

SECTION A-BIOLOGY

HIGHER ORDER THINKING SKILL (HOTS)

1. Is regeneration the same as reproduction? Justify your answer with an example. [2]
2. A tall pea plant has an unknown genotype (it could be TT or Tt). How would you determine its exact genotype? [2]
3. Why is diffusion alone insufficient to meet the oxygen requirements of large multicellular organisms like humans? [1]

CASE BASED STUDY

4. Respiration is the process by which organisms break down complex organic compounds (like glucose) to release energy for various life activities. In humans, air is inhaled through the nostrils, passes through the throat, and into the lungs. Within the lungs, the passage divides into smaller and smaller tubes that finally terminate in balloon-like structures called alveoli.

The alveoli provide a surface where the exchange of gases can take place. The walls of the alveoli contain an extensive network of blood vessels. When we breathe in, we lift our ribs and flatten our diaphragm, making the chest cavity larger. Because of this, air is sucked into the lungs and fills the expanded alveoli. The blood brings carbon dioxide from the rest of the body for release into the alveoli, while oxygen in the alveolar air is taken up by blood in the alveolar blood vessels to be transported to all body cells.

- i. Which mechanical change occurs during inhalation to create a pressure gradient that draws air into the lungs?**
 - a. Ribs lower and diaphragm becomes dome-shaped, decreasing chest volume
 - b. Ribs lift and diaphragm flattens, increasing chest volume
 - c. Ribs lift and diaphragm expands upwards, pushing air into alveoli
 - d. Ribs lower and diaphragm flattens, keeping chest volume constant
- ii. What structural feature of alveoli makes them optimal sites for rapid gas exchange?**
 - a. Thick muscular walls with minimal blood supply
 - b. Rigid cartilaginous rings with high elasticity
 - c. Balloon-like expandable shape with an extensive network of blood vessels
 - d. Smooth hair-like extensions that filter carbon dioxide
- iii. Based on the passage, what is the ultimate biological objective of respiration in organisms?**
 - a. To cool down body tissues through inhaled air
 - b. To break down complex organic molecules to release energy for life activities
 - c. To store excess oxygen inside alveolar sacs for later synthesis
 - d. To convert carbon dioxide directly into glucose within blood vessels
- iv. During gas exchange in the alveoli, what direction do oxygen and carbon dioxide diffuse relative to the blood?**
 - a. Oxygen enters blood from alveoli; Carbon dioxide enters alveoli from blood
 - b. Oxygen enters alveoli from blood; Carbon dioxide enters blood from alveoli
 - c. Both oxygen and carbon dioxide move from blood into alveolar space
 - d. Both gases remain static inside blood vessels without exchange
- v. Which correct sequence represents the pathway of inhaled air from entry point to gas exchange site?**
 - a. Lungs → Nostrils → Throat → Alveoli
 - b. Nostrils → Throat → Lungs (smaller branching tubes) → Alveoli
 - c. Throat → Nostrils → Alveoli → Lungs
 - d. Alveoli → Lungs → Throat → Nostrils

SECTION B: CHEMISTRY

CASE BASED STUDY

5. The indelible ink used in Indian elections, manufactured exclusively by Mysore Paints and Varnish Limited (MPVL) using a formulation developed by CSIR-NPL. The active constituent of this ink is silver nitrate AgNO_3 , typically present in concentrations between 5% and 25%. When applied to a voter's skin or nail, silver nitrate undergoes a reaction with sodium chloride NaCl present in sweat to form silver chloride AgCl , while also binding tightly to the keratin proteins in skin cells. Upon exposure to ambient sunlight or ultraviolet rays, the silver compounds undergo a reaction to form microscopic deposits of insoluble metallic silver Ag , which creates a dark, permanent stain. Combined with an alcohol solvent that evaporates in seconds to prevent smudging, the ink's stain cannot be washed away by water, soaps, or organic solvents due to the total insolubility of metallic silver and silver chloride; it disappears only through the natural shedding of dead epidermal skin cells over two to four weeks.

i. Which chemical compound is the primary active ingredient in the indelible voting ink used in Indian elections?

- a. Silver Chloride b. Silver Nitrate c. Sodium Chloride d. Potassium Nitrate

ii. When voting ink is applied to the finger, it turns dark brown or black upon exposure to light. Which type of chemical reaction is primarily responsible for this color change?

- a. Thermal decomposition reaction
b. Photochemical decomposition reaction
c. Combination reaction
d. Neutralization reaction

iii. Voting ink reacts with sodium chloride present in human sweat to form a precipitate. Identify the correct chemical equation and reaction type for this process.

a. $\text{AgNO}_3 (\text{aq}) + \text{NaCl} (\text{aq}) \rightarrow \text{AgCl} \downarrow (\text{s}) + \text{NaNO}_3 (\text{aq})$ — Double Displacement Reaction

b. $\text{AgNO}_3 (\text{aq}) + \text{NaCl} (\text{aq}) \rightarrow \text{AgCl}_2 (\text{s}) + \text{NaNO}_3 (\text{aq})$ — Combination Reaction

c. $\text{AgNO}_3 (\text{s}) \rightarrow \text{Ag} (\text{s}) + \text{NO}_2 (\text{g}) + \text{O}_2 (\text{g})$ — Thermal Decomposition

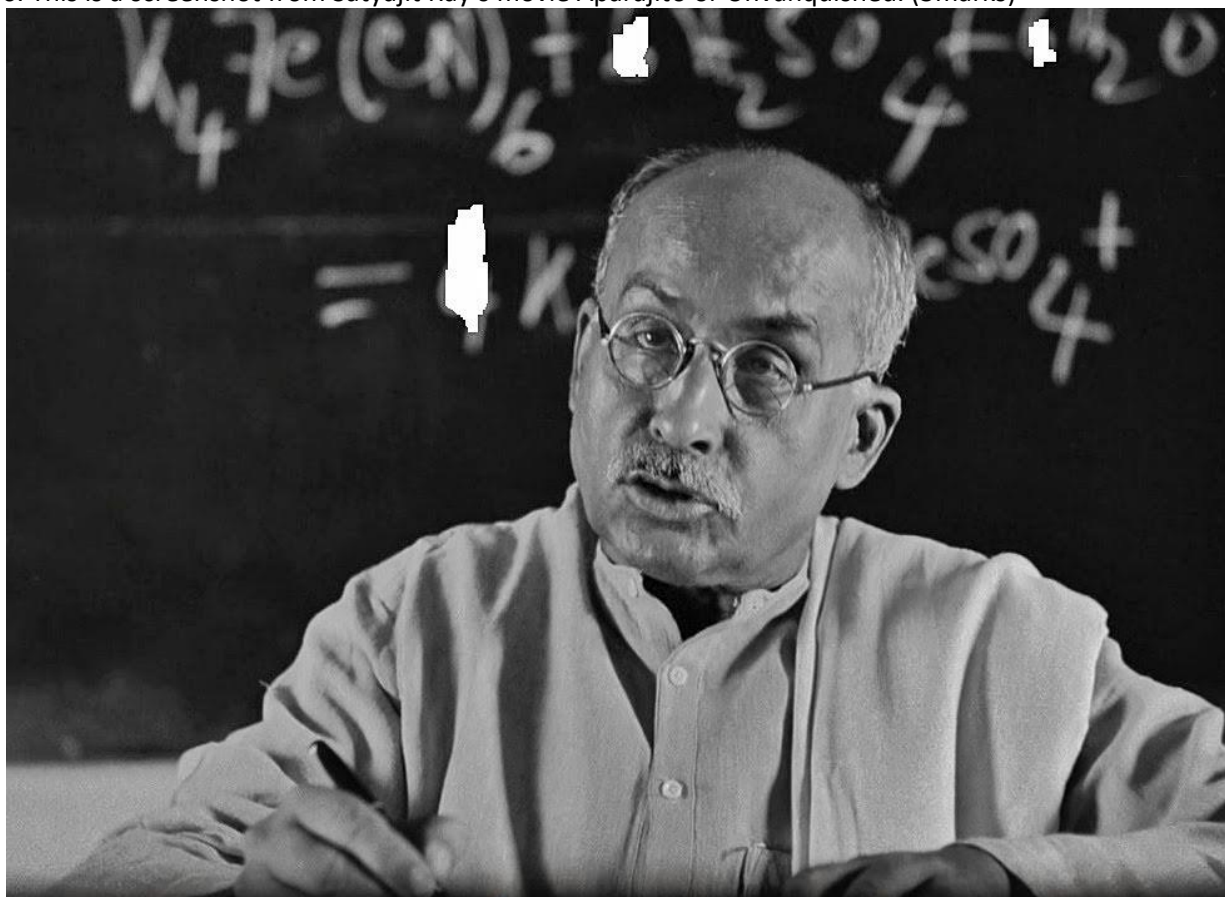
d. $\text{Ag} (\text{s}) + \text{HNO}_3 (\text{aq}) \rightarrow \text{AgNO}_3 (\text{aq}) + \text{H}_2 (\text{g})$ — Single Displacement Reaction

iv. Why is the mark of indelible ink impossible to wash off with water, soap, or organic solvents?

- a. Silver nitrate dissolves completely in water to form a permanent solution on skin cells.
b. It forms insoluble metallic silver and silver chloride complexes bound to skin keratin.
c. Alcohol in the ink corrodes the top layer of skin permanently.
d. It forms a soluble salt with epidermal lipids that repels liquid water.

HIGHER ORDER THINKING SKILL (HOTS)

6. This is a screenshot from Satyajit Ray's movie Aparajito or Unvanquished. (3marks)



balance the given chemical equation:



7. A white solid compound X, which forms the chief constituent of limestone and marble, is strongly heated in a kiln. It undergoes thermal decomposition to give a white solid Y and a colourless gas G. When water is added vigorously to solid Y, a large amount of heat is evolved with a hissing sound, producing a compound Z. An aqueous suspension/solution of compound Z is applied to walls during whitewashing. After 2 to 3 days, it reacts with gas G present in the atmosphere to give a shiny white coating of compound X back on the walls.

i. Identify X, Y, Z, and G. 2 marks

ii. Write balanced chemical equation of decomposition reaction of X. 1mark

SECTION C: PHYSICS

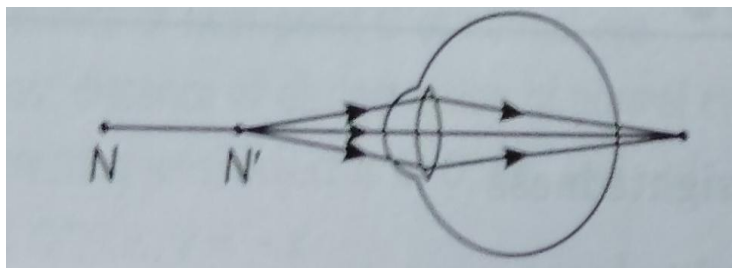
HIGHER ORDER THINKING SKILL (HOTS)

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

(i) Name the defect of vision depicted in the diagram stating the part of the eye responsible for this condition.

(ii) List two causes of this defect.

(iii) Name the type of the lens used to correct this defect. [1+1+1]



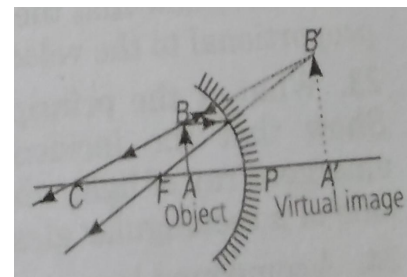
9. A current of 1 ampere is drawn by a filament of an electric bulb. Find the number of electrons passing through the cross-section of the filament in 16 seconds. [2]

CASE BASED STUDY

10. Read the following passage carefully and answer the questions that follow:

A spherical mirror in which the outer bulged surface is silvered polished and the reflection of light takes place from the inner surface is called a concave mirror.

The formula $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$ is applicable to all concave and convex mirrors, whether the image formed is real or virtual. A concave mirror is used as shaving or make-up mirror. It forms a magnified and erect image of the face when it is held closer to the face. [5]



i. An object is placed 10 cm in front of a concave mirror of radius of curvature 15 cm. Find the focal length of the concave mirror.

(a) -30 cm (b) +30 cm (c) -7.5 cm (d) +7.5 cm

ii. In the above question (question no. i), find the position of the image formed.

(a) -30 cm (b) +30 cm (c) -7.5 cm (d) +7.5 cm

iii. An object 20 cm from a spherical mirror gives rise to a virtual image 15 cm behind the mirror. State the type of the mirror. (a) concave (b) convex (c) plano-concave (d) convexo-concave

iv. In the above question (question no. iii), find the focal length of the mirror.

(a) -30 cm (b) +30 cm (c) -60 cm (d) +60 cm

v. Two concave mirrors have the same focal length but the aperture of one is larger than that of the other. Which mirror forms the sharper image? (a) the mirror having less aperture (b) the mirror having large aperture (c) both of them will form image of same sharpness (d) it does not depend upon the aperture

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