organisms consume them. Through **biomagnification**, the concentration of pesticides increases at each trophic level. When humans consume contaminated plants, water, or animals, the accumulated pesticides enter our bodies, potentially causing harmful health effects.

**Write the chemical formula and name of the compound which is the active ingredient of all alcoholic drinks. List its two uses. Write chemical equation and name of the product formed when this compound reacts with**

**(i) sodium metal**

**(ii) hot concentrated sulphuric acid. (Delhi 2019)**

**What happens when (write chemical equation in each case) (AI 2017)**

(a) ethanol is burnt in air?

(b) ethanol is heated with excess cone.  $\text{H}_2\text{SO}_4$  at 443 K?

(c) a piece of sodium is dropped into ethanol?

Write the respective chemical equations to show what happens when

- (i) ethanol is heated with concentrated sulphuric acid at 443 K ?
- (ii) ethanol reacts with ethanoic acid in the presence of an acid acting as a catalyst? (2/3, Foreign 2014)

**Explain why carbon forms compounds mainly by covalent bond. Explain in brief two main reasons for carbon forming a large number of compounds. Why does carbon form strong bond with most other elements? (Delhi 2015)**

**Elements forming ionic compounds attain noble gas electronic configuration by either gaining or losing electrons from their valence shells.**

- **Explain giving reason why carbon cannot attain such a configuration in this manner to form its compounds.**
- **Name the type of bonds formed in ionic compounds and in the compounds formed by carbon.**
- **Also explain with reason why carbon compounds are generally poor conductors of electricity. (Foreign 2015, AI 2014)**

**State two properties of carbon which lead to a very large number of carbon compounds. (2/5, AI 2011)**

In the case of carbon, it has four electrons in its outermost shell and needs to gain or lose four electrons to attain noble gas configuration. If it were to gain or lose electrons –

- (i) It could gain four electrons forming C<sup>4-</sup> anion. But it would be difficult for the nucleus with six protons to hold on to ten electrons, that is, four extra electrons.
- (ii) It could lose four electrons forming C<sup>4+</sup> cation. But it would require a large amount of energy to remove four electrons leaving behind a carbon cation with six protons in its nucleus holding on to just two electrons. Carbon overcomes this problem by sharing its valence electrons with other atoms of carbon or with atoms of other elements.

Such bonds which are formed by the sharing of an electron pair between two atoms are known as covalent bonds. Covalently bonded molecules are seen to have strong bonds within the molecule.

The nature of the covalent bond enables carbon to form a large number of compounds. Two factors noticed in the case of carbon are –

- (i) Carbon has the unique ability to form bonds with other atoms of carbon, giving rise to large molecules. This property is called catenation
- (ii) **TETRAVALENCY:** Since carbon has a valency of four, it is capable of bonding with four other atoms of carbon or atoms of some other monovalent element.

**“Affluent lifestyle has a negative effect on the environment.” Justify this statement with the help of an example. (Delhi 2014)**

53. Write one negative effect on the environment, of affluent lifestyle of few persons of a society. (AI 2016, 2014)

With the advancement in technology over time, there has been improvement in lifestyle of people. When people have more resources at their end they tend to overuse and misuse it thereby generating huge amounts of waste material.

For example:

- A) Affluent people tend to have a lot of clothes and most of these clothes end up in landfills when discarded and their non-biodegradable material makes them impossible to decompose.
- B) Similarly, excessive use of refrigerators and air conditioners, plastic foams, etc., also releases high quantities of CFCs which are responsible for ozone depletion.

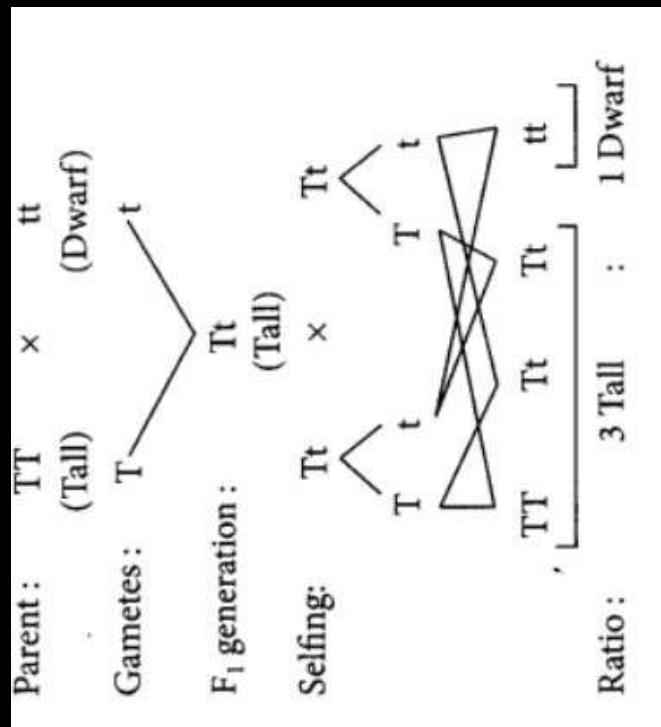
**With the help of an example justify the following statement: “A trait may be inherited, but may not be expressed.” (AI 2016, 2018)**

“It is possible that a trait is inherited but may not be expressed.” Give a suitable example to justify this statement. (Foreign 2015)

A trait may be inherited, but may not be expressed”. Justify this statement with the help of a suitable example. (AI 2014)

A trait may be inherited but may not be expressed, this could be explained by the given example. When a tall pea plant was crossed with a dwarf pea plant, then F<sub>1</sub> generation plants were all tall. When F<sub>1</sub> plants were selfed, then F<sub>2</sub> generation plants were both tall and dwarf. This shows that the F<sub>1</sub> plants had inherited both the parental traits but did not express dwarfness or recessive trait in the presence of the trait for tallness or dominant trait.

This could be explained by the given cross:



**“It is a matter of chance whether a couple will have a male or a female child.” Justify this statement by drawing a flow chart. (Foreign 2015)**

**“The sex of a newborn child is a matter of chance and none of the parents may be considered responsible for it”. Justify this statement with the help of flow chart showing determination of sex of a newborn. (Delhi 2013)**

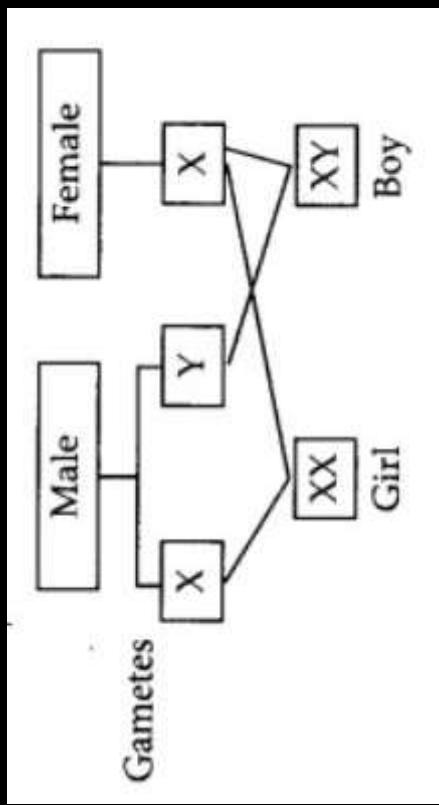
**With the help of a flow chart explain in brief how the sex of a newborn is genetically determined in human beings. Which of the two parents, the mother or the father, is responsible for determination of sex of a child? (CBSE 2012)**

**Sex is determined at the time of fertilisation when male and female gametes fuse.** Male produces two types of gametes, i.e., having X or Y chromosome and female produces same type of gametes containing X chromosomes. The sex of the child is determined at the time of fertilisation when male and female gametes fuse to form zygote.

If a sperm (male gamete) carrying X chromosome fertilises an egg, then the offspring will be a girl (female) with XX combination of sex chromosomes.

If a sperm (male gamete) carrying Y chromosome fertilises an egg, then the offspring will be a boy (male) with XY combination of sex chromosomes.

Therefore, there are 50% chance of a male child and 50% chance of a female child.



Distinguish between the acquired traits and the, inherited traits in tabular form, giving one example for each. (Delhi 2017)

With the help of two suitable examples, explain why certain experiences and traits earned by people during their lifetime are not passed on to their next generations. When can such traits be passed on? (AI 2017)

With the help of suitable examples, explain why certain traits cannot be passed on to the next generation? What are such traits called? (AI 2014)

List three distinguishing features, in tabular form, between acquired traits and the inherited traits. (Delhi 2016)

An individual cannot pass on to its progeny the experiences of its life-time". Justify the statement with the help of an example and also give reason for the same. (Foreign 2012)

Inherited traits	Acquired traits
(i) These are passed from the parent to offspring.	These are developed during the life of an individual.
(ii) These are genetic variations.	These are somatic variations.
(iii) These develop due to crossing over phenomenon and mutations.	These develop due to use and disuse of organs and direct effect of environment.
(iv) These are passed on from one generation to the other.	These traits die with the death of the individual.
(v) Example: Skin colour, eye colour, form of hair, polydactyly (extra fingers), free and attached ear lobes, blood groups of human beings.	Example: If a group of mice are normally bred, all their progenies will have tails. Now, if the tails of these mice are removed surgically in each generation, tailless mice will not be produced. It is so because removal of tail is an acquired character and it will not bring change in the genes of the germ cells of the mice.

### **HOMEWORK QUESTIONS:**

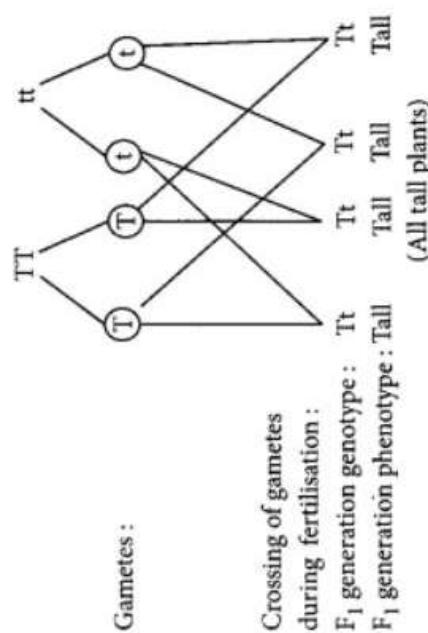
**How do Mendel experiments show that**  
**(a) traits may be dominant or recessive?**  
**(b) inheritance of two traits is independent of each other? (Delhi 2017)**

Answer:

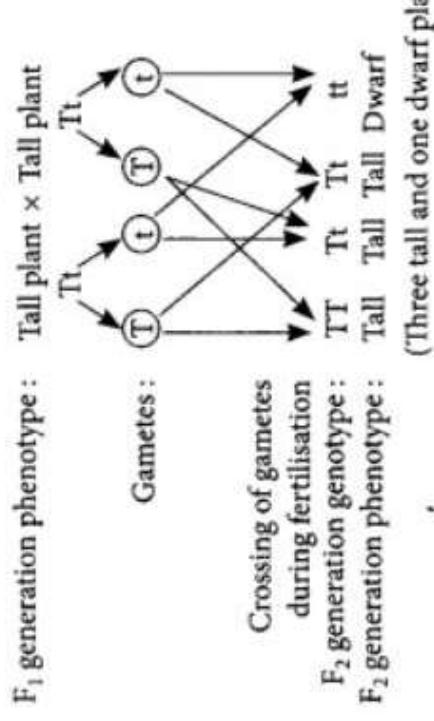
- (a) Mendel first crossed pure-bred tall pea plants with pure-bred dwarf pea plants and found that only tall pea plants were produced in the first generation ( $F_1$ ). He then self-crossed the tall pea plants of the  $F_1$  generation and found that tall plants and dwarf plants were obtained in the second generation or ( $F_2$ ) in the ratio of 3 : 1. Mendel said that the trait of dwarfness of one of the parent pea plant had not been lost, it was merely concealed or suppressed in the first generation to re-emerge in the second generation. He called the suppressed trait of 'dwarfness' as 'recessive trait' and the expressed trait of 'tallness' as the 'dominant trait'. In this way, Mendel's experiments with tall and dwarf pea plants showed that the traits may be dominant or recessive.

Hence this could be explained by the given cross :

Parental generation :      Tall plant     $\times$     Dwarf plant

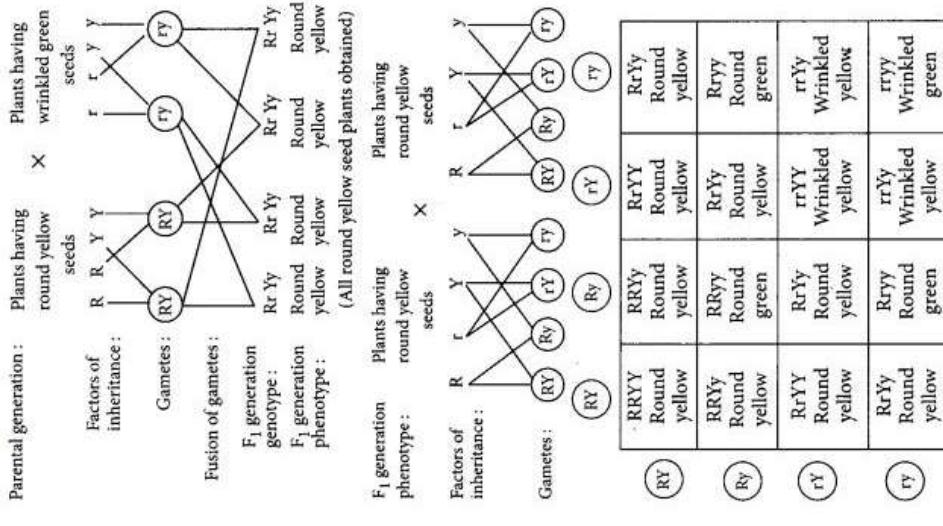


F<sub>1</sub> generation phenotype:      Tall plant  $\times$  Tall plant

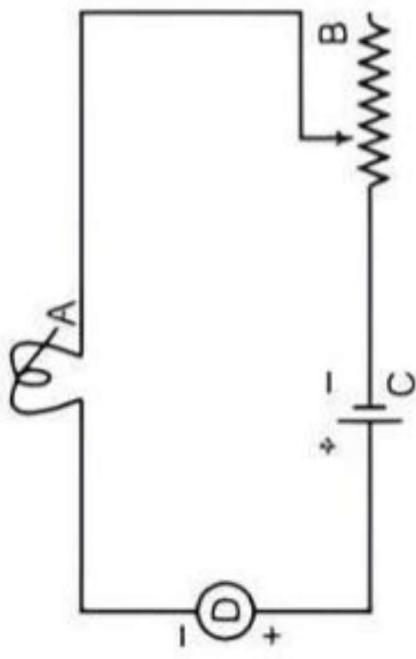


- (b) Mendel observed two combinations of characteristics in seeds, round-yellow and wrinkled-green, and two new combinations of characteristics had appeared in the  $F_2$  generation, round-green and wrinkled-yellow. According to Mendel's second law of inheritance more than one pair of traits are considered in a cross simultaneously, the factors responsible for each pair of trait are distributed independently to the gametes.

The cross given below showing dihybrid cross explains that the inheritance of two traits is independent of each other.

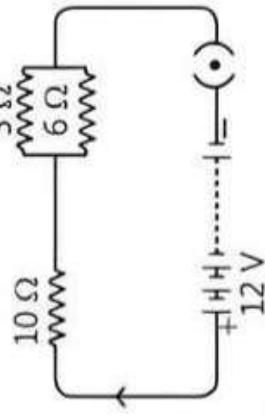


**Q 2.** Given below is a circuit showing current flowing in it. Identify each component A, B, C, D of this circuit:



**Ans.** A is Electric Bulb; B is Rheostat or variable resistance;  
C is an electric cell and D is ammeter.

**Q 5.** Consider the circuit shown in the diagram. Find the current in  $3\Omega$  resistor. (CBSE 2011)



**Sol.**  $3\Omega$  and  $6\Omega$  are connected in parallel

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{3} + \frac{1}{6} = \frac{1}{2}$$

$$R_p = 2\Omega$$

$R_p$  and  $10\Omega$  are connected in series.

$$\text{Hence, total amount of resistance, } R_s = R_p + 10 \\ = 2 + 10 = 12\Omega$$

$$\text{Total current in the circuit, } I = \frac{V}{R_s} = \frac{12}{12} = 1A$$

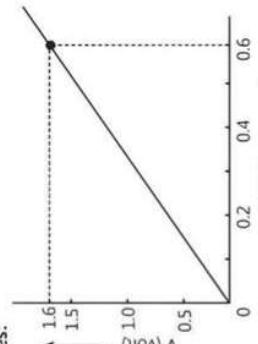
Now, voltage drop across the parallel connection

$$= 1 \times 2 = 2V$$

$$\text{So, current across the } 3\Omega \text{ resistance} = \frac{V}{R} = \frac{2}{3} A$$

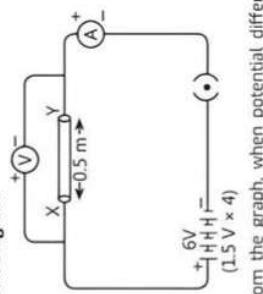
**Q 2.** (i) Draw a closed circuit diagram consisting of a  $0.5\text{ m}$  long nichrome wire XY, an ammeter, a voltmeter, four cells of  $1.5\text{ V}$  each and a plug-key.

(ii) Following graph was plotted between  $V$  and  $I$  values:



What would be the values of  $V/I$  ratios when the potential difference is  $0.8\text{ V}$ ,  $1.2\text{ V}$  and  $1.6\text{ V}$  respectively? What conclusion do you draw from these values? (CBSE 2015)

**Ans.** (i) Circuit Diagram:



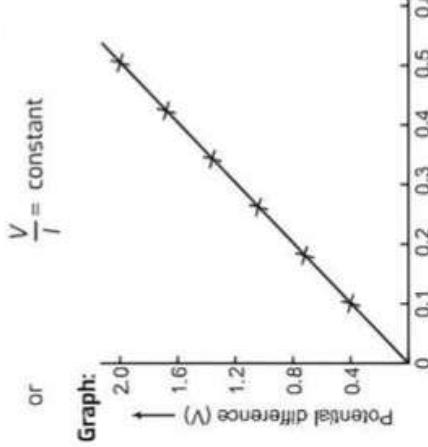
(ii) From the graph, when potential difference is  $1.6$  volt, the current is  $0.6$  A, thus

$$\frac{V}{I} = \frac{1.6}{0.6} = 2.67\Omega$$

The straight line nature of the graph shows that the value of  $\frac{V}{I}$  for all potential differences of  $0.8\text{ V}$ ,  $1.2\text{ V}$  and  $1.6\text{ V}$  will be constant and equal to  $2.67\Omega$ .

**Q 4.** (i) State the relation correlating the electric current flowing in a conductor and the voltage applied across it. Also draw a graph to show this relationship.

- (ii) Find the resistance of a conductor if the electric current flowing through it is 0.35 A when the potential difference across it is 1.4 V. (CBSE 2020)
- Ans.** (i) The Ohm's law i.e., potential difference across the ends of a conductor in an electric circuit is directly proportional to the current flowing through it correlates electric current and voltage.



$$(ii) \text{ Given, } I = 0.35 \text{ A and } V = 1.4 \text{ V}$$

From Ohm's law,

$$R = \frac{V}{I} \Rightarrow R = \frac{1.4}{0.35} \Rightarrow R = 4 \Omega$$

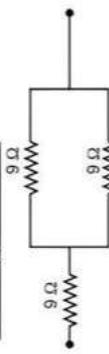
**Q 9.** Show how would you join three resistors, each of resistance 9  $\Omega$  so that the equivalent resistance of the combination is (i) 13.5  $\Omega$  and (ii) 6  $\Omega$ ? (CBSE 2018)

**Ans.**



*Practice plenty of numericals based on finding the equivalent resistance of series and parallel circuits.*

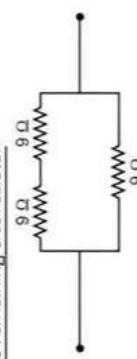
- (i) To get equivalent resistance of 13.5  $\Omega$ , two 9  $\Omega$  resistors are first connected in parallel and then their combination is connected in series with the remaining 9  $\Omega$  resistor.



$$\frac{1}{R_p} = \frac{1}{9} + \frac{1}{9} = \frac{2}{9}$$

$$R_p = \frac{9}{2} = 4.5 \Omega$$

- (ii) To get equivalent resistance of 6  $\Omega$ , two 9  $\Omega$  resistors are first connected in series and then this combination is connected in parallel with the remaining 9  $\Omega$  resistor.



$$R_s = (9 + 4.5)\Omega = 13.5 \Omega$$

$$\frac{1}{R_p} = \frac{1}{13.5} + \frac{1}{9} = \frac{3}{18}$$

$$R_p = \frac{18}{3} = 6 \Omega$$

**Q 11** Under what conditions permanent electromagnet is obtained if a current carrying solenoid is used?

(NCERT EXEMPLAR)

**Ans.** The conditions to obtain permanent electromagnet if a current carrying solenoid is used are:

- (i) The current through the solenoid should be direct current.

- (ii) The rod inside is made of a magnetic material such as steel.

**Q 12. What is the role of fuse, used in series with any electrical appliance? Why should a fuse with defined rating not be replaced by one with a larger rating?**

(NCERT EXEMPLAR)

**Ans.** Fuse is used for protecting appliances from short-circuiting or overloading.

When a fuse with defined rating for a particular appliance is replaced by one with larger rating, it does not blow off and the appliance is damaged due to larger current passing through it.

**Q1.** A student fixes a white sheet of paper on a drawing board. He places a bar magnet in the centre and sprinkles some iron filings uniformly around the bar magnet. Then he taps gently and observes that iron filings arrange themselves in a certain pattern.

(i) Why do iron filings arrange themselves in a particular pattern?

(ii) Which physical quantity is indicated by the pattern of field lines around the bar magnet?

(iii) State any two properties of magnetic field lines.

**Ans.** (i) When iron filings are placed in a magnetic field around a bar magnet, they behave like tiny magnets. The magnetic force experienced by these tiny magnets make them rotate and align themselves along the direction of field lines.

(ii) The physical property indicated by this arrangement is the magnetic field produced by the bar magnet.

(iii) Two properties of magnetic field lines are as follows:

(a) Magnetic field lines never intersect

(b) Magnetic field lines are closed curves.

A compass needle is placed near a current carrying wire. State your observations for the following cases and give reasons for the same in each case:

(i) Magnitude of electric current in wire is increased.

(ii) The compass needle is displaced away from the wire.

(CBSE SQP 2022-23)

(i) The deflection in the compass needle increases as magnetic field of the current carrying conductor is directly proportional to current flowing through it.

(ii) The deflection in the needle decreases as the magnetic field is inversely proportional to the perpendicular distance from the wire.

(CBSE SQP 2022-23)

(i) Magnitude of electric current in wire is increased.

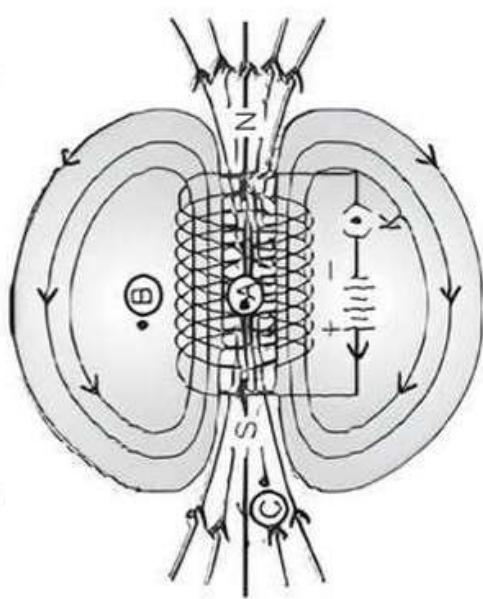
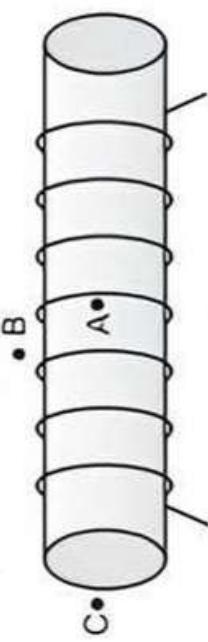
(ii) The compass needle is displaced away from the wire.

(CBSE SQP 2022-23)

(i) The deflection in the compass needle increases as magnetic field of the current carrying conductor is directly proportional to current flowing through it.

(ii) The deflection in the needle decreases as the magnetic field is inversely proportional to the perpendicular distance from the wire.

For the current carrying solenoid as shown below, draw magnetic field lines and giving reason, explain that out of the three points A, B and C at which point the field strength is maximum and at which point it is minimum? (CBSE 2023, 15)



Outside the solenoid, the magnetic field is minimum. At the end point C of the solenoid, the magnetic field strength is half of that inside it. So, it will be minimum at point B and maximum at point A.

Anannya responded to the question: Why do electrical appliances with metallic bodies are connected to the mains through a three pin plug, whereas an electric bulb can be connected with a two pin plug?

She wrote: Three pin connections reduce heating of connecting wires.

(i) Is her answer correct or incorrect? Justify.

(ii) What is the function of a fuse in a domestic circuit? (CBSE SQP 2023-24)

(i) Anannya's answer is wrong. Electrical appliances with metallic bodies need an earth wire which provides a low resistance conducting path to the flow of current in case there is an accidental leakage of current through the conducting body of the appliances.

(ii) An electrical fuse is a safety device that operates to provide protection against the overflow of current in an electrical circuit. An important component of an electrical fuse is a metal wire or strip that melts when excess current flows through it.

The absolute refractive index of Ruby is 1.7. Find the speed of light in Ruby. The speed of light in vacuum is  $3 \times 10^8$  m/s. (CBSE 2019)

We know that,

$$\mu = \frac{\text{Speed of light in vacuum}}{\text{Speed of light in Ruby}} = \frac{c}{v}$$

$$v = c/\mu$$

where,  $c$  = velocity of light and  $\mu$  = refractive index

$$v = \frac{3 \times 10^8}{1.7} = 1.76 \times 10^8 \text{ m/s}$$

**Q 17.** The power of a lens is +5 diopters. What is the nature and focal length of this lens? At what distance from this lens should an object be placed so as to get its inverted image of the same size?

**Ans.** Given,  $P = +5 \text{ D}$

We know that,  $f = 100/P = 100/5 = +20 \text{ cm}$   
 $+f$  indicates that the lens is convex (converging) in nature.

Object should be placed at a distance of 40 cm (at  $2F$ ) from the given convex lens to obtain an inverted image of same size.

### Short Answer Type-II Questions ↗

**Q 1.** Define the following terms in the context of a diverging mirror:

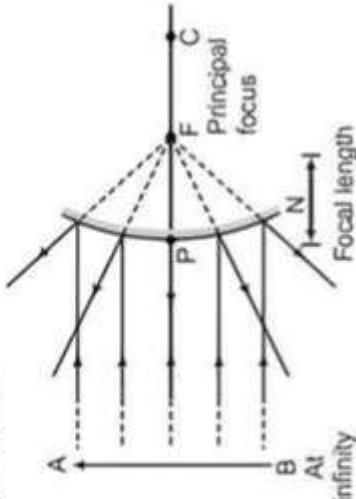
(i) Principal focus      (ii) Focal length

Draw a labelled ray diagram to illustrate your answer.

**Ans.** (i) The principal focus of a diverging (convex) mirror is a point on its principal axis from which a beam of light rays, initially parallel to the axis, appears to diverge after being reflected from the convex mirror.

(ii) The distance between the pole and the principal focus of diverging mirror is called focal length of diverging (convex) mirror.

### Ray Diagram:



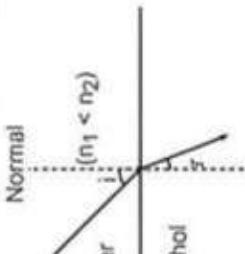
**Q 2.** A child is standing in front of a magic mirror. She finds the image of her head bigger, the middle portion of her body of the same size and that of the legs smaller. Explain the construction of the magic mirror using different types of mirrors. Also state the reasons in support of your answer.

**Ans.** The top part of the mirror is concave because it forms enlarged, erect and virtual image when the object is closer to the mirror.

The middle part is a plane mirror because it forms image of the same size.

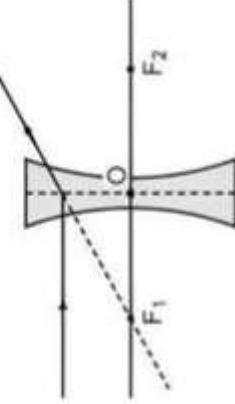
The lower part is a convex mirror because it forms erect and diminished image.

- Q 11.** (i) Water has refractive index 1.33 and alcohol has refractive index 1.36. Which of the two mediums is optically denser? Give reason for your answer.  
(ii) Draw a ray diagram to show the path of a ray of light passing obliquely from water to alcohol.  
(iii) State the relationship between angle of incidence and angle of refraction in the above case. (CBSE 2020)

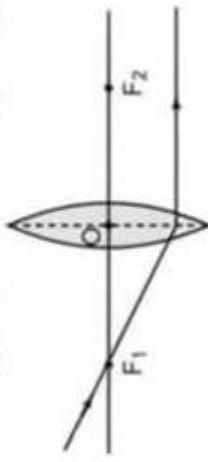
- Ans.** (i) Refractive index of alcohol is greater than refractive index of water. So, alcohol is optically denser than water.
- (ii) When a ray of light enters from water to alcohol, it bends towards the normal. 
- (iii) Angle of incidence is greater than angle of refraction. 

- Q 12. What happens after refraction, when:**
- (i) a ray of light parallel to the principal axis passes through a concave lens?  
(ii) a ray of light falls on a convex lens while passing through its principal focus?  
(iii) a ray of light passes through the optical centre of a convex lens? (CBSE 2020)

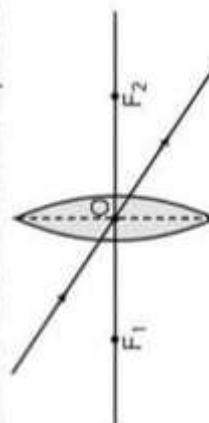
- Ans.** (i) It appears to be coming from focus after refraction through the lens.



(ii) It will appear parallel to the principal axis.



(iii) It suffers no refraction i.e. It passes undeviated.



**Q 1. Define the term power of accommodation. Write the modification in the curvature of the eye lens which enables us to see the nearby objects clearly? (CBSE 2019)**

**Ans.** The ability of the eye to focus on both near and distant objects, by adjusting its focal length, is called

the accommodation of the eye.

While looking at nearby objects, the ciliary muscles contract which increases the curvature of eye lens. The eye lens becomes thicker and focal length of eye lens decreases which enable us to see the nearby objects clearly.

**Q 2. Write the structure of eye lens and state the role of ciliary muscles in the human eye. (CBSE 2019)**

**Ans.** The eye lens is a bi-convex lens made of a fibrous, jelly-like material.

The key role of ciliary muscles is to modify the curvature of eye lens and thus change its focal length.

A glass prism is able to produce a spectrum when white light passes through it but a rectangular block of same transparent glass does not produce any spectrum. Why?

(CBSE 2019)

In a rectangular block, refraction of light takes place at the two parallel surfaces. In this case, the emergent ray is also a white light because the constituents of white light which are refracted at different angles at the first interface recombine at the second interface and emerge as a single white light.

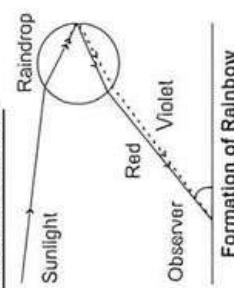
In a prism, the two interfaces through which the light ray has to pass are not parallel to each other and are inclined at an angle. In this case, the effects of the first interface are not reversed and the colours separated at the first interface continue along different paths upon leaving the glass at the second interface. Hence, we observe a spectrum in a glass prism.

When and where does a rainbow appear in the sky?

Draw a labelled ray diagram to show its formation.

(CBSE 2023)

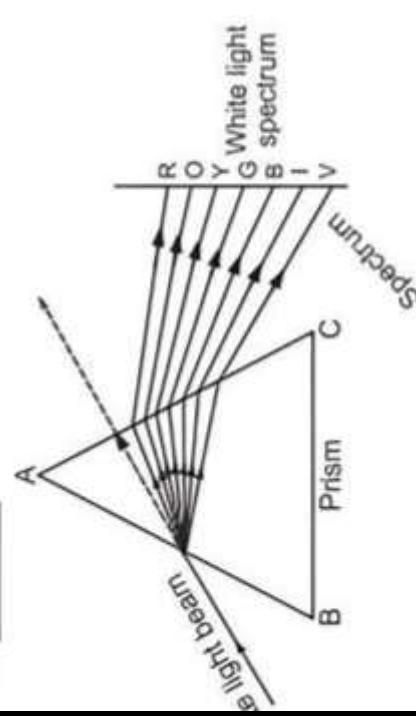
A rainbow is a natural spectrum appearing in the sky after a rain shower. It is always formed in a direction opposite to that of the Sun.



**Define the term dispersion of white light. State the colour which bends (i) the most, (ii) the least while passing through a glass prism. Draw a diagram to show the dispersion of white light.** (CBSE 2023)

The splitting of white light into its components due to different bending abilities of colours when it passes through a prism is called dispersion.

- (i) Violet colour bends the most.
- (ii) Red colour bends the least.



**What is a rainbow? Draw a labelled diagram to show the formation of a rainbow.** (CBSE 2023, 19)

A rainbow is a natural spectrum appearing in the sky after rainfall. It is caused by dispersion of sunlight by tiny water droplets present in the atmosphere.

