SECTION-A

1. **(b)**Stomata are tiny pores present mainly on the leaf surface. They allow the exchange of gases:
   •CO_2 enters for photosynthesis.
   • O_2 and water vapor exit from the leaf.
   Therefore, the structure mainly responsible for gaseous exchange is stomata.
2. **(d)** The diagram shows an amoeba-like organism dividing into two daughter cells, which is the process of binary fission.
3. **(d)** •Spirogyra reproduces asexually by fragmentation.
   •Leishmania reproduces asexually by binary fission.
   •Hydra reproduces asexually by budding.
   Therefore, the common statement for all three is that they reproduce asexually.
4. **(b)** The cerebellum is responsible for:
   •Precision and coordination of voluntary movements
   •Maintenance of balance and posture
   •Smooth functioning of muscles during movement
   Therefore, the part of the brain responsible for precision of voluntary actions is Cerebellum.
5. **(b)** •Trypsin is a protein-digesting enzyme that breaks down proteins into smaller peptides.
   •Lipase is a fat-digesting enzyme that acts on emulsified fats and converts them into fatty acids and glycerol.
6. **(a)** In humans, females have XX chromosomes and males have XY chromosomes.
   The female produces eggs carrying only the X chromosome.
   The male produces sperms carrying either X or Y chromosome.
   Therefore, the sex of the child is determined by whether the sperm carries X or Y.
   •(ii) Gamete carrying X chromosome from male parent
   •(iii) Gamete carrying Y chromosome from male parent
7. **(c)** •Biodegradable substances can be broken down by microorganisms.
   •Polythene bags, rubber bands, and ball pens do not decompose naturally in a short time and are therefore non-biodegradable.
8. **(a)** •Reflex actions are quick, automatic responses to stimuli and occur without conscious thinking.
   •Most reflex actions are coordinated by the spinal cord rather than the brain, allowing a rapid response.
9. **(c)** Assertion (A): In human beings, the respiratory pigment is haemoglobin present in red blood cells. → True
   Reason (R): Haemoglobin has a very high affinity for carbon dioxide. → False
   Haemoglobin has a much higher affinity for oxygen (and especially carbon monoxide) than for carbon dioxide.
   Most carbon dioxide is transported in the blood as bicarbonate ions.
10. Function of diaphragm:
    The diaphragm is a dome-shaped muscular sheet that plays an important role in breathing.
    •During inhalation (breathing in): It contracts and moves downward, increasing the volume of the chest cavity so that air enters the lungs.
    •During exhalation (breathing out): It relaxes and moves upward, decreasing the volume of the chest cavity so that air is expelled from the lungs.
    Location:
    The diaphragm is present below the lungs, separating the chest (thoracic) cavity from the abdominal cavity.
11. **(a)**

Chewing food	**Salivation on sight of food**
It is a voluntary action and can be controlled consciously.	It is an involuntary (reflex) action and occurs automatically.
It is carried out by the muscles of the jaw, teeth, and tongue to break down food mechanically.	It is controlled by the nervous system, which stimulates the salivary glands to secrete saliva when food is seen or smelled.

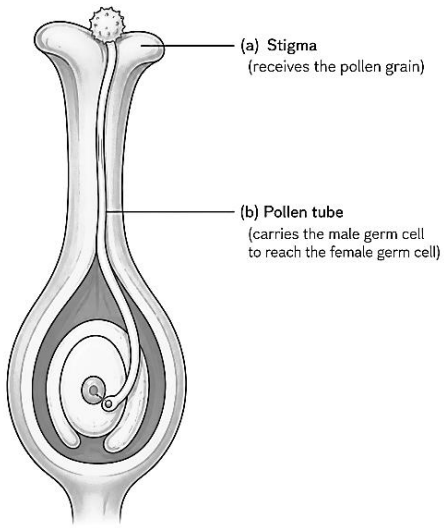
Thus, chewing is a voluntary mechanical process, whereas salivation on sight of food is an involuntary reflex action.

OR

(b)

Pollination	Fertilization
The transfer of pollen grains from the anther to the stigma.	The fusion of male sperm cells with female egg cells.
An external, physical or mechanical process.	An internal, biochemical and genetic process.
Pollen lands on the stigma and forms a pollen tube.	Formation of an embryo and development of a seed.

12. (a) and (b) show on diagram.



13. **(a)** Trophic Level Placement

•(i) Producers: Grass
•(ii) Primary consumers: Deer, Rabbit
•(iii) Secondary consumers: Snake
•(iv) Tertiary consumers: Lion

(b) Energy Availability

•10% Law: Only about 10% of the energy from one trophic level is transferred to the next higher level.
•Energy Loss: The remaining 90% is lost as heat during respiration and used for metabolic processes.
•Position: Primary consumers are one level closer to the source (producers), so they retain more energy than secondary consumers.

(c) Broad Base of the Pyramid

•Maximum Energy: Producers at the base trap the maximum amount of solar energy.
•Highest Biomass: This level contains the highest total biomass and number of individuals in the ecosystem.
•Support System: A large base is necessary to produce enough energy to sustain all higher trophic levels.

14. **(a)**

Nephron	Neuron
Structural and functional unit of the kidney.	Structural and functional unit of the nervous system.

Filters blood and forms urine.	Receives and transmits nerve impulses.

(b)

Sensory Nerve	**Motor Nerve**
Carries impulses from sense organs to the brain/spinal cord.	Carries impulses from the brain/spinal cord to musdes or glands.
Also called afferent nerve.	Also called efferent nerve.

(c)

Consumers	**Decomposers**
Obtain food by feeding on plants or animals.	Obtain food by breaking down dead plants and animals.
Examples: cow, deer, lion, human.	Examples: bacteria and fungi.

15. **(a)** Only tall pea plants were observed in F_1 generation because the trait for tallness is dominant over the trait for dwarfness. Hence, the dominant tall trait expressed itself in all F_1 plants.

(b) Mendel obtained the F_1 progeny by cross-pollination (hybridization) between a pure tall pea plant (TT) and a pure dwarf pea plant (tt).

(c) (i) One difference between dominant and recessive trait:

Dominant Trait

•Expresses itself even in the presence of another trait.

Recessive Trait

•Expresses itself only when both alleles are recessive.

OR

(ii) Two observations made by Mendel about F_2 progeny:

(1) Both tall and dwarf plants appeared in the F_2 generation.

(2) The ratio of tall to dwarf plants was approximately $3:1$.

16. **(a)** Analyse each situation and describe its possible impact:

(i) Increase in water temperature due to global warming may kill many bacteria. Only those bacteria that can tolerate higher temperatures will survive and reproduce.

(ii) When the sperm encounters the egg in the oviduct, fertilisation occurs, forming a zygote which develops into an embryo.

(iii) A flower containing only a pistil cannot undergo self-pollination because it lacks stamens. It will require cross-pollination from another flower.

(iv) If the egg is not fertilised in a human female, the uterine lining breaks down and is shed through menstruation.

(v) When a seed gets suitable conditions of water and air in the soil, it germinates and develops into a seedling.

OR

(b) Analyse and describe what would happen when:

(i) Spores released from the blob-like structures (sporangia) of bread mould disperse through air and, under favourable conditions, germinate into new mould plants.

(ii) Leaves of Bryophyllum falling on moist soil produce buds along their margins, which grow into new plants.

(iii) If pollen from a different, unrelated species lands on the stigma, it usually does not germinate, so fertilisation does not occur.

(iv) When a Copper-T is placed in the uterus, it acts as a contraceptive by preventing fertilisation and implantation, thus avoiding pregnancy.

(v) When Spirogyra breaks into smaller fragments, each fragment grows into a new individual by fragmentation, an asexual mode of reproduction.

SECTION-B

17. (c) Both reactions are:

(i)$AgNO_3 + NaCl \rightarrow NaNO_3 + AgCl$

(ii)$K_2SO_4 + BaCl_2 \rightarrow BaSO_4 \downarrow + 2KCl$

In both reactions, the ions exchange partners, so they are double displacement reactions.

Also, AgCl and $BaSO_4$ are insoluble solids that separate out from the solution, so both are precipitation reactions.

18. (b) A visually impaired student cannot rely on colour change indicators such as turmeric, methyl orange, or litmus. Instead, they can use an olfactory indicator, which changes its smell in acidic or basic solutions.

Vanilla essence is an olfactory indicator:

•In an acidic solution, its smell remains unchanged.

•In a basic solution, its smell becomes faint or cannot be detected.

19. (d) When lead(II) nitrate $[Pb(NO_3)_2]$ is heated, it decomposes as:

$2\ Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2$

The gases evolved are:

•Nitrogen dioxide (NO_2) - brown fumes

•Oxygen (O_2)

20. (b) The aldehyde functional group is - CHO .

•Methanal (HCHO)

•Ethanal (CH_3CHO)

Other options:

•COOH → Carboxylic acid

• $-OH$ → Alcohol

21. (a) Cu (Copper), Ag (Silver), and AI (Aluminium) are good conductors of electricity.

Lead (Pb) conducts electricity much less efficiently than these metals, so it is considered a poor conductor in comparison.

22. (a) •Oxalic acid → found in tomato (also spinach)

•Lactic acid → found in curd/sour milk

•Methanoic acid (Formic acid) → found in ant stings

23. (b) When calcium reacts with water:

$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$

The hydrogen gas bubbles produced stick to the surface of calcium, making it float on water.

24. (a) •Assertion (A): True

Carbon shares its valence electrons with other carbon atoms or atoms of other elements, forming covalent bonds.

•Reason (R): True

The shared electrons belong to the outermost shells of both atoms, helping them attain a stable noble gas configuration (octet).

25. (a) Amphoteric oxides are metal oxides that exhibit both acidic and basic properties. They neutralize both acids and bases to produce a salt and water.

(b) Categorisation based on nature:

•ZnO (Zinc oxide): Amphoteric (acts as both an acid and a base)

•Na_2O (Sodium oxide): Basic

• CO_2 (Carbon dioxide): Acidic

26. (a) Name the substance oxidised and reduced in the reaction:

$ZnO + C \rightarrow Zn + CO$

•Oxidised substance: Carbon (C) → CO (oxygen is added)

•Reduced substance: Zinc oxide (ZnO) → Zn (oxygen is removed)

(b) Balance the chemical reaction:

$Pb(NO_3)_2 + KI \rightarrow PbI_2 + KNO_3$

Balanced equation:

$Pb(NO_3)_2 + 2KI \rightarrow PbI_2 + 2KNO_3$

(c) Give one example each of:

(1)Electrolytic decomposition:

$2H_2O \xrightarrow{\text{electricity}} 2H_2 + O_2$

(2)Decomposition by sunlight (Photolytic decomposition):

$2AgCl \xrightarrow{\text{sunlight}} 2Ag + Cl_2$

(Alternatively: $2AgBr \xrightarrow{\text{sunlight}} 2Ag + Br_2$)

27. (a) Chlor-Alkali Process

The process of passing electricity through an aqueous solution of sodium chloride (brine) is called the chloralkali process.

Chemical equation:

$2NaCl(aq) + 2H_2O(l) \rightarrow 2NaOH(aq) + Cl_2(g) + H_2(g)$

Products formed:

•At anode (+): Chlorine gas (Cl_2)

•At cathode (-): Hydrogen gas (H_2)

•In solution: Sodium hydroxide (NaOH)

OR

(b) Preparation of Compounds

(i) Baking Soda ($NaHCO_3$)

Prepared by passing carbon dioxide through ammoniated brine:

$NaCl + NH_3 + CO_2 + H_2O \rightarrow NaHCO_3 + NH_4Cl$

(ii) Bleaching Powder ($CaOCl_2$)

Prepared by passing chlorine gas over dry slaked lime:

$Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$

(iii) Plaster of Paris ($CaSO_4 \cdot \frac{1}{2}H_2O$)

Prepared by heating gypsum at about $\mathbf{373}$K :

$CaSO_4 \cdot 2H_2O \xrightarrow{\text{heat}} CaSO_4 \cdot \frac{1}{2}H_2O + \frac{3}{2}H_2O$

(Plaster of Paris) ← (Gypsum)

28. (a) Carbonate and sulphide ores are first converted into oxides because metal oxides are easier to reduce to metals than their carbonate or sulphide ores.

(b) Aluminium acts as a reducing agent in the thermite reaction:

$Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe +$ Heat

(c) (i) Copper is obtained from copper sulphide ore (Cu_2S) as follows:

(1)Roasting:

$2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$

(2)Self-reduction:

$2Cu_2O + Cu_2S \rightarrow 6Cu + SO_2$

Thus, pure copper is obtained.

OR

(ii) (I) Highly reactive metals cannot be obtained from their oxides using carbon because these metals have a greater affinity for oxygen than carbon, so carbon cannot reduce their oxides.

(II) Solder (alloy of lead and tin) is used for welding electrical wires because:

•It has a low melting point.

•It conducts electricity reasonably well.

•It melts easily and joins wires without damaging them.

29. (a) (i) Give reasons:

(I) Covalent compounds are poor conductors of electricity.

Covalent compounds do not have free ions or free electrons to carry electric current; therefore, they are poor conductors of electricity.

(II) Soap does not form lather in hard water.

Hard water contains calcium and magnesium salts. These react with soap to form insoluble scum, preventing lather formation.

(III) Carbon shows catenation but silicon does not.

Carbon forms strong C-C bonds due to its small atomic size, allowing long chains of carbon atoms. Silicon forms weaker Si-Si bonds and therefore shows very little catenation.

(ii) Write chemical equations:
(I) Oxidation of ethanol by acidified potassium dichromate:

$$CH_3CH_2OH + 2[O] \xrightarrow{K_2Cr_2O_7/H_2SO_4} CH_3COOH + H_2O$$

(Ethanol → Ethanoic acid)
(II) Hydrogenation of ethene:

$$CH_2 = CH_2 + H_2 \xrightarrow{Ni} CH_3 - CH_3$$

(Ethene → Ethane)

OR

(b) (i) Identify X, Y and Z .
•x = Ethanoic acid (CH_3COOH)
• Y = Ethyl ethanoate ($CH_3COOC_2H_5$) (sweet-smelling ester)
•Z = Sodium ethanoate (CH_3COONa)
(ii) Role of concentrated H_2SO_4
Concentrated H_2SO_4 acts as a dehydrating agent and catalyst in the esterification reaction.
(iii) Chemical equations and names of reactions
(1)Esterification reaction

$$CH_3COOH + C_2H_5OH \xrightarrow{\text{conc. } H_2SO_4} CH_3COOC_2H_5 + H_2O$$

Ethanoic acid + Ethanol → Ethyl ethanoate + Water)
(2)Alkaline hydrolysis (Saponification)

$$CH_3COOC_2H_5 + NaOH \rightarrow CH_3COONa + C_2H_5OH$$

(Ethyl ethanoate + Sodium hydroxide → Sodium ethanoate + Ethanol)
Names of reactions:
(1)Esterification
(2)Saponification (alkaline hydrolysis of ester)

SECTION-C

30. (c) Given:
•Focal length, f = 15 cm
•Therefore, 2f = 30 cm
So:
•Object position = −30 cm (on the left side of the lens)
•Image position = +30 cm (on the right side of the lens)

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

31. (a) When we look at a nearby object, the eye needs more converging power. Therefore:
•Ciliary muscles contract
•The eye lens becomes thicker (more convex)
This decreases the focal length of the lens and helps focus the nearby object on the retina.

32. (c) Assertion (A): True
When white light passes through a prism, it splits into seven colours forming a spectrum.
Reason (R): False
The splitting occurs due to dispersion of light, not scattering. Different colours have different wavelengths and hence refract by different amounts. Violet bends the most and red bends the least.

33. From the ray diagram, the image $A'B'$ is virtual, erect and magnified, formed on the same side of the lens as the object. This happens when the object is placed between the focus and a convex lens.
(a) The lens used is a convex lens (converging lens).
(b) Given:
•Image distance, v = −30 cm (virtual image, so negative)
•Magnification, m = +2
Using,

$$m = \frac{v}{u}$$

$$2 = \frac{-30}{u}$$

$u = -15$ cm

Therefore, the object was placed 15 cm in front of the lens (between the optical centre and the principal focus).

34. **(a)** Calculate Resistivity

Given:

•Radius, $r = 0.01$ cm $= 1 \times 10^{-4}$ m

•Length, $l = 1.0$ cm $= 1 \times 10^{-2}$ m

•Resistance, $R = 50\Omega$

Formula:

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

where

$A = \pi r^2 = \pi(1 \times 10^{-4})^2 = 3.14 \times 10^{-8}$ m^2

Therefore,

$$\rho = \frac{50 \times 3.14 \times 10^{-8}}{1 \times 10^{-2}}$$

$\rho = 1.57 \times 10^{-4}\Omega$ m

OR

(b) Calculate Power Consumed

Given:

Heater rating $= 1000$ W, 250 V

Operating voltage $V = 200$ V

First find resistance of heater:

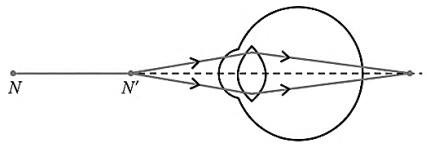
$$R = \frac{V^2}{P} = \frac{250^2}{1000} = 62.5\Omega$$

Power at 200 V :

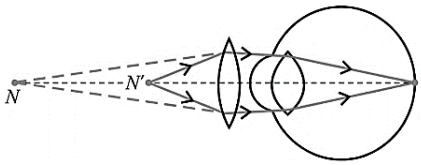
$$P = \frac{V^2}{R} = \frac{200^2}{62.5} = 640 \text{ W}$$

35. The defect of vision where a person is unable to see nearby objects clearly is called hypermetropia or long-sightedness. This condition occurs when the eye is unable to focus light directly on the retina, causing nearby objects to appear blurry. This can be corrected using a convex lens.

Hypermetropic eye:



Correction for hypermetropic eye:



36. **(a)** Activity to show that a current-carrying conductor placed in a magnetic field experiences a force

Aim: To demonstrate that a current-carrying conductor experiences a force in a magnetic field.

Procedure:

(1) Suspend a straight aluminium rod AB between the poles of a strong horseshoe magnet so that the rod can move freely.

(2) Connect the rod in a circuit containing a battery, key, and rheostat.

(3) Close the key and allow current to pass through the rod.

Observation:

•The rod is displaced from its rest position.

•When the direction of current is reversed, the rod moves in the opposite direction.

Conclusion:

A current-carrying conductor placed in an external magnetic field experiences a force. The direction of force

depends on the direction of current and magnetic field (given by Fleming's Left-Hand Rule).

(b) Direction of the magnetic field

Given:

•Electron beam moves from the back wall towards the front wall.

•It is deflected towards your right side.

Using Fleming's Left-Hand Rule (or $\vec{F} = q(\vec{v} \times \vec{B})$) and remembering that an electron is negatively charged:

•Direction of electron motion (current direction opposite to electron motion) is from front to back.

•Force is towards the right.

Therefore, the magnetic field must be vertically downward.

37. **(a)** Justify that the pattern of magnetic field depends upon the shape of the currentcarrying conductor.

The magnetic field produced by a current-carrying conductor depends on the shape of the conductor because different shapes produce different arrangements of magnetic field lines.

•Around a straight conductor, the magnetic field lines are concentric circles.

•Around a circular loop, the field lines become circular and are crowded near the centre.

•Around a solenoid, the magnetic field resembles that of a bar magnet, producing nearly parallel field lines inside it.

Hence, the pattern of the magnetic field changes with the shape of the current-carrying conductor.

(b) On which point (X, Y or Z) is the magnetic field maximum? Why?

The magnetic field due to a straight current-carrying conductor is given by:

$B \propto \frac{1}{r}$

where r is the distance from the wire.

Among the points X, Y, and Z , point X is closest to the wire AB .

Therefore, the magnetic field is maximum at **X** because the magnetic field strength decreases as the distance from the conductor increases.

38. **(a)** Given: $f = +20$ cm

$u = -40$ cm

Note that $u = 2f$

By using the lens formula:

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

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

$= \frac{1}{20} + \frac{1}{-40}$

$= \frac{2-1}{40}$

$\frac{1}{v} = \frac{1}{40}$

$v = +40$ cm

Since v is positive, the image is formed on the other side of the lens.

Magnification $(m) = \frac{v}{u}$

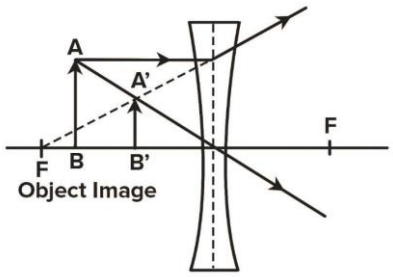
$= \frac{40}{-40}$

$= -1$

The negative sign indicates the image is real and inverted.

∴ The image is formed at 40 cm on the opposite side. It is real, inverted, and of the same size as the object.

(b)



Concave lens

(c) (i) Given: $f_1 = +30$ cm

$f_2 = -15$ cm (Concave)

By using the formula:

$$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2}$$

$$= \frac{1}{30} + \frac{1}{-15}$$

$$= \frac{1-2}{30}$$

$$\frac{1}{F} = -\frac{1}{30}$$

$F = -30$ cm

$= -0.3$ m

By using the formula for power:

$P = P_1 + P_2$

$$= \frac{1}{F}$$

$$= \frac{1}{-0.3}$$

$= -3.33$D

∴ The equivalent focal length is -30 cm , and the power is -3.33 Dioptres.

OR

(ii) Given: $f_{concave} = -2$ m

$$\Rightarrow P_1 = \frac{1}{-2}$$

$= -0.5$D

$f_{convex} = +1.5$ m

$$\Rightarrow P_2 = \frac{1}{1.5}$$

$= +0.67$D

Combined Power:

$P = P_1 + P_2$

$= -0.5 + 0.67$

$= +0.17$D

∴ The combination behaves as a convex lens because the power of the convex lens is greater than the power of the concave lens, resulting in a positive net power.

39. (a) (i) Resistance changes with length and area because

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

where R = resistance, l = length, A = area of cross-section and ρ = resistivity.

Resistivity is a property of the material and depends only on the nature of the material and temperature. Therefore, changing length or area changes resistance but not resistivity.

(ii) Conductors of electric toasters and electric irons are made of alloys because alloys:

•Have higher resistivity than pure metals.

•Have high melting points.

•Do not oxidize (burn) easily at high temperatures.

(iii) S.I. unit of electric current: Ampere (A).

One ampere is the current flowing through a conductor when 1 coulomb of charge passes through it it second.
$1A = 1C/s$

OR

(b) (i) Given:
•Resistance of each bulb $= 8\Omega$
•Voltage $V = 4V$
•Current required $I = 2A$
Equivalent resistance:
$R = \frac{V}{I} = \frac{4}{2} = 2\Omega$
For n bulbs of 8Ω connected in parallel,
$R_{eq} = \frac{8}{n}$
$\frac{8}{n} = 2$
$n = 4$
4 bulbs
(ii) The device used to measure electric current is an Ammeter.
It is connected in series with the circuit.
(iii) Joule's Law of Heating:
The heat produced in a conductor carrying current is:
•Directly proportional to the square of the current,
•Directly proportional to the resistance of the conductor,
•Directly proportional to the time for which current flows.
$H = I^2Rt$
where H = heat produced, I = current, R = resistance, and t = time.