Grade 10 Uttar Pradesh Board
Science

Time: 3 hours 15 min.   **Total marks: 70**

Note:

  i) The question paper is divided into two parts - **Part-A** and **Part-B**

  ii) **Part-A** and **Part-B** are divided into three Sub-Sections **- (1), (2)** and **(3).**

  iii) In Part-A of the question paper, there are multiple choice questions in which select the correct alternative and then by a blue or black ball point pen, fill completely in the circle in OMR Answer Sheet. Do not erase, cut or use whitener on the OMR Answer Sheet after answering.

  iv) 1 mark is allotted for each question in the multiple-choice question of Part-A.

  v) Part- B has descriptive questions.

  vi) The allotted marks are given in each question.

  vii) All the questions of Sub-Sections of Part-B are to be attempted all at a time. Start each Sub-Section from a new page.

  viii) All questions are compulsory

Part – A
(Multiple choice questions)
Sub-section – (1)   7

Q1. To have a real and enlarged image of an object by a concave mirror, the position of the object should be

(A) At the centre of curvature

(B) In between centre of curvature (C) and the focal point (F)

(C) At the pole (P) of the mirror

(D) In between pole (P) and the focal point (F) of the mirror

Correct answer: (A)

Solution:

When an object is placed at the center of curvature of a concave mirror, the image is formed at the same position, is real, inverted, and of the same size. If the object is slightly moved closer to the focus, the image enlarges while remaining real and inverted.

Q2. The unit of the power of the lens is

(A) Metre

(B) per metre

(C) metre per second.

(D) none of these

Correct answer: (D)

Solution:

The power of a lens is measured in diopters (D), which is the reciprocal of the focal length in meters (1/m).

Q3. When a beam of white light falls on the surface of a triangular prism of glass it splits, after emerging out from the prism, into various colours with different deviations. Which colour has maximum deviation?

(A) Red

(B) Yellow

(C) Green

(D) Violet

Correct answer: (D)

Solution:

When white light passes through a prism, it splits into different colors due to dispersion. Violet light undergoes the maximum deviation because it has the

shortest wavelength and interacts more with the medium, bending more than the other colors.

Q4. The sun appears whitish

(A) much before sunrise

(B) at the sunrise and sunset

(C) at noon

(D) much after sunset

Correct answer: (C)

Solution:

During noon, the sun is overhead, and its light travels the shortest distance through the atmosphere. Due to minimal scattering of shorter wavelengths (blue and violet), the sun appears white or slightly yellowish rather than red or orange.

Q5. On which of the following does the resistance of an electrical conductor not depend?

(A) Length of the conductor

(B) Density of the material of conductor

(C) The cross-section of the conductor

(D) The shape of the conductor

Correct answer: (B)

Solution:

Resistance depends on the length, cross-sectional area, and the resistivity of the material but not directly on its density. Resistivity is an intrinsic property of a material, independent of its density.

Q6. In which combination the four resistors be connected to have minimum resultant resistance?

(A) All of the resistors in parallel combination

(B) All of the resistors in series combination

(C) One in series with the parallel combination of other three

(D) Two resistors in series with the parallel combination of other two

Correct answer: (A)

Solution:

In a parallel combination, the reciprocal of the total resistance is the sum of the reciprocals of individual resistances. This results in a lower equivalent resistance than any of the individual resistors, achieving the minimum resistance.

Q7. One needs the help of which of the following rules to know the direction of the magnetic field produced due to a current carrying conductor?

(A) Fleming's right hand rule

(B) Fleming's left hand rule

(C) Right hand thumb rule

(D) Ohm's law

Correct answer: (C)

Solution:

According to the right-hand thumb rule, if you point your thumb in the direction of current flow, the curled fingers show the direction of the magnetic field around the conductor. This helps in determining the orientation of the magnetic field lines.

Sub-section – (2)   6

Q8. Which of the following metals produces hydrogen gas with cold water

(A) Copper

(B) Gold

(C) Potassium

(D) Aluminium

Correct answer: (C)

Solution:

Potassium reacts vigorously with cold water, producing hydrogen gas and forming potassium hydroxide. The reaction is highly exothermic and may even cause the hydrogen gas to ignite.

Q9. The alkene in the following is

(A) $HC = CH$

(B) $H_2C = CH_2$

(C) $CH_3 - CH_2 - CH_3$

(D) $CH_3 - C = CH$

Correct answer: (B)

Solution:

Alkenes are hydrocarbons with at least one double bond between carbon atoms. Ethene ($H_2C=CH_2$) has a C=C double bond, making it an alkene, whereas the other options contain single bonds (alkanes) or different functional groups.

Q10. A solution turns red litmus into blue. The possible pH value of this solution is

(A) 1

(B) 3

(C) 6

(D) 8

Correct answer: (D)

Solution:

A solution that turns red litmus blue is basic in nature. Basic solutions have pH values greater than 7, and since 8 is the only basic value given in the options, it is the correct answer.

Q11. The bond present in chlorine molecules is

(A) Ionic bond

(B) One covalent bond

(C) Double covalent bond

(D) Triple covalent bond

Correct answer: (B)

Solution:

A chlorine molecule (Cl_2) consists of two chlorine atoms sharing one pair of electrons, forming a single covalent bond. This allows each atom to achieve a stable noble gas configuration.

Q12. Useful substances in making water bacteria free is

(A) Washing soda

(B) Baking soda

(C) Alum

(D) Bleaching powder

Correct answer: (D)

Solution:

Bleaching powder ($Ca(OCl)_2$) releases chlorine when added to water, which acts as a disinfectant by killing bacteria and other pathogens, making the water safe for drinking.

Q13. The reactions in which new compounds are formed by exchange of ions, are called

(A) Substitution reactions

(B) Double decomposition

(C) Addition reactions

(D) Dissociation

Correct answer: (B)

Solution:

In double decomposition reactions, two compounds react by exchanging their ions to form two new compounds. These reactions are commonly seen in precipitation and neutralization reactions.

Sub-section – (3)   7

Q14. The function of xylem in plants is

(A) conduction of water

(B) translocation of food

(C) translocation of amino acid

(D) translocation of oxygen

Correct answer: (A)

Solution:

Xylem transports water and minerals from the roots to different parts of the plant. It consists of vessels and tracheids, which provide structural support and facilitate water conduction.

Q15. In which of the following plants did Mendel perform his experiments on inheritance?

(A) Tomato

(B) Brinjal

(C) Pea

(D) Mustard

Correct answer: (C)

Solution:

Gregor Mendel conducted experiments on the pea plant (Pisum sativum) because of its easily observable traits, short life cycle, and ability to self-pollinate and cross-pollinate. His studies led to the formulation of the laws of inheritance.

Q16. Which is not a part of the female genital system in human from the following?

(A) Ovary

(B) Uterus

(C) Vas deferens

(D) Fallopian tube

Correct answer: (C)

Solution:

The vas deferens is a part of the male reproductive system, responsible for transporting sperm from the testes to the urethra. The female reproductive system includes the ovary, uterus, and fallopian tube.

Q17. The autotrophic mode of nutrition requires

(A) Carbon dioxide & water

(B) Chlorophyll

(C) Sunlight

(D) All of these

Correct answer: (D)

Solution:

Autotrophic organisms, like plants, require carbon dioxide and water for photosynthesis, chlorophyll to absorb sunlight, and sunlight as the energy source for producing food.

Q18. The examples of homologous organs are

(A) Our hands and forearms of the dogs

(B) Our teeth and teeth of elephant

(C) Runner of potato and grass

(D) All of these

Correct answer: (A)

Solution:

Homologous organs have a similar structure but different functions due to common ancestry. Human hands and dog forelimbs have similar skeletal structures but serve different purposes.

Q19. Asexual reproduction takes place through budding in

(A) *Amoeba*

(B) *Yeast*

(C) *Plasmodium*

(D) *Leishmania*

Correct answer: (B)

Solution:

Yeast reproduces asexually by budding, where a small outgrowth (bud) forms on the parent cell, grows, and eventually detaches to form a new organism.

Q20. Who proposed Natural Selection Theory?

(A) Lamarck

(B) Darwin

(C) Mendel

(D) Morgan

Correct answer: (B)

Solution:

Charles Darwin proposed the theory of natural selection, stating that organisms with advantageous traits survive and reproduce, passing those traits to future generations, leading to evolution over time.

Part -B

(Descriptive Questions)

Sub-section – (1)

Q21. A convex mirror of radius of curvature 2 metre is attached to a motor bike to watch any other vehicle coming from behind. Calculate the location and position of a vehicle which is at 4 metre behind the bike as seen in the mirror. Also explain by the ray diagram. **2 + 2**

Solution:

Given Data:

- Radius of curvature, R=2mR = 2mR=2m

- Focal length, $f = \frac{R}{2} = \frac{2}{2} = 1m$

- Object distance, u=−4mu (behind the mirror, so negative)

- Mirror formula:

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

Calculation of Image Distance:

$$\frac{1}{1} = \frac{1}{v} + \frac{1}{-4}$$

$$\frac{1}{v} = \frac{1}{1} + \frac{1}{4}$$

$$\frac{1}{v} = \frac{4+1}{4} = \frac{5}{4}$$

$$v = \frac{4}{5} = 0.8m$$

Nature and Position of the Image:

- Location: The image is 0.8m behind the mirror.
- Position: The image is virtual, erect, and diminished.
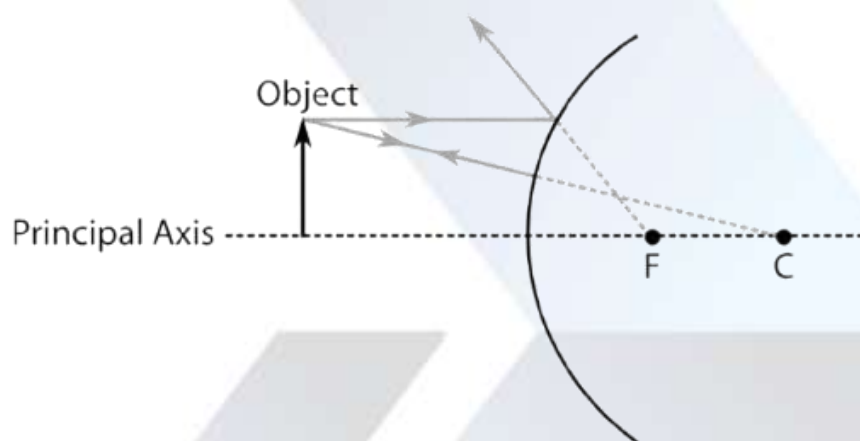
Q22. A person suffering from short-sightedness can see up to 100 metre. Calculate the nature and the focal length of the lens in order to correct this defect so that he can see objects at infinity hence correct vision. Also draw the ray diagram.   **2+2**

Solution:

Given Data:

Far point of the myopic person = 100 m

For clear distant vision, the image should form at = 100 m

Object distance for normal vision = ∞

Nature of the Lens:

Since the person is suffering from short-sightedness (myopia), a concave lens is required to diverge the light rays before they reach the eye, so the image forms at the far point (100 m).

Calculation of Focal Length:

Using the lens formula:

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

Here,

u = ∞ (object at infinity)

v = -100m (image should be formed at the person's far point)

$$\frac{1}{f} = \frac{1}{-100} - \frac{1}{\infty}$$
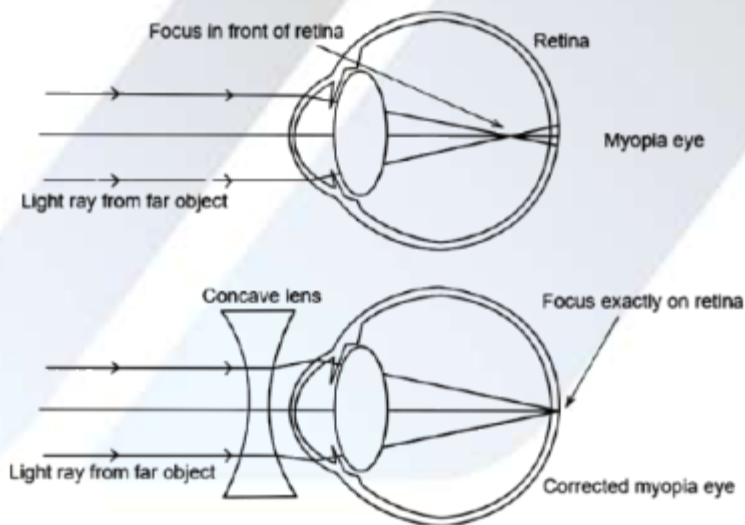
Since $1/\infty \approx 0$, we get:

$$\frac{1}{f} = \frac{1}{-100}$$

$$f = -100m$$

Final Answer:

Nature of Lens: Concave lens

Focal Length: -100 m (Negative sign indicates a concave lens)

Q23. What is Ohm's law? Explain by drawing the associated circuit diagram. Also discuss the terms on which the resistance of an electrical conductor depends. **2+2**

Solution:

Ohm's law states that the current (I) flowing through a conductor is directly proportional to the voltage (V) across its ends, provided the temperature and other physical conditions remain constant.

Mathematically,

$$V = IR$$

Where:

V = Voltage (volts)

I = Current (amperes)

R = Resistance (ohms, Ω)
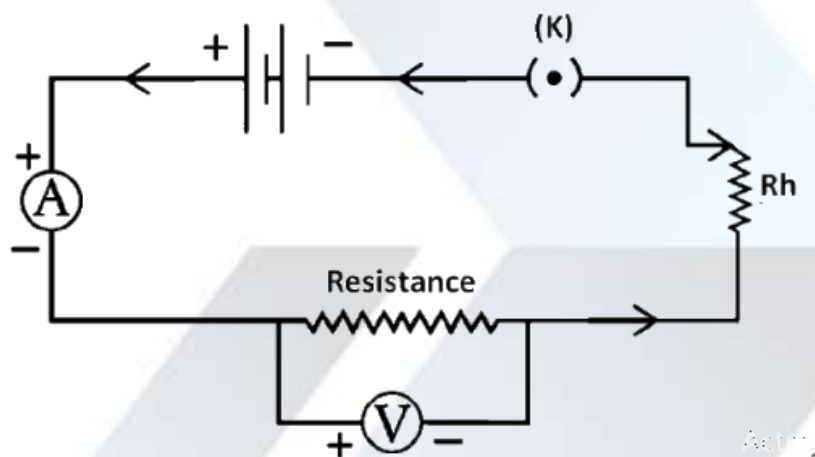
Q24. What is the working principle of an electrical motor? Describe clearly its construction and working method with the help of a diagram.   **1+2+2+1**

OR

What is the working principle of an alternating current generator? Describe its construction and working method with the help of a diagram.   **1+2+2+1**

Solution:

An electric motor works on the principle of electromagnetic induction, where a current-carrying conductor placed in a magnetic field experiences a force that causes it to rotate. This is based on Fleming's Left-Hand Rule.

An electric motor consists of:

   i) Armature – A rectangular coil wound on a soft iron core.

ii) **Magnetic Field** – Provided by permanent magnets or electromagnets.

iii) **Split Ring Commutator** – Reverses the direction of current to ensure continuous rotation.

iv) **Carbon Brushes** – Maintain contact with the commutator and allow current flow.

v) **Battery/Power Source** – Provides electrical energy.

Working:

Current flows through the coil, generating a magnetic field around it.

The magnetic field interacts with the external field, causing forces on opposite sides of the coil.

Due to Fleming's Left-Hand Rule, one side of the coil moves upward, while the other moves downward, creating rotation.

The commutator reverses the current every half-cycle, ensuring continuous rotation in the same direction.
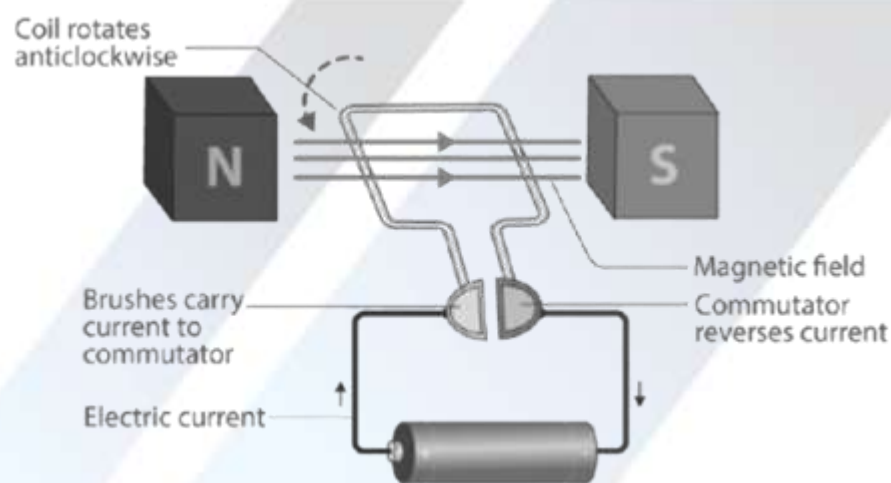
OR

An AC generator works on electromagnetic induction, where a rotating coil in a magnetic field induces an alternating current in the coil. This follows Faraday's Law of Electromagnetic Induction.

An AC generator consists of:

i) Armature Coil – A rectangular coil rotating in a magnetic field.

ii) Magnetic Field – Provided by permanent magnets or electromagnets.

iii) Slip Rings – Two conducting rings connected to the coil, ensuring continuous AC output.

iv) Carbon Brushes – Maintain contact with slip rings and transfer current to the external circuit.

v) External Load – Connected to the output to use the generated AC.

Working:

The coil rotates in the magnetic field, cutting magnetic lines of force.

According to Faraday's Law, a changing magnetic field induces an electromotive force (EMF) in the coil.

The direction of induced current changes every half-rotation, producing alternating current (AC).

Slip rings allow continuous AC flow, unlike a commutator in DC generators.
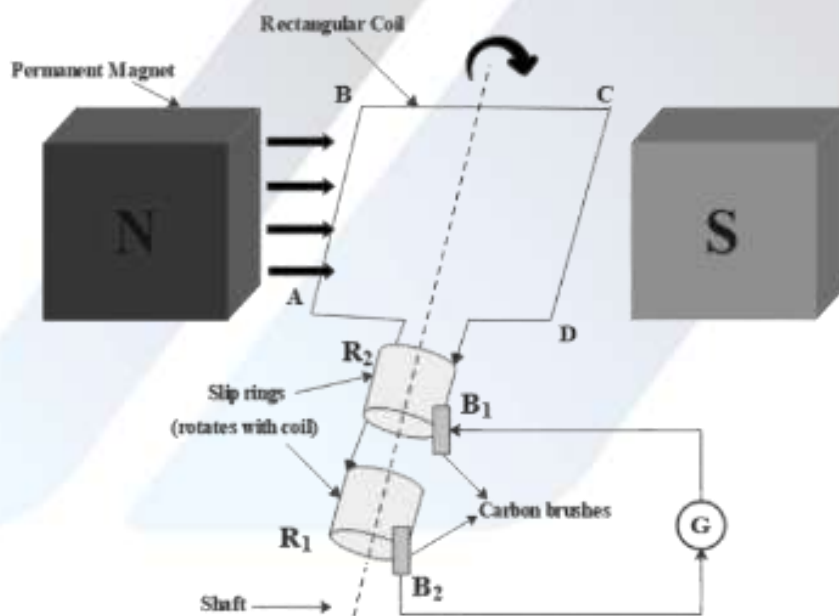
Sub-section – (2)

Q25. Write the structural formulae of the following compounds: **1+1+1+1**
(a) Propanal

(b) 2-methyl pentanoic acid

(c) Propene

(d) 2-methyl butanol-2

Solution:

Propanal	
2-methyl pentanoic acid	
Propene	
2-methyl butanol-2	

Q26. Na, Mg and and Al are the elements in which the numbers of valence electrons are one, two and three respectively. (a) Which of these elements has the maximum atomic radius? (b) Which of these elements is the least reactive? Answer each with the reason.   **2+2**

Solution:

(a) Sodium (Na) has the maximum atomic radius.

Reason: Atomic radius decreases across a period (left to right) in the periodic table because the nuclear charge increases, pulling the electrons closer to the nucleus.

Since Na, Mg, and Al belong to the same period (Period 3) and Na is the leftmost element, it has the largest atomic size among them.

(b) Aluminium (Al) is the least reactive.

Reason: Reactivity of metals decreases across a period from left to right because metals tend to lose electrons, and higher nuclear charge makes electron loss more difficult. Al has the highest nuclear charge among Na, Mg, and Al, making it the least reactive metal in this group.

Q27. Write the balanced chemical equation for each of the following reactions :

1+1+1+1+1+1

a) Plaster of Paris + ... $\longrightarrow$ Gypsum.

b) Hydrogen + Chlorine $\longrightarrow$ ....

c) Zinc carbonate $\longrightarrow$ Zinc oxide + ...

d) Magnesium + ... $\longrightarrow$ Magnesium chloride + Hydrogen

e) Barium chloride + Sulphuric acid $\longrightarrow$ .... + Hydrochloric acid

f) Silver nitrate + Sodium iodide $\longrightarrow$ .... + Sodium nitrate.

OR

Write notes on the following :

2+2+2

a) Dissociation reaction

b) Corrosion

c) Galvanization.

Solution:

a) $CaSO_4 \cdot \frac{1}{4} H_2O + 1\frac{1}{2} H_2O \rightarrow CaSO_4 \cdot 2H_2O$

b) $H_2 + Cl_2 \rightarrow 2HCl$

c) $ZnCO_3 \rightarrow ZnO + CO_2$

d) $Mg + 2HCl \rightarrow MgCl_2 + H_2$

e) $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$

f) $AgNO_3 + NaI \rightarrow AgI + NaNO_3$

OR

a) **Dissociation Reaction:** A dissociation reaction occurs when a compound breaks down into its ions in an aqueous solution. It is common for ionic compounds like salts, acids, and bases.

Example:

$NaCl \rightarrow Na^+ + Cl^-$

b) **Corrosion:** Corrosion is the gradual destruction of metals due to reactions with oxygen, moisture, or other environmental factors. The most common example is rusting of iron:

Example:

$$4Fe + 3O_2 + 6H_2O \rightarrow 4Fe(OH)_3$$
$$Fe(OH)_3 \rightarrow Fe_2O_3.xH_2O$$
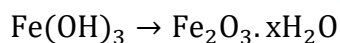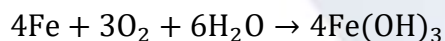
c) **Galvanisation:** Galvanisation is the process of coating iron or steel with zinc to prevent rusting. The zinc layer acts as a protective barrier and also undergoes oxidation instead of iron.

Example:

$$Zn + O_2 + H_2O \rightarrow Zn(OH)_2$$
$$Zn(OH)_2 \rightarrow ZnO + H_2O$$
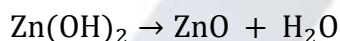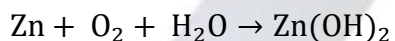
Sub-section – (3)

**Q28.** What are Mendel's laws? Explain them with suitable diagrams. **2 + 2**

Solution:

- Gregor Mendel, the father of genetics, proposed three fundamental laws of inheritance based on his experiments with pea plants. These laws are:

1. Law of Dominance

- **Definition**: When two different alleles are present in an organism, one allele (dominant) expresses itself, while the other (recessive) remains hidden.
- **Example**: In pea plants, the allele for **tallness (T)** is dominant over the allele for **shortness (t)**. A cross between **TT (tall) and tt (short)** results in all **Tt (tall) offspring**.
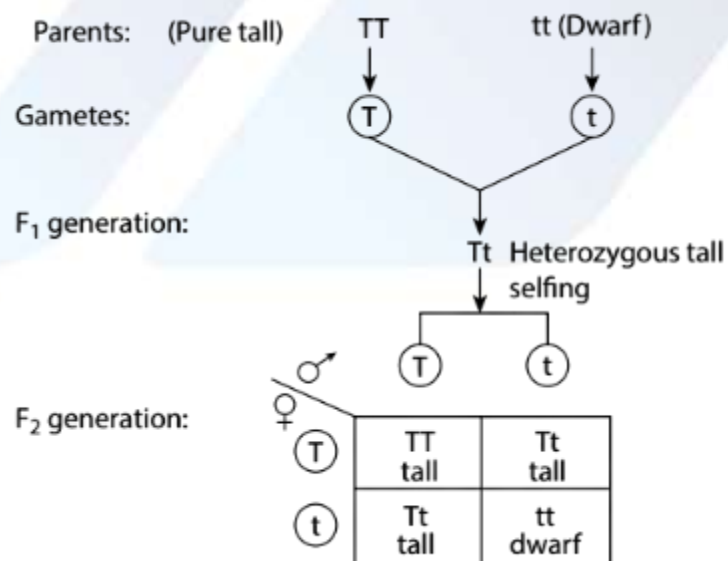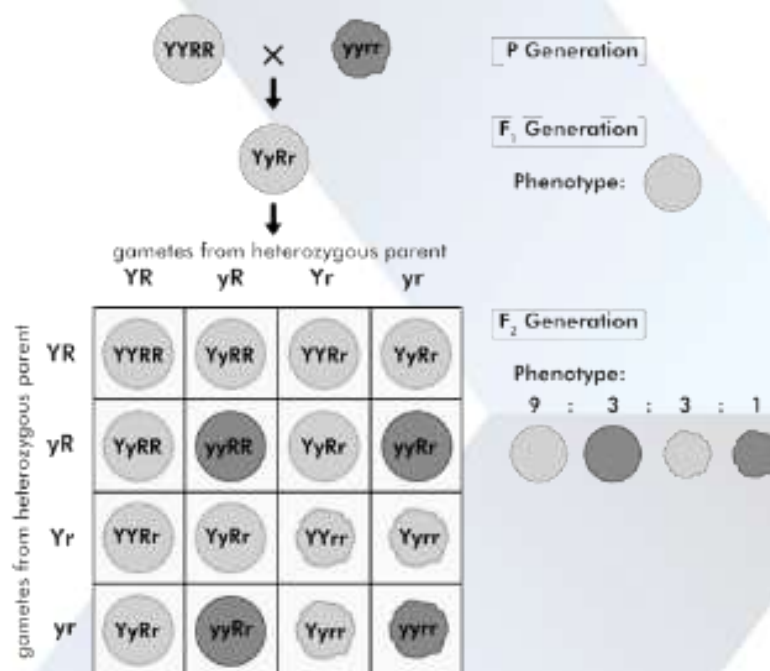
- **Diagram:**
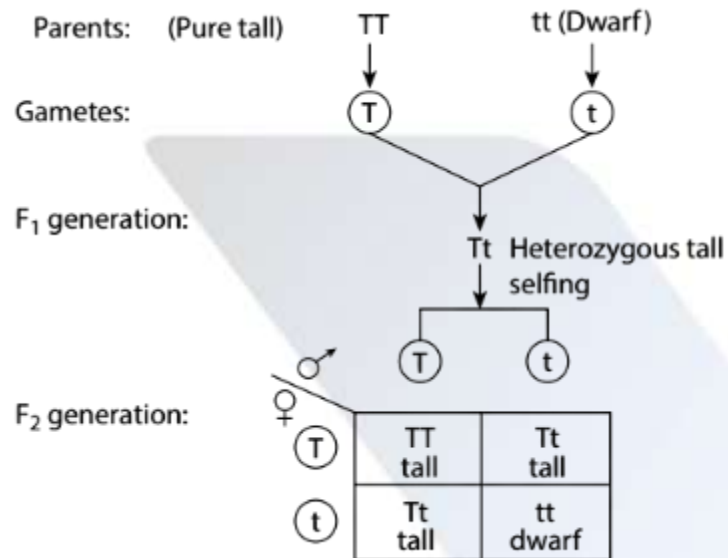
2. Law of Segregation

- **Definition**: Each parent has two alleles for a trait, but during gamete formation, these alleles separate (segregate), and each gamete gets only one allele.
- **Example**: A **Tt (tall) parent** produces gametes with **either T or t**, which recombine during fertilization.
- **Diagram:**

3. Law of Independent Assortment

- Alleles for different traits are inherited independently of each other.
- **Example**: A plant with **yellow, round seeds (YYRR)** is crossed with one having **green, wrinkled seeds (yyrr)**. The offspring exhibit new combinations like **yellow-wrinkled and green-round seeds**.
- **Diagram:**

Q29. Draw a labelled diagram of longitudinal section (L.S) of gynoecium to show the fertilization in flowers and describe it.   **2+2**

Solution:
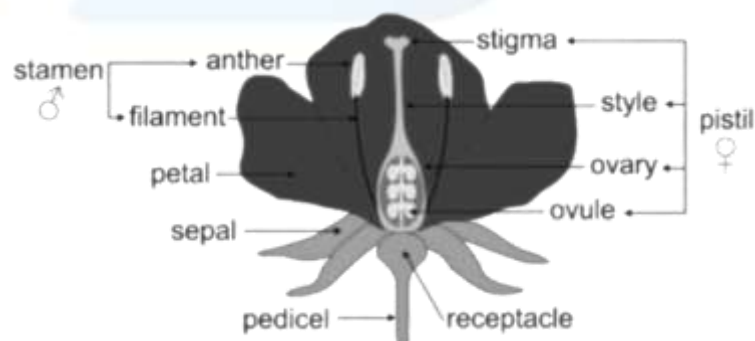
Fertilization in flowers occurs when the male gamete from the pollen grain fuses with the female gamete inside the ovule. The process involves the following steps:

i) Pollination – Pollen grains land on the stigma of the gynoecium.

ii) Pollen Tube Formation – The pollen grain germinates, forming a pollen tube that grows through the style toward the ovary.

iii) Entry into the Ovule – The pollen tube enters the ovule through a small opening called the micropyle.

iv) Double Fertilization – The male gametes travel through the pollen tube: One sperm nucleus fuses with the egg cell to form a zygote (2n), which develops into an embryo.

The other sperm nucleus fuses with the two polar nuclei, forming a triploid (3n) endosperm, which provides nourishment for the developing embryo.

v) Formation of Seed and Fruit – The ovule develops into a seed, while the ovary enlarges to form a fruit.

Q30. Why is conservation of forest necessary? Explain.   4

Solution:

Conservation of forests is essential for maintaining ecological balance, preserving biodiversity, and preventing climate change. Forests regulate the water cycle, prevent soil erosion, and act as carbon sinks, reducing global warming. They provide habitat for wildlife and resources like timber, medicinal plants, and oxygen.

Deforestation leads to desertification, loss of biodiversity, and climate instability. Measures like afforestation, sustainable forest management, and enforcing conservation laws are crucial. In Uttar Pradesh, initiatives like Social Forestry and Joint Forest Management promote community participation in forest conservation. Protecting forests ensures environmental stability and sustains life for future generations.

Q31. Explain the structure of Nephron and mechanism of its working.   **3+3**

OR

Draw a labelled diagram of human digestive system and explain the digestive process. **3+3**

Solution:

A nephron is the structural and functional unit of the kidney, responsible for filtration and formation of urine.

Structurally, it consists of:

i) **Bowman's Capsule** – A cup-shaped structure surrounding the glomerulus where filtration occurs.

ii) **Glomerulus** – A network of capillaries where blood is filtered under pressure.

iii) **Proximal Convoluted Tubule (PCT)** – Reabsorbs water, glucose, amino acids, and salts.

iv) **Loop of Henle** – Maintains salt and water balance.

v) **Distal Convoluted Tubule (DCT)** – Further reabsorption and secretion of ions occur.

vi) **Collecting Duct** – Final concentration of urine before it is transported to the ureter.

The working mechanism of a nephron includes three main steps:

i) **Ultrafiltration** – Blood enters the glomerulus, and pressure forces water, salts, glucose, and waste into Bowman's capsule, forming glomerular filtrate.

ii) **Selective Reabsorption** – Essential substances like glucose, amino acids, and some water are reabsorbed in the PCT and Loop of Henle.

iii) **Tubular Secretion & Urine Formation** – Unwanted substances like urea, excess ions, and water are secreted into the tubules and pass into the collecting duct, forming urine.

OR
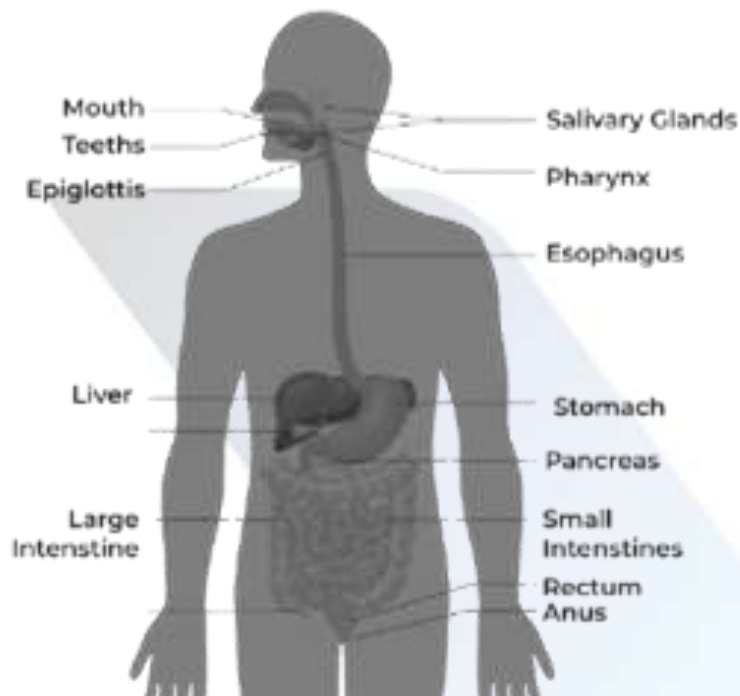
1. **Mouth & Oesophagus** – Food is chewed and mixed with saliva (contains amylase) to start carbohydrate digestion. It passes through the oesophagus by peristalsis.

2. **Stomach** – Gastric juices (HCl and pepsin) break down proteins into peptides.

3. **Small Intestine** – The duodenum receives bile (fat digestion) and pancreatic enzymes (protein, fat, and carbohydrate digestion). The jejunum and ileum absorb nutrients into the bloodstream.

4. **Large Intestine** – Water is absorbed, and undigested food is compacted into faeces.

5. **Rectum & Anus** – Waste is stored in the rectum and eliminated through the anus.