

10



CBSE

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Formula Book

SCIENCE

1 CHEMICAL REACTIONS AND EQUATIONS

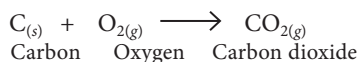
• Characteristics of Chemical Reactions

- change in state
- change in colour
- evolution of a gas
- change in temperature
- formation of a precipitate

• Types of Chemical Reactions

- Combination reactions

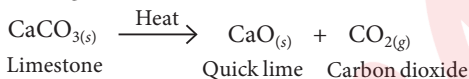
When two or more substances (elements or compounds) combine to form a single product, the reactions are called combination reactions.



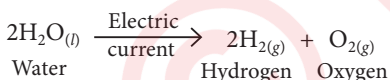
- Decomposition reactions

When a single reactant breaks down to give two or more simpler products, the reactions are called decomposition reactions. Decomposition reactions require energy either in the form of heat, light or electricity for breaking down the reactants.

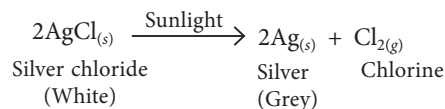
When a decomposition reaction is carried out by heating, it is called **thermal decomposition reaction**.



When a substance in the molten state or in aqueous solution is decomposed by passing electric current, it is called **electrolytic decomposition reaction** or simply **electrolysis**.



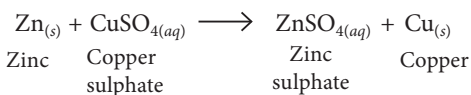
When a substance is decomposed by absorbing light energy, it is called **photodecomposition reaction** or simply **photolysis**.



- Displacement reactions

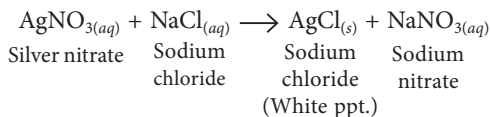
The chemical reactions in which one element takes the position of another element present in a compound are called displacement reactions.

These reactions occur mostly in solution form and a more active metal displaces or removes less active metal from its salt solution.



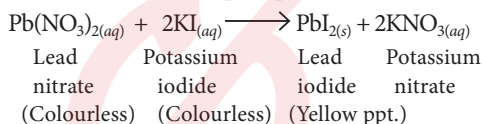
- Double displacement reactions

Reactions in which there is an exchange of ions between the reactants are called double displacement reactions.



- Precipitation reactions

Reaction that produces a precipitate (insoluble substance) is called a precipitation reaction.



• Oxidation and Reduction Reactions

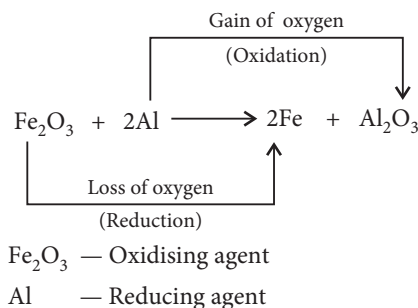
- Reactions in which one reactant gets oxidised while the other gets reduced are called oxidation-reduction reactions or **redox reactions**.

- Oxidation is defined as the addition of oxygen to a substance or removal of hydrogen from a substance in a chemical reaction.

- Reduction is defined as the addition of hydrogen to a substance or removal of oxygen from a substance in a chemical reaction.

- The substance which either gives oxygen or gains hydrogen in a reaction, is known as an **oxidising agent**.

- The substance which either gives hydrogen or gains oxygen in a reaction, is known as a **reducing agent**.



• Exothermic and Endothermic Reactions

- Exothermic reactions

Reactions in which heat is released along with the formation of products are called exothermic reactions.

- Endothermic reactions

Reactions in which energy is absorbed during the chemical reaction are known as endothermic reactions.

2 ACIDS, BASES AND SALTS

Colours of Some Common Indicators in Acidic and Basic Solutions

Nature of substance	Indicators						
	Blue litmus	Red litmus	Methyl orange	Phenolphthalein	Turmeric	China rose	Red cabbage
Acidic	Red	No change	Red	Colourless	No change	Dark pink	Red
Basic	No change	Blue	Yellow	Pink	Red	Green	Green

Chemical Properties of Acids and Bases

Reaction with acid

Metal + Dilute acid \rightarrow Metal salt + Hydrogen

Metal carbonate/Metal hydrogencarbonate +

Acid \rightarrow Metal Salt + Carbon dioxide + Water

Neutralization reaction

Base + Acid \rightarrow Salt + Water

Metallic oxides are basic oxides

Metallic oxide + Acid \rightarrow Salt + water

Non-metallic oxides are acidic oxides

Non-metallic oxide + Base \rightarrow Salt + Water

pH scale

pH can be defined as logarithm of reciprocal of H_3O^+ ions in aqueous solution.

In pH scale, lesser the value of pH, higher the acidic nature of the substance.

– pH = 0-7, Acidic (Salt of strong acid and weak base).

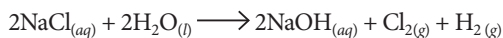
– pH = 7, Neutral (Salt of strong acid and strong base).

– pH = 7-14, Basic (Salt of weak acid and strong base).

Some Important Acids, Bases and Salts

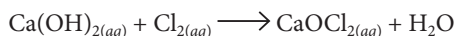
Sodium hydroxide or (NaOH)

– Caustic soda turns red litmus blue, soluble in water (Highly alkaline)



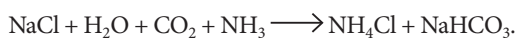
Bleaching powder or calcium oxychloride (CaOCl₂)

– Soluble in water



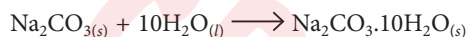
Baking soda or (NaHCO₃)

– Sodium hydrogencarbonate or Sodium bicarbonate, turns red litmus blue, sparingly soluble in water (Weakly basic)



Washing soda or (Na₂CO₃·10H₂O)

– Sodium carbonate decahydrate, turns red litmus blue, Sparingly soluble in water (Weakly basic)



Water of crystallization

– It is the fixed number of water molecules present in one formula unit of a salt.

Name	Formula
Hydrated copper sulphate	CuSO ₄ ·5H ₂ O
Gypsum	CaSO ₄ ·2H ₂ O
Plaster of Paris	CaSO ₄ · $\frac{1}{2}$ H ₂ O
Zinc sulphate	ZnSO ₄ ·7H ₂ O

3 METALS AND NON-METALS

Reactivity Series

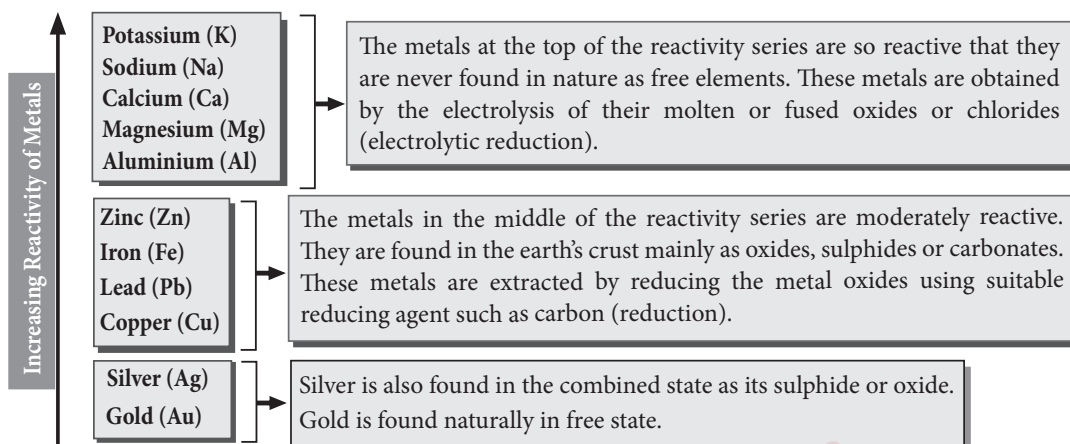
The reactivity series is a list of metals arranged in the order of their decreasing activities.

Metals more reactive than hydrogen	Potassium	K \rightarrow Most Reactive
	Sodium	Na Metal
	Calcium	Ca
	Magnesium	Mg
	Aluminium	Al
	Zinc	Zn
	Iron	Fe
	Nickel	Ni
	Tin	Sn
	Lead	Pb
Metals less reactive than hydrogen	Hydrogen	H
	Copper	Cu
	Mercury	Hg
	Silver	Ag
	Gold	Au \rightarrow Least Reactive Metal

REACTIVITY DECREASES

Extraction of Metals

– The position of a metal in the reactivity series determines the method used for its extraction.



4 CARBON AND ITS COMPOUNDS

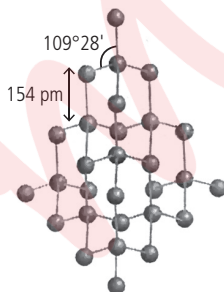
• Comparison of Properties of Ionic and Covalent Compounds

S.No.	Covalent compounds	Ionic compounds
1.	They consist of true molecules.	They do not have true molecules, but are aggregates of +ve and -ve ions.
2.	They are usually gaseous or liquids or soft solids.	They are usually crystalline solids.
3.	They have low melting and boiling points.	They have usually high melting and boiling points.
4.	They are usually soluble in organic solvents.	They are usually insoluble in organic solvents.
5.	They are usually insoluble in water.	They are usually soluble in water.
6.	They are bad conductors of electricity in aqueous solution or in molten form.	They are good conductor of electricity in molten and aqueous state.

Allotropes of Carbon

• Diamond

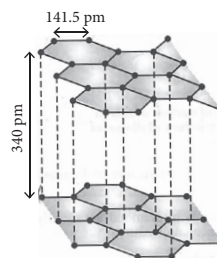
- Tetrahedral arrangement of carbon atoms gives diamond a rigid three-dimensional network which makes it the hardest natural substance known.
- Each carbon atom is joined to four other carbon atoms.
- Strong bonds exist between carbon atoms.



- As there are no free electrons in a diamond crystal, it is a bad conductor of electricity.

• Graphite

- Each carbon in the layer of hexagonal rings is attached to three other carbon atoms by strong covalent bonds. As only three valence electrons are used for bond formation hence, the fourth valence electron is free to move which makes it a good conductor of heat and electricity.



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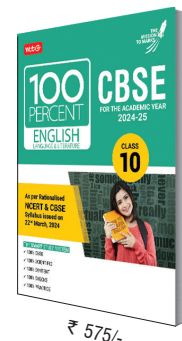
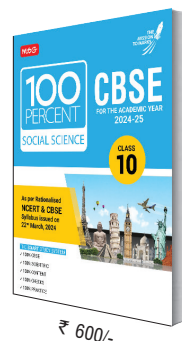
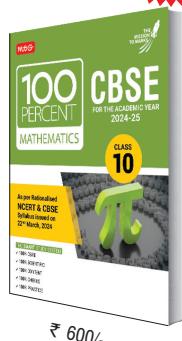
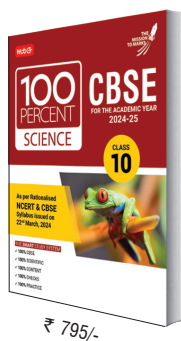
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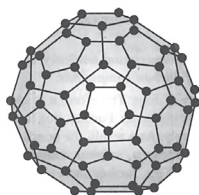


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- The various layers of carbon atoms in graphite are held together by weak van der Waals forces of attraction which make it smooth and slippery.
- Graphite structure is formed by the hexagonal arrays being placed in layers one above the other.
- One of these bonds is a double bond in order to satisfy the fourth valency of carbon.
- Graphite has a two-dimensional sheet like (layered) structure.

• Fullerenes

- The C_{60} fullerene is the most stable and was the first to be identified. It contains 60 carbon atoms which are arranged in the shape of a football or a soccer ball, therefore, it is also called buckyball.



- It contains 20 six-membered rings and 12 five-membered rings. Six-membered rings are fused to both six-membered and five-membered rings but five-membered rings are fused only to six-membered rings. In other words, no two five-membered rings are fused together.

• Saturated (Alkanes) and Unsaturated (Alkenes and Alkynes) Hydrocarbons

- Hydrocarbons having C—C single bond is termed as alkanes. Example : H_3C-CH_3 (Ethane).
- Hydrocarbons having carbon-carbon double bond are called alkenes. Example : $H_2C=CH_2$ (Ethene).
- Hydrocarbons having carbon-carbon triple bonds are called alkynes. Examples : $HC\equiv CH$ (ethyne).

• Some functional groups in carbon compounds

Heteroatom	Functional group	Formula of functional group
Cl/Br/I	Halo (Chloro/Bromo/Iodo)	—Cl, —Br, —I (substitutes for hydrogen atom)
Oxygen	1. Alcohol	—OH
	2. Aldehyde	$\begin{array}{c} H \\ \\ -C \\ \\ O \end{array}$
	3. Ketone	$\begin{array}{c} -C- \\ \\ O \end{array}$
	4. Carboxylic acid	$\begin{array}{c} O \\ \\ -C-OH \end{array}$

• Nomenclature of Carbon Compounds

The name of an organic compound is divided into two parts :

- The first part (prefix) tells us the number of carbon atoms in a compound.

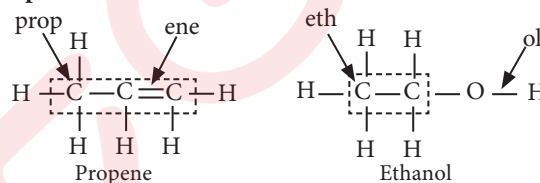
First part of the name	meth-	eth-	prop-	but-
Number of carbon atoms in a compound	one	two	three	four

- The second part (suffix) of the name tells us the homologous series of the compound.

Name of ending	-ane	-ene	-yne	-ol	-al	-one	-oic acid
Homologous series	alkane	alkene	alkyne	alcohol	aldehyde	ketone	carboxylic acid

- If functional group is halogen we use prefix as chloro, bromo, etc.

Examples :



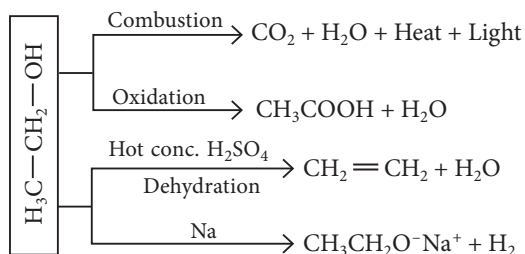
Thus, propene is an alkene with three carbon atoms and ethanol is an alcohol with two carbon atoms.

• Chemical Properties of Carbon Compounds

- Combustion
- Oxidation
- Addition reaction
- Substitution reaction

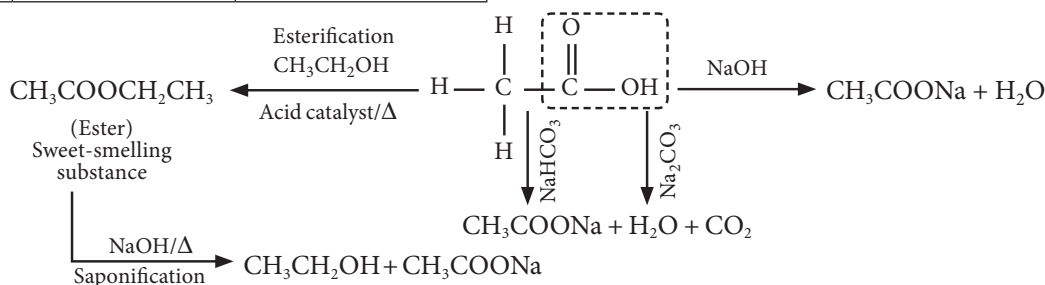
• Properties of Ethanol

- Functional group : —OH
- General formula : $C_nH_{2n+1}OH$



• Properties of Ethanoic Acid

- Functional group : —COOH
- General formula : $C_nH_{2n}O_2$



5 LIFE PROCESSES

S.No.	Autotrophic nutrition	Heterotrophic nutrition
1.	It occurs in green plants, some bacteria and in some protists.	It occurs in animals and in plants which lack chlorophyll.
2.	Chlorophyll is necessary for trapping solar energy.	Chlorophyll is absent; as such they do not trap solar energy.
3.	Food is self-manufactured using CO ₂ and water as raw materials.	Food is obtained directly or indirectly by consuming autotrophs.
4.	Digestion of food does not occur.	Digestion is required to convert complex organic substances present in food into simpler and soluble forms.
5.	They are placed at the bottom of the food chain as producers.	They are placed above producers in the food chain as consumers.

Table : Differences between light and dark phase

S.No.	Light phase	Dark phase
1.	It occurs over thylakoids.	It occurs in matrix of chloroplasts.
2.	The phase is dependent on light.	The phase does not require light.
3.	Temperature has little effect over it.	It is influenced by temperature.
4.	It produces NADPH and ATP (assimilatory power).	It consumes NADPH and ATP.
5.	Oxygen is evolved.	Glucose is the end product.

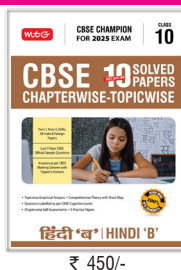
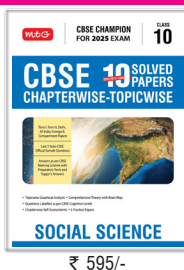
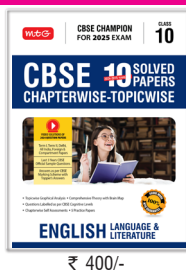
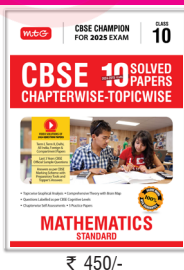
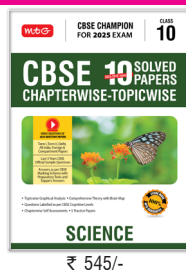
Table : Differences between inhalation and exhalation

S.No.	Inhalation (Inspiration)	Exhalation (Expiration)
1.	Intercostal muscles of the ribs contract pulling the ribs and sternum upwards and outwards.	Intercostal muscles of the ribs relax allowing the ribs and the sternum to return to their original.
2.	The radial muscles of diaphragm contract, and diaphragm is pulled down and flattened.	The radial muscles of diaphragm relax and diaphragm is pushed back to its original dome-like position.
3.	Volume inside the thorax increases.	Volume inside the thorax decreases.
4.	Intrathoracic pressure of the lungs decreases and outside air rich in oxygen rushes in through the nostrils.	Intrathoracic pressure of the lungs increases and the inside air rich in CO ₂ and water-vapour is forced out through the nostrils.

- The blood circulation in human heart is called **double circulation**. One circulation involves the entry of blood into the heart from all body parts. This blood is deoxygenated which goes to lungs for oxygenation. The second circulation involves entry of oxygenated blood from lungs into the heart and then its distribution to all parts of the body. Double circulation is made possible because the human heart is divided into two halves. One half pumps deoxygenated blood to the lungs and the other half pumps oxygenated blood to the rest of the body. Blood pressure is generally measured by **sphygmomanometer**.



CBSE Chapterwise -Topicwise 10 Years (2024-2015) Solved Papers



Highlights

- Based on Latest Syllabus
- Topicwise Graphical Analysis
- Quick Recap with Brain Map
- Previous 10 years (2024- 2015) questions of CBSE
- CBSE Cognitive Level Tagging
- Key Points, Answer Tips, Concept Applied, Shortcuts, Alternating Methods, Commonly Made Mistakes provided
- CBSE Topper's Answers
- Past 3 years CBSE Sample Question Papers
- Chapterwise Self-Assessment
- 5 Practice Papers as per latest pattern



VIDEO SOLUTIONS OF 2024 QUESTION PAPERS

- The sound of blood flow can be heard through a **stethoscope**. The normal blood pressure of a human being is written as $\frac{120}{80}$, i.e., 120 mm of Hg systolic blood pressure/ 80 mm of Hg diastolic blood pressure.

Table : Differences between blood and lymph

S.No.	Characteristic	Blood	Lymph
1.	Colour	Red in colour	Colourless
2.	Components	<ul style="list-style-type: none"> Consists of plasma, erythrocytes, leucocytes and platelets. Contains several plasma proteins and high concentration of calcium and phosphorus. 	<ul style="list-style-type: none"> Consists of plasma and leucocytes only. Contains fewer plasma proteins and low concentration of calcium and phosphorus.
3.	Flow	Flows rapidly.	Flow is very slow.
4.	Direction of flow	Path of circulation is heart to body organs and from body organs back to heart.	Path of circulation is body tissues to heart.

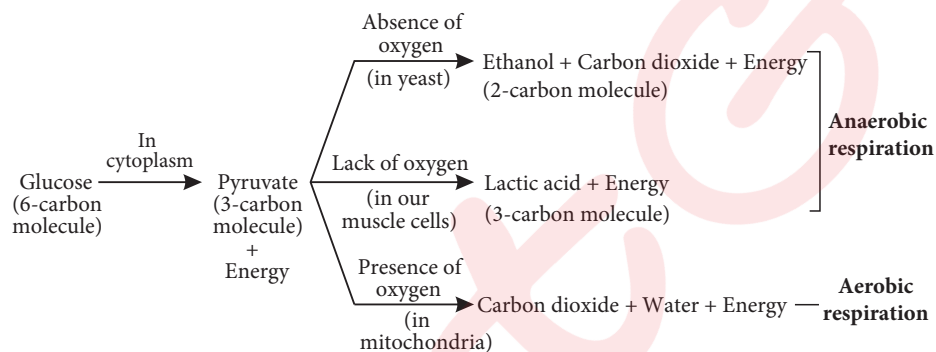


Fig.: Breakdown of glucose by various pathways

- In the **kidney**, the wastes are converted in urine by three processes :
 - Ultrafiltration** : In it, large amount of water along with certain harmful substances like urea, uric acid, K^+ , ammonium salts, creatinine, etc., and certain useful substances like glucose, amino acids, Na^+ , etc., pass through glomerular capillaries and glomerular membrane into cavity of Bowman's capsule of nephrons under pressure. The filtrate so formed is called nephric filtrate which is moved towards ureter.
 - Selective reabsorption** : In it, large amount of water and sodium; whole of glucose and amino acids and small amount of urea are passed back from nephric filtrate into blood capillaries. It occurs either by back diffusion (i.e. water and urea) or active transport (i.e., Na^+ , glucose and amino acids). It generally occurs in PCT of nephrons.
 - Tubular secretion** : In this, certain harmful chemicals like uric acid, creatinine, K^+ , etc. are passed from blood capillaries surrounding the nephron into nephric filtrate by active transport. It generally occurs in DCT of nephrons. Now, the fluid is termed as **urine** and is excreted out of the excretory organs.
- Central nervous system (CNS)** consisting of brain and spinal cord. The brain and spinal cord receive information from all parts of the body and integrate it.
 - Peripheral nervous system (PNS)** consisting of nerves that arise from brain (cranial nerves) and from spinal cord (spinal nerves). Through the nerves, the nervous system communicates with the muscles.
 - Autonomic nervous system (ANS)** made up of parasympathetic and sympathetic nervous systems. Though connected with the CNS, it works independently and regulates involuntary activities of the body like heart beat, and peristaltic movements of alimentary canal.
- The central nervous system (CNS) in human beings consists of the **brain** and **spinal cord**. Brain is the highest coordinating centre in the body. The brain is broadly divided into three regions: **fore brain**, **mid brain**, and **hind brain**. Fore brain includes cerebrum and olfactory lobes. Mid brain connects the fore brain to hind brain. Hind brain consists of three parts called cerebellum, pons and medulla oblongata.

6 CONTROL AND COORDINATION

- Nervous system** in humans consists of three parts:

Table : Types of plant hormones

S.No.	Plant hormones	Physiological effects on plant growth and development
1.	Auxin	Promotes cell division, root formation, control apical dominance.
2.	Gibberellins	Stimulate cell division, cell elongation, counteract dormancy, induce flowering, bring about increase in size of fruits, flower, etc.
3.	Cytokinins	Induce and control cell enlargement, cell differentiation, delay aging, break dormancy.
4.	Ethylene	Induce fruit ripening, flowering, break dormancy.
5.	Absciscic Acid (ABA)	Inhibits growth, reverse the growth providing effects of auxins and gibberellins.

Table : Some important hormones and their functions

S.No.	Hormone	Endocrine Gland	Functions
1.	Growth hormone	Pituitary gland	Stimulates growth in all organs
2.	Thyroid gland	Thyroxin	Regulates metabolism for body growth
3.	Testosterone	Testes	Stimulates spermatogenesis, regulates the growth, development and functioning of accessory sex organs and controls the secondary sexual characteristics
4.	Oestrogen and progesterone	Ovaries	Development of female sex organs, regulates menstrual cycle, etc.
5.	Adrenaline	Adrenal gland	Increase alertness
6.	Releasing hormones	–	Stimulates pituitary gland to release hormones

- **Reflex arc** is the nerve path involved in a reflex action for quick responses. A message from the receptor is taken by sensory nerves to spinal cord, which sends information for response by a motor nerve to the effector. *E.g.*, touching of hot object by hand.

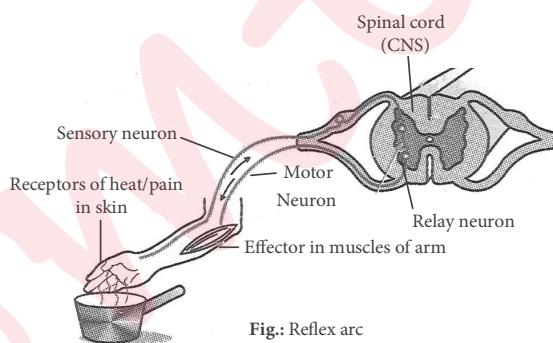


Fig.: Reflex arc

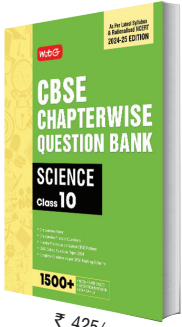
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Highlights

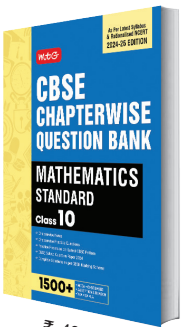
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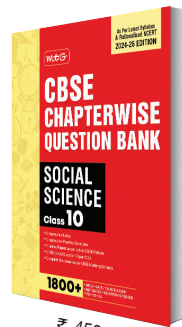
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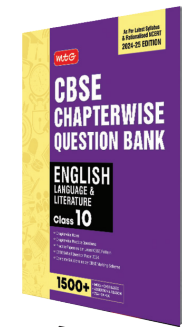
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7 HOW DO ORGANISMS REPRODUCE?

Table : Differences between self pollination and cross pollination

Characteristic	Self pollination	Cross pollination
Occurrence	Occurs within a flower or between two flowers of the same plant.	Occurs between two flowers of two different plants of the same species.
Agent of pollination	No external agent of pollination required (usually).	External agents such as wind, water, insects and birds required.
Production of pollen grains	Produced in small numbers, thus no wastage of pollen grains occurs.	Produced in large numbers (usually), thus, wastage of pollen grains occurs.
Appearance of flowers	Flowers are not attractive (usually).	Flowers are attractive with coloured petals.
Fragrance and nectar	Flowers do not (usually) produce scent or nectar.	Flowers generally produce scent and nectar.
Nature of offsprings produced	Offsprings produced have genetic make-up identical to the parent plant, purity of race maintained, no variation occurs.	Offsprings produced may differ in genetic make-up and variations occur.

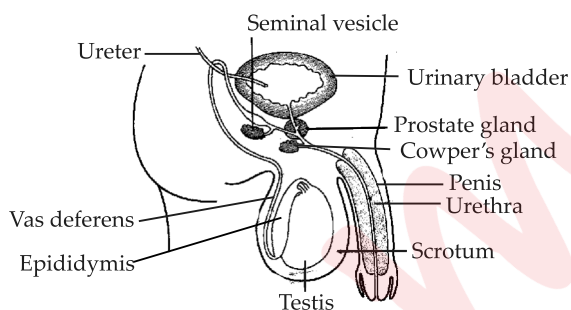


Fig.: Human male reproductive system

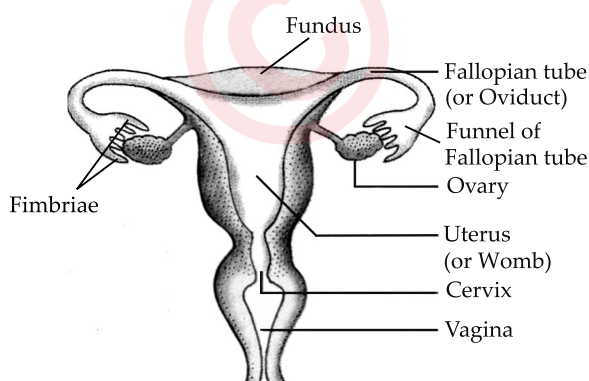


Fig.: Human female reproductive system

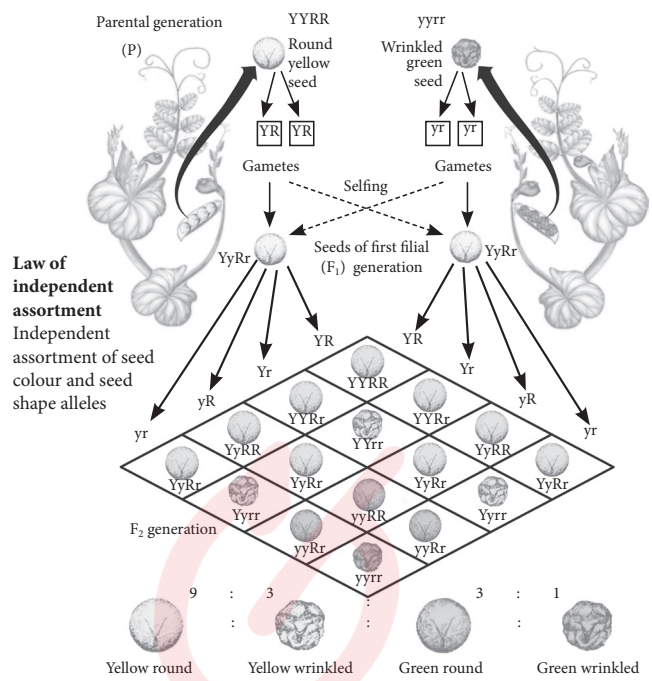
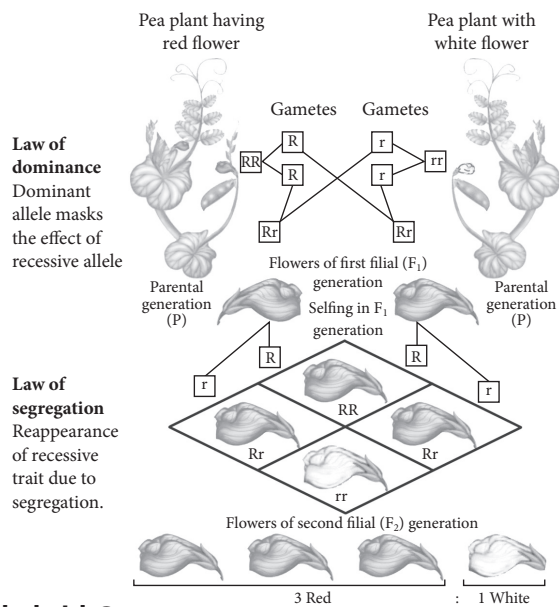
• Methods of contraception

- **Barrier method:** These are physical devices to prevent the entry of sperm into the female genital tract during copulation. They also protect against sexually transmitted diseases e.g., condoms.
- **Chemical method:** Foam tablets, jellies, pastes, creams and spermicides are some common chemicals used by females. These are placed in vagina. These chemicals adhere to the mucous membrane and immobilise and kill the sperms.
- **Surgical method:** Surgical methods are safe in the long run but they may cause infections and other problems if not done properly. These methods include–
 - (i) **Vasectomy** and (ii) **Tubectomy**.
- (i) Vasectomy is a small surgical operation performed in males. It involves removal of a small portion of the sperm duct (or vas deferens) by surgical operation. The two cut ends are then ligated (tied) with threads. This prevents the sperms from coming out.
- (ii) Tubectomy is done in females where oviducts are cut and cut ends tied with threads.

8 HEREDITY

Monohybrid Cross

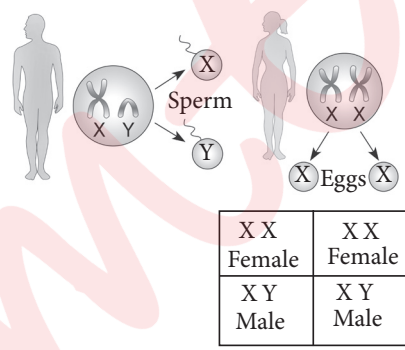
Crosses between the parents which differ only in one pair of contrasting characters.



Dihybrid Cross

Crosses which involve parents differing in two pairs of contrasting characters.

Sex Determination



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9 LIGHT - REFLECTION AND REFRACTION

• Reflection

The phenomenon of bouncing back of light in the same medium after striking the surface is called **reflection of light**.

• Laws of reflection of light :

- **First law** : The incident ray, the reflected ray, and the normal (at the point of incidence), all lie in the

same plane.

- **Second law** : The angle of reflection is always equal to the angle of incidence.

• Relation between focal length and radius of curvature :

- The focal length of the spherical mirror is equal to half of its radius of curvature, *i.e.*, $f = \frac{R}{2}$.

Position of Images with respect to object in Spherical Mirrors

• Formation of image by a concave mirror :

	Object position	Image position	Nature of image
(a)	at infinity	at F	real, inverted and point sized
(b)	between infinity and the centre of curvature C	between F and C	real, smaller than the object, inverted
(c)	at C	at C	real, same size of object, inverted
(d)	between C and F	between C and infinity	real, enlarged, inverted
(e)	at F	at infinity	real, infinitely large, inverted
(f)	between the pole P and F	behind the mirror	virtual, enlarged, erect

• Formation of image by a convex mirror:

	Object position	Image position	Nature of image
(a)	between infinity and the pole	between the focus and the pole	virtual, smaller and erect
(b)	at infinity	at the focus, behind the mirror	virtual, erect point-sized

• Mirror formula : $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$, where

v = distance of image from mirror,

u = distance of object from mirror,

f = focal length of the mirror.

• Magnification (m) :

- $m = \frac{h_i}{h_o} = \frac{-v}{u}$, where h_i and h_o are heights of image and object.

• Refraction

The change in direction of light when it passes from one medium to another obliquely, is called refraction of light.

• Laws of Refraction

- **First law** : The incident ray, the refracted ray and the normal at the point of incidence, all lie in the

same plane.

- **Second law** : The ratio of the sine of angle of incidence to the sine of angle of refraction is constant for a given pair of media.

$$i.e., \frac{\sin i}{\sin r} = \text{constant}$$

$$\text{or } \frac{\sin i}{\sin r} = n,$$

where, n = refractive index.

• Absolute Refractive Index

Absolute refractive index of a medium is defined as the ratio of the speed of light in vacuum or air to the speed of light in the medium. It is denoted by n .

$$\text{Then, } n = \frac{\text{speed of light in air}}{\text{speed of light in medium}} = \frac{c}{v}$$

It has no unit.

FORMATION OF IMAGE BY CONVEX AND CONCAVE LENSES

Convex Lens			Concave Lens			
	Position of the object	Position of the image	Nature and size	Position of the object	Position of the image	Nature and size
(a)	at infinity	at F	real, point-sized, inverted	at infinity	at F	virtual, point-sized and erect

(b)	between infinity and $2F$	between F and $2F$	real, diminished inverted	between infinity and O	between F and O	virtual, erect and smaller
(c)	at $2F$	at $2F$	real, same-sized, inverted	–	–	–
(d)	between $2F$ and F	between $2F$ and infinity	real, enlarged inverted	–	–	–
(e)	at F	at infinity	real, infinitely large, inverted	–	–	–
(f)	between F and O	on the same side of the object	virtual, enlarged erect	–	–	–

- **Lens formula :** $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

where, v and u are image distance and object distance from the lens respectively and f is the focal length of the lens.

- **Magnification produced by lenses :**

– **Magnification** = $\frac{\text{height of image}}{\text{height of object}}$ or $m = \frac{h_i}{h_o} = \frac{v}{u}$

- **Power of a lens (P) :** $P = \frac{1}{f(\text{metre})}$ or $\frac{1}{f}$ dioptre

- **Lenses in contact :**

– **Focal length of two lenses :** $\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2}$

– **Power of two lenses :** $P = P_1 + P_2$

10 THE HUMAN EYE AND THE COLOURFUL WORLD

The human eye works on the refraction of light through a natural convex lens made of transparent living material and enables us to see things around us.

Power of Accommodation

- The ability of an eye to adjust the focal length of the eye-lens with the help of ciliary muscles so as to see nearby as well as distant objects is called the power of accommodation.
 - Far point of human eye is infinity.
 - Near point or least distance of distinct vision of human eye is 25 cm.

Defects of Vision and their Correction

- **Myopia (Short-sightedness) :** Myopia (short-sightedness) is a defect in which a human eye can see nearby objects

clearly but is unable to see distant objects distinctly.

- Myopia is corrected by placing a concave lens of appropriate power before the eye.

- **Hypermetropia (Long-sightedness) :** Hypermetropia (long-sightedness) is a defect in which a human eye can see far off object clearly, but is unable to see nearby object distinctly.

- Hypermetropia is corrected by placing a convex lens of appropriate power before the eye.

- **Presbyopia :** The power of accommodation of the eye usually decreases with ageing and ciliary muscles lose the capacity to change the focal length of a lens.

- Presbyopia is corrected by placing convex lens of appropriate power before the eye.



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- **Hints & Explanations** for each exercise of all chapters are provided.

- **Astigmatism** : Cannot focus on both horizontal and vertical lines simultaneously.
 - It can be corrected by using cylindrical lens.
- **Dispersion** : Splitting of white light into seven component colours.
- **Atmospheric Refraction** :
 - Twinkling of stars
 - Advanced sunrise and delayed sunset.
- **Scattering of light** : Absorption of light and then re-radiating it in different directions.
- **Tyndall effect** : It deals with the phenomenon of scattering of light by colloidal particles.
- **Rainbow** : A rainbow is a natural spectrum of sunlight in the form of bows appearing in the sky when the sun shines on raindrops after the rain. The raindrops act like small prisms.

11 ELECTRICITY

- Electricity is a controllable and convenient form of energy used in homes, hospitals, industries and so on.
- **Electric current** : It is the rate of flow of electric charges. *i.e.*, $I = q/t$. SI unit of electric current is Ampere (A).
- **Electric potential** : Work done in moving a positive unit charge from infinity to that point.
 - Electric potential = $\frac{\text{Work}}{\text{Charge}}$ or $V = \frac{W}{Q}$
 - SI unit of electric potential is volt.
- **Potential difference** : Amount of work done in moving a unit positive charge from one point to the other. *i.e.*, $V = \frac{W}{Q}$.
 - The SI unit of electric potential difference is volt (V).
- **Ohm's Law**
At constant temperature, current flowing through a conductor is directly proportional to the potential difference across its ends.

$$R = \frac{V}{I}; V = IR$$
- **Resistance** : Opposition to the flow of current.

$$R = \rho \frac{l}{A}$$
 [ρ (rho) = resistivity of the conductor]

Resistance of a System of Resistors

- **Resistors in series** : When a number of resistors are joined end to end so that same current flows through each. Equivalent resistance is given by, $R_s = R_1 + R_2 + R_3$
- **Resistors in parallel** : Two or more resistors are said to be connected in parallel if the same potential difference exists across these resistors.
 - Equivalent resistance is given by

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

Joule's Heating Effects

- The heat produced in a resistor is directly proportional to the square of current for a given resistance, to resistance for a given current and to the time for which the current flows through the resistor.

$$H = I^2 R t = \frac{V^2}{R} \times t = VI t$$

Electric Power

- The rate at which electric energy is dissipated or consumed in an electrical appliance or circuit is called the electric power.

$$i.e., \text{Power} = \frac{\text{Work}}{\text{Time}} = \frac{\text{Energy}}{\text{Time}}$$

$$\text{or } P = \frac{W}{t} = \frac{I^2 R t}{t} \Rightarrow P = I^2 R$$

$$\text{or } P = \frac{V^2}{R} \Rightarrow P = VI$$

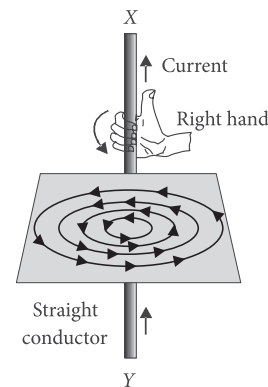
12 MAGNETIC EFFECTS OF ELECTRIC CURRENT

Magnet

Substances which have tendency to attract other magnetic substances e.g. iron, cobalt and nickel.

Properties of the magnet :

- A magnet has two poles, north pole and south pole.
- A freely suspended magnet always align itself in north-south direction.
- Like poles repel, while unlike poles of different magnets attract each other.
- **Magnetic field lines**
 - The path along which a free magnetic north pole will move in a magnetic field, is called magnetic field lines.
 - Magnetic field lines always repel each other and do not intersect.
- **Right hand thumb rule** : According to this rule, imagine a straight conductor in your right hand such that the thumb points in the direction of current. The direction of curl of fingers of the right hand gives the direction of magnetic field lines.

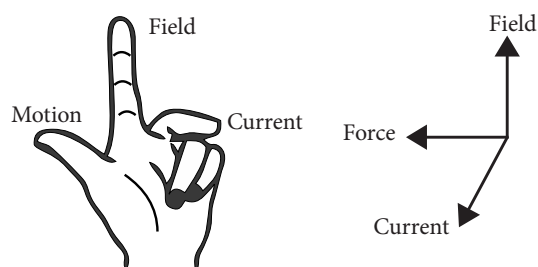


Solenoid

- A coil of many circular turns of insulated copper wire wrapped closely in the shape of a cylinder is called a solenoid.
 - The magnetic field inside a solenoid is uniform.
 - A current-carrying solenoid behaves like a bar magnet with fixed polarities at its ends.

Electromagnet

- An electromagnet is a temporary strong magnet and is just a solenoid with its winding on a soft iron core.
- **Fleming's Left Hand Rule:** The direction of the force experienced by a current-carrying conductor placed in a magnetic field is determined by Fleming's left-hand rule.



Domestic Electric Circuit

- **Electric fuse :** A safety device used to save the electrical appliances from burning when large amount of current flows in the circuit.

For example :				
1 st trophic level	2 nd trophic level	3 rd trophic level	4 th trophic level	5 th trophic level
Grass (Producer)	→ Grasshopper (Herbivore)	→ Frog (Primary carnivore)	→ Snake (Secondary carnivore)	→ Eagle (Top or tertiary carnivore)
	1° consumer	2° consumer	3° consumer	4° consumer

- **Decomposers** are microbes (bacteria and fungi), which act on the dead bodies of producers and consumers to break the complex organic substances into simpler ones. They absorb some of the substances and release others into the environment to be recycled and to be used in future by the producers.

- Made of a material of low melting point.
- Works on the principle of heating effect of current.

13 OUR ENVIRONMENT

Ecosystem

Natural ecosystem : They operate in nature by themselves without any human interference, e.g., desert, grassland, pond, lakes, etc.

Artificial ecosystem : These are man made and also maintained by them, e.g., cropfields, aquariums, etc.

Flow chart : Types of ecosystem

- Two basic processes involved in ecosystem are :
 - (i) Cycling of material
 - (ii) Flow of energy
- **Food chain** is a sequence of organisms through which energy is transferred in the form of food by the process of one organism consuming the other. In a food chain, **unidirectional** transfer of energy takes place. One of the simplest food chain is :

Grass → Deer → Lion
(Producer) (Herbivore) (Carnivore)
- **Trophic levels** are the various steps or levels in the food chain where transfer of food or energy takes place.

In this way, decomposers have a **very important role in cycling the materials** in the biosphere and maintaining the food chain by providing raw materials for producers. They also make the soil fertile and have become the integral part of ecosystem.

Table: Various sources of wastes

S.No.	Sources of wastes	Types of wastes
1.	Industrial wastes	<ul style="list-style-type: none"> • CO, CO₂, SO₂, H₂S and hydrocarbons (air released from automobiles also). • Hydrochloric acid, chlorine, nitrogen oxides, etc. • Heavy metals like mercury, lead, cadmium, nickel, etc. • Many organic compounds like phenol, naphtha, aromatic compounds, etc.

2.	Domestic wastes	<ul style="list-style-type: none"> Sewage of sanitary facilities of residential, commercial, institutional and other public places. Sewage with many types of pathogenic organisms like bacteria, encysted protozoans, viruses, eggs of helminthes, etc.
3.	Agricultural wastes	<ul style="list-style-type: none"> CO₂, methane (from paddy fields), organopesticides and chlorinated hydrocarbons, etc. Traces of fertilizers with nitrates, phosphates and sulphates of potassium.
4.	Commercial wastes	<ul style="list-style-type: none"> Building wastes, printing press wastes, biomedical wastes of medical institutions and hospitals, etc.

S.No.	Character	Biodegradable wastes	Non-biodegradable wastes
1.	Microbial decomposition	Undergo microbial degradation.	Do not undergo microbial degradation.
2.	Main sources	Living organisms	Industries, hospitals, nursing homes, etc.
3.	Examples	Domestic sewage, animal wastes, agricultural wastes, etc.	Pesticides, plastics, aluminium cans, synthetic polymers, heavy metals, etc.

- **Biomagnification** or **biological concentration** or **biological amplification** is increase in the amount of non-biodegradable substances in successive trophic levels of a food chain.
- **Harmful effects of biomagnification:**
 - DDT interferes with the egg-shell formation in many birds. The shells remain thin and break by bird's weight during incubation. Dieldrin is about 5 times more toxic than DDT when ingested and 40 times more poisonous when absorbed.
 - The chlorinated hydrocarbons are known to **affect CNS** (central nervous system), cause softening of brain, cerebral haemorrhage, cirrhosis of liver, hypertension, cancer, malformation of sex hormones, etc.



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CHAPTER

1

Chemical Reactions and Equations

- The electrolytic decomposition of water gives H_2 and O_2 in the ratio of
(a) 1 : 2 by volume (b) 2 : 1 by volume
(c) 8 : 1 by mass (d) 1 : 2 by mass.
- In the balanced equation, $aFe_2O_3 + bH_2 \rightarrow cFe + dH_2O$, a , b , c and d are respectively
(a) 1, 1, 2, 3 (b) 1, 1, 1, 1
(c) 1, 3, 2, 3 (d) 1, 2, 2, 3.
- When lead nitrate reacts with potassium iodide, yellow precipitate of _____ is formed.
(a) PbI_2 (b) KNO_3
(c) $Pb(NO_3)_2$ (d) $PbIO_3$
- Quick lime combines vigorously with water to form (A) which reacts slowly with the carbon dioxide in air to form (B). Identify (A) and (B).

(A)	(B)
(a) Calcium carbonate	Calcium hydroxide
(b) Calcium hydroxide	Calcium carbonate
(c) Calcium	Calcium bicarbonate
(d) Calcium bicarbonate	Calcium
- Assertion (A) :** Vegetable matter changing into compost is an endothermic reaction.
Reason (R) : In an endothermic reaction, energy in the form of heat or light is absorbed.
(a) Both assertion and reason are true and reason is the correct explanation of the assertion.
(b) Both assertion and reason are true but reason is not the correct explanation of the assertion.
(c) Assertion is true but reason is false.
(d) Assertion is false but reason is true.

CHAPTER

2

Acids, Bases and Salts

- When bitten by an ant, the sting causes irritation due to the presence of
(a) a base in the sting (b) formic acid in the sting
(c) poisonous chemicals in the sting (d) both (a) and (b).
- The solution with the lowest concentration of H^+ ion is
(a) pH = 7 (b) pH = 8.6 (c) pH = 2.0 (d) pH = 6.8
- Which one of the following will turn red litmus blue?
(a) Vinegar (b) Baking soda solution (c) Lemon juice (d) Soft drinks
- Which two substances react to give salt and water only?
(a) Copper(II) oxide and ethanoic acid (b) Magnesium and sulphuric acid
(c) Sodium oxide and water (d) Zinc carbonate and hydrochloric acid

5. **Assertion (A)** : NH_4Cl is a basic salt.

Reason (R) : NH_4Cl is a salt of strong acid and a weak base.

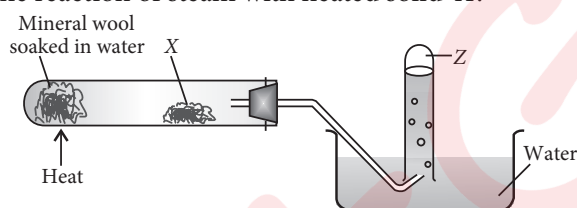
- (a) Both assertion and reason are true and reason is the correct explanation of the assertion.
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CHAPTER

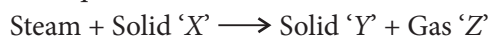
3

Metals and Non-metals

- 1. Which of the following elements produces basic oxide on reacting with oxygen?
 - (a) Chlorine
 - (b) Sulphur
 - (c) Phosphorus
 - (d) Magnesium
- 2. The given apparatus shows the reaction of steam with heated solid 'X'.



The equation for the reaction is



X, Y and Z are respectively

- (a) copper, copper oxide, oxygen
 - (b) lead, lead oxide, hydrogen
 - (c) silver, silver oxide, oxygen
 - (d) iron, iron oxide, hydrogen.
- 3. _____ is a non-metal but is lustrous.
 - (a) Carbon
 - (b) Sulphur
 - (c) Bromine
 - (d) Iodine
 - 4. When metal (Z) is added to dilute HCl solution, there is no evolution of gas. Metal (Z) is
 - (a) K
 - (b) Na
 - (c) Ag
 - (d) Zn
 - 5. The electronic structures of six elements A to F and formula of their compounds are given in the table below:

	Electronic structure		Formula of compound
(i)	A : 2, 1	B : 2, 6	A_2B
(ii)	B : 2, 6	C : 2, 7	B_2C
(iii)	C : 2, 7	D : 2, 8, 3	DC_3
(iv)	E : 2, 8, 6	F : 2, 8, 8, 2	FE_2

Which of the formula of compounds are wrong?

- (a) (i) and (iii)
- (b) (ii) and (iii)
- (c) (iii) and (iv)
- (d) (ii) and (iv)

6. During electrolytic refining of zinc, it gets
 (a) deposited on cathode (b) deposited on anode
 (c) deposited on cathode as well as anode (d) remains in the solution.
7. An alloy which does not contain copper is
 (a) solder (b) bronze
 (c) brass (d) bell metal.
8. Copper and silver get corroded in air by developing a coloured layer. The colour of the layers respectively is
 (a) green and black (b) brown and black
 (c) green and blue (d) black and green.

For question numbers 9 and 10, two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below :

- (a) Both assertion and reason are true and reason is the correct explanation of the assertion.
 (b) Both assertion and reason are true but reason is not the correct explanation of the assertion.
 (c) Assertion is true but reason is false.
 (d) Assertion is false but reason is true.
9. **Assertion (A) :** Pure gold, known as 24 carat gold, is not suitable for making jewellery.
Reason (R) : Pure gold is very soft.
10. **Assertion (A) :** Ionic compounds have high melting and boiling points.
Reason (R) : A large amount of energy is required to break the strong inter-ionic attraction in ionic compounds.

CHAPTER 4

Carbon and its Compounds

1. Ethene can be prepared by reaction of ethanol with
 (a) hot conc. H_2SO_4 (b) alkaline KMnO_4
 (c) sodium metal (d) NaHCO_3
2. The reaction $\text{CH}_4 + \text{Cl}_2 \xrightarrow[\text{light}]{h\nu} \text{CH}_3\text{Cl} + \text{HCl}$ is an example of
 (a) addition reaction (b) substitution reaction
 (c) elimination reaction (d) oxidation reaction.
3. Ethanol is made unfit for drinking by adding
 (a) propanol (b) methanal
 (c) methanol (d) ethanal.
4. The IUPAC name of $\text{CH}_3\text{CH}_2\text{CHO}$ is
 (a) acetaldehyde (b) methanal
 (c) propanal (d) formaldehyde.
5. Which of the following is the functional group for alcohols ?
 (a) $\text{C}=\text{O}$ (b) $\text{C}=\text{O}$
 (c) $-\text{OH}$ (d) $\text{C}=\text{O}$
 H
 OH

6. Which of the following does not contain a double bond?
- (a) CO_2 (b) C_2H_4
 (c) C_2H_6 (d) O_2
7. Buckminsterfullerene is an allotropic form of
- (a) phosphorus (b) carbon
 (c) sulphur (d) tin.
8. Saponification is the hydrolysis of an ester under basic conditions to form
- (a) alkane and salt of carboxylic acid
 (b) ketone and salt of carboxylic acid
 (c) aldehyde and salt of carboxylic acid
 (d) alcohol and salt of carboxylic acid.

For question numbers 9 and 10, two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below :

- (a) Both assertion and reason are true and reason is the correct explanation of the assertion.
 (b) Both assertion and reason are true but reason is not the correct explanation of the assertion.
 (c) Assertion is true but reason is false.
 (d) Assertion is false but reason is true.
9. **Assertion (A) :** Branched chain alkanes have lower boiling points.
Reason (R) : As molecular size increases, boiling point increases.
10. **Assertion (A) :** Carbon possesses property of catenation.
Reason (R) : Carbon atoms form double as well as triple bonds during catenation.

CHAPTER 5

Life Processes

1. Autotrophic nutrition is found in _____ .
- (a) rabbit (b) plants
 (c) cockroach (d) prawn
2. Define nutrition. What are the different modes of nutrition?
3. Which of the following organ conducts both urine and sperms in male?
- (a) Ureter (b) Urinary bladder
 (c) Urethra (d) Vas deferens
4. Which one of the following is connected with transport of water in plants?
- (a) Phloem (b) Xylem
 (c) Epidermis (d) Cambium
5. **Assertion :** High blood pressure is also called hypertension.
Reason : Hypertension causes rupturing of blood vessels leading to brain stroke.
- (a) Both assertion and reason are true and reason is the correct explanation of the assertion.
 (b) Both assertion and reason are true but reason is not the correct explanation of the assertion.
 (c) Assertion is true but reason is false.
 (d) Assertion is false but reason is true.

6. Match column I with column II and select the correct option.

Column I

- P. Trypsin
- Q. Bile
- R. Amylase
- S. Pepsin

- (a) P-2; Q-4; R-3; S-1
- (c) P-3; Q-2; R-1; S-4

Column II

- 1. Saliva
- 2. Gastric glands
- 3. Liver
- 4. Pancreas

- (b) P-4; Q-3; R-2; S-1
- (d) P-4; Q-3; R-1; S-2

7. During inhalation,

- (a) ribs move upward
- (b) diaphragm is raised
- (c) diaphragm is flat
- (d) both (a) and (c).

8. Define the two stages of photosynthesis.

9. Give any two functions of stomata?

10. *Amoeba* engulfs food by

- (a) pseudopodia
- (b) cilia
- (c) flagella
- (d) none of these.

CHAPTER

6

Control and Coordination

1. "There is a need of a system for control and coordination in an organism". Justify the statement.

2. The directional movement or orientation of a plant part in response to light is termed as

- (a) chemotropism
- (b) phototropism
- (c) thigmotaxis
- (d) photoperiodism.

3. Cytokinin promotes

- (a) wilting of leaves
- (b) cell division
- (c) growth
- (d) both (b) and (c).

4. Select the correct match.

- (a) Cerebrum – Part of midbrain
- (b) Forebrain – Main thinking part
- (c) Pons – Largest part of brain
- (d) Medulla oblongata – Voluntary functions

5. Match column I with column II and select the correct option.

Column I

- P. Adrenaline
- Q. Thyroxin
- R. Growth hormone
- S. Insulin

- (a) P-3; Q-4; R-1; S-2
- (c) P-4; Q-1; R-3; S-2

Column II

- 1. Stimulates growth
- 2. Regulates blood sugar level
- 3. Deal with stress situation
- 4. Regulates protein and fat metabolism

- (b) P-2; Q-1; R-4; S-3
- (d) P-2; Q-4; R-1; S-3

6. Which is the correct sequence of the components of a reflex arc?
 - (a) Receptors → muscles → sensory neuron → motor neuron → spinal cord
 - (b) Receptors → motor neuron → spinal cord → sensory neuron → muscles
 - (c) Receptors → spinal cord → sensory neuron → motor neuron → muscles
 - (d) Receptors → sensory neuron → spinal cord → motor neuron → muscles
7. Which plant hormone plays a role in apical dominance?
 - (a) Auxin
 - (b) Abscisic acid
 - (c) Ethylene
 - (d) Gibberellin
8. Which of the following hormones is/are known as growth regulators?
 - (a) Auxins
 - (b) Cytokinins
 - (c) Gibberellins
 - (d) All of these
9. Give the difference between sensory and motor nerves.
10. At the time of examination, the heartbeat often becomes faster due to release of _____.
 - (a) ADH
 - (b) growth hormone
 - (c) adrenaline
 - (d) renin

CHAPTER 7

How do Organisms Reproduce?

1. Mention the reproductive parts of a flower.
2. Which of the following is an example of barrier method of contraception?
 - (a) Vaginal pills
 - (b) Condom
 - (c) Oral pills
 - (d) Copper-T
3. Fruit is formed from
 - (a) stamen
 - (b) stigma
 - (c) ovary
 - (d) ovule.
4. Match the column I with column II and select the correct option.

Column I	Column II
P. Calyx	1. Stamens
Q. Androecium	2. Sepals
R. Corolla	3. Carpels
S. Gynoecium	4. Petals
(a) P-2; Q-1; R-4; S-3	(b) P-4; Q-2; R-3; S-1
(c) P-1; Q-3; R-4; S-2	(d) P-3; Q-4; R-1; S-2
5. Which of the following is not a part of the female reproductive system in human beings?
 - (a) Ovary
 - (b) Uterus
 - (c) Vas deferens
 - (d) Fallopian tube
6. What are sexually transmitted diseases? Name any two bacterial and two viral STDs.
7. Unisexual flowers contain
 - (a) both stamen and carpel
 - (b) only stamen
 - (c) only carpel
 - (d) either stamen or carpel.

8. **Assertion :** Pollination results in the deposition of related pollen grains over the receptive stigma of the flower.
Reason : Pollen grains absorb water, swell and then germinate to produce pollen tube.
- Both assertion and reason are true and reason is the correct explanation of the assertion.
 - Both assertion and reason are true but reason is not the correct explanation of the assertion.
 - Assertion is true but reason is false.
 - Assertion is false but reason is true.
9. What is the function of placenta?
10. Pollen grains are produced by
- carpel
 - anther
 - filament
 - micropyle.

CHAPTER 8

Heredity

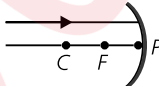
- Mendel conducted his famous breeding experiments by working on
 - Drosophila*
 - Pisum sativum*
 - Escherichia coli*
 - all of these.
- The genotypic ratio in F_2 generation of monohybrid cross will be
 - 1 : 2 : 1
 - 3 : 1
 - 1 : 1
 - 1 : 2.
- Which of the following is not a feature of the mechanism of inheritance?
 - Each gene controls two or more characters.
 - One form may be dominant over the other form.
 - An individual has two forms of the genes.
 - Both (a) and (b).
- How many genes a child receives from his father ?
 - 25%
 - 50%
 - 75%
 - 100%
- Assertion :** In a monohybrid cross, offsprings of F_1 generation express dominant character.
Reason : Dominance occurs only in heterozygous state.
 - Both assertion and reason are true and reason is the correct explanation of the assertion.
 - Both assertion and reason are true but reason is not the correct explanation of the assertion.
 - Assertion is true but reason is false.
 - Assertion is false but reason is true.
- Select the incorrect statement(s).
 - Minor variations are seen in sexually reproducing organisms.
 - Greater variation is observed in asexually reproducing organisms.
 - Genes are the hereditary units.
 - (i) and (iii)
 - (ii) and (iii)
 - (i) and (ii)
 - Only (iii)

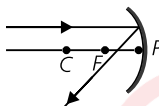
7. What decides the sex of the child, sperm or ova? Explain briefly.
8. When a tall man marries a short heighted woman, 50% of their children were short in height. Which of the following statement is correct for the given result?
 - (a) Mother is homozygous and father is heterozygous for this given trait.
 - (b) Both mother and father are homozygous.
 - (c) Mother is heterozygous and father is homozygous.
 - (d) Both mother and father are heterozygous for this given trait.
9. The phenotypic ratio in F_2 generation of monohybrid cross will be
 - (a) 1 : 1
 - (b) 1 : 2 : 1
 - (c) 1 : 2
 - (d) 3 : 1.
10. Mendel studied seven contrasting characters for his breeding experiment with *Pisum sativum*. Which of the following character he used?
 - (a) Plant height
 - (b) Seed shape
 - (c) Flower colour
 - (d) All of these

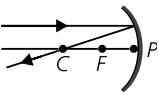
CHAPTER 9

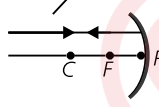
Light-Reflection and Refraction

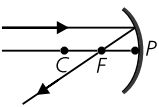
1. The refractive indices of four substances P , Q , R and S are 1.50, 1.36, 1.77 and 1.31 respectively. The speed of light is maximum in the substance
 - (a) P
 - (b) Q
 - (c) R
 - (d) S
2. Which of the following ray diagrams is correct for the ray of light incident on a concave mirror as shown in figure?











 - (a) Figure A
 - (b) Figure B
 - (c) Figure C
 - (d) Figure D
3. A concave spherical mirror forms a 40 cm high real image of an object whose height is 10 cm. The radius of the mirror is 60 cm. The distance from the object to its image is
 - (a) 90 cm
 - (b) 112.5 cm
 - (c) 97.5 cm
 - (d) 75 cm
4. A person standing in front of a mirror finds his image larger than himself. This implies that the mirror is
 - (a) concave
 - (b) cylindrical with bulging side outwards
 - (c) plane
 - (d) convex.
5. An object is placed at 10 cm from a lens and real image is formed with magnification of 0.5. Then the lens is
 - (a) Concave lens with focal length $10/3$ cm
 - (b) Convex lens with focal length $10/3$ cm
 - (c) Concave lens with focal length 10 cm
 - (d) Convex lens with focal length 10 cm.

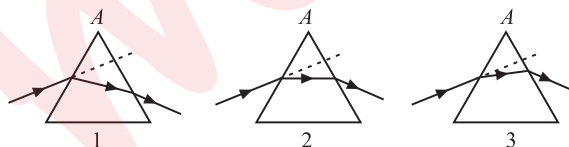
For question numbers 6 and 7, two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below :

- (a) Both assertion and reason are true and reason is the correct explanation of the assertion.
 (b) Both assertion and reason are true but reason is not the correct explanation of the assertion.
 (c) Assertion is true but reason is false.
 (d) Assertion is false but reason is true.
6. **Assertion (A) :** In diffused reflection, a parallel beam of incident light is reflected in different directions.
Reason (R) : The diffused reflection of light is due to the failure of the laws of reflection.
7. **Assertion (A) :** When a concave mirror is held under water, its focal length does not change.
Reason (R) : The focal length of a concave mirror is independent of the medium in which it is placed.
8. Light enters from air to glass having refractive index 1.5. What is the speed of light (in ms^{-1}) in glass? The speed of light in vacuum is $3 \times 10^8 \text{ m s}^{-1}$.
 (a) 4×10^8 (b) 1.5×10^8 (c) 2×10^8 (d) 3.8×10^8
9. A combination of a convex lens and a concave lens has a power of + 2 D. If the focal length of the convex lens is 25 cm. The focal length of the concave lens used in this combination is
 (a) 1 m (b) 2.5 m (c) 1.5 m (d) 0.5 m.
10. An object has image thrice of its original size when kept at 8 cm and 16 cm from a convex lens. Focal length of lens is
 (a) 8 cm (b) 16 cm
 (c) Between 8 and 16 cm (d) Less than 8 cm.

CHAPTER 10

The Human Eye and the Colourful World

1. The given figure shows three cases of a ray passing through a prism of refracting edge A. The case corresponding to minimum deviation is



- (a) 1 (b) 2 (c) 3 (d) none of these.
2. Match the column-I with column-II and select the correct option using given codes.
- | Column-I | Column-II |
|------------------------|--------------------------|
| (P) Presbyopia | 1. Real image |
| (Q) Retina | 2. Old age hypermetropia |
| (R) Astigmatism | 3. Ciliary muscles |
| (S) Accommodation | 4. Cylindrical lenses |
| (a) P-3, Q-1, R-2, S-4 | (b) P-2, Q-4, R-3, S-1 |
| (c) P-3, Q-1, R-4, S-2 | (d) P-2, Q-1, R-4, S-3 |
3. The size of an object as perceived by an eye depends primarily on
 (a) actual size of the object (b) distance of the object from the eye
 (c) aperture of the pupil (d) size of the image formed on the retina.
4. The amplitude of scattered light varies with wavelength λ as
 (a) $\propto \frac{1}{\lambda^4}$ (b) $\propto \frac{1}{\lambda}$ (c) $\propto \frac{1}{\lambda^2}$ (d) $\propto \lambda^2$

5. The focal length of the eye lens increases when eye muscles
 (a) are relaxed and lens becomes thinner (b) contract and lens becomes thicker
 (c) are relaxed and lens becomes thicker (d) contract and lens becomes thinner.

For question numbers 6 and 7, two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below :

- (a) Both assertion and reason are true and reason is the correct explanation of the assertion.
 (b) Both assertion and reason are true but reason is not the correct explanation of the assertion.
 (c) Assertion is true but reason is false.
 (d) Assertion is false but reason is true.

6. **Assertion (A)** : The rainbow is seen when the sun is behind the observer.

Reason (R) : Rainbow is produced due to dispersion of white light by small rain drops hanging in the air after the rain.

7. **Assertion (A)** : In astigmatism, the rays of light coming from the horizontal and vertical planes of an object do not come to focus at the same point.

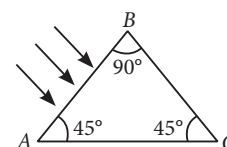
Reason (R) : Astigmatism occurs when the cornea or the eye lens or both are perfectly spherical.

8. After testing the eyes of a child, the optician has prescribed the following lenses for his spectacles :

Left eye : - 3.000 D Right eye : - 3.25 D

The child is suffering from the defect of vision called :

- (a) short-sightedness (b) long-sightedness (c) cataract (d) presbyopia
9. A beam of light consisting of red, green and blue colours is incident on a right-angled prism as shown. The refractive index of the material of the prism for the above red, green and blue wavelengths are 1.39, 1.44 and 1.47 respectively. The prism will
 (a) separate part of the red colour from the green and blue colours.
 (b) separate part of the blue colour from the red and green colours.
 (c) separate all the three colours any colour from the other two colours.
 (d) not separate even partially any colour from the other two colours.



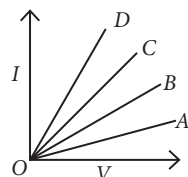
10. The near point of a hypermetropic eye is 50 cm. Calculate the power of the lens to enable him to read a book at 40 cm is

- (a) 0.50 D (b) 1 D (c) 4.5 D (d) 2.5 D

CHAPTER 11

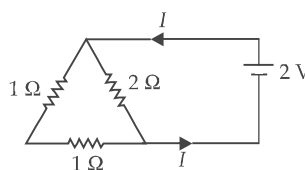
Electricity

1. Study the I - V graph of four conductors A, B, C and D having resistance R_A , R_B , R_C and R_D respectively. If all the conductors are of same thickness and of same material, which one is the longest?



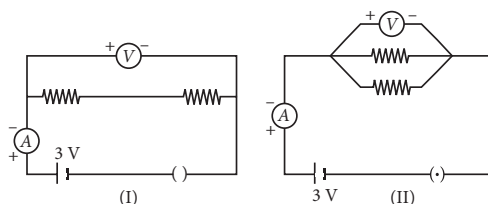
- (a) A (b) B (c) C (d) D

2. What is the current (I) in the circuit?



- (a) $\frac{1}{2}$ A (b) 2 A (c) $\frac{3}{2}$ A (d) $\frac{2}{3}$ A

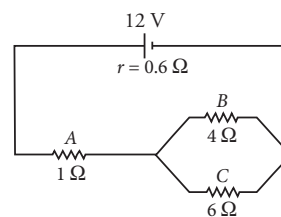
3. For the two circuit I and II shown below, the voltmeter readings would be



- (a) 0 V in circuit I and 2 V in circuit II. (b) 3 V in both the circuits.
 (c) 0 V in circuit I and 3 V in circuit II. (d) 3 V in circuit I and 0 V in circuit II.
4. An electric bulb is rated 220 V and 100 W. When it is operated on 110 V, the power consumed will be
 (a) 100 W (b) 75 W (c) 50 W (d) 25 W
5. The amount of heat energy produced in 5 minutes by an electric heater rated at 1000 W is
 (a) 2×10^5 J (b) 3×10^5 J (c) 4×10^5 J (d) 300 J

For question numbers 6 and 7, two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below :

- (a) Both assertion and reason are true and reason is the correct explanation of the assertion.
 (b) Both assertion and reason are true but reason is not the correct explanation of the assertion.
 (c) Assertion is true but reason is false.
 (d) Assertion is false but reason is true.
6. **Assertion (A) :** Heater wire must have high resistance and high melting point.
Reason (R) : If resistance is high, the electrical conductivity will be less.
7. **Assertion (A) :** Bending of a wire does not affect its resistance.
Reason (R) : Resistance of a wire depends on its resistivity.
8. Several electric bulbs designed to be used on a 220 V electric supply line, are rated 10 W. How many lamps can be connected in parallel with each other across the two wires of 220 V line if the maximum allowable current is 5 A?
 (a) 120 (b) 100 (c) 110 (d) 150
9. The specific resistance of the material of a wire is $44 \times 10^{-8} \Omega \text{ m}$. If the resistance of the wire is 14Ω and its diameter is 1 mm, calculate the length of the wire.
 (a) 25 m (b) 40 m (c) 50 m (d) 15 m
10. Figure shows a battery of 12 V and internal resistance 0.6Ω connected to three resistors A, B and C. The current in each resistor is



- (a) $I_A = 1.8 \text{ A}, I_B = 1.2 \text{ A}, I_C = 3 \text{ A}$
 (b) $I_A = 3 \text{ A}, I_B = 1.2 \text{ A}, I_C = 1.8 \text{ A}$
 (c) $I_A = 1.2 \text{ A}, I_B = 1.8 \text{ A}, I_C = 3 \text{ A}$
 (d) $I_A = 3 \text{ A}, I_B = 1.8 \text{ A}, I_C = 1.2 \text{ A}$.

CHAPTER 12

Magnetic Effects of Electric Current

1. When S-pole of a magnet is placed near an unknown pole of another magnet, the two magnets
 (i) repel each other because the unknown pole is a N-pole.
 (ii) repel each other because the unknown pole is a S-pole.
 (iii) attract each other because the unknown pole is a S-pole.
 Which statement(s) is/are correct?
 (a) Only (i) (b) Only (ii)
 (c) (i) and (iii) (d) (ii) and (iii)

2. Which of the following statements is true?
 (a) In tree type distribution of electric power, fuses are present only on the main board.
 (b) In ring type distribution of electric power, there is an individual fuse for each appliance.
 (c) Ring type distribution of electric power is advantageous than the tree type distribution.
 (d) All the above.
3. A charged particle is moving along a magnetic field line. The magnetic force on the particle is
 (a) along its velocity (b) opposite to its velocity
 (c) perpendicular to its velocity (d) zero.
4. Potential difference between a live wire and the neutral wire in domestic electric circuits is
 (a) 200 V (b) 220 V (c) 150 V (d) 210 V.
5. Match column-I with column-II and select the correct option using given codes.

Column-I

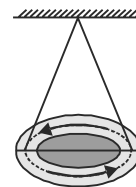
- P. Contact between a live and a neutral wire
 Q. A safety device placed in the live wire
 R. Mechanism to protect from electrical shock
 (a) P-1, Q-3, R-2
 (c) P-1, Q-2, R-3

Column-II

1. Earthing
 2. Fuse
 3. Short circuiting
 (b) P-3, Q-2, R-1
 (d) P-2, Q-3, R-1

For question numbers 6 and 7, two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below :

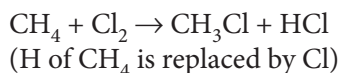
- (a) Both assertion and reason are true and reason is the correct explanation of the assertion.
 (b) Both assertion and reason are true but reason is not the correct explanation of the assertion.
 (c) Assertion is true but reason is false.
 (d) Assertion is false but reason is true.
6. **Assertion (A) :** The magnetic field produced by a current carrying solenoid is independent of its length and cross-sectional area.
Reason (R) : The magnetic field inside the solenoid is uniform.
7. **Assertion (A) :** Magnetic field lines show the direction (at every point) along which a small magnetised needle aligns (at the point).
Reason (R) : Magnetic field lines certainly represent the direction of magnetic field, but not the direction of force, this is because force is always perpendicular to magnetic field B .
8. Two long conductors, separated by a distance d carry current I_1 and I_2 in the same direction. They exert a force F on each other. Now the current in one of them is increased to two times and its direction is reversed. The distance is also increased to $3d$. The new value of the force between them is
 (a) $-2F$ (b) $F/3$ (c) $-2F/3$ (d) $-F/3$
9. A circular loop is suspended in air as shown in figure. When the loop is seen from above, current flows anticlockwise and when seen from below, current flows clockwise. This loop behaves as a magnet. The N-pole of this magnet is on
 (a) the upper face
 (b) lower face
 (c) the lower face if current is large
 (d) upper face if current is large



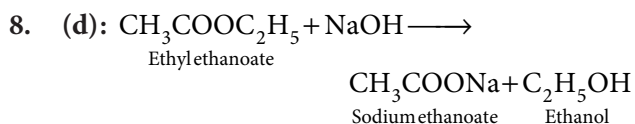
10. Electric supply of a house is through a 15 A fuse. When a 2000 W heater is used in this house, how many 100 W bulbs can be used simultaneously? The supply is at 220 V, and the heater and the bulbs are rated for 220 V.
 (a) 12 (b) 13 (c) 14 (d) 15

- What is an ecosystem?
- Which of the followings is/are caused due to ozone depletion?
 - Damage to immune system
 - Decline in photosynthesis
 - Cancer
 - All of these
- Match the column I with column II and select the correct answer by choosing an appropriate option.

Column I	Column II
P. Ecosystem	1. Recycling of materials
Q. Energy Flow	2. Chlorofluorocarbons
R. Ozone layer	3. Biotic and abiotic components
S. Decomposers	4. 10% law
T. Ozone depletion	5. Protection from UV-rays
(a) P-2, Q-4, R-5, S-3, T-1	(b) P-3, Q-4, R-5, S-1, T-2
(c) P-3, Q-5, R-4, S-1, T-2	(d) P-4, Q-2, R-3, S-5, T-1
- The right path of energy flow in an ecosystem is
 - Producer → Herbivore → Carnivore
 - Producer → Carnivore → Herbivore
 - Herbivore → Carnivore → Producer
 - Herbivore → Producer → Carnivore.
- In natural ecosystem, Nature's cleaners are
 - producers
 - consumers
 - decomposers
 - carnivores.
- Assertion :** Ozone is useful as well as harmful.
Reason : Ozone stops UV radiations but destroy foliage.
 - Both assertion and reason are true and reason is the correct explanation of the assertion.
 - Both assertion and reason are true but reason is not the correct explanation of the assertion.
 - Assertion is true but reason is false.
 - Assertion is false but reason is true.
- Which of the followings is/are non-biodegradable wastes?
 - Sewage
 - Cattle dung
 - Pesticides
 - Vegetable peels
- Which of the followings is abiotic component of an ecosystem?
 - Producer
 - Consumer
 - Soil and minerals
 - All of these
- In a food chain consisting of rabbit, snake and peacock, identify the primary, secondary and tertiary consumers.
- In the food chain given below, if the amount of energy available at fourth trophic level is 3 kJ, what was the energy available at the herbivore level?
Grass → Grasshopper → Frog → Snake → Hawk
 - 3000 kJ
 - 300 kJ
 - 30 kJ
 - 3 kJ



- (c): Ethanol is denatured by adding methanol.
- (c): The given compound has three carbon atoms.
- (c)
- (c): $\text{CO}_2 : \text{O} = \text{C} = \text{O}$, $\text{O}_2 : \text{O} = \text{O}$,
 $\text{C}_2\text{H}_4 : \text{H}_2\text{C} = \text{CH}_2$
- (b): Buckminsterfullerene is an allotrope of carbon made up of 60 carbon atoms.



- (b): The *n*-alkanes have larger surface area in comparison to branched chain isomers (as the shape approaches that of a sphere in the branched chain isomers). Thus, intermolecular forces are weaker in branched chain isomers, therefore they have lower boiling points in comparison to straight chain isomers.
- (b): Catenation property of carbon is primarily due to its small size, electronic configuration and unique strength of carbon-carbon bonds.

CHAPTER 5

Life Processes

- (b)
- Nutrition is a process of intake, as well as utilisation of nutrients by an organism. The different modes of nutrition are : (i) Autotrophic and (ii) Heterotrophic. The heterotrophic nutrition may be (a) Saprotrophic (saprophytic), (b) Parasitic and (c) Holozoic.
- (c)
- (b)
- (a): Hypertension or high blood pressure is commonly called silent killer as it may cause rupturing of blood vessels called haemorrhage, which causes internal bleeding.
- (d)
- (d)
- The two stages in photosynthesis are :
(i) Light reaction and (ii) Dark reaction
Light reaction occurs inside thylakoids and is dependent upon light. In it, chlorophyll molecule absorbs light and through a chain of reaction water is splitted into hydrogen and oxygen and NADPH and ATP are produced.

Dark reaction occurs in stroma of chloroplast in which glucose is produced using CO_2 , ATP and NADPH.

- (i) Gaseous exchange in plants.
(ii) Loss of water in the form of vapours in the process of transpiration.
- (a): *Amoeba* engulfs food by the process of phagocytosis using pseudopodia.

CHAPTER 6

Control and Coordination

- Advanced and complex organisms have specific organs for specific functions. All organs should function in perfect coordination. To facilitate this, there should be a system for control and coordination.
- (b): Phototropism is the directional movement or orientation of the plant part in response to light stimulus. If the plant part moves towards light, it is called positive phototropism. Alternatively, if the plant part moves away from light, it is called negative phototropism.
- (d)
- (b)
- (a) : P-3; Q-4; R-1; S-2
- (d): The path taken by nerve impulse in a reflex action is called reflex arc. The correct sequence of the components of a reflex arc is receptors \rightarrow sensory neuron \rightarrow spinal cord \rightarrow motor neuron \rightarrow muscles.
- (a): Auxin is the plant hormone which plays a role in apical dominance. Apical dominance is the phenomenon by which presence of apical bud does not allow the nearby lateral buds to grow. When the apical bud is removed, the lateral buds sprout. This produces dense bushy growth. The phenomenon is widely used in tea plucking. Apical bud inhibits the growth of lateral buds by releasing auxins.
- (d)
- The main difference between sensory nerve and motor nerve is that the sensory nerve takes the information from receptors and transmit it to brain and motor nerve transmits the information for action to be taken from brain to the effector organs, *i.e.*, muscles.
- (c) : When a person faces stress or danger, adrenaline hormone is secreted which results in fastening of heartbeat and increased supply of oxygen in body.

1. Stamens are the male reproductive parts and the carpels are the female reproductive parts of a flower. Each stamen has anther and filament. Anther produces pollen grains which possess male gametes. Each carpel has stigma, style and ovary. The ovules situated inside the ovary possess female gametes.

2. (b): Vaginal and oral pills are examples of chemical methods while copper-T is an example of Intra-uterine devices (IUDs).

3. (c): After fertilisation, the ovary develops into fruit.

4. (a): P-2; Q-1; R-4; S-3

5. (c)

6. The diseases which spread by sexual contact with an infected person are called as sexually transmitted diseases.

Two bacterial STDs - Syphilis, Gonorrhoea

Two viral STDs - Genital herpes, AIDS

7. (d)

8. (b)

9. During pregnancy, exchange of materials between mother's blood and the blood of fetus takes place through placenta. The placenta serves as the nutritive, respiratory and excretory organ of the fetus.

10. (b): The anther produces powdery particles called pollen grains.

1. (b): Mendel conducted his famous breeding experiments by working on garden pea, *Pisum sativum*.

2. (a): The genotypic ratio in F_2 generation of monohybrid cross will be 1(pure, dominant) : 2(hybrid, dominant) : 1 (pure, recessive).

3. (a): During the mechanism of inheritance generally one gene controls one character.

4. (b): Father and mother both give haploid number (n) of chromosomes to child which together form diploid (2n) chromosome number. Thus one parent's contribution is

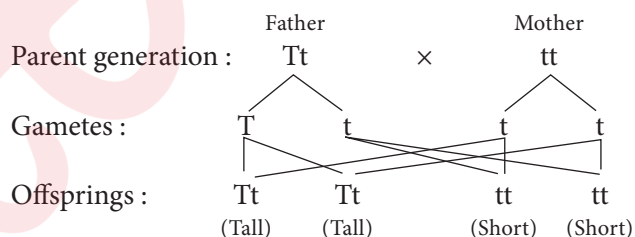
$$= \frac{n}{2n} \times 100 = 50\%$$

5. (c): Monohybrid cross is a cross between two organisms of a species considering a single pair of alleles or factors of a character. Dominant character express itself whether present in homozygous or heterozygous state. In F_1 generation, progenies are heterozygous dominant.

6. (c): In asexually reproducing organisms, e.g., bacteria, individual bacteria generated would be very similar to parents and are known as clones. There would be very minor variations between them, due to small inaccuracies in DNA copying. However, if sexual reproduction is involved, even greater diversity will be generated.

7. The sperm decides the sex of the child because it may be carrying X chromosome or Y chromosome, while egg always carries X chromosome.

8. (a): In this case, mother is homozygous and father is heterozygous. This can be shown by the following cross results:



Genotype : 1 : 1

Phenotype : 50% tall and 50% short

9. (d)

10. (d): Mendel used seven characters which were pod colour, pod shape, seed shape, seed colour, flower colour, flower position and stem height.

1. (d): The speed of light will be maximum in the substance which has the lowest refractive index. So, the light will travel fastest in substance S.

2. (d): When a light ray parallel to the principal axis is incident on a concave mirror, it passes through the principal focus after reflection. Therefore, figure D is correct.

3. (b): Here, $m = \frac{h_i}{h_o} = \frac{u}{v} = \frac{40}{10} \Rightarrow v = 4u$

using mirror formula,

$$\Rightarrow \frac{1}{u} + \frac{1}{v} = \frac{1}{f} \Rightarrow \frac{1}{u} + \frac{1}{4u} = \frac{1}{30} \quad [\because v = 4u]$$

$$\Rightarrow u = 37.5 \text{ cm and } v = 150 \text{ cm}$$

Distance between object and its image

$$v - u = 150 - 37.5 = 112.5 \text{ cm}$$

4. (a): Concave mirror gives magnified image, whereas convex mirror gives diminished image and plane mirror gives image of equal size.

5. (b): Here, $u = 10$, $m = -0.5$ (For real image)

By magnification formula,

$$\Rightarrow -0.5 = \frac{f}{f - 10}$$

$$\Rightarrow -0.5f + 5 = f$$

$$\Rightarrow 1.5f = 5$$

$$\Rightarrow f = \frac{50}{15} = \frac{10}{3} \text{ cm convex lens}$$

6. (c): Diffuse reflection is caused by the roughness (or irregularities) in the reflecting surface of an object. The laws of reflection are valid at each point even on the rough surface of an object.

7. (a): Focal length is the property of mirror, and is independent of the medium in which it is placed.

8. (c): Here, refractive index, $n = 1.5$, speed of light in vacuum $= c = 3 \times 10^8 \text{ m s}^{-1}$
speed of light in glass, $v = ?$

$$\text{From, } n = \frac{c}{v}$$

$$\Rightarrow v = \frac{c}{n} = \frac{3 \times 10^8}{1.5} = 2 \times 10^8 \text{ m s}^{-1}$$

9. (d): Power of the combination of the lenses $= +2 \text{ D}$

From the given data,

$$\text{Power of the convex lens} = \frac{100}{25} \text{ D} = 4 \text{ D}$$

Therefore,

$$\text{Power of the combination} = \text{Power of the concave lens} + \text{Power of the convex lens}$$

Therefore, power of the concave lens

$$= +2 \text{ D} - 4 \text{ D} = -2 \text{ D}$$

So, focal length of the concave lens

$$= \frac{1}{-2 \text{ D}} = -0.5 \text{ m}$$

10. (c): As, $m = \pm 3$, Using $m = \frac{f}{f + u}$

$$\text{For virtual image, } 3 = \frac{f}{f - 8} \quad \dots(i)$$

$$\text{For real image, } -3 = \frac{f}{f - 16} \quad \dots(ii)$$

From equation (i) and (ii), we get $f = 12 \text{ cm}$

CHAPTER 10

The Human Eye and the Colourful World

1. (b): When deviation is minimum, refracted ray inside the prism is parallel to base of prism. Therefore, case (2) is correct.

2. (d): P - 2, Q - 1, R - 4, S - 3

3. (d)

4. (c): As, intensity $\propto \frac{1}{\lambda^4}$
and intensity $\propto (\text{amplitude})^2$

$$\therefore \text{Amplitude} \propto \frac{1}{\lambda^2}$$

5. (a): When ciliary muscles are relaxed, eye lens is thin and it has maximum focal length and minimum converging power.

6. (b): Just after the rain, a large number of small droplets of water remain suspended in the air. Each drop acts like a small prism. When sunlight falls on these drops, the white light splits into seven colours. The dispersed light from a large number of drops forms a continuous band of seven colours.

7. (c): Astigmatism occurs when the cornea or the eye lens or both are not perfectly spherical.

8. (b): The child has acquired 'negative power' in both his eyes. Therefore, the child has near-sightedness in his eyes. It is also called myopia. The concave lens is used for the correction of this defect.

9. (a): There is a less difference in refractive indices of blue and green colour. Therefore, they are seen seem together and red is seen separate because deviation in path of light depends on the refractive index.

10. (a): Here, $x' = 50 \text{ cm}$, $d = 40 \text{ cm}$, $P = ?$

$$\text{As } f = \frac{x'd}{x' - d} = \frac{50 \times 40}{50 - 40} = 200 \text{ cm}$$

$$\text{As } P = \frac{100}{f} \therefore P = \frac{100}{200} = 0.5 \text{ D}$$

1. (a): Slope = $\frac{I}{V} = \frac{1}{R}$ is least for R_A .

So, $R_A > R_B > R_C > R_D$

As, resistance \propto length. So, A is the longest.

2. (b): The equivalent resistance of the circuit,

$$R = \frac{(1\ \Omega + 1\ \Omega) \times 2\ \Omega}{1\ \Omega + 1\ \Omega + 2\ \Omega} = 1\ \Omega$$

Current in the circuit,

$$I = \frac{V}{R} = \frac{2\ \text{V}}{1\ \Omega} = 2\ \text{A}$$

3. (c): Circuit I is a open circuit *i.e.*, no current flows in the circuit.

4. (d): Resistance of bulb, $R = \frac{220^2}{100}$

Power consumed at 110 V

$$= \frac{V^2}{R} = \frac{110^2}{R} = \frac{110^2}{220^2} \times 100 = 25\ \text{W}$$

5. (b): Heat produced = Power \times Time

$$= 1000 \times 5 \times 60 = 3 \times 10^5\ \text{J}$$

6. (b): Heater wire must have high resistance and high melting point, because in series current remains same, therefore according to Joule's law $H = I^2Rt$, heat produced is high if R is high. Melting point must be high, so that wire may not melt with increase in temperature.

7. (b): Due to bending, there is no change in the length of the wire and resistance $R = \rho \frac{l}{A}$ does not change.

Also, resistance depends on the resistivity of material of a conductor.

8. (c): In a parallel combination, each bulb has the voltage equal to that of the main line, and the sum of the currents drawn by each bulb would be equal to the allowable current.

From the given data,

Current flowing through each bulb

$$= \frac{\text{Wattage}}{\text{Voltage}} = \frac{10\ \text{W}}{220\ \text{V}} = \frac{1}{22}\ \text{A}$$

Total maximum allowed current = 5 A

No. of bulbs which can be connected

$$= \frac{5\ \text{A}}{1/22\ \text{A}} = 22 \times 5 = 110$$

9. (a): Given : $\rho = 44 \times 10^{-8}\ \Omega\ \text{m}$, $R = 14\ \Omega$

Diameter (D) = 1 mm

$$\text{Area, } A = \frac{\pi D^2}{4} = \frac{\pi}{4} \times (10^{-3})^2\ \text{m}^2 = \frac{\pi}{4} \times 10^{-6}\ \text{m}^2$$

$$\text{We know, } R = \rho \frac{l}{A}$$

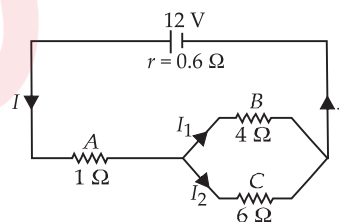
$$\begin{aligned} \therefore l &= \frac{RA}{\rho} = 14 \times \frac{\pi}{4} \times (10^{-6}) \times \frac{1}{44 \times 10^{-8}} \\ &= 14 \times \frac{22}{7 \times 4} \times (10^{-6}) \times \frac{1}{44 \times 10^{-8}} = \frac{100}{4} = 25\ \text{m} \end{aligned}$$

10. (d): The equivalent resistance of B and C is given by

$$\frac{1}{R} = \frac{1}{4\ \Omega} + \frac{1}{6\ \Omega} = \frac{6\ \Omega + 4\ \Omega}{(6\ \Omega)(4\ \Omega)} = \frac{10}{24}\ \Omega = \frac{5}{12}\ \Omega$$

$$\text{or } R = \frac{12}{5}\ \Omega = 2.4\ \Omega$$

$$\begin{aligned} \text{Total resistance in circuit} &= 1.0\ \Omega + 2.4\ \Omega + 0.6\ \Omega \\ &= 4.0\ \Omega \end{aligned}$$



$$\text{Current in circuit, } I_A = \frac{12\ \text{V}}{4\ \Omega} = 3\ \text{A}$$

$$\begin{aligned} \text{The potential difference across both B and C} \\ &= 3.0\ \text{A} \times 2.4\ \Omega = 7.2\ \text{V} \end{aligned}$$

$$\text{Current through B, } I_B = \frac{7.2\ \text{V}}{4.0\ \Omega} = 1.8\ \text{A}$$

$$\text{Current through C, } I_C = \frac{7.2\ \text{V}}{6\ \Omega} = 1.2\ \text{A}$$

Thus, current through resistor A = 3.0 A

Current through resistor B = 1.8 A

Current through resistor C = 1.2 A

1. (b): Unlike poles attract and like poles repel. Two N-poles or two S-poles will always repel each other.

2. (c): In tree type distribution of electric power, fuses are present only on the distribution board where as in ring type, there is an individual fuse for

each appliance. As there is an individual fuse for each appliance in ring type, only faulty appliance will not work and all the other appliances will not be affected. It is easier to install. So, ring type is advantageous than that of tree type.

3. (d): The angle between velocity and magnetic field is zero. Therefore, magnetic force on the particle is zero.

4. (b)

5. (b): Short-circuit occur when live and neutral wires comes in contact.

Fuse is a safety device placed in the live wire.

Earthing is a mechanism used to protect from electrical shock.

6. (b): The magnetic field produced by a solenoid is independent of its length and cross-sectional area.

7. (a)

8. (c): Initially, $F = \frac{\mu_0}{2\pi} \frac{I_1 I_2}{d} l$

Finally, $F' = \frac{\mu_0}{2\pi} \frac{(-2I_1)(I_2)}{3d} l$

$$\therefore \frac{F'}{F} = \frac{-\mu_0}{2\pi} \frac{2I_1 I_2 l}{3d} \times \frac{2\pi d}{\mu_0 I_1 I_2 l} = -\frac{2}{3}$$

$$\therefore F' = -\frac{2}{3} F$$

9. (a)

10. (b): The current drawn by the 2000 W heater is

$$I = \frac{P}{V} = \frac{2000 \text{ W}}{220 \text{ V}} = \frac{100}{11} \text{ A.}$$

The maximum current the bulbs can draw is

$$15 \text{ A} - \frac{100}{11} \text{ A} = \frac{65}{11} \text{ A.}$$

Each bulb will take a current

$$I = \frac{P}{V} = \frac{100 \text{ W}}{220 \text{ V}} = \frac{5}{11} \text{ A.}$$

The number of bulbs that can be used is

$$\frac{\frac{65}{11} \text{ A}}{\frac{5}{11} \text{ A}} = 13.$$

1. Any area or unit of nature that includes living organisms and non-living substances interacting to execute cycling of material between living and non-living part is said to be an ecosystem.

2. (d)

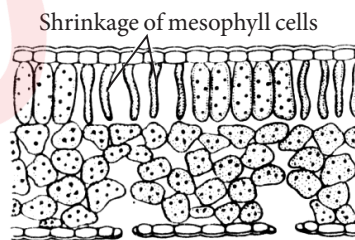
3. (b)

4. (a): Energy flows in an ecosystem in the following direction:

Producer → Herbivore → Carnivore.

5. (c)

6. (a): Ozone layer in the stratosphere protects the earth from high energy UV radiations. Ozone found in the troposphere has a warming effect. At concentration of only 0.02 ppm ozone destroys chlorenchyma cells of plants and produces necrotic areas. There is a positive correlation between ozone concentration and destruction of foliage in a large number of plants.



7. (c): Non-biodegradable wastes are mainly man made. Sewage, cattle dung, household garbage, etc., are examples of biodegradable wastes.

8. (c)

9. Rabbit is the primary consumer because it directly feeds upon producers. Snake is the secondary consumer because it preys upon primary consumer, *i.e.*, rabbit. Peacock is the tertiary consumer because it feeds upon secondary consumer, *i.e.*, snake.

10. (b): According to ten percent law, nearly 90% of energy is lost when it moves from one trophic level to the next. Only 10% of energy is transferred from one trophic level to the next.

Grass	→	Grasshopper	→	Frog	→	Snake	→	Hawk
3000 kJ		300 kJ		30 kJ		3 kJ		0.3 kJ
trophic level I		trophic level II		trophic level III		trophic level IV		trophic level V



CBSE Board
Solved Paper 2024
Class 10



SOLVED PAPER 2024

General Instructions :

Read the following instructions very carefully and strictly follow them :

- (i) This question paper comprises 39 questions. All questions are compulsory.
- (ii) This question paper is divided into five sections - A, B, C, D and E.
- (iii) Section A - Questions No. 1 to 20 are multiple choice questions. Each question carries 1 mark.
- (iv) Section B - Questions No. 21 to 26 are very short answer type questions. Each questions carries 2 marks. Answer to these questions should be in the range of 30 to 50 words.
- (v) Section C - Questions No. 27 to 33 are short answer type questions. Each question carries 3 marks. Answer to these questions should in the range of 50 to 80 words.
- (vi) Section D - Questions No. 34 to 36 are long answer type questions. Each question carries 5 marks. Answer to these questions should be in the range of 80 to 120 words.
- (vii) Section E - Questions No. 37 to 39 are of 3 source-based/case-based units of assessment carrying 4 marks each with sub-parts.
- (viii) There is no overall choice. However, an internal choice has been provided in some sections. Only one of the alternatives has to be attempted in such questions.

Section-A

Select and write the most appropriate option out of the four options given for each of the questions 1-20. There is no negative mark for the incorrect response.

1. When 2 mL of sodium hydroxide solution is added to few pieces of granulated zinc in a test tube and then warmed, the reaction that occurs can be written in the form of a balanced chemical equation as:
 - (a) $\text{NaOH} + \text{Zn} \rightarrow \text{NaZnO}_2 + \text{H}_2\text{O}$
 - (b) $2\text{NaOH} + \text{Zn} \rightarrow \text{Na}_2\text{ZnO}_2 + \text{H}_2$
 - (c) $2\text{NaOH} + \text{Zn} \rightarrow \text{NaZnO}_2 + \text{H}_2$
 - (d) $2\text{NaOH} + \text{Zn} \rightarrow \text{Na}_2\text{ZnO}_2 + \text{H}_2\text{O}$
 2. Select from the following a decomposition reaction in which source of energy for decomposition is light:
 - (a) $2\text{FeSO}_4 \rightarrow \text{Fe}_2\text{O}_3 + \text{SO}_2 + \text{SO}_3$
 - (b) $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$
 - (c) $2\text{AgBr} \rightarrow 2\text{Ag} + \text{Br}_2$
 - (d) $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$
 3. A metal and a non-metal that exists in liquid state at the room temperature are respectively
 - (a) bromine and mercury
 - (b) mercury and iodine
 - (c) mercury and bromine
 - (d) iodine and mercury.
 4. Carbon compounds
 - (i) are good conductors of electricity
 - (ii) are bad conductors of electricity
 - (iii) have strong forces of attraction between their molecules
 - (iv) have weak forces of attraction between their molecules.
- The correct statements are
- (a) (i) and (ii)
 - (b) (ii) and (iii)
 - (c) (ii) and (iv)
 - (d) (i) and (iii)
5. Consider the following compounds :
 FeSO_4 ; CuSO_4 ; CaSO_4 ; Na_2CO_3
The compound having maximum number of water of crystallisation in its crystalline form in one molecule is
 - (a) FeSO_4
 - (b) CuSO_4
 - (c) CaSO_4
 - (d) Na_2CO_3
6. Oxides of aluminium and zinc are
 - (a) acidic
 - (b) basic
 - (c) amphoteric
 - (d) neutral.
7. $\text{MnO}_2 + 4\text{HCl} \rightarrow \text{MnCl}_2 + 2\text{H}_2\text{O} + \text{Cl}_2$
The reaction given above is a redox reaction because in this case:
 - (a) MnO_2 is oxidised and HCl is reduced.
 - (b) HCl is oxidised.
 - (c) MnO_2 is reduced.
 - (d) MnO_2 is reduced and HCl is oxidised.
8. Consider the following statements:
 - (i) The sex of a child is determined by what it inherits from the mother.
 - (ii) The sex of a child is determined by what it inherits from the father.
 - (iii) The probability of having a male child is more than that of a female child.
 - (iv) The sex of a child is determined at the time of fertilisation when male and female gametes fuse to form a zygote.The correct statements are
 - (a) (i) and (iii)
 - (b) (ii) and (iv)
 - (c) (iii) and (iv)
 - (d) (i), (iii) and (iv).

9. Chromosomes:
- carry hereditary information from parents to the next generation.
 - are thread like structures located inside the nucleus of an animal cell.
 - always exist in pairs in human reproductive cells.
 - are involved in the process of cell division.

The correct statements are:

- (i) and (ii)
 - (iii) and (iv)
 - (i), (ii) and (iv)
 - (i) and (iv).
10. In a nerve cell, the site where the electrical impulse is converted into a chemical signal is known as:
- axon
 - dendrites
 - neuromuscular junction
 - cell body.

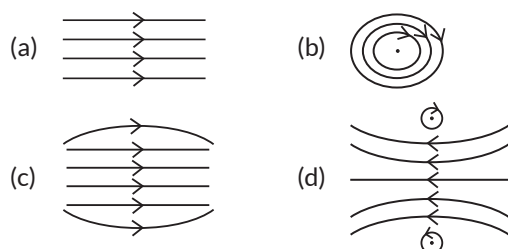
11. A stomata closes when
- it needs carbon dioxide for photosynthesis.
 - it does not need carbon dioxide for photosynthesis.
 - water flows out of the guard cells.
 - water flows into the guard cells.

The correct reason(s) in this process is/are

- (i) only
 - (i) and (iii)
 - (ii) and (iii)
 - (ii) and (iv)
12. At what distance from a convex lens should an object be placed to get an image of the same size as that of the object on a screen?
- Beyond twice the focal length of the lens.
 - At the principal focus of the lens.
 - At twice the focal length of the lens.
 - Between the optical centre of the lens and its principal focus.

13. The lens system of human eye forms an image on a light sensitive screen, which is called as
- cornea
 - ciliary muscles
 - optic nerves
 - retina

14. The pattern of the magnetic field produced inside a current carrying solenoid is



15. Identify the food chain in which the organisms of the second trophic level are missing.
- Grass, goat, lion
 - Zooplankton, phytoplankton, small fish, large fish

- Tiger, grass, snake, frog
- Grasshopper, grass, snake, frog, eagle

16. In which of the following organisms, multiple fission is a means of asexual reproduction?
- Yeast
 - Leishmania*
 - Paramecium*
 - Plasmodium*

For Q. Nos. 17 to 20, two statements are given - One labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below :

- Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
- Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
- Assertion (A) is true, but Reason (R) is false.
- Assertion (A) is false, but Reason (R) is true.

17. **Assertion (A)** : Hydrogen gas is not evolved when zinc reacts with nitric acid.

Reason (R) : Nitric acid oxidises the hydrogen gas produced to water and itself gets reduced.

18. **Assertion (A)** : Accumulation of harmful chemicals is maximum in the organisms at the highest trophic level of a food chain.

Reason (R) : Harmful chemicals are sprayed on the crops to protect them from diseases and pests.

19. **Assertion (A)** : The rate of breathing in aquatic organisms is much faster than in terrestrial organisms.

Reason (R) : The amount of oxygen dissolved in water is very high as compared to the amount of oxygen in air.

20. **Assertion (A)** : The rainbow is a natural spectrum of sunlight in the sky.

Reason (R) : Rainbow is formed in the sky when the sun is overhead and water droplets are also present in air.

Section-B

21. Name the type of chemical reaction in which calcium oxide reacts with water. Justify your answer by giving balanced chemical equation for the chemical reaction.

22. State one role of each of the following in human digestive system :
- Hydrochloric acid
 - Villi
 - Anal Sphincter
 - Lipase

23. (A) How is the movement of leaves of a sensitive plant different from the downward movement of the roots ?

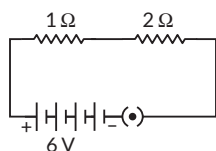
OR

- (B) There is a hormone which regulates carbohydrate, protein and fat metabolism in our body. Name the hormone and the gland which secretes it. Why is it important for us to have iodised salt in our diet?
24. An object is placed at a distance of 10 cm from a convex mirror of focal length 15 cm. Find the position of the image formed by the mirror.

25. (A) Show how you would connect three resistors each of resistance $6\ \Omega$, so that the combination has a resistance of $9\ \Omega$. Also justify your answer.

OR

- (B) In the given circuit calculate the power consumed in watts in the resistor of $2\ \Omega$.



26. (i) Two magnetic field lines do not intersect each other. Why?
 (ii) How is a uniform magnetic field in a given region represented?
 Draw a diagram in support of your answer.

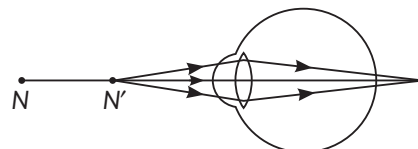
Section-C

27. Write one chemical equation each for the chemical reaction in which the following have taken place :
 (i) Change in colour
 (ii) Change in temperature
 (iii) Formation of precipitate
 Mention colour change/temperature change (rise/fall)/compound precipitated along with equation.
28. (i) The pH of a sample of tomato juice is 4.6. How is this juice likely to be in taste? Give reason to justify your answer.
 (ii) How do we differentiate between a strong acid and a weak base in terms of ion-formation in aqueous solutions?
 (iii) The acid rain can make the survival of aquatic animals difficult. How?
29. (i) Why is respiratory pigment needed in multicellular organisms with large body size?
 (ii) Give reasons for the following:
 (a) Rings of cartilage are present in the throat.
 (b) Lungs always contain residual volume of air.

- (c) The diaphragm flattens and ribs are lifted up when we breathe in.
 (d) Walls of alveoli contain an extensive network of blood vessels.

30. Define reflex action. With the help of a flow chart shown the path of a reflex such as sneezing.

31. Study the diagram given below and answer the questions that follow:



- (i) Name the defect of vision represented in the diagram. Give reason for your answer.
 (ii) List two causes of this defect.
 (iii) With the help of a diagram show how this defect of vision is corrected.
32. Name and state the rule to determine the direction of a
 (i) magnetic field produced around a current carrying straight conductor.
 (ii) force experienced by a current carrying straight conductor placed in a magnetic field which is perpendicular to it.

33. (A) Plants → Deer → Lion

In the given food chain, what will be the impact of removing all the organisms of second trophic level on the first and third trophic level?

Will the impact be the same for the organisms of the third trophic level in the above food chain if they were present in a food web? Justify.

OR

(B) A gas 'X' which is a deadly poison is found at the higher levels of atmosphere and performs an essential function.

Name the gas and write the function performed by this gas in the atmosphere. Which chemical is linked to the decrease in the level of this gas? What measures have been taken by an international organisation to check the depletion of the layer containing this gas?

Section-D

34. (A) (i) Define a homologous series of carbon compounds.
 (ii) Why is the melting and boiling points of C_4H_8 higher than that of C_3H_6 or C_2H_4 ?
 (iii) Why do we not see any gradation in chemical properties of a homologous series compounds?
 (iv) Write the name and structures of (i) aldehyde and (ii) ketone with molecular form C_3H_6O .

OR

- (B) (i) Write the name and structure of an organic compound 'X' having two carbon atoms in its molecule and its name is suffixed with '-ol'.
- (ii) What happens when 'X' is heated with excess concentrated sulphuric acid at 443 K? Write chemical equation for the reaction stating the conditions for the reaction. Also state the role played by concentrated sulphuric acid in the reaction.
- (iii) Name and draw the electron dot structure of hydrocarbon produced in the above reaction.
35. (A) (i) Name three techniques/devices used by human females to avoid pregnancy. Mention the side effects caused by each.
- (ii) What will happen if in a human female (a) fertilisation takes place, (b) an egg is not fertilised?

OR

- (B) (i) Draw a diagram showing spore formation in *Rhizopus* and label the (a) reproductive and (b) non-reproductive parts. Why does *Rhizopus* not multiply on a dry slice of bread?
- (ii) Name and explain the process by which reproduction takes place in *Hydra*.
36. (A) (i) Define electric power. Express it in terms of potential difference (V) and resistance (R).
- (ii) An electric oven is designed to work on the mains voltage of 220 V. This oven consumes 11 units of electrical energy in 5 hours. Calculate :
- (a) power rating of the oven.
- (b) current drawn by the oven.
- (c) resistance of the oven when it is red hot.

OR

- (B) (i) Write the relation between resistance R and electrical resistivity ρ of the material of a conductor in the shape of cylinder of length l and area of cross-section A . Hence derive the SI unit of electrical resistivity.
- (ii) The resistance of a metal wire of length 3 m is 60 Ω . If the area of cross-section of the wire is $4 \times 10^{-7} \text{ m}^2$, calculate the electrical resistivity of the wire.
- (iii) State how would electrical resistivity be affected if the wire (of part 'ii') is stretched so that its length is doubled. Justify your answer.

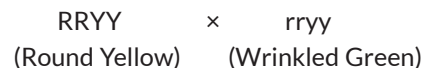
Section-E

Q.Nos. 37-39 are source-based/case-based questions with 2 to 3 short sub-parts. Internal choice is provided in one of these sub-parts:

37. The metals produced by various reduction processes are not very pure. They contain impurities, which must be removed to obtain pure metals. The most widely used method for refining impure metals is electrolytic refining.
- (i) What is the cathode and anode made of in the refining of copper by this process?
- (ii) Name the solution used in the above process and write its formula.
- (iii) (A) How copper gets refined when electric current is passed in the electrolytic cell?

OR

- (iii) (B) You have two beakers 'A' and 'B' containing copper sulphate solution. What would you observe after about 2 hours if you dip a strip of zinc in beaker 'A' and a strip of silver in beaker 'B'? Give reason for your observations in each case.
38. Mendel worked out the rules of heredity by working on garden pea using a number of visible contrasting characters. He conducted several experiments by making a cross with one or two pairs of contrasting characters of pea plant. On the basis of his observations he gave some interpretations which helped to study the mechanism of inheritance.
- (i) When Mendel crossed pea plants with pure tall and pure short characteristics to produce F_1 progeny, which two observations were made by him in F_1 plants?
- (ii) Write one difference between dominant and recessive trait.
- (iii) (A) In a cross with two pairs of contrasting characters



Mendel observed 4 types of combinations in F_2 generation. By which method did he obtain F_2 generation? Write the ratio of the parental combinations obtained and what conclusions were drawn from the experiment.

OR

- (iii) (B) Justify the statement :
"It is possible that a trait is inherited but may not be expressed".
39. Study the data given below showing the focal length of three concave mirrors A, B and C and the respective distances of objects placed in front of the mirrors :

Case	Mirror	Focal Length (cm)	Object Distance (cm)
1	A	20	45
2	B	15	30
3	C	30	20

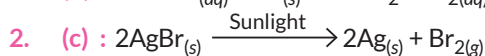
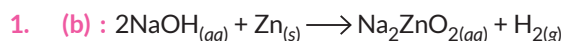
- (i) In which one of the above cases the mirror will form a diminished image of the object? Justify your answer.

- (ii) List two properties of the image formed in case 2.
 (iii) (A) What is the nature and size of the image formed by mirror C? Draw ray diagram to justify your answer.

OR

- (iii) (B) An object is placed at a distance of 18 cm from the pole of a concave mirror of focal length 12 cm. Find the position of the image formed in this case.

Detailed SOLUTIONS



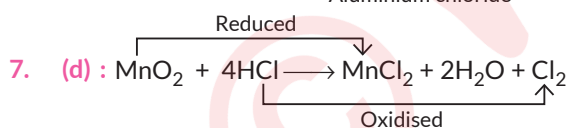
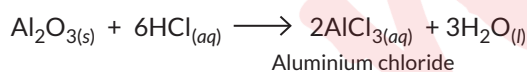
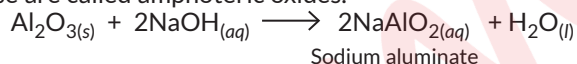
It is a photodecomposition reaction.

3. (c) : Mercury is a liquid metal and bromine is a liquid non-metal.

4. (c)

5. (d) : $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$: Green vitriol
 $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$: Blue vitriol
 $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$: Gypsum
 $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$: Washing soda

6. (c) : Some metal oxides, such as aluminium oxide and zinc oxide show amphoteric behaviour and react with both acids as well as alkalies to form salt and water. These are called amphoteric oxides.



As hydrogen is removed from HCl to give Cl_2 , HCl is being oxidised whereas oxygen is removed from MnO_2 to give MnCl_2 , hence MnO_2 is reduced. Here MnO_2 acts as an oxidising agent and HCl acts as a reducing agent.

8. (b) : The sex of the children is determined by what they inherit from their father as the father is heterogametic, i.e., chromosomes with X and Y. During fertilisation, there are equal chances that an ovum is fertilised by either a sperm having X-chromosome or a sperm having Y chromosome. Therefore, the probability of having a male or female child is equal.

9. (c)

10. (c) : The neuromuscular junction is found between neuron and muscle fibres. The neural signal reaching this junction and releases the neurotransmitter that converts electric impulse into chemical signal.

11. (c)

12. (c) : When the object is placed at twice the focal length i.e. centre of curvature, the image formed by the convex lens is real and of the same size as the object.

13. (d) : The light sensitive screen on which the image is formed is called retina.

14. (d) : The field lines inside the solenoid are same as field lines produced by a bar magnets which is same as in option (d).

15. (c)

16. (d) : Yeast reproduces by budding. *Leishmania* and *Paramecium* reproduce by binary fission. The malarial parasite, *Plasmodium*, divides into many daughter cells simultaneously by multiple fission.

17. (a) : Hydrogen gas is not evolved when a metal reacts with nitric acid. This is because HNO_3 is a strong oxidising agent. It oxidises the H_2 produced to water and itself gets reduced to any of the nitrogen oxides (N_2O , NO , NO_2).

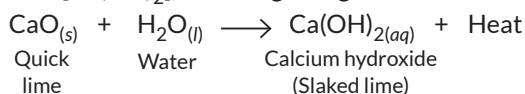
18. (b)

19. (c) : The rate of breathing in aquatic organisms is much faster than that of terrestrial organisms, since the amount of dissolved oxygen in water is fairly low as compared to the amount of oxygen in the air.

20. (c) : A rainbow is a natural spectrum appearing in the sky after a rain shower.

A rainbow can only be seen in the sky when the sun is behind the observer.

21. Quick lime (CaO) reacts with water to form slaked lime [$\text{Ca}(\text{OH})_2$], releasing a large amount of heat.



This is an example of combination and exothermic reaction.

22. (i) The acidic pH of stomach is maintained by HCl acid which converts pepsinogen into pepsin that acts on proteins.

29. (i) The respiratory pigments are required in multicellular organisms with large body size because they need large amount of oxygen to do various metabolic activities.

These pigments carry oxygen to the blood and then circulate to the different parts of the body and convert the deoxygenated blood into the oxygenated blood and carbon dioxide is released from the body.

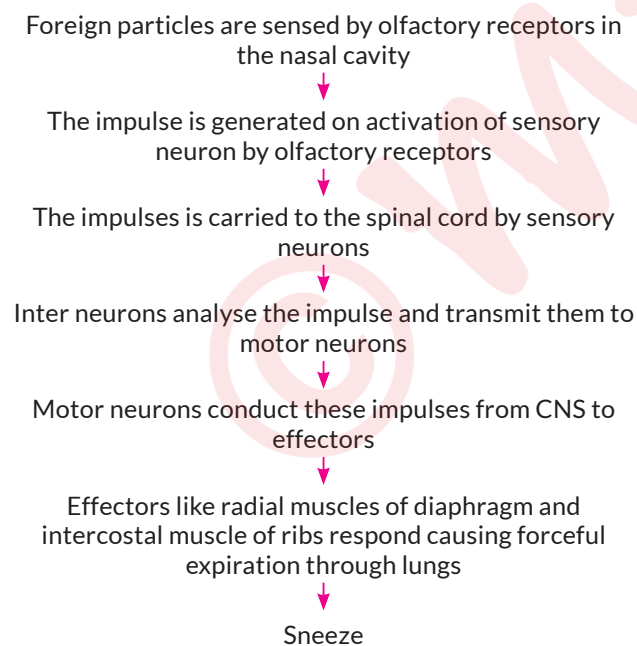
(ii) (a) Rings of cartilage are C-shaped, cartilaginous rings which prevent the trachea from collapsing and blocking the airway.

(b) Lungs always contain residual volume of air that prevents the lungs from collapsing.

(c) Diaphragm flattens and ribs are lifted up during inhalation, which increase the space in chest cavity so that air can rush into the lungs and fills the expanded alveoli.

(d) Alveoli are small, rounded, polyhedral pouches which are extremely thin-walled and possess an extensive network of blood vessels for the exchange of gases. Oxygen diffuses from alveoli into pulmonary blood capillaries and CO_2 diffuses out from capillaries into alveoli.

30. Reflex action is an automatic and spontaneous response to a stimulus. Sequences of events that occur during sneezing can be depicted as :



31. (i) The given diagram represents hypermetropia or far-sightedness.

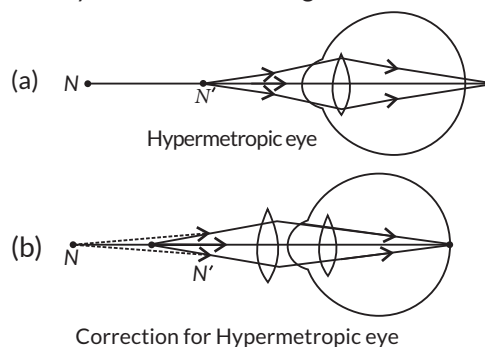
This is so because the near point of the eye becomes more than 25 cm due to which the image is formed behind the retina.

(ii) Hypermetropia is caused due to following reasons:

(a) Shortening of the eyeball.

(b) Focal length of crystalline lens becomes too long.

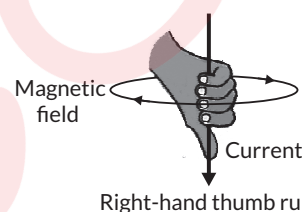
(iii) It is corrected by using a convex lens which converges the rays and shifts the image to the retina from beyond.



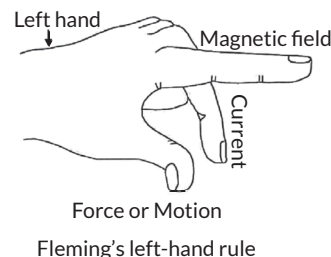
32. (i) Magnetic field produced around a current carrying straight conductor is determined by right hand thumb rule.

The straight thumb of right hand points in the direction of electric current.

The direction of the curl of fingers represents the direction of magnetic field.



(ii) Force experienced by a current carrying straight conductor placed in a magnetic field which is perpendicular to it is determined by Fleming's left hand rule.



33. (A) In the given food chain, if the population of second trophic level, i.e., deer removed than the population of first trophic level, i.e., plants will increase whereas the population of third trophic level, i.e., lion will decrease.

Food web is a network of food chains which become interconnected at various trophic levels so as to form a number of feeding connections amongst different organisms of a biotic community. Thus, if the organisms of third trophic level are present in the food web then their population remains same as alternative source of food for lion will be there in the food web.

(B) The deadly poisonous gas X found at the higher levels of atmosphere is the ozone(O_3) gas.

The functions of ozone gas in the atmosphere are as follows:

$$\text{Power} = \frac{\text{Energy consumed}}{\text{Time}}$$

$$P = VI = I^2R = \frac{V^2}{R} \quad (\because V = IR)$$

where, 'V' is potential difference and 'R' is the resistance.

(ii) (a) Voltage, $V = 220 \text{ V}$

Electrical energy = 11 units = 11 kWh

Time, $t = 5 \text{ hours}$

Power rating is the power consumed in one hour.

$$\text{Power} = \frac{11 \text{ units}}{5 \text{ hours}} = 2.2 \text{ kW}$$

(b) As, $P = VI$

$$I = \frac{P}{V} = \frac{2.2 \text{ kW}}{220 \text{ V}} = \frac{2200 \text{ W}}{220 \text{ V}} = 10 \text{ A}$$

(c) Also, $P = I^2R$

$$R = \frac{P}{I^2} = \frac{2200}{(10)^2} = 22 \Omega$$

Hence, resistance of oven is 22Ω .

OR

36. (B) (i) For a conductor in the shape of cylinder of length l , area of cross-section A , resistance R and its resistivity, ρ are related by relation

$$\rho = \frac{RA}{l}$$

As, SI unit of length l is meter, SI unit of area of cross-section (A) is $(\text{meter})^2$ and of resistance R is ohm, the SI unit of resistivity will be

$$\rho = \frac{\text{ohm} \times (\text{meter})^2}{\text{meter}} = \text{ohm} \cdot \text{m}$$

(ii) Given, length of metal wire, $l = 3 \text{ m}$

Resistance, $R = 60 \Omega$

Area of cross-section, $A = 4 \times 10^{-7} \text{ m}^2$

$$\text{Resistivity, } \rho = \frac{RA}{l} = \frac{60 \times 4 \times 10^{-7}}{3}$$

$$= 80 \times 10^{-7} = 8 \times 10^{-6} \text{ ohm} \cdot \text{m}$$

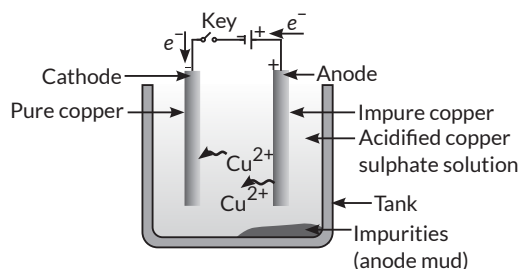
(iii) Electrical resistivity of the wire remains the same as the material is same for wire in both cases. While electric resistance gets changed with change in the dimension of the wire.

37. (i) In the electrolytic refining of copper, the impure copper is made the anode and a thin strip of pure copper is made the cathode.

(ii) A solution of the copper salt *i.e.*, copper sulphate is taken as an electrolyte. The formula of copper sulphate is CuSO_4 .

(iii) (A) On passing the electric current through the electrolyte, the pure copper metal from the anode dissolves into the electrolyte. An equivalent amount of pure copper from the electrolyte is deposited on the

cathode. The soluble impurities go into the solution, whereas, the insoluble impurities settle down at the bottom of the anode and are known as anode mud.



At anode : $\text{Cu} \rightarrow \text{Cu}^{2+} + 2e^-$

At cathode : $\text{Cu}^{2+} + 2e^- \rightarrow \text{Cu}$

OR

(iii) (B) When a strip of zinc metal is placed in copper sulphate solution in beaker A, zinc being more reactive displaces copper from copper sulphate solution and thus colourless solution of zinc sulphate is formed. Due to the formation of this colourless zinc sulphate solution, blue colour of copper sulphate fades gradually.



When silver (Ag) is added to CuSO_4 solution in beaker B, no reaction will take place as Cu is more reactive than Ag.

38. (i) Two observations made by Mendel are as follows:

(i) Law of dominance : The expression of only one of the parental characters in a monohybrid cross in the F_1 .

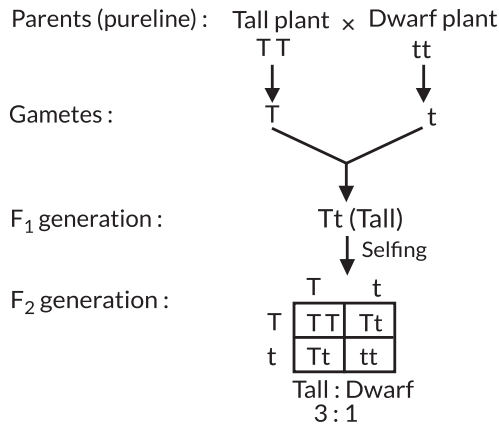
(ii) Law of segregation : A homozygous parent produces all similar gametes while a heterozygous one produces two kinds of gametes each having one allele with equal proportion.

(ii) Dominant trait is a trait which can express itself whether present in homozygous (TT) or heterozygous (Tt) state, *e.g.*, for height, Tallness gene (T) is dominant over the dwarfness gene (t) whereas recessive trait is a trait which is unable to express its effect in the presence of its contrasting factor in a heterozygote, *e.g.*, the allele of 't' in hybrid tall pea plant Tt. Recessive trait is expressed only in the homozygous state, *e.g.*, tt in dwarf pea plant.

(iii) (A) By test cross (*i.e.*, crossing the dominant trait with the recessive trait) using Punnett square method, Mendel obtained F_2 generation. Parental phenotypic combinations obtained were 10 parental (Round yellow and wrinkled green) : 6 non-parental (Round green and wrinkled yellow). Parental genotypic combinations obtained were 2 (RRYY, rryy parental) : 14 (non-parental). The conclusion were drawn by him from the given experiment: When two pairs of traits are combined in a hybrid, segregation of one pair of characters is independent of the other pair of characters *i.e.*, 50 percent of R gametes and 50 percent of r gametes is independent from the segregation of 50 percent of Y gametes and 50 percent of y gametes.

OR

(iii) (B) Mendel first selected two pureline plants. He then crossed such plants having contrasting characters. In the F_1 generation, he observed that only one of the two contrasting character appeared, he called it dominant and the one which does not get expressed in F_1 was recessive. He later selfed the F_1 plants and observed that both the traits appear but in a definite proportion. It can be explained by the following cross :



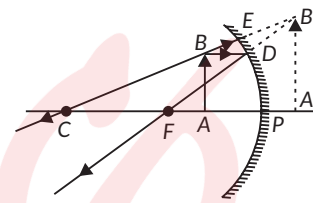
This is how Mendel explained that a trait may be inherited but not expressed in the organism.

39. (i) As in given data, concave mirror A will form the diminished image of the object, since the object in this

case is placed before centre of curvature as, $u = 45$ cm, $f = 20$ cm.

(ii) In case 2, the object distance is twice the focal length (as, $u = 30$ cm, $f = 15$ cm) of concave mirror and hence it is placed at the centre of curvature. Therefore, the image formed will be real, inverted and of same size as the object.

(iii) (A) For concave mirror C, the object is placed in between focal point and pole as, $u = 20$ cm, $f = 30$ cm. Thus, the image formed will be virtual, enlarged and the ray diagram for this case is shown in the given figure.



OR

(iii) (B) For concave mirror, $f = -12$ cm
Object distance, $u = -18$ cm

By mirror formula,

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} \Rightarrow \frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{-1}{12} + \frac{1}{18}$$

$$v = -36 \text{ cm}$$

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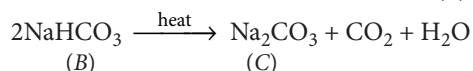
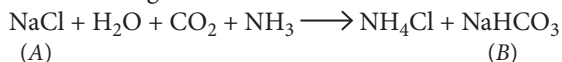
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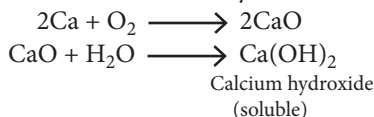
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SCIENCE

- (c)
- (a) : $\text{Pb}(\text{NO}_3)_2 + 2\text{KI} \rightarrow \text{PbI}_2 + 2\text{KNO}_3$
 (P) (Q) (Yellow ppt.)
- (b) : The balanced chemical equation is
 $2\text{Na}_{(s)} + 2\text{H}_2\text{O}_{(l)} \rightarrow 2\text{NaOH}_{(aq)} + \text{H}_2(g)$
- (d) : Baking soda is commonly used in kitchen for making tasty, crispy *pakoras*. Sometimes, it is added for faster cooking.

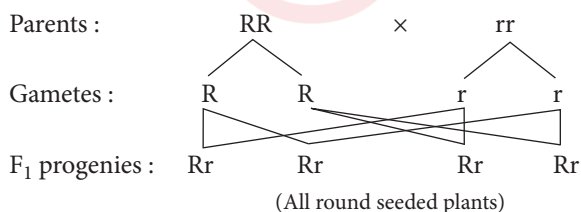


- (d)
- (a) : Calcium (Ca) combines with oxygen to form calcium oxide (CaO) with very high melting point. It dissolves in water to form calcium hydroxide.



- (d) : Acids remain colourless, while bases give pink colour with phenolphthalein.
- (b) : Urine formation begins with the filtration of blood through the epithelial walls of the glomerulus and Bowman's capsule. The fluid portion of the blood, which consists of water, urea, ions, nutrients and small proteins, is able to move across the capillary wall. Blood cells and larger proteins, however, cannot cross and are retained in the blood.
- (a) : The absorption of water mainly takes place in the terminal ends of the roots but occurs maximum in the area of root hair (1–10 cm behind the root tip). A root hair contains cell sap which has higher concentration of salts as compared to the soil water. Hence the root hair cells absorb water from soil by endosmosis.

- (a) : The given cross can be represented as follows :



Here, genes of both the traits, *i.e.*, round seed and wrinkled seed were present in the F₁ progeny, however, only round seed trait was expressed because, round seed shape is a dominant trait.

- (c)

- (d) : Malarial parasite, *Plasmodium*, divides into many daughter cells simultaneously by multiple fission.

- (b) : $H = I^2Rt$; $80 = (2)^2 \times R \times 10$

$$R = \frac{80}{40} = 2 \Omega$$

- (a) : Using right hand rule, the direction of current is clockwise at B, so on curling the fingers clockwise, we get that the north pole is developed at B and the south pole is developed at A.

- (b) : We know,

$$R = \frac{\rho l}{A} \Rightarrow l = \frac{RA}{\rho}$$

$$l = \frac{1.56 \times 10^{-2} \times 1 \times 10^{-6}}{2.6 \times 10^{-8}} = 0.6 \text{ m} = 60.0 \text{ cm}$$

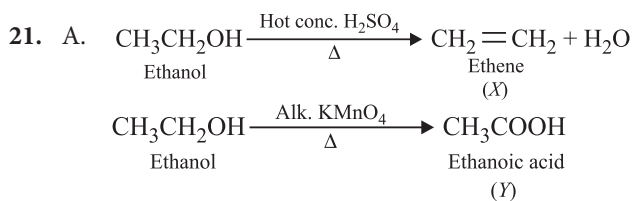
- (c) : If the copper rod carries a direct current, the magnetic field associated with the current will be both inside and outside the rod.

- (a)

- (c) : Acquired traits are non-genetic changes and are not transferred to future generations while inherited traits are controlled by specific genes and are passed on from one generation to another. Any alteration in the DNA (genes) will be passed on through germ cells to the progeny resulting in variations in them.

- (b)

- (c) : The magnitude of magnetic field produced by a current carrying circular coil is maximum at the centre and is not proportional to the distance of a point from the circular coil.



- X = Dehydration, Y = Oxidation

-

S.No	Feature	Endocrine glands	Exocrine glands
1.	Ducts	These glands lack ducts and pour their secretions directly into the blood.	These glands have ducts which carry their secretions at the site of action.
2.	Secretions	They secrete chemical messengers called hormones.	They secrete biocatalysts called enzymes, mucus and some other juices.

- A. Human intestine is several metres long. The mucosa of small intestine is folded and projected in the

form of finger-like structures, the villi, which increase the absorptive surface manifolds. Moreover, villi are highly vascular containing blood capillaries and lymph capillaries. Furthermore, the epithelial lining of small intestine is very thin which facilitates rapid diffusion of substances.

OR

B. (i) Blood vessels : All types of blood vessels, *i.e.*, arteries, veins and capillaries are connected to form a closed circulatory system for transporting blood from one part of the body to other.

(ii) Blood platelets : They play an important role in blood clotting.

(iii) WBCs : They fight against the disease-causing germs in the body and are also known as soldiers of the body.

24. A. The digestive juices P, Q and R are saliva, gastric juice and intestinal juice respectively.

B. Gastric juice (Q) contains dilute HCl, mucus, rennin and pepsin. Pepsin gets activated in an acidic medium and acts upon the proteins to convert them into proteoses and peptones.

C. Salivary amylase present in saliva acts in an alkaline medium and digests starch partially.

25. A. (i) The eye can focus the images of all the objects, distant or nearby at the retina by changing the focal length of its lens. The eye lens can change its focal length by changing its thickness with the help of ciliary muscles.

(ii) Eye lens and ciliary muscles are involved in it. This property is called accommodation of the eye.

OR

B. The ray should follow the path shown in the below figure.

So, the incident angle on the side AB is $\angle PQN = 45^\circ$. For 45° it shows total internal reflection, therefore it is greater than its critical angle.

So, critical angle $C < 45^\circ$

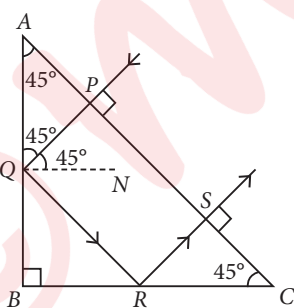
$$\text{as } \mu = \frac{1}{\sin C} \quad \dots(i)$$

$$\mu > \frac{1}{\sin 45^\circ} \quad (\text{Using equation (i)})$$

$$\text{or } \mu > \sqrt{2}$$

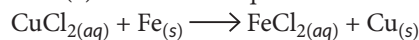
26. The given figure represents biomagnification of DDT in an aquatic food chain.

Some harmful chemicals may enter our bodies through the food chain. Several pesticides and other chemicals used to protect our crops from pests and diseases pollutes the water bodies as well as the soil. From the soil, these are absorbed by the plants along with water and mineral salts and from

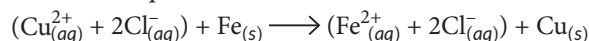


the water bodies these are taken up by aquatic plants and animals. These chemicals are non-biodegradable and get accumulated progressively at each trophic level through the food chains. This phenomenon is known as biological magnification that is well known for mercury and DDT.

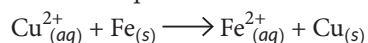
27. (a) Molecular equation :



Total ionic equation :



Net ionic equation :



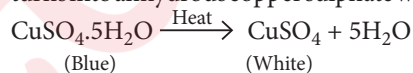
For (b) and (c) no reaction takes place.

28. A. (i) Only one-half of water molecule is shown in the

formula of Plaster of Paris ($\text{CaSO}_4 \cdot \frac{1}{2} \text{H}_2\text{O}$) as one molecule of water is being shared by two molecules of calcium sulphate (CaSO_4). So the effective water of crystallisation for one CaSO_4 unit comes to be half molecule of water.

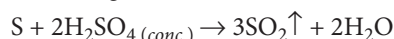
(ii) Acidity can be neutralised by a base. Sodium hydrogen carbonate can be used as an antacid solution because it is a weak base and will react with excess acid produced in the stomach due to hyperacidity and will neutralise it.

(iii) Blue coloured copper sulphate crystals are hydrated copper sulphate, $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$. On heating, blue coloured copper sulphate crystal loses its water of crystallisation and turns into anhydrous copper sulphate which is white in colour.



OR

B. (i) SO_2 gas is formed.



(ii) $2\text{Al} + 2\text{NaOH} + 2\text{H}_2\text{O} \rightarrow 2\text{NaAlO}_2 + 3\text{H}_2 \uparrow$

(iii) $2\text{CaOCl}_2 + \text{H}_2\text{SO}_4(\text{dil.}) \rightarrow \text{CaSO}_4 + \text{CaCl}_2 + 2\text{HOCl}$

29. The phloem cells transport the soluble food materials to all parts of plant. The transport of food from leaves to different parts of plant is termed as translocation. Components of phloem are sieve tubes, companion cells, phloem parenchyma and phloem fibres. The food is manufactured in the mesophyll cells (or photosynthetic cells) of a leaf. The manufactured food enters into sieve tubes of the phloem and is transported as a dilute aqueous solution either in upward or downward direction. Food is transported to all non-green parts of the plant for their growth and metabolic activities. Besides food molecules, phloem also transports amino acids, hormones synthesised in the shoot tips and root tips and other metabolites.

In this process, glucose is transferred to phloem tissue using energy from ATP. This increases the osmotic pressure of the tissue causing the water to move into it (endosmosis). Soluble material is then transferred from phloem tissue to other tissues which have less pressure than in the phloem. Thus, according to plant's requirement, the material is

translocated from higher osmotic pressure areas to lower osmotic pressure areas.

30. A. Given, $h = 5 \text{ cm}$, $f = 20 \text{ cm}$, $u = -30 \text{ cm}$

Using lens formula, $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

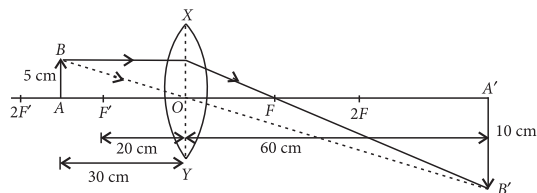
$$\frac{1}{v} = \frac{1}{u} + \frac{1}{f} = \frac{1}{-30} + \frac{1}{20} = \frac{-2+3}{60} = \frac{1}{60} \Rightarrow v = 60 \text{ cm}$$

Now, magnification, $m = \frac{h'}{h} = \frac{v}{u}$

$$\Rightarrow h' = \frac{v}{u} \times h = \frac{60}{-30} \times 5 = -10 \text{ cm}$$

Hence, image of size 10 cm, which is real, inverted and magnified, is formed at 60 cm from the lens.

B.

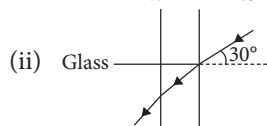


31. A. It gives us the idea about the speed of light in the air and in the glass, *i.e.*, the speed of light is 1.5 time more in air than the speed of light in the glass

B. (i) Applying Snell's law, let r be the angle of refraction. Given, $i = 30^\circ$, $n = 1.5$

$$\therefore \text{Refractive index, } n = \frac{\sin i}{\sin r}$$

$$\Rightarrow \sin r = \frac{\sin i}{n} = \frac{\sin 30^\circ}{1.5} \Rightarrow r = 19.5^\circ$$

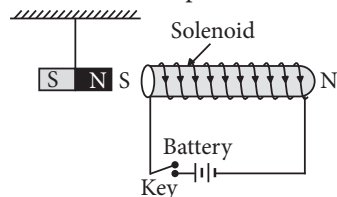


(iii) The object is seen slightly displaced from its original position.

32. A. Long cylindrical coil consisting of a large number of turns of an insulated wire is called a solenoid. When current is passed through a solenoid, it acts as a bar magnet.

B. Suspended a bar magnet from a support, bring a current-carrying solenoid near the North pole of the bar magnet. Observe if it gets attracted or repelled. Now, bring the same end of the solenoid near the South pole of the bar magnet. Observe if it gets attracted or repelled.

You will find, one of the poles of the bar magnet getting attracted, and the other repelled.



Following the rule that opposite poles attract each other, one can identify the poles of the solenoid.

33. A. The food chain is as follows:

Grass \rightarrow Insect \rightarrow Frog \rightarrow Snake \rightarrow Hawk

B. In the constructed food chain, snake occupies the fourth trophic level (T_4).

C. In an ecosystem, a species may occupy more than one trophic level simultaneously. As the trophic level represents a functional level, not a species as such. A species may occupy more than one trophic level in the same ecosystem at the same time, for example, a sparrow is a primary consumer when it eats seeds, fruits, etc, and a secondary consumer when it eats insects and worms.

34. A. (a) Anodized articles of aluminium have a thick coating of an oxide layer on the surface. It protects the surface of aluminium from corrosion. Moreover, we get beautiful coloured shades because oxide layer can be easily dyed.

(b) After attack of oxygen and moisture on the surface of iron, rust is formed which does not stick to the surface. It peels off easily exposing fresh surface for rusting. Attack of oxygen on aluminium surface forms an oxide layer which is impervious and protects the surface from further attack.

(c) The mechanic is likely to use a mixture of brown iron(III) oxide (Fe_2O_3) and aluminium powder and ignite it with a magnesium ribbon.

OR

B. (a) Order of reactivity : $C > A > B > D$

(b) Between B and D.

(c) Electrolysis

35. A. (i) V - Cervix, W - Vagina, Y - Uterus and Z - Uterine lining

(ii) The egg is conducted from the ovary to the uterus by the oviducts (S). Usually, fertilisation occurs at the oviducts. X is an ovary, which is the site where ova (female gametes) as well as female sex hormones, such as estrogen and progesterone, are produced.

(iii) Structure Y (uterus) allows implantation of the embryo to allow it to develop safely and contracts to push the fetus out during birth.

(iv) The cervix (V) is a ring of muscle that dilates during birth to allow passage of the fetus.

OR

B. (i) A - Pollen grain

B - Stigma

C - Pollen tube

D - Ovary

(ii) Fertilisation in plants occurs when the male gamete present in pollen grain fuses with the female gamete (or egg) present in ovule. When a pollen grain falls on the stigma of the carpel, it bursts open and grows a pollen tube downwards through the style towards the female gamete in the ovary.

Male gametes move down the pollen tube. The pollen tube enters the ovule in the ovary. The tip of pollen tube bursts and male gametes come out of pollen tube. In ovary, the male gamete of pollen combines with the female gamete or egg present in ovule to form a diploid zygote.

(iii) After fertilisation, ovule develops into seed and ovary develops into fruit.

(iv) Part B (Stigma) is the terminal receptive part of the pistil which function as landing platform for the pollen grains and it also determines the compatibility of the pollen grains.

36. A. (i) The compass needle will deflect to the left and point West.

(ii) The compass needle will deflect to the right and point East.

(iii) The alternating current will change the direction of the current 50 times per second. Hence, the compass needle will deflect to the left and then to the right and then back to the left 50 times per second.

OR

B. (i) DC in case I and AC in the case II.

(ii) Cell or a battery – Source of DC.

Generator – Source of AC.

(iii) Frequency of AC is 50 Hz in India while DC has zero frequency.

(iv) In case I, current remains constant and frequency is zero whereas in case II, current varies periodically with a

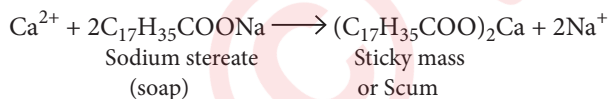
$$\text{frequency of } \frac{1}{0.02 \text{ sec}} = 50 \text{ Hz}$$

37. A. Ordinary soaps hydrolyse in water and give NaOH which causes irritation to skin.

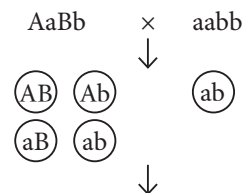
B. Soaps cannot be used in acidic water because these get precipitated as insoluble free acids and adhere to fabrics, thereby even preventing their drying.

OR

C. When soap is added to a sample of hard water, calcium and / or magnesium ions present in hard water react with soap forming insoluble calcium/magnesium soap which is a sticky and greasy mass (called scum) and thus no lather is formed.



38. A. If the parent plant is test crossed, then half of the offsprings will have green seeds. This can be illustrated as given.



♀ \ ♂	AB	Ab	aB	ab
ab	AaBb Tall with yellow seeds	Aabb Tall with green seeds	aaBb Dwarf with yellow seeds	aabb Dwarf with green seeds

B. 3 out of 16 plants obtained would have dwarf height with yellow seeds. So, if 320 plants were obtained then,

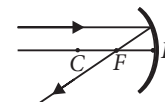
$$\text{No. of dwarf plants with yellow seeds will be } \frac{3}{16} \times 320 = 60.$$

C. The total number of offsprings with a recombinant phenotypes, i.e., with tall height with green seeds and dwarf height with yellow seeds are 6 out of 16.

D. In a dihybrid cross, the genotypic ratio will be 1 : 2 : 2 : 4 : 1 : 2 : 1 : 2 : 1.

39. A. When an object is placed at the focus of a concave mirror, the image is formed at infinity.

B. When a light ray parallel to the principal axis is incident on a concave mirror, it passes through the principal focus after reflection.



C. The distance of object from mirror = ∞

$$\text{Using, } \frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{\infty} + \left(-\frac{1}{7.5}\right) = \frac{1}{f} \Rightarrow f = -7.5 \text{ cm}$$

OR

D. A concave mirror can produce a magnified image of an object when object is placed:

(i) in between its pole and its focus,

(ii) in between its focus and its centre of curvature.

Difference between these two images:

The image produced in first case will be virtual and erect.

The image produced in second case will be real and inverted.



strike colloidal particles, the path of the beam becomes visible. This is known as Tyndall effect. This phenomenon can be observed when :

- (i) sunlight passes through a canopy of dense forest, when tiny water droplets in the mist scatter light.
- (ii) torch light is switched on in a foggy environment, light rays are visible after being scattered by the fog particles in the surrounding air.
- (iii) a fine beam of sunlight enters a smoke-filled room through a small hole.
- (iv) shining a flashlight beam into a glass of diluted milk produces Tyndall effect.

C. As our earth has atmosphere and space has no atmosphere, so the sunlight scatters by the particles in atmosphere. The amount of scattering of light is inversely proportional to wavelength thus violet, blue colours scatter more than red and hence the colour of sky appears blue from earth.

25. A. (i) S-pole.
 (ii) A charged particle moving in a magnetic field may experience a force in the direction perpendicular to direction of magnetic field and direction of motion of particle. This force deflects the charged particle from its path.

OR

B. Use Fleming's left hand rule,
 For X-perpendicular to the plane of paper upwards.
 For Y-perpendicular to the plane of paper downwards.
 $F = Bil$.

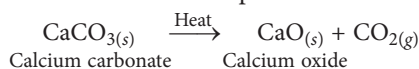
So, force is directly proportional to applied magnetic field, current and length of the conductor.

26. The given image shows the hole in the ozone layer. The ozone layer is very important for the existence of life on earth because it forms a protective shield around earth by absorbing most of the harmful ultraviolet (UV) radiations. As a result of ozone layer depletion, the UV radiations would have extremely harmful effects on human beings, animals and plants. It causes mutations, skin cancer, cataract and damages immune system, etc.

27. (i) $C_2H_5OH + 3O_2 \xrightarrow[\text{(Burning)}]{\text{Combustion}} 2CO_2 + 3H_2O + \text{heat + light}$
- (ii) $C_2H_5OH \xrightarrow[443\text{ K}]{\text{Conc. } H_2SO_4} CH_2 = CH_2 + H_2O$
 Ethanol Ethene
- (iii) $CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + CO_2 + H_2O$
 Ethanoic acid Sodium bicarbonate Sodium ethanoate Carbon dioxide

28. A. (i) Calcium carbonate is abundant in earth's crust and calcium hydroxide is used in white washing. Hence, metal X is calcium (Ca).

(ii) $CaCO_3$ is strongly heated in the absence of air to get the metal oxide. This process is called calcination.



OR

- B. (a) (i) Bronze (Cu = 90%, Sn = 10%)

(ii) Steel (Fe = 99.95% and C = 0.05%)

(b) Advantages of making alloys :

- (i) The various properties of a metal like malleability, ductility, tensile strength, resistance to corrosion and appearance (*i.e.*, colour) can be improved by mixing it with other metal or a non-metal.
- (ii) The chemical reactivity of a metal can be reduced by making its alloy with mercury *i.e.*, by making amalgam.

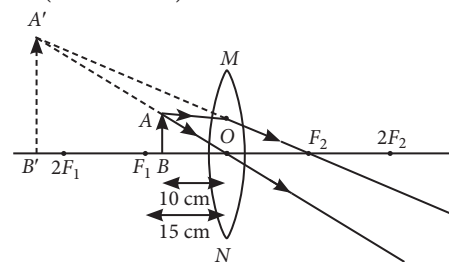
For example, sodium is a very reactive metal but sodium amalgam is less reactive.

29. During digestion of fats which is largely done in small intestine, emulsification is required. Emulsification involves addition of bile to fat. Bile salts break down fat droplets into many small ones by reducing the surface tension of fat droplets. This increases further digestion of fat by increasing lipase action on fat. The process is called emulsification, because it produces a fine emulsion of fats in the aqueous intestinal contents. The small fat droplets present larger surface area to lipase.

30. A. In some animals, environmental factors such as association with families, egg size and incubation temperature determine the sex of the individuals. For example, in lizards the temperature at which fertilised eggs are kept, determines whether the developing animals in eggs will be male or female.

B. In humans, sex of individuals is determined genetically by sex chromosomes. If a child inherits X-chromosome from the father, then a child will be a girl and if a child inherits a Y-chromosome from the father, then a child will be a boy.

31. A. Given focal length,
 $f = +15\text{ cm}$ (convex lens) and $u = -10\text{ cm}$



B. (i) For a spherical lens, according to lens formula,

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

where, f is the focal length of the lens, v is the image distance and u is the object distance.

(ii) For a spherical mirror, according to mirror formula,

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

where, f is the focal length of the mirror, v is the image distance and u is the object distance.

(iii) For convex lens, magnification, $m = \frac{v}{u}$

32. A. When iron filings are brought in contact to solenoid they rearrange in a particular pattern which indicate the

magnetic field lines of a solenoid and it aligns in the North-South direction.

B. The field lines inside the solenoid are in the form of parallel straight lines. This indicates that the magnetic field is same at all points inside a current carrying solenoid.

33. A. Bulbs B_1 , B_2 and B_3 are connected in parallel, so potential difference across each is same. When bulb B_1 gets fused, potential difference across B_2 and B_3 does not change, so, their glow remains unchanged.

B. Let the resistance of each bulb be $R \Omega$, then net resistance of the circuit,

$$\frac{1}{R_p} = \frac{1}{R} + \frac{1}{R} + \frac{1}{R} = \frac{3}{R} \text{ or } R_p = \frac{R}{3} \Omega$$

Now, $I = 3 \text{ A}$, $V = 4.5 \text{ V}$

$$\therefore R_p = \frac{V}{I} \text{ or } \frac{R}{3} = \frac{4.5}{3} \text{ or } R = 4.5 \Omega$$

When bulb B_2 gets fused, no current flows through ammeter A_2 .

\therefore Resistance of the circuit,

$$\frac{1}{R_{\text{new}}} = \frac{1}{R} + \frac{1}{R} = \frac{2}{R} \text{ or } R_{\text{new}} = \frac{R}{2} = \frac{4.5}{2} \Omega$$

$$\therefore I_{\text{new}} = \frac{V}{R_{\text{new}}} = \frac{4.5 \times 2}{4.5} = 2 \text{ A}$$

This current divides equally in bulb B_1 and B_3 .

Therefore, reading of A_1 , A_2 , A_3 and A are 1 A, 0, 1 A and 2 A respectively.

C. When all the three bulbs glow, $I = 3 \text{ A}$, $V = 4.5 \text{ V}$

$$\therefore \text{Power dissipated in the circuit, } P = VI \\ = 3 \text{ A} \times 4.5 \text{ V} = 13.5 \text{ W}$$

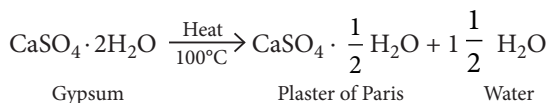
34. A. (a) The formula of plaster of Paris is written as $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$ because one molecule of water is shared by two formula units of CaSO_4 , i.e., the formula is $(\text{CaSO}_4)_2 \cdot \text{H}_2\text{O}$. Thus, it represents half molecule of H_2O per formula unit of CaSO_4 .

(b) Sodium hydrogencarbonate being basic, neutralises the excess acid produced in the stomach. Hence, it is used as antacid.

(c) Electrolysis of an aqueous solution of sodium chloride gives NaOH , Cl_2 and H_2 . Due to the products Cl_2 and NaOH formed, the process is called chlor-alkali process (Chlor for chlorine and alkali for sodium hydroxide).

OR

B. (a) Gypsum is a soft sulphate mineral composed of calcium sulphate dihydrate. On heating gypsum at 373 K, it loses water molecules and becomes calcium sulphate hemihydrate.



(b) The substance X is tartaric acid. Its function is to neutralise sodium carbonate formed during heating as otherwise the cake or bread being baked will taste bitter.

(c) Sodium carbonate

35. A. (i) The surgical method of contraception shown in the image 'P' is tubectomy.

(ii) The two advantage of tubectomy method are :

(a) This method is safe in the long run.

(b) It is irreversible method of contraception.

(iii) A small portion of fallopian tube is cut and tied in this method.

(iv) Tubectomy prevents the egg to enter the uterus and thus helps in preventing pregnancy.

OR

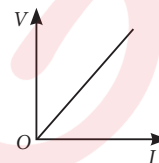
B. (i) From the given image anther (R) produces pollen grains.

(ii) Pollen grains are transferred to stigma(s) of the flower. This process is called pollination.

(iii) When flower contains either stamens (X) or pistil (Y). It will be called a unisexual flower.

(iv) If a flower contains both stamens (X) and pistil (Y), it is called bisexual flower.

36. A. (i)



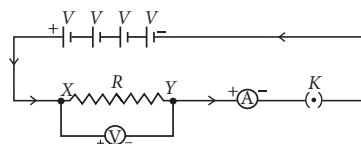
The shape of the graph obtained by plotting potential difference applied across conductor against the current flowing through it will be a straight line.

According to ohm's law,

$$V = IR \text{ or } R = \frac{V}{I}$$

So, the slope of V - I graph at any point represents the resistance of the given conductor.

(ii)



(iii) As we know that if R , ρ , l and A are respectively the resistance, resistivity, length and cross-sectional area of a

given wire, then $R = \rho \frac{l}{A}$

Given : $R = 20 \Omega$

If l is increased to $2l$, then $l' = 2l$

As $A'l' = Al$. So, $A' = A \frac{l}{l'} = A/2$

$$R' = \rho \frac{l'}{A'}$$

$$\text{So, } R' = \rho \frac{2l}{A/2} = 4 \left(\rho \frac{l}{A} \right)$$

$$R' = 4R$$

$$\therefore R' = 4 \times 20 \Omega = 80 \Omega$$

So, the resistance of wire in the new situation is 80Ω .

OR

B. (i) As given in the circuit diagram, two 3Ω resistors are connected in series, so

$$R_1 = 3 \Omega + 3 \Omega = 6 \Omega$$

Now the third resistor, R_2 is parallel to R_1 .

Hence, equivalent resistance of circuit (R_{eq}) is given by

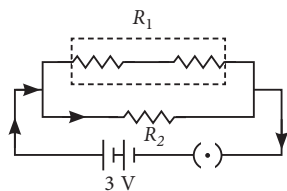
$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} \Rightarrow \frac{1}{R_{eq}} = \frac{1}{6} + \frac{1}{3} = \frac{1+2}{6} = \frac{3}{6} = \frac{1}{2}$$

or $R_{eq} = 2 \Omega$

Using Ohm's law, $V = IR$

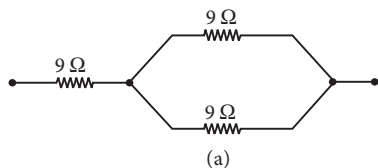
We get, $3 \text{ V} = I \times 2 \Omega$

or $I = \frac{3}{2} \text{ A} = 1.5 \text{ A}$

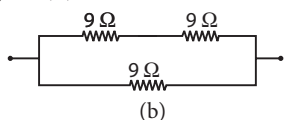


Current drawn from the battery is 1.5 A.

(ii) The resistance of the series combination is higher than each of the resistances. A parallel combination of two 9Ω resistors is equivalent to 4.5Ω . We can obtain 13.5Ω by coupling 4.5Ω and 9Ω in series. So, to obtain 13.5Ω , the combination is as shown in figure (a).



(iii) To obtain an equivalent resistance of 6Ω , we have to connect two 9Ω resistors in series and then connect the third 9Ω resistor in parallel to the series combination as shown in the figure (b).



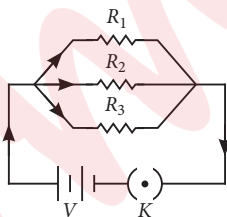
(iv) Given : $R_1 = 6 \Omega$, $R_2 = 9 \Omega$, $R_3 = 18 \Omega$ are connected in parallel.

Equivalent resistance, R_{eq} is given by

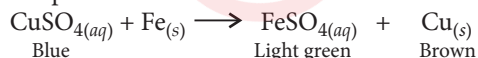
$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\therefore \frac{1}{R_{eq}} = \frac{1}{6} + \frac{1}{9} + \frac{1}{18}$$

$$= \frac{3+2+1}{18} = \frac{6}{18} = \frac{1}{3} \text{ or } R_{eq} = 3 \Omega$$



37. A. (i) The reaction between copper(II) sulphate and iron is represented as



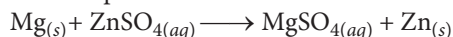
In this displacement reaction, a more reactive element iron displaces less reactive element from its compound copper(II) sulphate. The brown copper metal gets deposited on the iron nails.

(ii) The colour of the solution changes from blue to light green due to the formation of FeSO_4 .

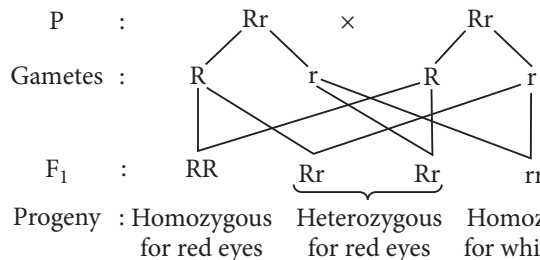
B. The colour of solution will change from blue to colourless.

OR

C. It is a displacement reaction.



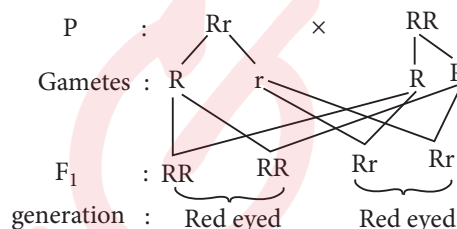
38. A. When organism with heterozygous red eyes are selfed, progenies obtained are as follows :



The number of progenies heterozygous for red eyes (Rr) will be 2 out of 4. Therefore, their ratio will be $2/4$ or $1/2$.

OR

B. Cross between heterozygous red eyed male with homozygous red eyed female is represented as follows :



All the progenies would be red eyed.

C. If a heterozygous red eyed male (Rr) is mated with white eyed female (rr) then, the progenies produced with red eyes will always contain Rr genotype.

D. In this cross, out of 4 progenies 2 are red eyed and 2 are white eyed. Therefore, the ratio between them is $2:2$ or $1:1$.

39. A. Linear magnification (m) of a concave mirror is the ratio of the size of the image (h_2) to the size of the object

$$(h_1) \text{ i.e., } m = \frac{h_2}{h_1}$$

B. Yes, because the parallel rays reflected from the mirror actually pass through the principal focus of concave mirror.

C. Here, $\frac{40}{10} = \frac{I}{O} = \frac{v}{u} = m$

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

$$\Rightarrow \frac{1}{u} + \frac{1}{4u} = \frac{1}{30}$$

$$[\because v = 4u]$$

$$\Rightarrow u = 37.5 \text{ cm and } v = 150 \text{ cm}$$

Distance between object and its image

$$v - u = 150 - 37.5 = 112.5 \text{ cm}$$

OR

D. Focal length of the mirror = 15 cm

$$\therefore \text{Radius of curvature of the mirror} = 15 \times 2 = 30 \text{ cm}$$

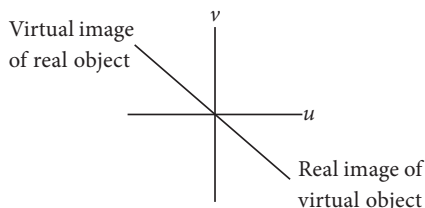
As radius of curvature is less than the object distance. Thus image is formed between focus and centre of curvature.

Hence, image is real, inverted and diminished.



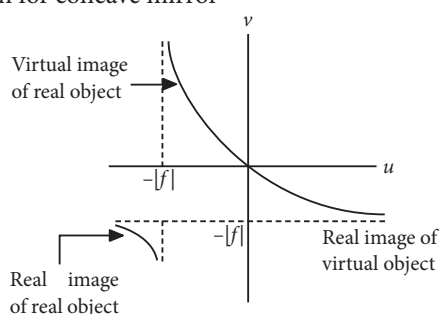
1. (c) : Iris is a dark muscular diaphragm that controls the size of the pupil.

2. (a) : v - u graph for plane mirror



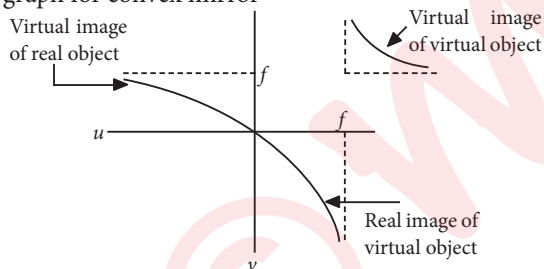
Thus, plane mirror forms virtual image of real object and real image of virtual object.

v - u graph for concave mirror



Thus, concave mirror never forms virtual image of virtual object.

v - u graph for convex mirror



Thus, convex mirror never forms real image of real object.

3. (a) : Magnetic field lines emerge from North pole and merge at South pole. As the magnetic field lines point from B to A, i.e., they emerge from A and merge at B, so, the North pole of the resultant magnet is on the face close to A.

4. (c) : $R_s = nR$

$$R_p = \frac{R}{n}$$

$$\therefore \frac{R_{\max}}{R_{\min}} = \frac{R_s}{R_p} = \frac{nR}{(R/n)} = n^2$$

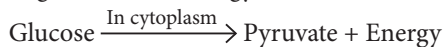
5. (c) : Refractive index, $n = \frac{c}{v}$

Larger the value of n , smaller is the value of v .

Therefore, $v_{\text{air}} > v_{\text{water}} > v_{\text{glass}}$ is the decreasing order of speed of light through them.

6. (c)

7. (a) : In aerobic respiration, glucose is completely broken down to CO_2 and H_2O with the production of a large amount of energy (ATP).



Thus, CO_2 and water are formed as a result of aerobic respiration and will not be formed in the absence of oxygen (anaerobic respiration).

8. (c) : Dramatic changes in body features associated with puberty are known as secondary sexual characters. Secretion of testosterone from testes and estrogen from ovary cause these changes.

9. (b) : During the growth of fungus *Rhizopus*, small rounded, bulb-like structure called sporangia develop at the tip of the erect hyphae. Hyphae are tubular thread-like structures.

10. (d) : Green seed colour is a recessive trait studied by Mendel in a pea plant.

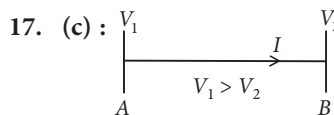
11. (c) : If deer is missing in the given food chain, then tiger will eventually die.

12. (a) 13. (a)

14. (b) : A more reactive metal can displace a less reactive metal from its salt solution. Iron lies above copper in the reactivity series so it is more reactive. It will displace the copper ions in the solution. At the same time, copper ions will be reduced and are deposited on the surface of the container in contact with the solution.

15. (d) : Metals are good conductors of heat and have high melting points.

16. (d) : The reactivity decreases in the order :



Suppose A and B are two regions having potentials V_1 and V_2 such that $V_1 > V_2$. So the electric current will flow from A to B (i.e., from higher potential to lower potential). Since electrons move opposite to the direction of current, hence, the electrons move from a region of lower potential to a region of higher potential.

18. (d) : Force on moving charge will be maximum if direction of velocity of charge is perpendicular to direction of magnetic field.

19. (a) : Noble metals are not attacked by common chemical reagents.

20. (c) : Aerobic respiration involves the exchange of respiratory gases at two places in multicellular animals—one between the body surface and surrounding medium, the other between the individual cells and the extracellular fluid. Lungs are involved in the first step of exchange, but not the heart.

21. A. The aquatic vertebrates like fish have gills to oxygenate blood. The flow of blood in a fish is single circulation because the blood passes through the heart only once in one complete cycle of body. The terrestrial vertebrates like birds and humans have double circulation as the blood travels heart twice in one complete cycle of blood and they have lungs for oxygenation of blood.

B. During daytime, water and minerals travel faster through xylem because rate of transpiration is higher during daytime.

22. Differences between transport in xylem and transport in phloem are as follows:

S. No.	Feature	Xylem	Phloem
(i)	Materials transported	Water and mineral salts are transported.	Food in aqueous form is translocated.
(ii)	Path of transport	The transport is unidirectional, <i>i.e.</i> , from roots to tip.	The transport is bidirectional, <i>i.e.</i> , from leaves to all other parts.

23. A. When a bright light is focussed on eye, receptor cell receives the stimulus and an impulse is generated. This impulse is passed on to sensory neuron, then it goes to brain, brain then sends the impulse to the motor neuron which contracts the pupil. Sequence of events can be summarised as :

Photoreceptors in eye → Sensory neuron → Brain → Motor neuron → Eye muscle (Effector) → Constriction of pupils

OR

B. (i) Thyroxine regulates carbohydrate, fat and protein metabolism.

(ii) Insulin regulates carbohydrate metabolism in the body and maintains proper glucose level in blood. It promotes body cells to utilise glucose and stimulates conversion of extra glucose from blood into glycogen by liver cells to store in liver and muscle cells.

(iii) Adrenaline increases heartbeat rate and supply of blood to various organs. It also prepares the body to meet emergency situations.

(iv) Growth hormones control overall development or growth of the body, tissues, bones and muscles.

24. A. If male gamete carrying X chromosome fertilises an egg, which carries X chromosome, then the offspring A will be a girl (XX). If male gamete carrying Y chromosome fertilises the egg, then the offspring B will be a boy (XY).

B. No, genetic combination of mothers do not play role in determining the sex of new born. Mothers (human female) are homogametic, *i.e.*, they have a pair of X chromosomes. All children will inherit an X chromosome from their mother regardless of whether they are boys or girls.

C. There are 50% chance of a male child (B) and 50% of a female child (A).

25. A. Alcohols ; $C_nH_{2n+1}OH$

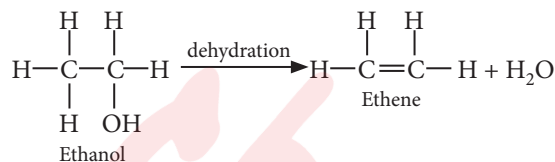
The given compound is butanol.

Preceding homologue : Propanol

Succeeding homologue : Pentanol

OR

B. Ethene is obtained on dehydration of ethanol.



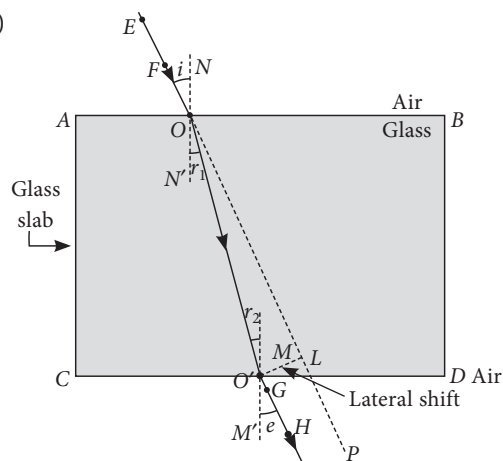
26. Even though a plane mirror and a sheet of paper reflect light, we can see our image in the mirror and not in the paper. The mirror has a smooth and polished reflective surface which is able to reflect the light rays according to the laws of reflection. On the other hand, a paper sheet has a rough surface which is uneven (microscopically), so when light rays hit its surface, they get reflected back unevenly *i.e.*, not following the laws of reflection and get scattered. That is why we can see our image in a plane mirror but not in a sheet of paper. The image seen in plane mirror is called virtual image as it cannot be obtained on screen.

27. A. The lines along which the iron filings align themselves represent the magnetic field lines of the bar-magnet.

This pattern of iron filings demonstrate that the magnet exerts its influence in the region surrounding it. Therefore, the iron filings experience a force.

B. It is taken by convention that the field lines emerges from north pole and merge at the south pole. Inside the magnet, the direction of field lines is from its south pole to its north pole. Thus, the magnetic field lines are closed curves.

28. A. (i)



(ii) The perpendicular distance between the incident ray and the emergent ray is defined as lateral shift.

(iii) Refractive index of glass w.r.t air is, ${}_g n_a = \frac{3}{2}$

Now, refractive index of air w.r.t glass will be

$${}_a n_g = \frac{1}{{}_g n_a} = \frac{1}{(3/2)} = \frac{2}{3}$$

OR

B. (i) Given, image distance, $v = -25$ cm, focal length, $f = 5$ cm, magnification, $m = ?$

From lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{u} = \frac{1}{v} - \frac{1}{f}$

$$\frac{1}{u} = \frac{1}{-25} - \frac{1}{5} = \frac{-1-5}{25} = \frac{-6}{25}$$

$$\text{Object distance, } u = \frac{-25}{6} \text{ cm.}$$

$$\text{We know that, } m = \frac{v}{u} = \frac{-25 \times 6}{-25} = 6$$

(ii) Since, her least distance of distinct vision is 25 cm, therefore she would not be able to read the book placed at a distance 10 cm from her eyes.

(iii) When convex lens is used as a magnifying glass, then object should be placed at a distance less than the focal length.

29. A. As pH increases, basic nature increases and acidic nature decreases.

(i) Neutral solutions have pH = 7.

Hence B is neutral (pH = 7).

(ii) D is strongly alkaline (pH = 11).

(iii) C is strongly acidic (pH = 1).

(iv) A is weakly acidic (pH = 6).

(v) E is weakly alkaline (pH = 9).

B. An acid-base indicator is a substance which shows one colour (or odour) in the acidic medium and a different colour (or odour) in the basic medium.

30. A. (i) Solution of glucose will not conduct electricity because it does not give ions.

(ii) Dil. hydrochloric acid will conduct electricity because it produces H^+ ions in water.

B. Hydrochloric acid is a stronger acid because it produces more H^+ ions in aqueous solution than acetic acid.

C. The strength of an acid decreases when water is added to it due to decrease in concentration of acid.

31.

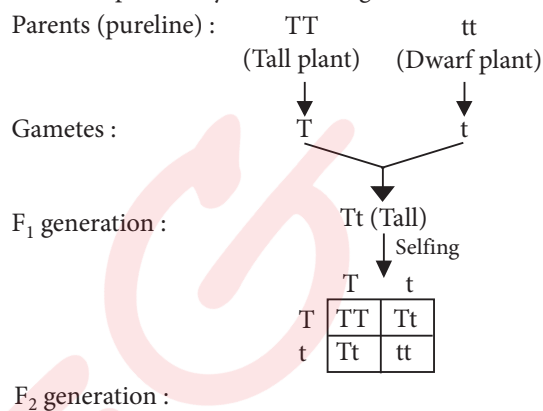
	Roasting	Calcination
1.	In this process, the ore is heated in the presence of excess of air.	In this process, the ore is heated strongly in limited supply or absence of air.
2.	It is done for sulphide ores.	It is done for carbonate ores.
3.	SO_2 gas is evolved.	CO_2 gas is evolved.
4.	$2MS + 3O_2 \xrightarrow{\text{Heat}} 2MO + 2SO_2 \uparrow$	$MCO_3 \xrightarrow{\text{Heat}} MO + CO_2 \uparrow$

32. A. Mendel selected garden pea (*Pisum sativum*) for his series of hybridisation experiments.

He first selected two pureline plants (tall plant having gene TT and short plant having gene tt) and then crossed such plants having contrasting characters. In the F_1 generation, he observed that only one of the two contrasting characters appeared, he called this character as dominant and the one which does not get expressed in F_1 was called recessive.

B. He later selfed the F_1 plants and observed that both the traits appear in next generation but in a definite proportion.

This can be explained by the following cross :



Phenotypic ratio : 3(Tall) : 1(Dwarf)

Genotypic ratio : 1(TT) : 2(Tt) : 1(tt)

So, the plants of F_1 generation will be all tall plants and after selfing F_1 , the ratio of tall and dwarf plants that Mendel obtained in F_2 generation plants is 3 : 1.

33. A. Small fish would occupy the third trophic level of the given food chain.

B. Large fish is the top consumer of this food chain, so, it will have highest concentration of non-biodegradable chemicals.

C. As per 10% law of energy in an ecosystem, only 10% of energy is received by the next trophic level. Hence, in the given food chain, if 10,000 Joules of energy is available to small fish, then the energy available to large fish will be 1000 Joules.

34. A. (i) The force on a current-carrying conductor in a magnetic-field is due to interaction between :

- magnetic field due to current carrying conductor and
- the external magnetic field in which the conductor is placed.

The resultant of these two magnetic fields is not uniform. It is weaker on one side of the conductor than on its other side. The conductor, therefore, experiences a resultant force in the direction of the weaker magnetic field.

(ii) The direction of the force acting on the current carrying conductor placed in the magnetic field depends upon

- (a) direction of the current through the conductor and
 (b) direction of the magnetic field in which the conductor is placed.
 (iii) The direction of the force acting on the current carrying conductor placed in the magnetic field is determined by using Fleming's left hand rule.

OR

B. (i) Fuse and the connection of earthing wire are the two safety measure commonly used in electric circuit and appliances.

(ii) Fuse, used in series with any electrical appliance protects it from short-circuiting and overloading. When an suddenly high electric current flows through the circuit, the fuse melts due to Joule heating effect and breaks the circuit. If a fuse is replaced by one with larger ratings, fuse will not burn off for just high current for appliances and the appliances may get damaged.

(iii) Suppose x bulbs can be used safely.

Power of 1 bulb = 60 W

So, Power of x bulbs, $P = 60 \times x$ watts

Potential difference, $V = 220$ V

Now, Power, $P = V \times I$

$60 \times x = 220 \times 5$

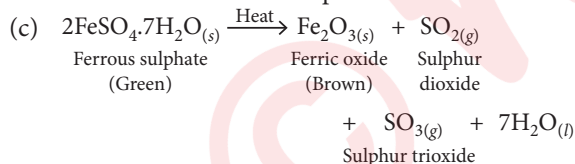
$$\Rightarrow x = \frac{220 \times 5}{60} \Rightarrow x = 18.33 \approx 18$$

Thus, a maximum number of 18 bulbs can be used.

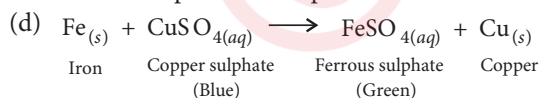
35. A. (a) $\text{BaCl}_{2(aq)} + \text{CuSO}_{4(aq)} \rightarrow \text{BaSO}_{4(s)} \downarrow + \text{CuCl}_{2(aq)}$
 It is an example of a double displacement and precipitation reaction.



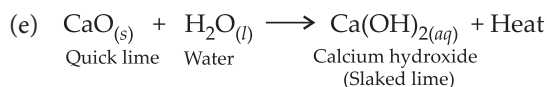
Since, copper is oxidised to copper oxide, it is an oxidation reaction. This is also an example of combination reaction.



This is an example of decomposition reaction.



This is an example of displacement reaction.

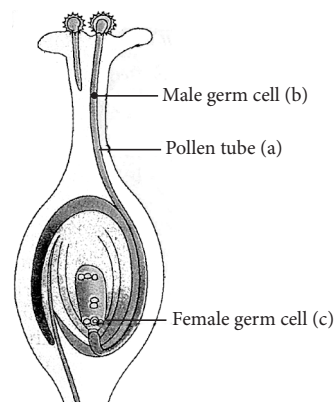


This is an example of combination and exothermic reaction.

OR

- B. (a) $\text{Ba}_{(s)} + \text{I}_{2(s)} \longrightarrow \text{BaI}_{2(s)}$
 (b) $\text{HBr}_{(aq)} + \text{RbOH}_{(aq)} \longrightarrow \text{RbBr}_{(aq)} + \text{H}_2\text{O}_{(l)}$
 (c) $\text{Ca}_{(s)} + 2\text{HNO}_{3(aq)} \longrightarrow \text{Ca(NO}_3)_2(aq) + \text{H}_2(g)$
 (d) $\text{C}_{10}\text{H}_8(s) + 12\text{O}_2(g) \longrightarrow 10\text{CO}_2(g) + 4\text{H}_2\text{O}(g)$
 (e) $2\text{Al(OH)}_3(s) \longrightarrow \text{Al}_2\text{O}_3(s) + 3\text{H}_2\text{O}(g)$

36. A (i) Diagram showing fertilisation in a flower is as follows:



(ii) Fertilisation, in plants, occurs when the male gamete present in pollen grain fuses with the female gamete (or egg) present in ovule. When a pollen grain falls on the stigma of the carpel, it bursts, open and grows a pollen tube downwards through the style towards the female gamete in the ovary. Male gametes move down the pollen tube. The pollen tube enters the ovule in the ovary. The tip of pollen tube bursts and male gamete comes out of pollen tube. In ovary, the male gamete of pollen combines with the female gamete or egg present in ovule to form a fertilised egg.

(iii) After fertilisation,

- (a) ovule develops into seed
 (b) ovary develops into fruit.

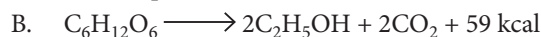
OR

B. (i) The mode of asexual reproduction shown in the image is budding.

(ii) *Hydra* reproduce by the process of budding. A small bud arises from the parent body and later develops into adult-like structure. It develops hypostome and tentacles at its free end and also develops a basal disc at the point of attachment with the parent body. Finally it gets detached to lead an independent life.

(iii) *Hydra* use regenerative cells for reproduction in the process of budding.

37. A. In the test tube full of mercury (figure A) there is no air and, therefore, the introduced soaked seeds do not get air for aerobic respiration. But they are capable of respiration in the absence of oxygen as is indicated by the evolution of carbon dioxide (figure B). Therefore, anaerobic respiration takes place in the seeds in the absence of free oxygen. The experiment also shows that CO_2 is evolved in anaerobic respiration of seeds.



Ethyl alcohol fermentation occurs in fungi such as *Rhizopus*, yeast and bacteria.

OR

C. Muscle fatigue is the reduction in force of contraction of a muscle after prolonged stimulation. In the absence of oxygen, skeletal muscle of human beings can contract for a short time, but it gets fatigued soon. This is due to the fact that in the absence of oxygen, products of glycolysis mainly lactic acid is not disposed off and accumulates in the muscles. This leads to muscle fatigue and pain in the muscles. A muscle gets fatigued sooner after a strenuous exercise than after a mild exercise. Faster breathing for sometime after a strenuous exercise supplies extra oxygen, disposes off excess lactic acid and muscle fatigue disappears.

38. A. (i) Both NH_3 and HCl have only single bonds.

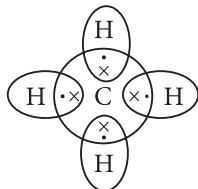
(ii) SO_2 and O_2 contain only double bonds.

$\text{N}\equiv\text{N}$ or N_2 (dinitrogen) is a diatomic molecule with triple bond.

CCl_4 contains only single bonds.

B. (i) The number of electrons contributed by each atom for sharing is known as covalency. $\text{O}=\text{C}=\text{O}$ or CO_2 molecule has all the atoms joined together by double covalent bonds.

(ii)

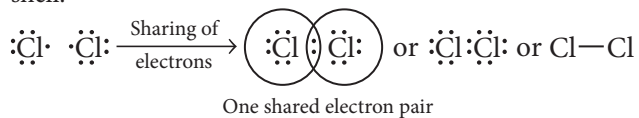


OR

C. A chlorine atom has seven valence electrons. It needs one more electron to form stable octet; $\text{Cl} (Z=17)$: $\begin{matrix} K & L & M \\ 2 & 8 & 7 \end{matrix}$



In chlorine molecule, both chlorine atoms contribute one electron and thus share single electron pair to form single covalent bond. As shared pair is shared by both atoms, they acquire inert gas configuration of argon atom in valence shell.



39. A. The angle between the incident ray and the emergent ray is called angle of deviation.

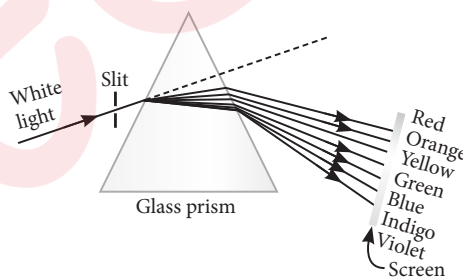
B. More be the refractive index of colour, more be the angle of deviation and it also depends on the refractive index of material of prism.

C. The colour of light that deviates least is red and violet deviates the maximum. The difference in deviation is due to the difference in wavelength and speed of each colour of light, also due to different bending ability when it passes through the prism.

OR

D. Dispersion of white light by a prism is shown here.

The seven colours which appear in the spectrum are violet, indigo, blue, green, yellow, orange, red (VIBGYOR).

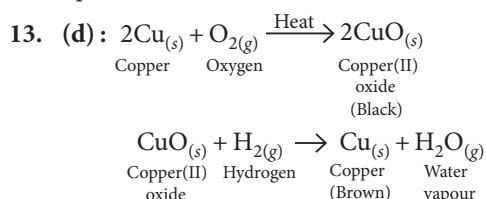


- (a) : In minimum deviation position,

$$r = r_1 = r_2 = \frac{A}{2} = \frac{60^\circ}{2} = 30^\circ$$
 for both the colours.
- (b)
- (c) : Circuit I is an open circuit *i.e.* no current flows in the circuit.
- (c) : Electric current can be produced by connecting battery to the closed loop. It can also be produced, when magnet is moved relative to the closed loop.
- (b) : Refraction is defined as a change in direction of light when it passes from one transparent medium into another of different optical density. Light deviates towards the normal when it enters an optically dense medium from a less dense medium. The reverse applies.
 The velocity of light is changed during refraction but not its frequency.
 The angle of refraction is different for light of different wavelengths. Light of shorter wavelength is deviated more than one with longer wavelength.
- (c) : The magnetic field lines inside a current carrying solenoid are along the axis and parallel to each other.
- (a) : In multiple fission single parent organism divides and forms many new organisms. *E.g.*, *Plasmodium* reproduces by this method.
- (c) : In a neuron, information travels as an electrical impulse through axons.
- (a)
- (c) : Green pod colour is a dominant trait studied by Mendel in a pea plant.
- (d) : According to 10% law of Lindeman, only 10% energy passes from one trophic level to another. In the given food chain, energy at fourth trophic level is 5 KJ therefore, at producer level 5000 KJ energy will be available.

Producer → Herbivore → Carnivore I → Carnivore II
 (I Trophic level) (II Trophic level) (III Trophic level) (IV Trophic level)
 5000 KJ 500 KJ 50 KJ 5 KJ

12. (d) : For an ecosystem to work as a unit, production of organic matter (productivity), breakdown of organic matter (decomposition), flow of energy and nutrient cycling are important.



All the given statements are correct.

- (c) : (A)-(Q), (B)-(R), (C)-(S), (D)-(P)
- (b)
- (d) : CuO is basic in nature, ZnO is amphoteric in nature.
 Oxide of K dissolves in water to form alkali.

$$\text{K}_2\text{O}_{(s)} + \text{H}_2\text{O}_{(l)} \rightarrow 2\text{KOH}_{(aq)}$$
 Pb does not react with water at all.
 Thus, K, L, M and N are Cu, Zn, K and Pb.
- (c) : Resistance is directly proportional to length of wire.
- (c) : When current is straight, it means the current is passing through a straight conductor, the magnetic field produced due to current through a straight conductor is in the form of concentric circular magnetic lines of force whose centres lie on the linear conductor and are in a plane perpendicular to the plane of linear conductor. It means the magnetic field is circular.
- (b) : The reaction involved is :

$$\text{CaOCl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{CaSO}_4 + \text{H}_2\text{O} + \text{Cl}_2 \uparrow$$
- (a)
- A. The phloem cells transport the soluble food materials to all parts of plant. The transport of food from leaves to different parts of plant is termed as translocation. The manufactured food enters into sieve tubes of the phloem and is transported as a dilute aqueous solution in upward or downward direction. Food is transported to all non-green parts of the plant for growth and metabolic activities.
 B. Xylem transports water only from the roots to the leaves in an upward direction. The water with other nutrients such as salts and minerals is absorbed from the soil through roots. This water flows from roots to the aerial parts of plant in one direction.

22.

S. No.	Feature	Aquatic vertebrates	Terrestrial vertebrates
1.	Circulation of blood	Circulation of blood involves only single circulation, <i>e.g.</i> , fishes.	Double circulation is involved, <i>e.g.</i> , birds, mammals.
2.	Excretory waste	Release mostly ammonia and urea as their excretory waste.	Release mainly urea as their excretory waste.

23. A. When growing plants detect light, auxin hormone synthesised at the shoot tips, helps the cell to grow long. When light comes from one side of the plant, auxin diffuses towards the shady side of the shoot. This concentration of auxin stimulates the cells to grow longer on the side of the shoot which is away from light. Thus, the plant appears to bend towards light.

OR

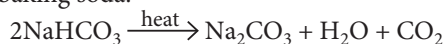
- B. (i) Pituitary gland
(ii) Adrenaline
(iii) Insulin
(iv) Thyroxine

24. A. The colour of the flower in F_1 generation will be blue with Bb genotype.

B. If the flowers of F_1 generation (Bb) are self crossed then the percentage of white flowers (bb) in F_2 generation would be 25%.

C. Mendel's law of dominance is used to determine whether the trait in F_1 is dominant or recessive.

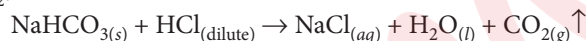
25. A. (a) If baking soda is used in place of baking powder, the cake will taste bitter as Na_2CO_3 is formed on heating baking soda.



(b) Baking soda can be converted into baking powder by adding a small amount of tartaric acid to it.

OR

B. The gas evolved is CO_2 . Passing the gas through lime water turns it milky which confirms the presence of CO_2 .



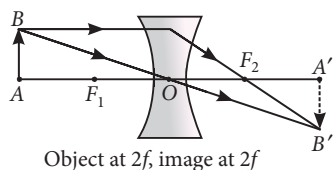
26. Not-so-thick lenses would not make the telescope very heavy and they will also allow considerable amount of light to pass through them.

27. A. We know that when object is placed at $2f$, the distance of an object from lens = distance of image from lens. Therefore, from III observation, radius of curvature

$$R = 30 \text{ cm. Thus, focal length, } f = \frac{R}{2} = \frac{30}{2} = 15 \text{ cm}$$

Last observation is incorrect because when an object is placed at a distance less than 15 cm away from concave lens, we will have virtual image, which cannot be taken on screen.

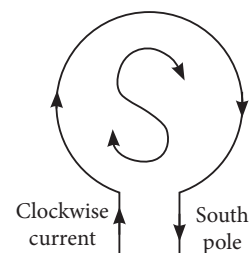
B. For observation III,



28. A. (i) We know if the current at a loop face facing us is in clockwise direction, that face of the coil behaves like South pole. So, the polarity of the loop facing us is South pole.

(ii) The end B, when looked at from right carries a clockwise current. So, the polarity of the end B of the solenoid will be the South pole.

(iii) By Fleming's left-hand rule, the direction of the magnetic field at the centre of the loop will be perpendicular to the plane of the loop and will be directed inwards.



OR

B. (i) Live wire is at 220 V and neutral wire is at zero volt. Since the electric current flows from higher potential to lower potential, we can get an electric shock by touching live wire but that is not the case with neutral wire.

(ii) In parallel combination, each resistor gets same potential from the source. We can use separate on/off switches with each appliance. Also in case if any one resistor fails then the circuit will not break. So, it is safe and convenient to connect household circuit in parallel combination of resistors

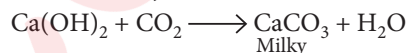
(iii) Fuse is an important safety device. It is used in series with any electrical appliance and protects it from short-circuiting and overloading.

29. (a) Calcium hydroxide or lime water will turn milky.

(b) In test tube A,



In test tube B,



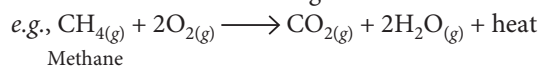
(c) Ethanol does not react with sodium carbonate hence, there will be no change.

30. A. A : acidic, B : alkaline, C : acidic, D : neutral, E : alkaline

B. Solution 'C' is most acidic as it has the lowest pH value whereas solution 'E' is the most alkaline because it has the highest pH value among the given solutions.

C. In a neutral solution, universal indicator shows green colour.

31. A. Exothermic reactions are those reactions in which heat is released during chemical reaction.

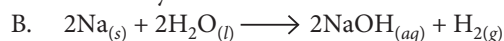


The natural gas (methane) burns in air to form carbon dioxide and water and releases large amount of heat.

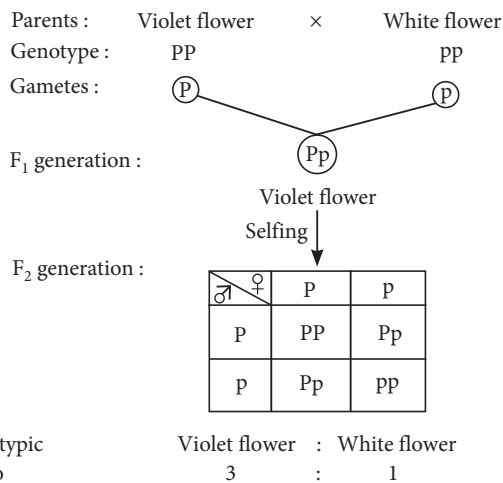
Endothermic reactions are those reactions in which heat is absorbed during chemical reaction.



When ammonium chloride is added to water, it forms ammonium hydroxide and in this reaction heat is absorbed.



32. A. In pea plant, violet colour is dominant over the white colour. The cross between the two can be shown as follows :

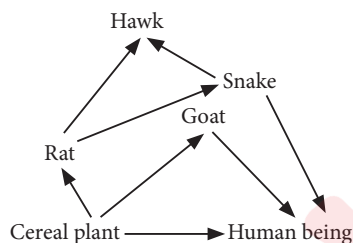


B. On crossing hybrid parents with genotype Tt, both tall and dwarf plants would be obtained in the ratio of 3 : 1 in F₂ generation.

33. A. A food chain which is most advantageous for human beings in terms of energy is:



B.



C. If the cereal plant is growing in soil rich in pesticides, then the pesticides are absorbed by growing plants along with water and minerals. When animals eat these cereal plants, these poisonous chemical pesticides enter their bodies through food. This increase in concentration of harmful pesticides in the body of living organisms at each trophic level of a food chain is called biological magnification. Pesticides are lethal to non-target species also. The extensive use of pesticides in agriculture can change the community of microorganisms living in soil.

34. (A) (i) Cell or a battery – Source of dc.
 (ii) Frequency of ac is 50 Hz in India while dc has zero frequency.
 In dc, current remains constant and frequency is zero whereas in ac, current varies periodically with a frequency of $\frac{1}{0.02 \text{ sec}} = 50 \text{ Hz}$ in India.
 (iii) The time interval after which ac current changes its direction is 0.01 second.

OR

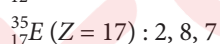
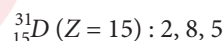
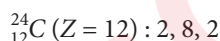
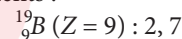
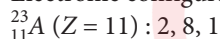
B. (i) By earthing means the metallic body of the appliances is connected to a thick copper wire, which is buried deep in the Earth and its end is connected to a copper plate surrounded by a mixture of charcoal and common salt.

(ii) As the amount of magnetic field strength is directly proportional to the amount of current, so the deflection of compass needle increases. It indicates that stronger the current, stronger the magnetic force acting on the needle of the compass.

(iii) Right hand thumb rule states that when you are holding a current carrying straight conductor in your right hand such that the thumb points towards the direction of current, then your finger will wrap around the conductor in the direction of the field lines of the magnetic field.

35. A. (i) Elements which contain 1 to 3 electrons in their outermost valence shells are metals. Elements containing 4 to 7 electrons in the valence shell are non-metals.

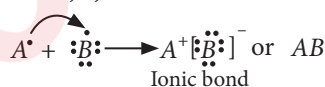
Electronic configurations of elements :



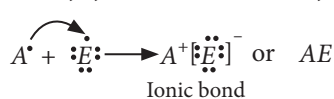
Hence, A and C are metals, whereas B, D and E are non-metals.

(ii) Type of bonds formed:

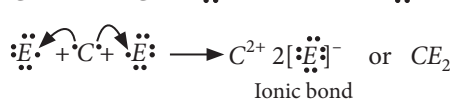
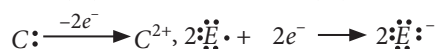
(I) A is metal and B is non-metal, so the bond formed will be ionic.



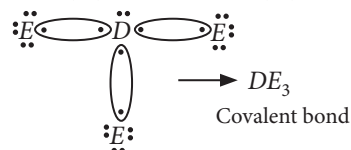
(II) A is metal and E is non-metal, so the bond formed will be ionic.



(III) C is metal and E is non-metal, so the bond formed will be ionic.

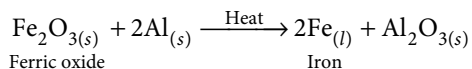
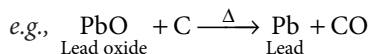


(IV) D is a non-metal and E is also a non-metal, so the bond formed will be covalent.



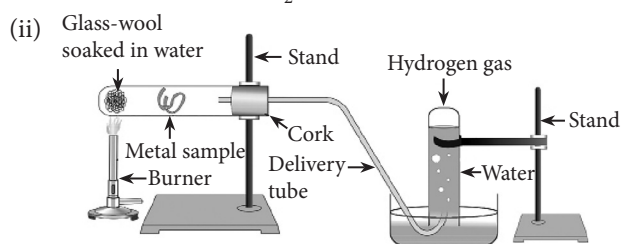
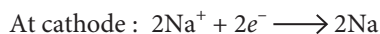
OR

B. (i) (a) Those metals (*M*) which have moderate reactivity such as zinc, lead, iron, copper, etc. are obtained by the reduction of their oxides by reducing agents such as carbon or aluminium.



(b) Those metals (*N*) which are high up in the reactivity series are extracted by electrolytic reduction method.

e.g., sodium is obtained by the electrolysis of its molten chloride. The sodium metal is deposited at the cathode, whereas chlorine is liberated at the anode.



Action of steam on metal

36. A. (i) Testes (A) in male are the sites where male gametes, *i.e.*, sperms are formed.

(ii) Testes (A) produce the male sex hormone called testosterone. Testosterone regulates formation of sperm and brings about puberty changes in boys, *i.e.*, development of secondary sexual characters.

(iii) The correct path of sperm is



OR

B. (i) In human female, the fertilisation occurs in the oviduct or fallopian tube (D).

(ii) The developing embryo gets nourishment in uterus (C) from the mother's blood with the help of a special tissue called placenta. This is a disc like structure embedded in uterine wall. It contains villi that provides a large surface area to pass glucose and oxygen from mother to embryo.

(iii) In the absence of fertilisation, the egg along with endometrial lining is expelled out of the body in the form of menstruation. Menstruation is the cyclic discharge of blood along with endometrial lining of the uterus (C) and unfertilised egg in women. It lasts for 3-5 days.

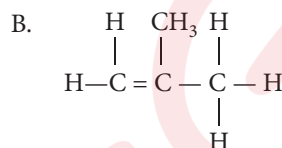
37. A. Number of RBCs per cubic millimetre of blood is likely to be higher in people living at high altitudes. This is in response to the air being less dense at high altitude and thus, more RBCs (and hence more Hb) are needed to absorb the required amount of O_2 from the air having low $p\text{O}_2$ (partial pressure of O_2).

B. The change from II to III indicates decrease in the volume of lungs and thus, increase in the pressure of air inside the lungs. This results in movement of air out of the lungs.

OR

C. In big sized animals, the diffusion pressure alone cannot take care of transportation of oxygen to all parts of the body. Hence, respiratory pigments such as haemoglobin (in humans) is required to take up oxygen from lungs and carry it to the tissues.

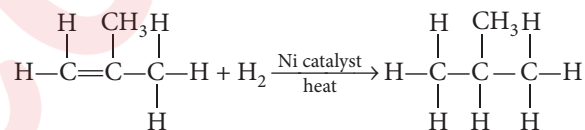
38. A. Reagent : Excess concentrated sulphuric acid
Condition : Heating the mixture at 170°C



Alkene decolourised the reddish-brown bromine.

OR

C. Alkenes are converted into alkanes by hydrogenation.



39. A. The increasing order of wavelength of visible spectrum is

Violet < Indigo < Blue < Green < Yellow < Orange < Red.

B. The more be the wavelength, more be the speed. Therefore, the correct decreasing order of speed in light is Red > Green > Blue.

C. Frequency is inversely proportional to the wavelength. Violet has minimum wavelength among all these colours, so violet has maximum frequency.

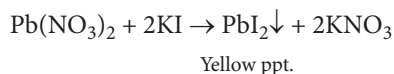
OR

D. The angle between the extrapolated sections of the incident ray and the emergent ray during refraction through a prism is called the angle of deviation.

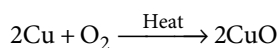
The angle of deviation is more for more refractive index. *i.e.* Blue > Yellow > Orange.



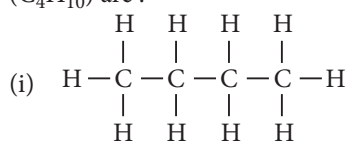
1. (b) : Yellow precipitate is formed.



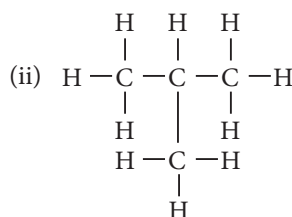
2. (d) : When copper wire is heated in presence of air at high temperature, copper oxide is formed hence, it is a chemical reaction. Other changes are just physical changes.



3. (c)
4. (c) : The correct structures of isomers of butane (C_4H_{10}) are :

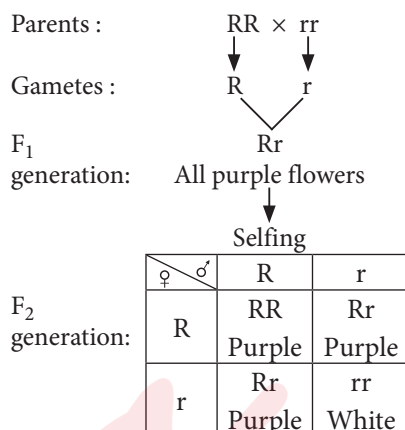


n-Butane



iso-Butane

5. (c) : It is a single displacement reaction.
6. (b) : Given structures are of fullerenes and diamond and these are allotropes of carbon.
7. (d) : Propene ($\text{CH}_3-\text{CH}=\text{CH}_2$) and propyne ($\text{CH}_3-\text{C}\equiv\text{CH}$) are unsaturated hydrocarbons.
8. (b) : Water needed by plants is absorbed by roots. The root hair absorb water from soil by osmosis. Difference in concentration of ions is created between roots and soil which enables water to enter into roots to compensate difference in concentration.
9. (c) : Medulla oblongata of hindbrain controls involuntary actions like vomiting.
10. (c) : Tissue culture should be the best way to produce a greater number of offspring in a less time. In this method, the new plants are grown by culturing cells from the growing tip of plant. The cells are placed in artificial medium where they produce callus. The callus produces a greater number of plantlets in less time.
11. (a) : A cross between plant with purple flower and plant with white flower produces three purple flower plants and one white flower plant shown as follows :



Thus, the ratio of white flower plants to purple flower plants is 1:3.

12. (c) : The mucous lining in the nasal passage helps to moisten and warm the inhaled air and also trap dust particles (*i.e.*, helps in filtering the inhaled air).

13. (d) : Given, converging lens image is three times magnified, focal length, $f = 30$ cm.

As we know, when a convex lens forms a magnified and real image, then the image is inverted *i.e.*, magnification must be negative.

Therefore, magnification, $m = -3$

Using lens formula, $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

we get, $\frac{v}{f} = 1 - m$

$$\Rightarrow \frac{v}{f} = 1 - (-3) \Rightarrow \frac{v}{30} = 4 \Rightarrow v = 120 \text{ cm}$$

$$\text{using, } m = \frac{v}{u} \Rightarrow -3 = \frac{120}{u} \Rightarrow u = -40 \text{ cm}$$

Thus, object distance is at -40 cm from the lens.

14. (b) : The resistance of the wire of length l having diameter d and resistivity ρ can be given by the formula,

$$R = \frac{\rho l}{\pi \left(\frac{d}{2}\right)^2} \Rightarrow R \propto \frac{1}{d^2}$$

Therefore, on decreasing the resistance, there would be an increase in the diameter of the wire.

15. (c) : In the given food chain, if the amount of energy at fourth trophic level is 5 KJ, then 5000 KJ will be the energy available at the producer level. As only 10% of energy is transferred to next higher trophic level, hence, 500 KJ energy will be stored in body of primary consumer *i.e.*, grasshopper and 50 KJ in frog. 5 KJ energy will be present in the body of snake and 0.5 KJ in hawk.

16. (d) : Abscisic acid is a growth inhibitor.

17. (a) : A balanced chemical equation must obey the law of conservation of mass.

18. (a)

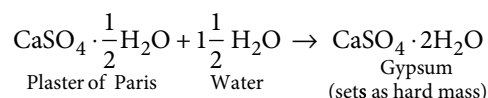
19. (b) : The blue colour of clear sky is due to Rayleigh elastic scattering of sunlight.

20. (d) : Vegetative propagation produces genetically similar cells as they develop from the somatic parts of the plants namely root, stem and leaves.

21. A. Chemical name of the given powder is calcium sulphate hemihydrate. It is also known as plaster of Paris.

Chemical formula of the powder is $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$.

B. When water is added to plaster of Paris, it sets into a hard mass in about half an hour. The setting of plaster of Paris is due to its hydration to form crystals of gypsum which set to form hard solid mass.



Character	Self pollination	Cross pollination
Agent of pollination	Usually no external agent of pollination is required.	External agents such as wind, water, insects and birds are required.
Production of pollen grains	Produced in small numbers, thus no wastage of pollen grains occurs.	Produced in large numbers thus, wastage of pollen grains occurs.

23. A. In plants, respiration occurs during day as well as during night. However, photosynthesis does not occur at night and CO_2 elimination is the major exchange activity going on. During the day, the rate of photosynthesis is faster than respiration thus, CO_2 generated during respiration is used up for photosynthesis, hence there is no CO_2 release. Instead, oxygen release is the major event during daytime. Therefore, we agree with the statement that, all plants give out oxygen during day and carbon dioxide during night.

OR

B. In desert plants, stomata open at night and take in carbon dioxide (CO_2). Stomata remain closed during daytime to prevent the loss of water by transpiration. They store the CO_2 in their cells until the sun comes out so that they can carry on with photosynthesis during the daytime.

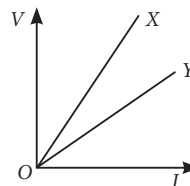
24. A. Red will have greater wavelength than green.

B. White light constitutes of different colours. The different colours of white light bend through different angles. There is a difference in speed of light of different wavelength through a medium. Violet light travels slowest while the red light travels fastest.

C. Dispersion of light.

25. A. (i) The slope of $V-I$ graph gives the resistance. The greater the slope greater will be the resistance $X > Y$.

So, X is series combination.



(ii) Given, potential difference $V = 2\text{ V}$

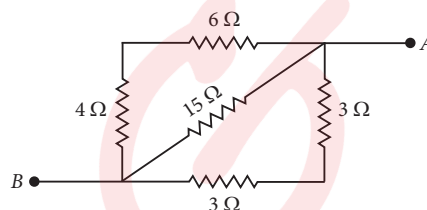
Current, $I = 0.5\text{ A}$

Using Ohm's law, $V = IR$

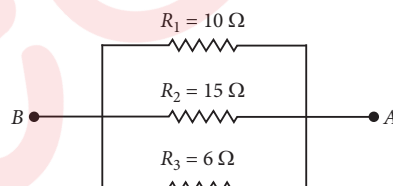
$$\Rightarrow R = \frac{V}{I} \Rightarrow R = \frac{2\text{ V}}{0.5\text{ A}} = 4\ \Omega$$

OR

B.



Now, equivalent resistance between A and B



We know that $6\ \Omega$ and $4\ \Omega$ are in series, then

$$R_1 = 6\ \Omega + 4\ \Omega = 10\ \Omega$$

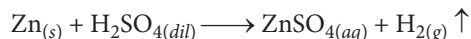
and $3\ \Omega$ and $3\ \Omega$ are in series, $R_3 = 3\ \Omega + 3\ \Omega = 6\ \Omega$

Now equivalent resistance between A and B,

$$\frac{1}{R_{AB}} = \frac{1}{10} + \frac{1}{15} + \frac{1}{6}, \quad \frac{1}{R_{AB}} = \frac{3+2+5}{30} \Rightarrow R_{AB} = 3\ \Omega.$$

26. Movement of leaves in *Mimosa* plant is due to nastic movement *i.e.*, independent of growth that are non-directional and occur due to turgor changes, whereas Y is showing geotropism which refers to the downward (directional) growth of roots in response to the pull of earth or gravity.

27. A. When zinc reacts with dilute sulphuric acid, a gas (*i.e.*, hydrogen) is evolved and also a rise in temperature takes place.



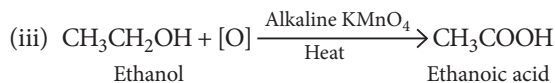
B. (a) This is an exothermic reaction as heat is evolved during the reaction.

(b) This is an endothermic reaction as heat is absorbed during the reaction.

28. A. (i) 5% solution of KMnO_4 is prepared by adding 5 g of KMnO_4 in 95 g of water.

(ii) Here, alkaline KMnO_4 acts as an oxidising agent. It oxidises ethanol to ethanoic acid by donating nascent oxygen. If excess of KMnO_4 is added then, the purple colour

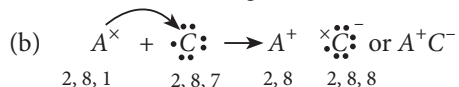
will persist, indicating no more alcohol is left and there is no reaction.



OR



It has covalent bonding.



It has ionic bonding.

(c) A is a good conductor of electricity because it has free or mobile electron in its valence shell to conduct electricity.

29. Mendel selected pea plant for breeding experiments because of the following features:

S. No.	Feature	Advantage
(i)	Annual plant	Short life cycle helped to study larger number of generations in shorter time.
(ii)	Contrasting characters	Made analysis more convenient and reliable.
(iii)	Easy hybridisation	Artificial cross pollination is quite easy due to large reproductive structures. It helped in crossing pure plants with contrasting characters.
(iv)	Self fertility	Made possible to maintain homozygous purelines for a particular character.
(v)	High number of seeds	Sufficient number of progenies of each generation obtained.

30. A. A food chain consists of series of populations which are related by eating and being eaten. There is a unidirectional flow of energy from sun to producers and subsequently to series of different types of consumers, *i.e.*, Solar radiations → Producers → Herbivores → Carnivores. It cannot pass in reverse direction. There is always a decrease in the flow of energy and content with rise in trophic level. As some energy is lost at each step as heat and is also used up in various metabolic activities.

B. Herbivores always occupy the second trophic level in any food chain as they feed on producers (T_1).

31. A. Power is the degree of convergence or divergence of light rays achieved by a lens.

It is defined as the reciprocal of its focal length.

$$\text{i.e., } P = \frac{1}{f}$$

B. (i) For a spherical lens, according to lens formula,

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

where f is the focal length of the lens, v is the image distance and u is the object distance.

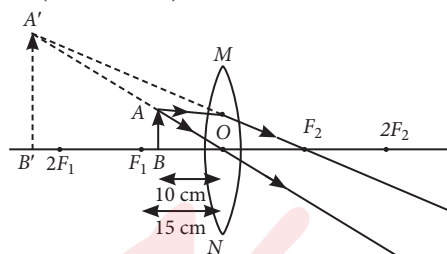
(ii) For a spherical mirror, according to mirror formula,

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

where f is the focal length of the mirror, v is the image distance and u is the object distance.

(iii) Given focal length,

$f = +15$ cm (convex lens) and $u = -10$ cm



32. A. The direction of current I is opposite to the direction electron beam as shown in figure.

Since the beam is deflected to the right side, the force, F acting on the beam is as shown. Applying Fleming's left hand rule, it is found that magnetic field, B is acting vertically downwards (*i.e.*, perpendicular to the plane of the paper and directed inwards) as shown by \otimes .

B. The three factors are current, length of the conductor and magnitude of magnetic field. The position will be parallel alignment of conductor with magnetic field.

33. A. The shape of the graph obtained by plotting potential difference applied across conductor against the current flowing through it is a straight line.

According to ohm's law,

$$V = IR \text{ or } R = \frac{V}{I}$$

So, the slope of $V-I$ graph at any point represents the resistance of the given conductor.

As graph is a straight line, so it is clear from the graph that $V \propto I$.

B. Resistance of a conductor depends upon the following factors :

(i) Length of the conductor : As, $R \propto l$ greater the length (l) of the conductor more will be the resistance (R).

(ii) Area of cross-section of the conductor: Greater the cross-sectional area of the conductor, less will be the resistance.

$$R \propto \frac{1}{A}$$

(iii) Nature of conductor.

C. Potential difference between two points in a current carrying conductor is said to be 1 volt if 1 joule of work is done to carry a charge of 1 coulomb from one point to the

turpentine is different from that of water, so, the pencil will not appear to be bent to the same extent.

OR

B. (i) Optical centre is the central part of the lens through which a ray of light passes without suffering any deviation. It is usually represented by the letter O .

(ii) Given : $f = -20$ cm, $h = 4$ cm, $v = -10$ cm

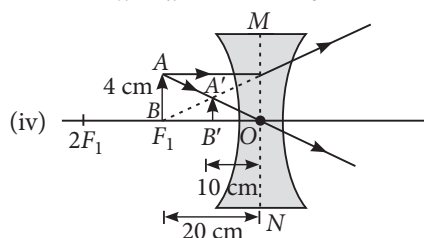
From lens formula, $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$$\frac{1}{-10} - \frac{1}{u} = \frac{1}{-20}$$

$$\Rightarrow \frac{1}{u} = \frac{-1}{10} + \frac{1}{20} \Rightarrow u = -20 \text{ cm}$$

(iii) Magnification of the lens,

$$m = \frac{h'}{h} = \frac{v}{u} \Rightarrow h' = \frac{10}{20} \times 4 \Rightarrow h' = 2 \text{ cm}$$



37. A. A base which completely ionises in water and thus produces a large amount of hydroxide ions (OH^- ions) is called a strong base.

A base which is partially ionised in water and thus produces a small amount of hydroxide ions is called a weak base.

Strong base: KOH, NaOH.

Weak base: NH_4OH , $\text{Ca}(\text{OH})_2$, $\text{Mg}(\text{OH})_2$.

B. (i) The solution having lower pH will have more hydrogen ion concentration. Hence, solution 'A' will have highest H^+ ion concentration.

(ii) Solution 'C' i.e., pH = 5 has the lowest concentration of H^+ ions.

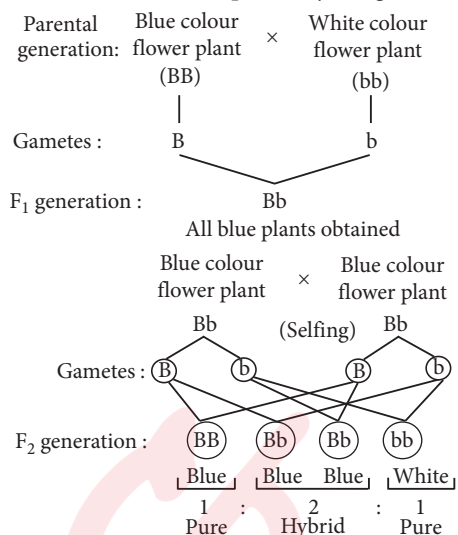
OR

C. If concentration of H_3O^+ is increased in a solution, pH will decrease.

Colour of pH paper if the pH ranges 0.5 to 2.0 is red.

38. A. The expected ratio of the genotypes BB and Bb in the F_2 progeny is 1 : 2.

The above results could be depicted by the given cross:



OR

B. If the flowers of F_1 generations are self pollinated, then the percentage of white flowers in F_2 generation must be 25%.

C. The colour of the flower in F_1 generation will be blue with Bb genotype.

D. Only single trait is involved in this cross, thus cross, is known as monohybrid cross.

39. A. The current flows in the east-west direction. From right hand thumb rule, we get the direction of magnetic field as from north to south. The direction of magnetic field will be same at every point below the power line.

B. Magnetic field lines will be concentric circles to any point of the circular loop.

C. At centre, the field lines appear straight.

OR

D. By clock rule, we can find the direction of magnetic field. The magnetic field produce due to a circular wire at its centre is perpendicular to the plane of the wire.

