

## PART – A: PHYSICS

### I. Multiple Choice Questions ( $3 \times 1 = 3$ marks)

Q.No.    Answer    Explanation

1            (B) Rear view mirrors of vehicles

Convex mirrors provide a wider field of view and always form erect, diminished images

2            (A) Refraction of light

Atmospheric refraction bends sunlight, making the sun appear above the horizon when it's actually below

3            (C)  $90^\circ$

Maximum force (and displacement) occurs when current is perpendicular to magnetic field ( $F = BIL \sin \theta$ ,  $\sin 90^\circ = 1$ )

### II. Answer the following ( $3 \times 1 = 3$ marks)

4. Symbol diagram of resistor:

——

or

——

5. Justification: Two magnetic field lines never intersect because if they did, it would mean two different directions of magnetic field at the point of intersection, which is impossible. A magnetic field at any point can have only one direction.

6. Direction of magnetic field:

- At point P: Perpendicular to the plane of paper, going INWARDS (clockwise current  $\rightarrow$  into the page)

- At point Q: Perpendicular to the plane of paper, coming OUTWARDS (clockwise current  $\rightarrow$  out of the page)

[Use right-hand thumb rule: thumb along current, fingers curl in direction of B-field]

### III. Answer the following ( $2 \times 2 = 4$ marks)

7. Newton's Experiment - Recombination of Spectrum:

Newton passed white light through a prism to obtain the seven-color spectrum (VIBGYOR). He then placed an inverted second prism near the first prism. The seven colors recombined to form white light on a screen, proving that:

- White light consists of seven colors

- Prism only separates the colors, doesn't create them

#### 8. Differences between Myopia and Hypermetropia:

Feature Myopia (Near-sighted) Hypermetropia (Far-sighted)

Defect Can see near objects clearly, not distant objects Can see distant objects clearly, not near objects

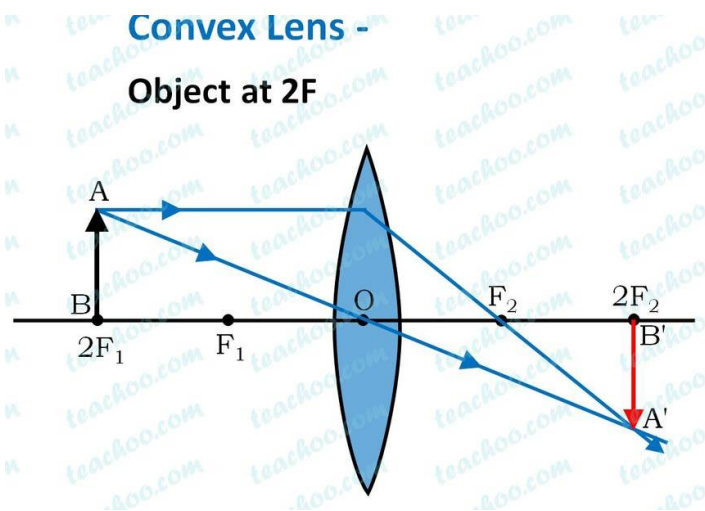
Cause Eyeball too long or lens too curved Eyeball too short or lens too flat

Correction Concave (diverging) lens Convex (converging) lens

Image formation Image forms in front of retina Image forms behind retina

#### IV. Answer the following ( $3 \times 3 = 9$ marks)

##### 9. Ray diagram for object at $2F_1$ of convex lens:



- Position: At  $2F_2$  on the other side

- Nature: Real, inverted, same size as object

10. a) Ohm's Law: At constant temperature, the current (I) flowing through a conductor is directly proportional to the potential difference (V) across its ends

$$V = IR \quad \text{or} \quad I = V/R \quad \text{or} \quad R = V/I$$

b) Factors affecting resistance:

1. Length of conductor ( $R \propto L$ )
2. Cross-sectional area ( $R \propto 1/A$ )
3. Nature of material (resistivity  $\rho$ )
4. Temperature

11. a) The closeness of field lines determines relative strength of magnetic field. Closer lines = stronger field.

b) Solenoid: A coil of many circular turns of insulated copper wire wrapped closely in the shape of a cylinder.

Electromagnet preparation: Insert a soft iron rod inside the solenoid. When current flows, the iron rod gets magnetized. The strength increases with:

- Number of turns
- Current magnitude
- Presence of soft iron core

OR

11. a) Function of earth wire: Provides a low-resistance path for leakage current to flow to the ground, preventing electric shock if live wire touches metal body of appliance.

b) Precautions to avoid overloading:

1. Avoid connecting too many appliances to a single socket
2. Use proper fuse rating for each circuit
3. Use good quality wires with proper insulation
4. Turn off appliances when not in use

V. Answer the following ( $2 \times 4 = 8$  marks)

12. a) Connections and functions:

Instrument	Connection	Function
Ammeter	In series	Measures current in the circuit
Voltmeter	In parallel	Measures potential difference across a component

b) Appliances in parallel - Reasons:

- Same voltage (220V) across all appliances
- Independent operation - one fails, others work
- Total resistance decreases, current divides appropriately
- Different power ratings can be used simultaneously

13. Given:  $R = 36$  cm (convex mirror),  $u = -27$  cm,  $h_o = 5$  cm

Solution:

- $f = R/2 = 36/2 = 18$  cm (positive for convex mirror)
- $1/f = 1/v + 1/u$

$$- \frac{1}{18} = \frac{1}{v} + \frac{1}{(-27)}$$

$$- \frac{1}{v} = \frac{1}{18} + \frac{1}{27} = \frac{(3+2)}{54} = \frac{5}{54}$$

$$- v = \frac{54}{5} = 10.8 \text{ cm (behind mirror)}$$

$$\text{Magnification: } m = -v/u = -10.8/(-27) = 0.4$$

$$\text{Image height: } h_i = m \times h_o = 0.4 \times 5 = 2 \text{ cm}$$

- Position: 10.8 cm behind the mirror (virtual)

- Nature: Virtual, erect, diminished

OR

Given:  $f = 10 \text{ cm}$  (concave),  $u = -20 \text{ cm}$ ,  $h_o = 4 \text{ cm}$

Solution:

$$- R = 2f = 20 \text{ cm}$$

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

$$- \frac{1}{(-10)} = \frac{1}{v} + \frac{1}{(-20)} \text{ [Note: } f \text{ is negative for concave]}$$

$$- \frac{1}{v} = -\frac{1}{10} + \frac{1}{20} = \frac{(-2+1)}{20} = -\frac{1}{20}$$

$$- v = -20 \text{ cm (in front of mirror)}$$

Screen should be placed at 20 cm from mirror.

$$\text{Magnification: } m = -v/u = -(-20)/(-20) = -1$$

$$\text{Image height: } h_i = -1 \times 4 = -4 \text{ cm (negative = inverted)}$$

- Nature: Real, inverted, same size as object

## PART – B: CHEMISTRY

VI. Multiple Choice Questions ( $2 \times 1 = 2$  marks)

Q.No.    Answer Explanation

14        (B) Form insoluble precipitate in hard water        Soaps react with  $\text{Ca}^{2+}/\text{Mg}^{2+}$  in hard water to form insoluble scum (precipitate)

15        (D) Copper oxide is reduced to form copper        CuO loses oxygen (reduction),  $\text{H}_2$  gains oxygen (oxidation)

VII. Answer the following ( $2 \times 1 = 2$  marks)

16. Prevention of corrosion:

1. Painting or coating with oil/grease
2. Galvanization (coating with zinc)
3. Electroplating with non-corroding metals
4. Alloying (e.g., stainless steel)

17. Dilution of concentrated acid:

- Always add acid to water, never water to acid
- Add slowly with constant stirring
- Use glass rod for stirring
- Use cooling if necessary (exothermic reaction)

VIII. Answer the following ( $3 \times 2 = 6$  marks)

18. Rancidity: Oxidation of fats and oils in food materials by atmospheric oxygen, causing unpleasant smell and taste.

Prevention methods:

1. Adding antioxidants (e.g., BHA, BHT)
2. Storing in airtight containers
3. Refrigeration
4. Flushing with nitrogen gas
5. Adding vitamin E

19. a) Zinc oxide is amphoteric: It reacts with both acids and bases:

- With acid:  $\text{ZnO} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2\text{O}$
- With base:  $\text{ZnO} + 2\text{NaOH} \rightarrow \text{Na}_2\text{ZnO}_2 + \text{H}_2\text{O}$

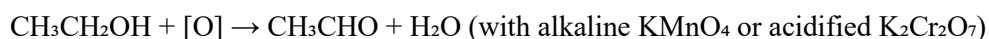
b) Sodium stored in kerosene: Sodium is highly reactive and reacts vigorously with air (oxygen) and moisture. Kerosene prevents contact with air/moisture.

OR

19. a) Gold for jewellery: Gold is highly malleable, ductile, does not tarnish (unreactive), and has attractive luster.

b) Ionic compounds don't conduct in solid state: Ions are fixed in position in solid state and cannot move. In molten/aqueous state, ions are free to move and conduct electricity.

20. Oxidation of ethanol:

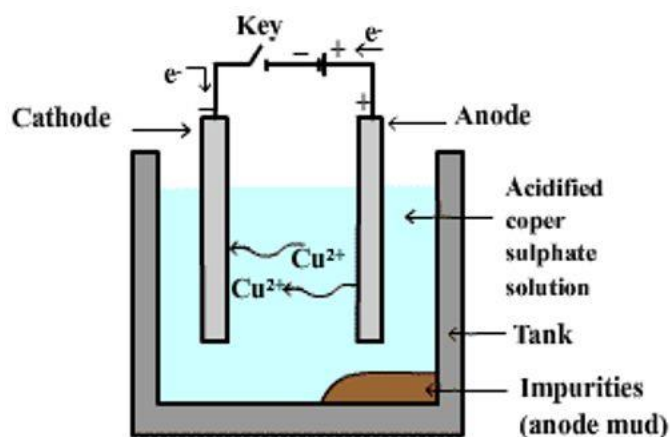


Ethanol      Ethanal (Acetaldehyde)

- Reagent 1: Alkaline  $\text{KMnO}_4$  + Heat
- Reagent 2: Acidified  $\text{K}_2\text{Cr}_2\text{O}_7$  + Heat
- Product: Ethanal/Acetaldehyde
- Functional group: Aldehyde group ( $-\text{CHO}$ )

IX. Answer the following ( $2 \times 3 = 6$  marks)

21. Electrolytic refining of copper:



[Diagram description]

- Anode: Impure copper block
- Cathode: Pure copper strip
- Electrolyte: Acidified copper sulphate solution
- Battery connected with anode to positive, cathode to negative

Labeling:

- i) Cathode: Pure copper strip (where pure Cu deposits)
- ii) Anode: Impure copper block (dissolves)

Reactions:

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

22. Chemical equations:

- i)  $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2$  (Quicklime + Water  $\rightarrow$  Slaked lime)
- ii)  $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$  (Displacement reaction, blue to colorless)
- iii)  $\text{NaCl} + \text{AgNO}_3 \rightarrow \text{AgCl}\downarrow + \text{NaNO}_3$  (White precipitate of silver chloride)

OR

Balanced equations:

- i)  $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
- ii)  $\text{Na}_2\text{CO}_3 + 2\text{HCl} \rightarrow 2\text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$
- iii)  $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$

X. Answer the following ( $1 \times 4 = 4$  marks)

23. a) Bleaching powder preparation:

- Materials used:  $\text{Ca(OH)}_2$  (slaked lime) +  $\text{Cl}_2$  (chlorine gas)

- Reaction:  $\text{Ca(OH)}_2 + \text{Cl}_2 \rightarrow \text{CaOCl}_2 + \text{H}_2\text{O}$

- Chemical name: Calcium oxychloride

- Use: Bleaching clothes, disinfecting water, bleaching wood pulp in paper industry

b) i) Identifying basic solution with blue litmus: Blue litmus paper remains blue in basic solution (turns red in acid, no change in base).

ii) Condition for using slaked lime: When soil becomes too acidic ( $\text{pH} < 6.5$ ) due to excessive use of chemical fertilizers or acid rain.

XI. Answer the following ( $1 \times 5 = 5$  marks)

24. a) Differences between saturated and unsaturated compounds:

Saturated          Unsaturated

Single bonds only (C-C) Double or triple bonds (C=C, C $\equiv$ C)

Less reactive      More reactive

General formula:  $\text{C}_n\text{H}_{2n+2}$  (alkanes)          General formula:  $\text{C}_n\text{H}_{2n}$  (alkenes),  $\text{C}_n\text{H}_{2n-2}$  (alkynes)

Undergo substitution reactions      Undergo addition reactions

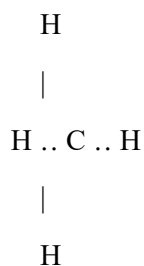
b) Structural isomers: Compounds with same molecular formula but different structural arrangements.

Structural isomers of butane ( $\text{C}_4\text{H}_{10}$ ):

1. n-butane:  $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_3$  (straight chain)

2. Isobutane:  $\text{CH}_3\text{-CH(CH}_3\text{)-CH}_3$  or  $(\text{CH}_3)_3\text{CH}$  (branched)

c) Electron dot structure of methane ( $\text{CH}_4$ ):



Or showing all valence electrons:



H · · C · · H

.

H

## PART – C: BIOLOGY

### XII. Multiple Choice Questions ( $3 \times 1 = 3$ marks)

Q.No.	Answer	Explanation
25	(C) DNA	DNA contains genetic information for protein synthesis
26	(A) Undersecretion of thyroxine hormone	Swelling of neck (goiter) is caused by iodine deficiency leading to low thyroxine
27	(D) Fragmentation	Spirogyra breaks into fragments, each grows into new organism

### XIII. Answer the following ( $3 \times 1 = 3$ marks)

28. Function of ozone layer: Absorbs harmful UV radiation from the sun, protecting living organisms from skin cancer, eye damage, and genetic mutations.

29. Neuron: A nerve cell that is the basic functional unit of the nervous system. It consists of:

- Cell body (soma)
- Dendrites (receive signals)
- Axon (transmits signals)

30. Correct order of photosynthesis events:

Order    Event

- 1        ii) Absorption of light energy by chlorophyll
- 2        iv) Conversion of light energy to chemical energy
- 3        i) Splitting of water molecules into hydrogen and oxygen
- 4        iii) Conversion of carbon dioxide to carbohydrates

### XIV. Answer the following ( $3 \times 2 = 6$ marks)

31. Auxins and tendril growth:

- Auxins are plant hormones produced at the shoot tip
- When tendril touches a support, auxins accumulate on the opposite side
- Higher auxin concentration causes more cell elongation on that side
- This differential growth causes the tendril to coil around the support

OR

Body response to adrenaline:



- Heart beats faster
- Breathing rate increases
- Blood pressure rises
- Blood diverted to essential organs (muscles, heart, brain)
- Liver releases glucose for energy
- Prepares body for "fight or flight" response

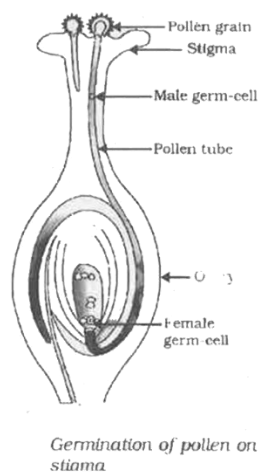
32. Food chain:

Grass → Grasshopper → Frog → Snake

(Producer) (Primary Consumer) (Secondary Consumer) (Tertiary Consumer)

-Snake has maximum accumulation of harmful chemicals (biomagnification - toxins increase at higher trophic levels)

33. Diagram - Germination of pollen on stigma:



Label: Ovary - The swollen basal part of the pistil containing ovules.

XV. Answer the following ( $4 \times 3 = 12$  marks)

34. Enzymes in alimentary canal:

Enzyme	Source	Function
Trypsin	Pancreas	Digests proteins into peptides in small intestine
Amylase	Salivary glands, Pancreas	Converts starch into maltose (salivary) and further digestion (pancreatic)
Lipase	Pancreas, Small intestine	Digests fats into fatty acids and glycerol

35. a) Sexual reproduction leads to more variations:

- Involves two parents with different genetic makeup
- Crossing over during meiosis creates new gene combinations
- Random fusion of gametes adds variation
- Essential for evolution and adaptation

b) Significance of placenta:

- Provides nutrition to embryo from mother's blood
- Removes waste products from embryo
- Exchange of respiratory gases ( $O_2$  and  $CO_2$ )
- Produces hormones (hCG, progesterone) to maintain pregnancy
- Protects embryo from mechanical shocks and infections

OR

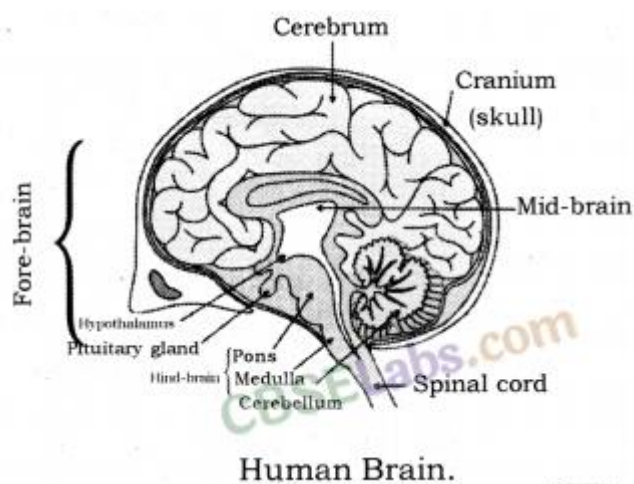
35. a) Menstruation:

- If egg is not fertilized, corpus luteum degenerates
- Progesterone and estrogen levels drop
- Uterine lining (endometrium) breaks down
- Blood, mucus, and tissue discharged through vagina
- Lasts 3-5 days; cycle repeats every 28 days

b) Testes outside abdominal cavity:

- Sperm production requires  $2-3^\circ C$  lower temperature than body temperature
- Scrotum maintains this lower temperature
- If inside body, sperm production would be impaired leading to infertility

36. Diagram of human brain:



- i) Hypothalamus: Controls body temperature, hunger, thirst, sleep, emotions; links nervous and endocrine systems

- ii) Medulla: Controls involuntary actions like heartbeat, breathing, blood pressure, vomiting, salivation

XVI. Answer the following ( $1 \times 4 = 4$  marks)

37. Dihybrid cross:  $RRyy$  (Round green)  $\times$   $rrYY$  (Wrinkled yellow)

$F_1$  generation: All  $RrYy$  (Round yellow)

$F_2$  generation ( $RrYy \times RrYy$ ):

	$RY$	$Ry$	$rY$	$ry$
$RY$	$RRYY$	$RRYy$	$RrYY$	$RrYy$
$Ry$	$RRYy$	$RRyy$	$RrYy$	$Rryy$
$rY$	$RrYY$	$RrYy$	$rrYY$	$rrYy$
$ry$	$RrYy$	$Rryy$	$rrYy$	$rryy$

Phenotypic ratio: 9:3:3:1

- 9 Round yellow ( $R\_Y$ )
- 3 Round green ( $R\_yy$ )
- 3 Wrinkled yellow ( $rrY$ )
- 1 Wrinkled green ( $rryy$ )

OR

37. a) Sex determination in humans:

- Females:  $XX$  (homogametic - produce only X eggs)
- Males:  $XY$  (heterogametic - produce 50% X and 50% Y sperm)
- If X sperm fertilizes egg  $\rightarrow XX$  (Female)
- If Y sperm fertilizes egg  $\rightarrow XY$  (Male)
- Father determines sex of the child

b) Determining dominant/recessive traits:

- Dominant: Expressed in both homozygous ( $TT$ ) and heterozygous ( $Tt$ ) conditions; appears in  $F_1$  generation; masks other trait
- Recessive: Expressed only in homozygous condition ( $tt$ ); suppressed in  $F_1$ ; reappears in  $F_2$  in 3:1 ratio

38. a) Role of haemoglobin:

- Red pigment in RBCs
- Has high affinity for oxygen
- Transports O<sub>2</sub> from lungs to body tissues
- Transports CO<sub>2</sub> from tissues to lungs (as carbaminohemoglobin)
- Contains iron (Fe<sup>2+</sup>) which binds to oxygen

b) Excretion strategies in plants:

1. Transpiration: Loss of water vapor through stomata (removes excess water)
2. Storing waste: In vacuoles, leaves (fall off), bark, or wood
3. Resin and gum: Excreted through bark (e.g., rubber, resin)
4. Abscission: Shedding of leaves containing waste products
5. Diffusion: Release of O<sub>2</sub> (byproduct of photosynthesis) and CO<sub>2</sub>