बोर्ड परीक्षा परिणाम उन्नयन हेतु ऐतिहासिक पहल ...

शेखावाटी मिशन 100

2026

(Class X)

SCIENCE

विभिन्न विषयों की नवीनतम बुकलेट डाउनलोड करने हेतु टेलीग्राम QR CODE स्कैन करें

पढ़ेगा राजस्थान

बढ़ेगा राजस्थान

कार्यालय: संयुक्त निदेशक स्कूल शिक्षा, चूरू संभाग, चूरू (राज.)

संयोजक कार्यालय - संयुक्त निदेशक कार्यालय, चूरू संभाग, चूरू

शेखावाटी मिशन - 100 मार्गदर्शक

संगीता मानवी
संयुक्त निदेशक (स्कूल शिक्षा)
चूरू संभाग, चूरू

महेन्द्र सिंह बड़सरा
संभागीय कॉडिनेटर, शेखावाटी मिशन 100
संयुक्त निदेशक कार्यालय, चूरू संभाग, चूरू

संकलनकर्ता टीम : विज्ञान

रामावतार भदाला
रा.उ.मा.वि. - मदनी
(सीकर)

संजय कुमार पूनियां
रा.उ.मा.वि. - हामुसर
(चुरू)

दिनेश कुमार सैनी
शहीद सरफुद्दीन रा.उ.मा.वि.
पिपराली, (सीकर)

अनिल कुमार
महात्मा गांधी राजकीय विद्यालय
सादुलपुर (चूरू)

पूनम खेदड़
महात्मा गांधी राजकीय विद्यालय, चिराना
नवलगढ़ (झुंझुनू)

सांवर मल सिंहमार
रा.उ.मा.वि. - भारीजा
(सीकर)

कार्यालय: संयुक्त निदेशक स्कूल शिक्षा, चूरू संभाग, चूरू (राज.)

प्रश्न–पत्र की योजना 2025–2026

कक्षा – 10th
विषय – विज्ञान
अवधि – 3 घंटा 15 मिनट पूर्णांक – 80

1. उद्देश्य हेतु अंकभार –

क्र.सं.	उद्देश्य	अंकभार	प्रतिशत
1.	ज्ञान	23	28.75
2.	अवबोध	24	30
3.	ज्ञानोपयोग	17	21.25
4.	कौशल	08	10
5.	विश्लेषण	08	10
योग		20	100

2. प्रश्नों के प्रकार वार अंकभार –

क्र.सं.	प्रश्नों का प्रकार	प्रश्नों की संख्या	अंक प्रति प्रश्न	कुल अंक	प्रतिशत (अंको का)	प्रतिशत (प्रश्नों का)	संभावित समय
1.	बहुविकल्पात्मक	18	1	18	22.5	33.97	20
2.	रिक्त स्थान	6	1	6	7.5	11.33	15
3.	अतिलघुत्तरात्मक	12	1	12	15.00	22.64	25
4.	लघुत्तरात्मक	10	2	20	25.00	18.86	35
5.	दीर्घउत्तरीय	4	3	12	15.00	7.54	50
6.	निबंधात्मक	3	4	12	15.00	5.66	50
	योग	53		80	100	100	195 मिनट

विकल्प योजना : खण्ड 'स' एवं 'द' में हैं

3. विषय वस्तु का अंकभार –

क्र.सं.	विषय वस्तु	अंकभर	प्रतिशत
1.	रासायनिक अभिक्रियाएँ एवं समीकरण	6	7.50
2.	अम्ल, क्षारक एवं लवण	7	8.75
3.	धातु एवं अधातु	5	6.25
4.	कार्बन एवं उसके यौगिक	7	8.75
5.	जैव प्रक्रम	8	10.00
6.	नियंत्रण एव समन्वय	6	7.50
7.	जीव जनन कैसे करते है	7	8.75
8.	आनुवंशिकता	4	5.00
9.	प्रकाश परावर्तन, तथा अपवर्तन	8	10.00
10.	मानव नेत्र तथा रंग–बिरंगा संसार	4	5.00
11.	विद्युत	7	8.75
12.	विद्युत धारा के चुम्बकीय प्रभाव	6	7.50
13.	हमारा पर्यावरण	5	6.25
	योग	80	100

प्रश्न–पत्र ब्ल्यू प्रिन्ट 2025–2026

कक्षा – 10th विषय :– विज्ञान समय : 3 घंटा 15 मिनट पूर्णांक – 80

क्र.सं.	उद्देश्य इकाई / उप इकाई	ज्ञान						अवबोध						ज्ञानोपयोग						कौशल						विश्लेषण						योग
		बहुविकल्पात्मक	रिक्त स्थान	अतिलघुत्तरात्मक	लघुत्तरात्मक	दीर्घउत्तरात्मक	निबंधात्मक	बहुविकल्पात्मक	रिक्त स्थान	अतिलघुत्तरात्मक	लघुत्तरात्मक	दीर्घउत्तरात्मक	निबंधात्मक	बहुविकल्पात्मक	रिक्त स्थान	अतिलघुत्तरात्मक	लघुत्तरात्मक	दीर्घउत्तरात्मक	निबंधात्मक	बहुविकल्पात्मक	रिक्त स्थान	अतिलघुत्तरात्मक	लघुत्तरात्मक	दीर्घउत्तरात्मक	निबंधात्मक	बहुविकल्पात्मक	रिक्त स्थान	अतिलघुत्तरात्मक	लघुत्तरात्मक	दीर्घउत्तरात्मक	निबंधात्मक	
1.	रासायनिक अभिक्रियाएँ एवं समीकरण	1(1)						1(1)		1(1)								3(1)*														6(4)
2.	अम्ल, क्षारक एवं लवण								1(1)				2(1)*		1(1)							1(1)									2(-)*	7(4)
3.	धातु एवं अधातु			1(1)													2(1)									1(2)						5(4)
4.	कार्बन एवं उसके यौगिक	1(2)										3(1)*											2(1)									7(4)
5.	जैव प्रक्रम		1(1)				2(-)*		1(1)								2(1)								2(1)*							8(4)
6.	नियंत्रण एवं समन्वय	1(1)		1(1)				1(1)			2(1)					1(1)																6(5)
7.	जीव जनन कैसे करते है	1(2)									2(1)	3(1)*																				7(4)
8.	आनुवंशिकता		1(2)	1(1)																		1(1)										4(4)
9.	प्रकाश परावर्तन, तथा अपवर्तन			1(2)			3(-)*										2(1)														2(1)*	8(4)
10.	मानव नेत्र तथा रंग–बिरंगा संसार	1(2)																											2(1)			4(3)
11.	विद्युत	1(2)																3(1)*					2(1)									7(4)
12.	विद्युत धारा के चुम्बकीय प्रभाव			1(1)				1(2)			2(1)					1(1)																6(5)
13.	हमारा पर्यावरण									1(1)	2(1)			1(2)																		5(4)
		10(10)	3(3)	6(6)			4(-)	4(4)	2(2)	3(3)	8(4)	6(2)	2(1)	2(2)	1(1)	2(2)	6(3)	6(2)				2(2)	4(2)		2(1)	2(2)			2(1)		4(1)	80(53)
	सर्वयोग	23(19						24(15						17(10)						8(5)						8(4)						80(53)

विकल्पों की योजना :– खण्ड 'स' एवं 'द' में प्रत्येक में एक आंतरिक विकल्प है नोट:– कोष्ठक के बाहर की संख्या 'अंकों' की तथा अंदर की संख्या 'प्रश्नों' के द्योतक है।

बोर्ड परीक्षा परिणाम उन्नयन हेतु ऐतिहासिक पहल ...

शेखावाटी मिशन 100

2026

विभिन्न विषयों की नवीनतम बुकलेट PDF डाउनलोड करने हेतु टेलीग्राम QR CODE स्कैन करें

विभिन्न विषयों की नवीनतम बुकलेट
डाउनलोड करने हेतु टेलीग्राम
QR CODE स्कैन करें

पढ़ेगा राजस्थान
बढ़ेगा राजस्थान

कार्यालय: संयुक्त निदेशक स्कूल शिक्षा, चूरू संभाग, चूरू (राज.)

Shekhawati Mission - 100

Secondary Examination - 2026

Model Question Paper

Subject – Science **Session 2025-26** **Class - 10**

Time: 3 hours 15 minutes Marks - 80

Instructions for examinees:-

1. Examinees must first write their roll number on their question paper.
2. All questions are compulsory.
3. The answer to each question should be written in the given answer book only.
4. If questions have internal sections, write all their answers together.
5. Before writing the answer to the question, definitely write the question number.

Section - A

(1) Multiple Choice Questions

(i) The process of a black layer forming on silver in the atmosphere is-

(1) Reduction (2) Corrosion (3) Rancidity (4)Double displacement ( )

(ii) $Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$ What type of reaction is the given reaction-

(1) Combination reaction (2) Double displacement reaction

(3) Decomposition reaction (4) Displacement reaction ( )

(iii) An element Q is soft and can be easily cut with a knife. The element reacts quickly with cold water. Identify the element from the following.

(1) K (2) Ag (3) Cu (4) Pb ( )

(iv) Food items are coated with tin instead of zinc. Because

(1) Zinc is more expensive than tin. (2) Zinc has a higher melting point than tin.

(3) Zinc is more reactive than tin. (4) Zinc is less reactive than tin. ( )

(v) What is the formula for cyclopentane?

(1) C_6H_{12} (2) C_6H_{10} (3) C_5H_{10} (4) C_4H_8 ( )

(vi) How many double bonds are there in the structure of benzene?

(1) One (2) Three (3) Four (4) None ( )

(vii) What is the site of fertilization in humans?

(1) Fallopian tube (2) Ovary (3) Uterus (4) Seminal vesicle ( )

(viii) What is the method of reproduction in amoeba?

(1) Fission (2) Regeneration (3) Spore formation (4) None ( )

(ix) In which part of the brain are the centers for hearing, smelling, seeing, and hunger located?

(1) Forebrain (2) Midbrain (3) Hindbrain (4) None ( )

(x) Where do reflex arcs form?

(1) Brain (2) Stomach (3) Spinal cord (4) Ovary ( )

(xi) Light enters the eye through a thin membrane, which is called-

(1) Cornea (2) Retina (3) Iris (4) Vitreous humor ( )

(xii) The reason for advanced sunrise and delayed sunset is-

(1) Scattering (2) Atmospheric refraction (3) Dispersion (4) Reflection ( )

(xiii) What will be the resistance of the filament of a 100W - 220V electric bulb?

(1) 900 Ohm (2) 320 Ohm (3) 484 Ohm (4) 100 Ohm ( )

(xiv) What is the S.I. unit of energy?

(1) Calorie (2) Joule (3) Coulomb (4) Ohm ( )

(xv) What is the direction of the magnetic field inside a solenoid?

(1) North to South (2) South to North (3) East to West (4) West to East ( )

(xvi) What is the potential difference between the live wire and the neutral wire in our country?

(1) 260 V (2) 240 V (3) 200 V (4) 220 V ( )

(xvii) In a food chain, how much energy is transferred from one trophic level to another trophic level?

(1) 50% (2) 5% (3) 10% (4) 100% ( )

(xviii) Consumers are mainly divided into-

(1) Herbivores (2) Carnivores (3) Omnivores (4) All of the above ( )

(2) Fill in the blanks (i to vi)

(i) The atmosphere of ..... planet is made up of yellow-white clouds of sulfuric acid.

(ii) ..... acid is found in curd.

(iii) The name of the instrument for measuring blood pressure is .....

(iv) The functional unit of heredity is .....

(v) The number of sex chromosomes in humans is .....

(vi) Amoeba takes food with the help of .....

(3) Very Short Answer Questions: (i to xii)

(Answer the following questions in one word or one line.)

(i) Write the chemical name of marble.

(ii) Write the names of two synthetic indicators.

(iii) What is the nature of a non-metallic oxide?

(iv) What type of movement is shown by the growth of the pollen tube towards the ovule?

(v) What is a reflex action?

(vi) What is the genotypic ratio of the F_2 generation of a monohybrid cross?

(vii) What is the definition of genotype?

(viii) What is the magnification of a lens called?

(ix) Write Snell's law.

(x) Why do two magnetic field lines not intersect each other?

(xi) How does short circuit happen?

(xii) Define an ecosystem.

Section - B

Short Answer Questions -

(4) Define roasting and calcination.

(5) Draw the electron dot structure of methane.

(6) Explain the role of pancreatic juice in the digestion of food.

(7) How does pollen germinate on the stigma?

(8) Write the name and function of the hormone secreted by the pituitary gland.

(9) Write the laws of reflection of light.

(10) Why don't planets twinkle?

(11) Draw the electric circuit of resistors connected in parallel.

(12) Write Fleming's right-hand rule.

(13) Write the difference between biodegradable and non-biodegradable substances.

Section - C

(14) What is an exothermic chemical reaction called? Explain with an example.

OR

In the reaction $CuO + H_2 \rightarrow Cu + H_2O$, which substance is being oxidized and reduced? Give another example of this type of reaction.

(15) (i) Write the full form of IUPAC.
(ii) Explain esterification reaction with an example.

OR

(i) What are saturated hydrocarbons called?
(ii) Write the differences between soap and detergent.

(16) (i) What are sexually transmitted diseases called?
(ii) What happens when an egg is not fertilized?

OR

(i) What is binary fission called?
(ii) Differentiatebetween a unisexual flower and a bisexual flower.

(17) (i) Define one ohm.
(ii) On what factors does the resistance of a conductor wire depend?

OR

(i) What is resistance called?
(ii) 100 J of heat is produced every second in a 4Ω resistor. Find the potential difference across the ends of the resistor.

Section - D

Essay Questions -

(18) (i) Explain tooth decay due to pH change.
(ii) What is the chlor-alkali process? Give its equation.

OR

(i) What is a neutralization reaction called? Also give its equation.
(ii) Write the method of preparation of baking soda and its uses.

(19) (i) Define digestion.
(ii) Explain the process of digestion in the small intestine.
(iii) Draw a labeled diagram of the human respiratory system.

OR

(i) Define life process.
(ii) Explain the mechanism of respiration in the human body.
(iii) Draw a labeled diagram of the human excretory system.

(20) (i) Differentiatebetween convex and concave mirrors.
(ii) Draw a ray diagram showing the formation of an image by a convex lens when the object is located between F_1 and $2F_1$.

OR

(i) Write the laws of refraction of light.
(ii) Draw a ray diagram of an image formed by a concave mirror when the object is between C and F.

1. Chemical Reaction and Equation

(Marks Weightage = **6**) Question -4= MCQ-2, very short-1, long Ans type-1

1. Consider the following chemical equation:

$$pAl + qH_2O \longrightarrow rAl_2O_3 + sH_2$$

To balance this chemical equation, the values of 'p', 'q', 'r', and 's' should be, respectively:

(A) 3, 2, 2, 1 (B) 2, 3, 3, 1
(C) 2, 3, 1, 3 (D) 3, 1.2, 2 (C)

2. Which of the following is a thermal decomposition reaction?

(i) $2AgCl \longrightarrow 2Ag + Cl_2$
(ii) $CaCO_3 \longrightarrow CaO + CO_2$
(iii) $2H_2O \longrightarrow 2H_2 + O_2$
(iv) $2KClO_3 \longrightarrow 2KCl + 3O_2$

(A) (i) and (ii) (B) (ii) and (iii)
(C) (iii) and (iv) (D) (ii) and (iv) (D)

3. Which statement is true regarding the reaction given below?

$$2PbO + C \longrightarrow 2Pb + CO_2$$

(1) Lead is being oxidized
(2) Carbon dioxide is being oxidized
(3) Carbon is being oxidized
(4) Lead oxide is being reduced (RBSE 2025)

(A) 1, 2 (B) only (1)
(C) only (B) (D) 3, 4 (D)

4. $Fe + H_2O \longrightarrow Fe_3O_4 + H_2$ (RBSE 2024)

The coefficient of Fe in the balanced equation of the above reaction will be –

(A) 1 (B) 2 (C) 3 (D) 4 (C)

5. The process of a black layer forming on silver in the atmosphere is (RBSE 2022)

(A) reduction (B) corrosion
(C) rancidity (D) double displacement (B)

6. $2Mg + O_2 \longrightarrow 2MgO$ **The reaction of combustion of magnesium is an example of what type of reaction?** (RBSE 2022)

(A) decomposition (B) displacement
(C) combination (D) none of these (C)

7. $Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Fe$

What type of reaction is given above?

(A) combination (B) double displacement
(C) decomposition (D) displacement (D)

8. What happens when dilute HCl acid is added to iron filings, select the correct option -(Model Paper 2026)

(A) H_2 gas and $FeCl_2$ are formed
(B) Cl_2 gas and $Fe(OH)_3$ are formed
(C) no reaction occurs
(D) iron salt and water are formed (A)

9. In a chemical reaction, the substances that undergo a chemical change are called-

(A) products (B) reactants
(C) catalysts (D) none of these (B)

10. What is the general method for balancing chemical equations called?

(A) hit and trial (B) displacement
(C) combination (D) none of these (A)

11. What is the chemical formula of marble?

(A) CaO (B) $Ca(OH)_2$
(C) $CaCO3$ (D) $CaCl_2$ (C)

12. Before burning in air, the magnesium ribbon is cleaned with sandpaper to remove the layer of:

(A) Magnesium chloride
(B) Basic magnesium carbonate/oxide
(C) Magnesium sulphide
(D) Magnesium nitrate (B)

13. Fatty foods become rancid and smell bad when kept for a long time. This is due to:

(A) Oxidation (B) Reduction
(C) Displacement (D) Hydrogenation (A)

14. Which of the following is an example of an Exothermic reaction?

(A) Photosynthesis (B) Respiration
(C) Decomposition of silver chloride
(D) Electrolysis of water (B)

15. When carbon dioxide gas is passed through lime water, it turns milky due to the formation of:

(A) Calcium oxide
(B) Calcium carbonate ($CaCO3$)
(C) Calcium hydroxide
(D) Calcium bicarbonate (B)

16. Which gas is filled in bags of potato chips to prevent them from getting oxidized?

(A) Oxygen (B) Chlorine
(C) Hydrogen (D) Nitrogen (D)

17. A chemical equation is balanced to satisfy the:

(A) Law of conservation of energy
(B) Law of conservation of mass
(C) Law of constant proportions
(D) Law of momentum (B)

18. The brown-coloured gas evolved during the thermal decomposition of lead nitrate[$Pb(NO_3)_2$] is-

(A) $O2$ (B) N_2 (C) NO_2 (D) N_2O (C)

19. When silver chloride is kept in sunlight, it turns grey due to the formation of:

(A) Silver oxide (B) Silver metal
(C) Silver sulphide (D) Chlorine gas (B)

20. The reaction in which two different atoms or groups of atoms are exchanged is called:

(A) Displacement reaction
(B) Combination reaction
(C) Double displacement reaction
(D) Oxidation reaction (C)

Q1: What colour layer gets deposited on the outer surface of copper when exposed to moist air?
Ans: A greenish layer (due to the formation of basic copper carbonate).

Q2: Which gas is used to preserve oily and fatty food items for a long time?
Ans: Nitrogen gas (it prevents oxidation and rancidity).

Q3: Which white-coloured precipitate is formed by the reaction of sodium sulphate and barium chloride?
Ans: Barium sulphate ($BaSO_4$).

Q4: In the reaction

$$MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$$

identify the substance oxidized.
Ans: HCl is oxidized to $Cl2$ (due to the removal of hydrogen).

Q5: Slaked lime solution [$Ca(OH)_2$] is used for whitewashing. It reacts with which gas in the air to make the walls shine?
Ans: Carbon dioxide (CO_2). It forms a thin layer of calcium carbonate ($CaCO_3$).

Q6: Combustion of coal is an example of which type of reaction?
Ans: It is a Combination Reaction (it is also an Exothermic reaction). $C(s) + O_2(g) \rightarrow CO_2(g)$

Q7: When is a substance said to be oxidized in a reaction?
Ans: A substance is oxidized when there is a gain of oxygen or a loss of hydrogen.

Q8: When does the reduction of a substance occur in a reaction?
Ans: Reduction occurs when there is a loss of oxygen or a gain of hydrogen.

Q9: On burning a magnesium ribbon, it turns into a white powder. Which compound does this powder belong to?
Ans: Magnesium Oxide (MgO).

Q10: Brown-coloured smoke is emitted when lead nitrate is heated. Which substance causes this smoke?
Ans: Nitrogen Dioxide (NO_2).

Q11: Why does the blue colour of copper sulphate fade when an iron nail is inserted into the solution?
Ans: Because iron is more reactive than copper, it displaces copper from the solution to form iron sulphate (which is light green).

$$Fe(s) + CuSO4(aq) \rightarrow FeSO4\ (aq) + Cu(s)$$

The colour of an iron nail turns brown when placed in a copper sulphate solution due to the deposition of copper metal on its surface.

Q12: Why is a magnesium ribbon cleaned before burning in air?
Ans: Magnesium ribbon is cleaned (usually with sandpaper) to remove the protective layer of basic magnesium oxide from its surface so that it can react properly with oxygen.

Q13: Write the chemical equation for the decomposition reaction used in black and white photography.
Ans: $2AgBr(s) \xrightarrow{\text{Sunlight}} 2Ag(s) + Br2(g)$
(Silver chloride $2AgCl$ can also be used).

Q14: What changes can take place in a substance during a chemical reaction?
Ans- (A) Change of state (B) Change in colour (C) Emission of gas (D) Change in temperature

Q15: State the Law of Conservation of Mass.
Ans: Mass can neither be created nor destroyed in a chemical reaction. The total mass of the products must equal the total mass of the reactants.

Q16: What is the rusting of iron?
Ans: When iron articles are exposed to moisture and air for some time, they get covered with a reddish-brown flaky layer. This process is called rusting.

Q17: Write the signs of physical states in the following chemical equation:

$$\mathbf{3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2}$$

Ans: $3Fe(s) + 4H_2O(g) \rightarrow Fe_3O_4(s) + 4H_2(g)$
(Note: H_2O is written as (g) because it reacts in the form of steam).

Q18: What is a balanced chemical equation?
Ans: A chemical equation in which the number of atoms of each element is the same on both the reactant side and the product side.

Q19: Nitrogen gas combines with hydrogen gas to form ammonia. Write the chemical equation and the type of reaction.
Ans: $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$
Type: Combination Reaction.

Q20: Potassium metal reacts with water to give potassium hydroxide and hydrogen gas. Write the chemical equation.
Ans: $2K(s) + 2H_2O(l) \rightarrow 2KOH(aq) + H_2(g)$

Q21: What is a skeletal chemical equation?
Ans: An equation that represents a chemical reaction simply by using the chemical formulas of the reactants and products, without balancing the number of atoms, is called a skeletal chemical equation. Example: $Mg + O_2 \rightarrow MgO$

Q22: Which gas is liberated when dilute sulfuric acid is added to granulated zinc?
Ans: Hydrogen gas (H_2) is liberated.

$$Zn(s) + H_2SO_4(aq) \rightarrow ZnSO_4(aq) + H_2(g)$$

Q- Explain the combination reaction with an example.
Ans- A chemical reaction in which two or more reactants combine to form a single product is called a combination reaction.

Example- (A) $CaO + H_2O \longrightarrow Ca(OH)_2$
quicklime slaked lime

(B) Formation of water from H_2 and O_2

$$2H_2 + O_2 \rightarrow H_2O$$

Q- What is an exothermic chemical reaction, explain with examples

Ans- Such chemical reactions in which heat is generated along with product formation. Exothermic chemical reaction is called.

Ex. (A) Combustion of natural gas-

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O + \text{Energy}$$

(B) Respiration is considered an **exothermic reaction** because during digestion, food is broken down into simpler substances. For instance, carbohydrates from foods like rice, potatoes, and bread are broken down into **glucose**. This glucose then combines with oxygen in the cells of our body to release **energy**. Since energy is released during this process, respiration is an exothermic reaction.

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{Energy}$$

(C) The dissociation of vegetable matter to become compost is also an example of exothermic reaction.

Q- Whose solution is used for whitewashing the walls?

$$CaO + H_2O \rightarrow Ca(OH)_2 + \text{Energy}$$

quicklime — slaked lime

The solution of slaked lime produced by this reaction is used for whitewashing the walls, which slowly reacts with the CO_2 present in the air to form a shiny layer of $CaCO_3$.

$$Ca(OH) + CO_2 \rightarrow CaCO_3 + H_2O$$

Q- Explain the decomposition reaction. OR Explain thermal, light and electrolysis decomposition reaction with equation.

Ans- A chemical reaction in which a single reactant is decomposed by heat, light or electricity to form smaller products is called decomposition reaction.

1. Thermal decomposition

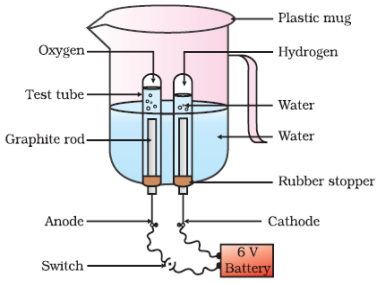
(A) $2FeSO_4 \xrightarrow{\text{Heat}} Fe_2O_3 + SO_2 + SO_3$

(B) $CaCO_3 \xrightarrow{\text{Heat}} CaO + CO_2$

(C) $2Pb(NO_3)_2 \xrightarrow{\text{Heat}} 2Pb + 4NO_2 + O_2$

2. Electrolysis- When water is electrolysed, O_2 gas is liberated at the anode and H_2 gas at the cathode.

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



3. Photolysis- (A) $2AgCl \xrightarrow{\text{Sunlight}} 2Ag + Cl_2$

(B) $2AgBr \xrightarrow{\text{Sunlight}} 2Ag + Br_2$ This reaction is used in black and white photography.

Q- Write the equation of the chemical reaction that occurs when ammonium chloride is added to barium hydroxide.

Ans- $Ba(OH)_2 + 2NH_4Cl \longrightarrow BaCl_2 + 2NH_4OH$

Q- Explain displacement reaction.

Ans- Such a chemical reaction in which a less active element is displaced or removed from its solution by a more active element. It is called displacement reaction. For example, when an iron nail is immersed in a solution of copper sulphate, the colour of the iron nail becomes brown and the blue colour of the solution of copper sulphate turns fade.

$$CuSO_4 + Fe \longrightarrow FeSO_4 + Cu$$
$$Zn + CuSO_4 \longrightarrow ZnSO_4 + Cu$$
$$Pb + CuCl_2 \longrightarrow PbCl_2 + Cu$$

Q- Explain the double displacement reaction with an example.

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

$Na_2SO_4 + BaCl_2 \longrightarrow BaSO_4 + 2NaCl$

sodium sulfate — barium chloride — barium sulfate (white precipitate) — sodium chloride

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

Q- What is called precipitation reaction?

Ans- A chemical double displacement reaction in which a precipitate is formed which is insoluble in water is called a precipitation reaction.

$Na_2SO_4 + BaCl_2 \longrightarrow BaSO_4 + 2NaCl$

sodium sulfate — barium chloride — barium sulfate (white precipitate) — sodium chloride

Q- What is corrosion? Give example.

Ans- When a metal is attacked by substances around it such as moisture, acids, and air, it oxidizes and begins to degrade. This process is called corrosion. Examples: Rusting of iron: Formation of a reddish-brown layer.

Silver: Formation of a black layer (Silver Sulphide).

Copper: Formation of a green layer (Basic Copper Carbonate).

Impact & Prevention: Corrosion causes serious damage to car bodies, bridges, iron railings, and ships. To prevent corrosion, especially in iron (rusting), we use methods like painting, oiling, or galvanizing.

Q25: Which white powder is obtained as a product when a magnesium ribbon is combusted in the air?

Ans- Product MgO, on combustion of magnesium ribbon in air, white powder of magnesium oxide is obtained as a product in the watch glass. This reaction is an example of a combination and oxidation reaction.

Q- What is exothermic chemical reaction? Write the equation of chemical reaction of combustion of natural gas?

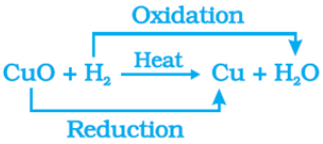
Ans- The reactions in which heat is also produced along with the formation of products are called exothermic chemical reactions.

Combustion of natural gas:-

$$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O + \text{Energy}$$

Q- $CuO + H_2 \rightarrow Cu + H_2O$ Which substance is being oxidised and reduced in the reaction? Give one more example of this type of reaction.

Ans- The substances in which there is an increase of oxygen or lack of hydrogen are oxidised ((oxidation-reactions) and those in which there is lack of oxygen or increase of hydrogen, they are reduced (reduction reactions).

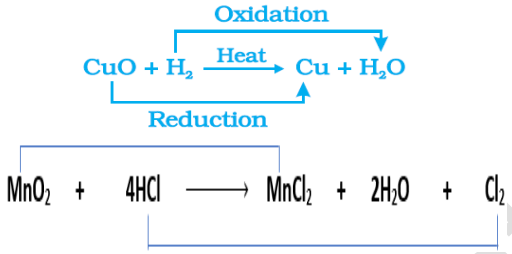


In this reaction oxygen is being lost in copper oxide (CuO). Hence it is reduced and due to increase of oxygen in H2 it is oxidised. Others ex.

In this reaction oxygen is being lost in zinc oxide (ZnO). Hence it is reduced and due to increase of oxygen in C it is oxidised.

Q-**What are redox (oxidation-reduction) reactions?**

Ans- A chemical reaction in which one reactant is oxidised and the other reactant is reduced is called a redox reaction.



In this reaction, HCl is reduced to Cl_2 and MnO_2 is reduced to $MnCl_2$.

Q- What is called oxidation reaction? Give an example.

Ans- Such a reaction in which oxygen is increased or hydrogen is lost in a substance is called oxidation reaction.

$2Cu + O_2 \xrightarrow{Heat} 2CuO$ copper oxide (black substance)

In this reaction there is an increase of oxygen in Cu, hence Cu has been oxidised.

Q- What is called reduction reaction. Give an example.

Ans- Such a reaction in which there is a reduction of oxygen or an increase of hydrogen in a substance is called a reduction reaction**.**

$CuO + H_2 \xrightarrow{Heat} Cu + H_2O$

In this reaction, there is a lack of oxygen in CuO, hence CuO has reduction.

Q- What is called endothermic reaction? Give example.

Ans- Such reactions in which energy in the any form (of heat, light or electricity) is absorbed to break down the reactants are called endothermic reactions.

$2FeSO_4 \longrightarrow Fe_2O_3 + SO_2 + SO_3$

(ferrous sulfate) (ferric oxide)

Q- Balance the following chemical equation.

(a) $HNO_3 + Ca(OH)_2 \rightarrow Ca(NO_3)_2 + H_2O$
(b) $NaOH + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$
(c) $NaCl + AgNO_3 \rightarrow AgCl + NaNO_3$
(d) $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + HCl$
(e) $NH3 + CuO \rightarrow Cu + N_2 + H_2O$

Ans-

(a) $\mathbf{2}HNO_3 + Ca(OH)_2 \rightarrow Ca(NO_3)_2 + \mathbf{2}H_2O$
(b) $\mathbf{2}NaOH + H_2SO_4 \rightarrow Na_2SO_4 + \mathbf{2}H_2O$
(c) $NaCl + AgNO_3 \rightarrow AgCl + NaNO_3$
(d) $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + \mathbf{2}HCl$
(e) $2NH_3 + 3CuO \rightarrow 3Cu + N_2 + 3H_2O$

Q- A solution of a substance X is used for whitening. (A) Name the substance X and write its formula. (B) Write the reaction of substance X with water.

Ans- (A) Name of X – Calcium oxide - CaO
(B) reaction of CaO with water

$CaO + H_2O \longrightarrow Ca(OH)_2$

Q. When a brown coloured shiny element 'X' is heated in the presence of air, it turns black. Name this element 'X' and that black coloured compound-

Ans- Element 'X' is copper. And the black coloured compound is copper (II) oxide (CuO).

Copper is a brown shiny element. When it is heated in the presence of air, it turns into black coloured copper (II) oxide.

$2Cu + O_2 \rightarrow 2CuO$

Decomposition, Thermal decomposition, Endothermic reaction-

$CaCO_3 \xrightarrow{Heat} CaO + CO_2$

lime stone quicklime

Combination reaction, Exothermic reaction-

$CaO + H_2O \longrightarrow Ca(OH)_2 + Heat$

quicklime slaked lime

Precipitation reaction-

$Ca(OH)_2 + CO_2 \longrightarrow CaCO_3$

lime water lime precipitate

2. Acids, Bases and Salts

Marks Weighting – 7 Question 4: Fill in the Blanks-2, Very Short- 1, Essay Type-1

1. **Certain substances whose odor changes in an acidic or basic medium are called.....**
   Ans- Olfactory indicators.
2. **Metal carbonates metal hydrogen carbonates react with acid to produce..... gas.**
   Ans- Carbon dioxide (CO_2)
3. **The blue-green colour of the solution on adding dilute hydrochloric acid to copper oxide is due to the formation of the compound.....**
   Ans- Copper(II) chloride ($CuCl_2$)
4. **The chemical formula of the anion obtained from the dissociation of HCl is.....**
   Ans- Cl^- (Chloride ion)
5. **The pH of lemon juice is.....**
   Ans- 2.2
6. **The medicine used to treat indigestion is.....**
   Ans- Antacid
7. **The pH value of blood is.....**
   Ans- pH = 7.4
8. **Our stomach produces the acid ..... acid.**
   Ans- HCl (hydrochloric acid).
9. **..... acid is found in orange.**
   Ans- Citric acid
10. **..... acid is found in tamarind.**
    Ans- Tartaric acid
11. **..... acid is found in vinegar.**
    Ans- Acetic acid
12. **When the pH value of rain water becomes less than 5.6 then such rain is called .....**
    Ans- Acid rain
13. **What is the P^H of a neutral solution or pure water (distilled water)?**
    Ans- 7.0
14. **Which substance reacts with chlorine to form bleaching powder?**
    Ans- Dry slaked lime ($Ca(OH)_2$)
15. **Which salt is used in food?**
    Ans- Sodium chloride (NaCl)
16. **The natural indicator called litmus is obtained from which plant?**
    Ans- Lichen (Thallophyta group)
17. **Write the names of major natural indicators –**
    Ans- Litmus paper, red cabbage, turmeric, hydrangea, petunia and geranium
18. **When a metal reacts with an acid, which gas is emitted?** (RBSE 2025)
    Ans- Hydrogen gas
19. **Write three examples of olfactory indicators.**
    Ans: Vanilla, Onion and Clove Oil.
20. **What is the nature of metallic oxides?**
    Ans: Basic (Alkaline).
21. **What is the nature of non-metallic oxides?**
    Ans: Acidic.
22. **What is the effect of acids on litmus paper?**
    Ans: Acids turn blue litmus to red.
23. **What does the word 'p' stand for in the pH scale?**
    Ans: 'Potenz' (a German word meaning power).
24. **What is the pH value of gastric juice?**
    Ans: About 1.2.
25. **Which planet has an atmosphere of sulfuric acid clouds?**
    Ans: Venus.
26. **In what pH range does the human body normally work?**
    Ans: 7.0 to 7.8.
27. **Write the chemical name and formula of milk of magnesia.**
    Ans: Magnesium Hydroxide [$Mg(OH)_2$].
28. **Give one example of an antacid.**
    Ans: Milk of Magnesia.
29. **Which is the hardest substance in the human body?**
    Ans: Dental enamel.
30. **What chemical substance is dental enamel made of**
    Ans: Calcium Hydroxyapatite.
31. **At what pH value does tooth decay start?**
    Ans: When the pH is less than 5.5.
32. **Which acid is found in bee stings and nettle stings?**
    Ans: Methanoic acid.
33. **What is the remedy for a painful nettle sting?**
    Ans: Rubbing the leaf of a dock plant on the area.
34. **Name two synthetic indicators.**
    Ans: Methyl Orange and Phenolphthalein.
35. **What is baking powder?**
    Ans: Baking powder is a mixture of baking soda (sodium hydrogen carbonate) and tartaric acid.
36. **What is used to disinfect drinking water?**
    Ans: Bleaching Powder ($CaOCl_2$).
37. **Which sodium compound is used to convert hard water into soft water?**
    Ans: Sodium carbonate (Na_2CO_3), also known as washing soda.
38. **What happens when CO_2 gas is passed through lime water?**
    Ans: Lime water turns milky due to the formation of white precipitates of calcium carbonate.
39. **What colour does phenolphthalein give when it reacts with an alkali?**
    Ans: Pink colour.
40. **What are the different forms of $CaCO_3$ (calcium carbonate)?**
    Ans: Limestone, chalk and marble.
41. **Write the chemical formula of Plaster of Paris.**
    Ans: $CaSO_4 . \frac{1}{2}H_2O$
42. **Write the chemical equation for the formation of P.O.P.**

$$CaSO_4.2H_2O \xrightarrow{373\ K} CaSO_4 . \frac{1}{2}H_2O + 1\frac{1}{2}H_2O$$

43. Write the chemical formula of the following

1- Bleaching powder - $CaOCl_2$

2- Banking soda - $NaHCO_3$

3- Washing soda - $Na_2CO_3.10H_2O$

4- Gypsum- $CaSO_4.2H_2O$

44. What is an acid?

Ans: Those substances which dissociate in an aqueous solution to release hydrogen ions (H^+) are called acids.

45. What is a base?

Ans: Those substances which dissociate in an aqueous solution to release hydroxyl ions (OH^-) are called bases.

46. Write the general properties of acids.

Ans: General properties of acids:

They have a sour taste.

They turn blue litmus paper red.

They react with active metals to produce hydrogen gas.

They react with bases to form salt and water (Neutralization reaction).

They conduct electricity in an aqueous solution.

47. What is dilution?

Ans: Dilution is the process of adding an acid or a base to water, which results in a decrease in the concentration of ions (H_3O^+ or OH^-) per unit volume.

48. Why should curd and sour substances not be kept in brass and copper utensils?

Ans: Curd and sour substances are acidic in nature. These acids react with brass and copper to form toxic (poisonous) metal salts, which can make the food unfit for consumption and cause food poisoning.

49. What is called a neutralization reaction?

Ans: The reaction between an acid and a base to form salt and water is called a neutralization reaction.

$HCl + NaOH \longrightarrow NaCl + H_2O$

Acid Base Salt Water

1. What happens when a solution reacts with ground eggshells to produce a gas that turns limewater milky?

Ans: The solution contains Hydrochloric acid (HCl). Eggshells are made of calcium carbonate ($CaCO_3$), which reacts with HCl to release Carbon dioxide (CO_2) gas.

$CaCO_3 + HCl \longrightarrow CaCl_2 + H_2O + CO_2$

2. Why is the behavior of an acid not acidic in the absence of water?

Ans: The acidic behavior of an acid is due to the presence of hydrogen ions (H^+). Since acids cannot dissociate to release H^+ ions in the absence of water, they do not show acidic behavior.

3. What is called water of crystallization?

Ans: The fixed number of water molecules present in one formula unit of a salt is called water of crystallization.

Example: $CuSO_4 \cdot 5H_2O$ (It has 5 molecules of water of crystallization).

4. The pH of fresh milk is 6. What will be the change in its pH when it becomes curd?

Ans: When milk turns into curd, its pH value will decrease (it will fall below 6).

This happens because the lactose present in milk gets converted into lactic acid, which increases its acidity (making it more acidic).

5. Write the preparation method, equation and two uses of bleaching powder.

Ans: Bleaching powder is prepared by the action of chlorine gas on dry slaked lime [$Ca(OH)_2$].

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

Uses: To make drinking water free from germs (disinfectant).

For bleaching cotton and linen in the textile industry.

6. Write the equation and uses for making baking soda.

Ans: Baking soda is prepared by reacting sodium chloride with water, carbon dioxide and ammonia.

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

Uses: Used as an ingredient in antacids to reduce stomach acidity.

Used in soda-acid fire extinguishers.

Used for making baking powder and making bread or cakes fluffy.

7. How can washing soda be obtained? Write its equation and uses.

Ans: Washing soda is obtained by the recrystallization of sodium carbonate.

$$Na_2CO_3 + 10H_2O \rightarrow Na_2CO_3 \cdot 10H_2O$$

Uses: Used in glass, soap and paper industries.

Used for removing the permanent hardness of water.

Used in the manufacture of sodium compounds like Borax.

8. **While diluting an acid, why is it recommended that acid should be added to water and not water to acid?**

Ans: While diluting, acid should always be added to water slowly with constant stirring. This is because the process is highly exothermic (releases a lot of heat). If water is added to concentrated acid, the large amount of heat generated may cause the mixture to splash out and cause burns, or the glass container may break due to excessive local heating.

9. Why does dry hydrochloric gas not change the colour of dry litmus paper?

Ans: Dry HCl gas does not change the colour of dry litmus paper because it does not release hydrogen ions (H^+) in the absence of moisture. Acidic behavior is only shown when H^+ions are present.

Since H^+ ions are only produced in an aqueous (water) solution, dry HCl gas does not show acidic properties and thus doesn't change the colour of the litmus paper.

10. Why should Plaster of Paris (P.O.P.) be kept in a moisture-proof container? Write the equation of the reaction of Plaster of Paris with water.

Ans: Plaster of Paris should be kept in a moisture-proof container because it reacts with moisture (water) to form a hard solid mass called Gypsum. This reaction makes the P.O.P. useless for future use.

$CaSO_4 \cdot \frac{1}{2}H_2O + 1\frac{1}{2}H_2O \rightarrow CaSO_4 \cdot 2H_2O$ (Gypsum)

11. What is the Chlor-alkali process? Write the equation and explain it.

Ans: When electricity is passed through an aqueous solution of sodium chloride, it decomposes to form sodium hydroxide. This is called the chlor-alkali process because the products formed are chlorine (chlor) and sodium hydroxide (alkali).

$2NaCl(aq) + 2H_2O(l) \xrightarrow{\text{Electricity}} 2NaOH(aq) + Cl_2(g) + H_2(g)$

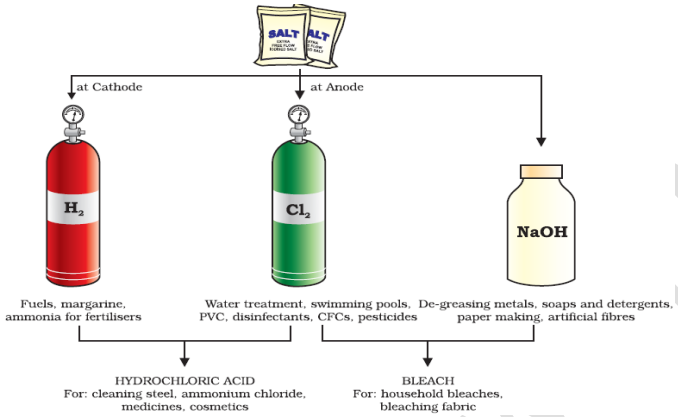
Process Details:

Chlorine gas (Cl_2) is released at the Anode (+).

Hydrogen gas (H_2) is released at the Cathode (-).

Sodium hydroxide (NaOH) solution is formed near the cathode.

$2NaCl + 2H_2O \longrightarrow 2NaOH + Cl_2 + H_2$



12. Write the names of any two strong acids and two weak acids.

Ans-Strong acid:-(1) Hydrochloric acid [HCl]
(2) Sulphuric acid [H_2SO_4]
Weak acid:- (1) Acetic acid [CH_3COOH]
(2) Carbonic acid [H_2CO_3]

13. Write the names of any two strong bases and weak bases-

Ans- Strong base:- Potassium hydroxide [KOH], Sodium hydroxide [NaOH]
Weak base:- Ammonium Hydroxide [NH_4OH]
Magnesium Hydroxide [$Mg(OH)_2$]

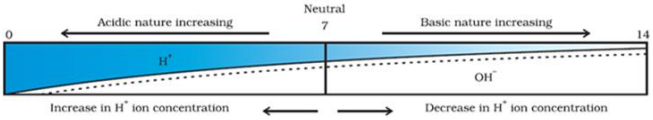
14. If a metal compound 'A' reacts with dilute HCl, bubbling (effervescence) is produced. The gas evolved extinguishes a burning candle. If one of the compounds formed is calcium chloride, write a balanced chemical equation.

Ans: The metal compound 'A' is Calcium Carbonate ($CaCO_3$) and the gas evolved is Carbon Dioxide (CO_2) (since it extinguishes fire).

$CaCO_3 + 2HCl \longrightarrow CaCl_2 + H_2O + CO_2$

15. What is the pH scale? Explain the pH scale.

Ans: A scale developed for measuring the concentration of hydrogen ions (H^+) in a solution is known as the pH scale.



The 'p' in pH stands for 'potenz' in German, which means 'power'.

Range: The scale ranges from 0 to 14.

0 indicates a very acidic solution.

14 indicates a very alkaline (basic) solution.

Nature of Solution: pH is a number that represents the acidic or basic nature of a solution.

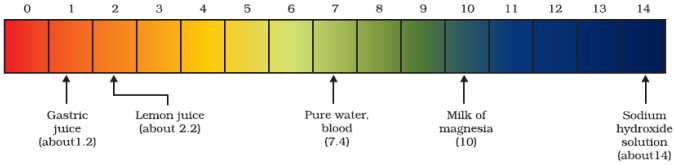
Neutral Solution: If pH = 7, the solution is neutral (e.g., pure water).

Acidic Solution: If pH < 7, the solution is acidic.

Basic Solution: If pH > 7, the solution is alkaline (basic).

The pH value is inversely proportional to the hydronium ion concentration. This means the higher the hydronium ion (H_3O^+) concentration, the lower the pH value.

The strength of an acid or a base depends on the number of H^+ ions and OH^- ions produced, respectively. Strong acids produce more H+ions, while strong bases produce more OH^- ions.



16. Why does the aqueous solution of an acid conduct electricity?

Ans: The conduction of electricity through a solution is due to the movement of ions. In an aqueous solution, an acid dissociates to produce hydrogen ions (H^+) or hydronium ions (H_3O^+). These ions act as charge carriers, allowing the flow of electric current through the solution.

17. Explain any two importance of pH in daily life.

Ans: pH Sensitivity of Plants and Animals: Living organisms can survive only in a narrow range of pH change (usually 7.0 to 7.8). When the pH of rain water is less than 5.6, it is called acid rain. When this water flows into rivers, it lowers the pH of the river water, making the survival of aquatic life difficult.

Self-defense by Animals and Plants: A bee sting leaves an acid (methanoic acid) which causes pain and irritation. Using a mild base like baking soda on the stung area provides relief by neutralizing the acid. Similarly, nettle leaf stings inject methanoic acid causing burning pain.

18. Write the chemical equation for the reaction of sodium hydroxide with zinc metal.

$2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2$
Sodium zincate

19. Write the chemical name, formula, method of preparation and any two uses of Plaster of Paris.

Ans-Chemical name:-Calcium Sulphate Hemihydrate
Formula:- $CaSO4.½\ H_2O$

It is prepared by heating Gypsum at 373 K. At this temperature, Gypsum loses water molecules to become Plaster of Paris.

$2CaSO_4.2H_2O \xrightarrow{373K} 2CaSO_4.½\ H_2O + 1½\ H_2O$
Gypsum → Plaster of paris

Uses: It is used by doctors as a plaster for supporting fractured bones in the right position.

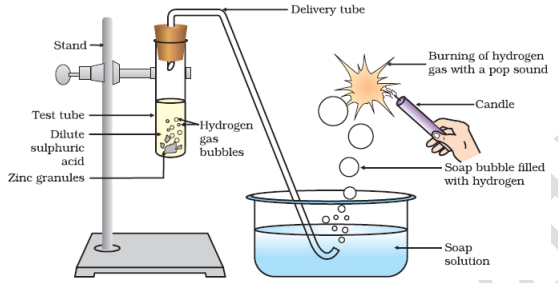
It is used for making toys, decorative materials and smooth surfaces.

20. Which gas is released when acid reacts with metal? How will you check the presence of this gas? Draw a labelled diagram.

Ans: When an acid reacts with a metal, Hydrogen gas (H_2) is generally released.

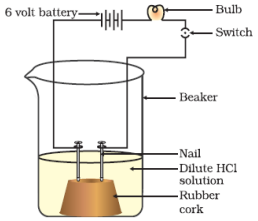
$Zn(s) + H_2SO_4(aq) \longrightarrow ZnSO_4(aq) + H_2(g)\uparrow$
(Zinc + Sulphuric acid → Zinc sulphate + Hydrogen)

To check the presence of hydrogen gas, pass the gas through a soap solution so that bubbles are formed. When a burning candle is brought near these gas-filled bubbles, the gas burns with a characteristic 'pop' sound. This 'pop' sound confirms that the evolved gas is hydrogen.



21. Why do HCl, HNO_3 etc., show acidic characteristics in water solutions, whereas alcohol and glucose do not?

Ans: HCl and HNO_3 dissociate in aqueous solutions to produce hydrogen ions (H^+), which are responsible for their acidic characteristics and ability to conduct electricity. On the other hand, compounds like glucose and alcohol do not dissociate into ions in water. Since they do not produce H+ ions, they do not show acidic behavior or conduct electricity.



22. What is baking powder?

Ans: Baking powder is a mixture of baking soda (sodium hydrogen carbonate, $NaHCO_3$) and a mild edible acid, such as tartaric acid.

When baking powder is heated or mixed with water, the following reaction takes place:

$NaHCO_3 + H^+$ (from any acid) $\rightarrow CO_2 + H_2O +$ Sodium salt

The carbon dioxide (CO_2) produced during this reaction causes the bread or cake to rise, making them soft and spongy.

23. How do metal carbonates and metal hydrogen carbonates react with acids? Or

A metal compound 'A' is formed by the reaction of hydrochloric acid with sodium carbonate. Compound 'A' is also known as common salt. When electricity is passed through an aqueous solution of 'A', sodium hydroxide is produced. Write the chemical name of 'A' and the balanced chemical equations for the reactions involved.

Ans- All metal carbonates and hydrogencarbonates react with acids to produce a salt, carbon dioxide and water.

Metal carbonate/hydrogencarbonate + Acid → Salt + Carbon dioxide + Water

$Na_2CO_3 + 2HCl \rightarrow 2NaCl + CO_2 + H_2O$
sodium carbonate

$NaHCO_3 + HCl \rightarrow NaCl + CO_2 + H_2O$
sodium hydrogencarbonate

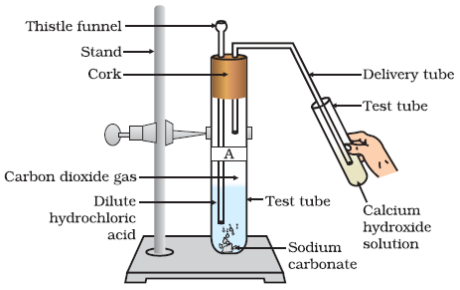
24. When CO_2 gas is passed through lime water, a white precipitate of compound 'A' is formed. If excess carbon dioxide gas is passed into the solution, a water-soluble substance 'B' is formed. Identify compounds 'A' and 'B' and write the chemical equations involved.

Ans: When CO_2 is passed through lime water, it turns milky due to the formation of a white precipitate of Calcium Carbonate (Compound A)

$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$
(Lime water) → (White precipitate)

If excess CO_2 is passed, the milkiness disappears because of the formation of Calcium Hydrogencarbonate (Compound B), which is soluble in water:

$CaCO_3 + H_2O + CO_2 \rightarrow Ca(HCO_3)_2$
(Soluble in water)



25. Match the following-

Natural source	Acid
1. Vinegar	i. Acetic acid
2. Sour milk (Curd)	ii. Lactic acid
3. Orange	iii. Citric acid
4. Lemon	iv. Citric acid
5. Tamarind	v. Tartaric acid
6. Ant sting	vi. Methanoic acid
7. Tomato	vii. Oxalic acid
8. Nettle sting	viii. Methanoic acid

3. Metals and Non-metals

Weightage: **5** Marks Question 4= MCQ-2, Very Short-1, Short Type- 1.

1. Silver articles become black after being exposed to air for a long time. This is due to the formation of –
(1) Ag_2O (2) Ag_2N (3) Ag_2S (4) $AgNO_3$ (3)

2. Which method is suitable for preventing an iron frying pan from rusting?
(1) Applying a coating of zinc (2) Applying paint
(3) Applying grease (4) All of the above (1)

3. In stainless steel, iron is mixed with? –
(1) Ni and Cr (2) Cu and Cr
(3) Ni and Cu (4) Cu and Pb (1)

4. The number of electrons present in the M shell of a phosphorus atom is (BSER 2025) –
(1) 3 (2) 5 (3) 6 (4) 7 (2)

5. The formula for finding the maximum number of electrons in any shell of an atom is –
(1) n^2 (2) 2n (3) $2n^2$ (4) n^3 (3)

6. A mixture of two or more metals of which kind is called an alloy? –
(1) Heterogeneous (2) Homogeneous
(3) Colloidal (4) All of the above (2)

7. A metal reacts with oxygen to form a compound with a high melting point. This compound is dissolved in water. What element could it be ?
(BSER Model Paper- 2026) –
(1) Silicon (2) Calcium
(3) Carbon (4) Iron (2)

8. Based on the reactivity of metals, the most reactive metal is -(BSER Model Paper- 2026)
(1) Zinc (2) Potassium
(3) Gold (4) Copper (2)

9. The most ductile metal is –
(1) Silver (2) Gold (3) Iron (4) Copper (2)

10. What is the nature of a non-metal oxide? –
(1) Acidic (2) Basic
(3) Neutral (4) Both acidic and basic (1)

11. The metal found in maximum amount in the earth's crust is –
(1) Iron (2) Copper
(3) Mercury (4) Aluminium (4)

12. Which non-metal is lustrous? –
(1) Oxygen (2) Sulphur
(3) Iodine (4) Nitrogen (3)

13. The removal of 'gangue' from an ore is called? –
(1) Concentration (2) Calcination
(3) Roasting (4) Reduction (1)

14. Which of the following are neutral oxides? –
(1) Carbon monoxide (2) Carbon dioxide
(3) Sulphur dioxide (4) Sulphur trioxide (1)

15. When copper is left exposed, a green layer forms on it. The reason for this is –
(1) $CuSO_4$ (2) $CuCO_3$
(3) $Cu(NO_3)_2$ (4) CuO (2)

16. The nature of HNO_3 (nitric acid) is –
(1) Strong reducing agent
(2) Strong oxidising agent
(3) Weak oxidising agent
(4) Weak reducing agent (2)

17. Identify the gas evolved when zinc granules react with dilute sulfuric acid. –
(1) O_2 (2) CO_2 (3) H_2 (4) NO (3)

18. An element Q is soft and can be easily cut with a knife. The element reacts rapidly with cold water. Identify the element (RBSE 2022). –
(1) K (2) Ag (3) Cu (4) Pb (1)

19. Metals form which of the following by losing electrons from the valence shell? –
(1) Anion (2) Cation
(3) Both cation and anion
(4) Can form any one of them (2)

20. Which metal cannot be cut with a knife? –
(1) Lithium (2) Sodium
(3) Potassium (4) Zinc (4)

21. What is the nature of metal oxides? –
(1) Acidic (2) Basic (Alkaline)
(3) Neutral (4) None of these (2)

22. A metal X is heated in the presence of air. It combines with oxygen to form a black coloured metallic oxide. The metal X is –
(1) Copper (2) Iron
(3) Silver (4) Gold (1)

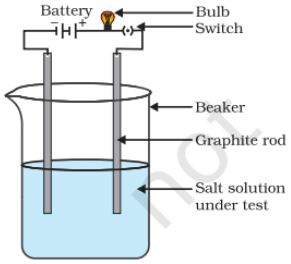
23. Which gas do metals produce when reacting with acid? –
(1) N_2 (2) O_2 (3) Cl_2 (4) H_2 (4)

24. Cinnabar is an ore of which metal? –
(1) Iron (2) Copper
(3) Mercury (4) Zinc (3)

25. Which of the following is an alloy? –
(1) Brass (2) Bronze
(3) Solder (4) All of the above (4)

26. Food cans are coated with tin instead of zinc. Because- (RBSE 2021)
(1) Zinc is more expensive than tin.
(2) Zinc has a higher melting point than tin.
(3) Zinc is more reactive than tin.
(4) Zinc is less reactive than tin. (3)

1. **Draw a labeled diagram for checking the conductivity of a salt solution.**



2. **Aluminium is a highly reactive metal, yet it is used for making cooking utensils. Why?**
   Ans: Aluminium is cheap, abundant, and does not react with cold or hot water. It is also a good conductor of heat.
3. **Why is pure iron not used?**
   Ans: Pure iron is very soft and stretches easily when hot.
4. **What is done to increase the hardness of iron?**
   Ans: A small amount of carbon (about 0.05%) is added to iron to increase its hardness.
5. **Why do metals not liberate hydrogen gas when reacting with nitric acid (HNO_3)?**
   Ans: Nitric acid is a strong oxidizing agent that oxidizes the produced H_2 into water and is itself reduced to any of its nitrogen oxides (N_2O,NO, NO_2).
6. **Write the formulas of the following ores:**
   (i) Hematite = Fe_2O_3
   (ii) Copper pyrites = $CuFeS_2$.
7. **What is meant by 'Sonorous'?**
   Ans: Metals produce sound when struck against a hard surface; this property of metals is called sonorous.
8. **You must have seen tarnished copper vessels being cleaned with lemon or tamarind juice. Explain why these sour substances are effective in cleaning the vessels.**
   Ans: The sour substances (acids) react with the basic copper carbonate layer on the tarnished surface and dissolve it, which cleans the vessel.
9. **Copper is used for making hot water tanks, but steel (an alloy of iron) is not. Give a reason.**
   Ans: Copper is a good conductor of heat and does not react with water or steam, whereas the iron in steel reacts with steam and corrodes easily.
10. **Why are electric wires usually made of copper?**
    Ans: Because copper is a good conductor of electricity. (BSER 2025)
11. **Which is more ductile between gold and iron?**
    Ans: Gold.
12. **Amalgam is an alloy that is a mixture of one or more metals with which element?**
    Ans: With mercury.
13. **Which are the most malleable metals?**
    Ans: Gold and silver.
14. **How does the electrical conductivity and melting point of an alloy compare to that of the pure metal?**
    Ans: Electrical conductivity and melting point are lower in alloys.
15. **What is the correct increasing order of reactivity of Al, Fe, Zn?**
    Ans: Fe < Zn < Al.
16. **What is the process of a brown layer forming on iron in the atmosphere called?**
    Ans: Corrosion.
17. **What type of reaction is the reaction of sodium and potassium metal with cold water?**
    Ans: Exothermic reaction.
18. **What do you understand by 'Flux'?**
    Ans: Flux are substances added to ore to convert acidic impurities into fusible (meltable) substances.
19. **What is the characteristic of titanium metal that makes it a metal of strategic importance?**
    Ans: Titanium is a low-reactive metal with very high tensile strength, making it resistant to corrosion and useful in nuclear plants and military equipment.
20. **Name a metal and its ore:**
    Ans: **Aluminium**- Bauxite **Lead-** Galena
    Mercury- Cinnabar, **Zinc-** Calamine
    Iron- Hematite, **Calcium-** Dolomite
21. **What is metallic lustre?**
    Ans: The property where pure metals have a shiny surface is called metallic lustre.
22. **What is the full form of PVC?**
    Ans: Polyvinyl chloride.
23. **Which non-metal is in a liquid state at room temperature?** (BSER 2024)
    Ans: Bromine.
24. **What is gangue?**
    Ans: The large amount of impurities, such as soil, sand, clay and rocky material, that contaminate ores mined from the earth are called gangue.
25. **Which non-metal is lustrous?**
    Ans: Iodine.
26. **When iron is kept in moist air for a long time, a brown layer forms on it. What is this substance called?**
    Ans: Rust.
27. **Which non-metal exists in various forms?**
    Ans: Carbon (as allotropes like diamond, graphite)
28. **What substance does copper form when left in moist air (CO_2)?**
    Ans: Basic copper carbonate (green substance).
29. **Name a metal that melts when kept on the palm.**
    Ans: Gallium and Caesium, due to their very low melting points.
30. **Which metals are poor conductors of heat?**
    Ans: Lead and mercury.

31. Define ductility and name the most ductile metal.
Ans: The ability of a metal to be drawn into thin wires is called ductility. Gold is the most ductile metal.

32. Define roasting and calcination. (RBSE 2023, 2017)
Ans: Roasting is the process of heating an ore in the presence of air to convert it into an oxide (used for sulfide ores like ZnS).
Calcination is the process of heating an ore in limited air to convert it into an oxide (used for carbonate ores like $ZnCO_3$).

33. The compound X and Aluminium are used for joining railway tracks. (RBSE 2018)
(i) Name the compound X.
(ii) Name the reaction.
(iii) Write the reaction.
Ans: (i) The compound X is Iron (III) oxide (Fe_2O_3)
(ii) The reaction is called the thermit reaction.
(iii) Fe_2O_3 (s) + 2Al (s) → 2Fe (l) + Al_2O_3 + heat

34. What is the nature of non-metallic oxides?
Ans: Acidic nature.

35. Which metal exists in a liquid state at room temperature?
Ans: Mercury (Hg).

36. Among sodium, silicon, and chlorine, which is a metalloid?
Ans: Silicon (Si).

37. What is malleability?
Ans: The property where some metals can be beaten into thin sheets is called malleability.

38. Why are metals used to make utensils?
Ans: Metals are good conductors of heat, so they are used to make utensils.

39. Which metal is the best conductor of heat? (2024)
Ans: Silver and copper.

40. Why are school bells made of metal?
Ans: Metals produce sound when struck, a property called sonorous.

41. What is the hardest natural substance?
Ans: Diamond, an allotrope of carbon, with a very high melting and boiling point.

42. What are ionic compounds?
Ans: Compounds formed by the transfer of electrons from a metal to a non-metal are called ionic or electrovalent compounds.

43. Name the metals used to make coins.
Ans: Copper (Cu), Silver (Ag), Gold (Au).

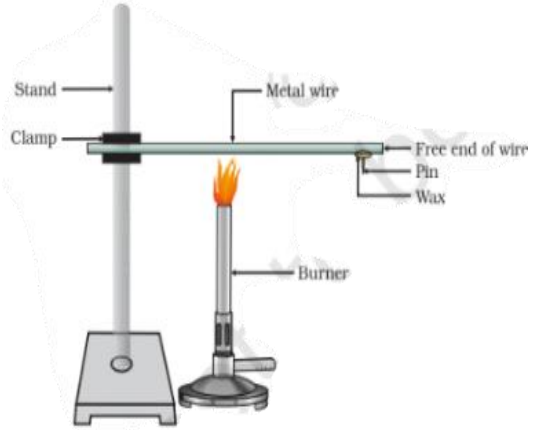
44. What is a mineral?
Ans: The naturally occurring elements or compounds in the earth's crust are called minerals.

45. What is an ore?
Ans: Minerals from which metals can be extracted profitably are called ores.

46. A metal is reacted with dilute sulphuric acid H_2SO_4. Write the properties of the gas evolved.
Ans: The gas evolved is Hydrogen (H_2).
Its properties are as follows:
Color and Odor: It is a colorless and odorless gas.
Combustibility: It is highly flammable and burns with a characteristic 'pop' sound when a burning matchstick or candle is brought near it.
Density: It is much lighter than air.
Solubility: It is practically insoluble in water, which is why it is often collected by the downward displacement of water.
Nature: It is neutral to litmus paper (it does not change the color of red or blue litmus).

47. What happens when Copper (Cu) and Aluminium (Al) are heated in the presence of air? What is the nature of the oxides formed? Are metal oxides soluble in water? Explain with reactions.
Ans: When heated, copper forms black copper(II) oxide: $2Cu + O_2 \rightarrow 2CuO$
Aluminium forms aluminium oxide:
$4Al + 3O_2 \rightarrow 2Al_2O_3$
Metal oxides are generally **basic** in nature. However, aluminium oxide and zinc oxide are **amphoteric** oxides (react with both acids and bases).
$Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + 3H_2O$
$Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$
Most metal oxides are insoluble in water, but some dissolve to form alkalis (e.g. sodium and potassium oxides) soluble oxide reaction-
Na_2O (s) + H_2O (l) → 2NaOH(aq)

48. Prove by an experiment that metals are good conductors of heat. (BSER Model Paper, 2022)
Ans: An experiment can be performed using an aluminium or copper wire clamped to a stand, with a pin attached by wax to the free end. Heating the wire near the clamp causes the wax to melt and the pin to drop, demonstrating that heat is conducted along the metal wire.



49. What happens when magnesium and sulphur are burnt? Make a solution of the obtained compounds in water and check with litmus to tell which element forms an acidic oxide and which a basic oxide? Explain with equations.

Ans: Magnesium burns in air to form magnesium oxide $2Mg(s) + O_2(g) \rightarrow 2MgO(s)$, which is basic in nature. Its aqueous solution ($MgO + H_2O \rightarrow Mg(OH)_2$) turns red litmus blue. Sulphur burns in air to form sulphur dioxide $S(s) + O_2(g) \rightarrow SO_2(g)$, which is acidic in nature. Its aqueous solution ($SO_2(g) + H_2O(l) \rightarrow H_2SO_3(aq)$ (sulphurous acid) turns blue litmus red.

50. Why do silver articles turn black when kept in the open air for a few days?

Ans: Silver reacts with sulfur in the air to form a layer of silver sulfide, which is black.

51. The brown shiny surface of copper slowly fades away in moist air?

Ans: Copper reacts with moist carbon dioxide in the air to form a green layer of basic copper carbonate, causing the brown shine to fade.

52. Explain the different methods used for extracting metals from their ores based on their position in the reactivity series.

Ans: The extraction process is divided into three categories:

High Reactivity Metals (e.g.- Na, Mg, Ca): These metals are very reactive and cannot be reduced by carbon. They are obtained by the electrolysis of their molten ores (usually chlorides or oxides).

Medium Reactivity Metals (e.g.- Zn, Fe, Pb): These are usually found as carbonates or sulphides.

Calcination: Heating carbonate ores in limited air to form oxides.

Roasting: Heating sulphide ores in excess air to form oxides.

Once converted to oxides, they are reduced to metal using reducing agents like carbon.

Low Reactivity Metals (e.g., Hg, Cu): These are often found as sulphide ores and can be obtained by simply roasting (heating in air). The resulting oxides are then further heated to get the pure metal.

53. What are amphoteric oxides called ?

(BSER Model Paper 2026).

Ans: Metal oxides that react with both acids and bases to produce salt and water are called amphoteric oxides.

Examples:

Aluminium oxide (Al_2O_3) and Zinc oxide (ZnO).

54. Why are potassium and sodium kept immersed in kerosene oil?

Ans: Potassium and sodium metals are so reactive that they catch fire when kept in the open. Therefore, they are kept immersed in kerosene oil to prevent accidental fire and for safe storage.

55. Explain anodising. What are its uses?

Ans: Anodising is the process of forming a thick oxide layer on aluminium. This layer protects the aluminium from **corrosion**, and by colouring this layer, attractive articles can be made.

56. Why do calcium and magnesium start floating when reacted with water?

Ans: The reaction with water is slow. The hydrogen gas bubbles produced in the reaction stick to the surface of the metal, causing the metal to float.

57. What is aqua regia?

Ans: Aqua regia is a fresh mixture of concentrated hydrochloric acid (HCl) and concentrated nitric acid (HNO_3) in a 3:1 ratio by volume. It is a strong corrosive agent that can dissolve noble metals like gold and platinum.

58. Explain the reactivity series.

Ans: The reactivity series is a list in which metals are arranged in descending order (decreasing order) of their reactivity.

59. Explain the formation of sodium chloride.

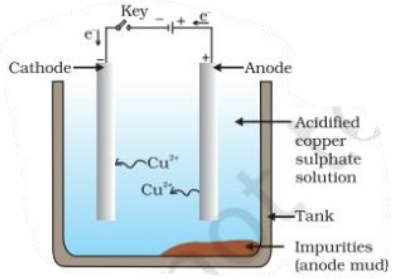
Ans: A sodium atom loses an electron to form a cation (Na^+), and a chlorine atom gains an electron to form an anion (Cl^-). Due to opposite charges, they attract each other and form sodium chloride (NaCl).

60. Why do ionic compounds have high melting and boiling points?

Ans: Ionic compounds have strong inter-ionic forces of attraction. A sufficient amount of energy is required to break this attraction, which is why their melting and boiling points are high.

61. Explain electrolytic refining.

Ans: In this process, the impure metal is made the anode and a thin layer of pure metal is made the cathode. When current is passed, the impure metal at the anode dissolves and an equal amount of pure metal is deposited at the cathode.



62. Give two ways to prevent iron from rusting. (BSER Model Paper 2026)

Ans: Iron can be protected by painting, oiling, greasing, chromium plating, galvanisation, or making alloys. Galvanisation is the method of coating iron and steel with a thin layer of zinc to protect them from rusting.

63. Why is pure gold not used to make gold jewellery?

Ans: Pure gold is 24 carat and is very soft. To make it hard enough for jewellery, silver or copper is added (usually 22 carat gold is used).

65. Write equations for these reactions.

(i) Iron with steam

$$3Fe\,(s) + 4H_2O\,(g) \rightarrow Fe_3O_4\,(s) + 4H_2\,(g)$$

(ii) Calcium and potassium with water

$$Ca\,(s) + 2H_2O\,(l) \rightarrow Ca(OH)_2\,(aq) + H_2\,(g)$$

$$2K\,(s) + 2H_2O\,(l) \rightarrow 2KOH\,(aq) + H_2\,(g) + Heat$$

64. What is an alloy? What is the primary purpose of making them?

Ans: An alloy is a homogeneous mixture of two or more metals, or a metal and a non-metal. They are created to improve the properties of metals, such as increasing strength and providing resistance to corrosion (rusting). Example-

- **Brass:** A mixture of copper (Cu) and zinc (Zn).
- **Bronze:** A mixture of copper (Cu) and tin (Sn).
- **Solder:** A mixture of lead (Pb) and tin (Sn). It has a low melting point and is used for welding electrical wires.
- **Stainless Steel:** Iron (Fe) mixed with nickel (Ni) and chromium (Cr). It is hard and does not rust.
- **Steel:** Iron (Fe) mixed with a small amount of carbon (about 0.05%), which makes it hard and strong.
- **Amalgam:** An alloy where one of the metals is mercury (Hg).
- **22 Carat Gold:** Pure gold (24 carat) is very soft, so it is alloyed with silver or copper to make it hard enough for jewelry.

4. Carbon and Its Compounds

Marks Weightage – 7 Question 4: MCQ-2, Short-1, Long Answer-1

Q. $CH_3COOH + Na_2CO_3 \rightarrow A + H_2O + CO_2$
Compound [A] in the above reaction is -
(1) CH_3COO (2) CH_3COONa
(3) C_2H_5OH (4) $CaCO_3$ (2)

Q. $2CH_3COOH + CH_3CH_2OH \leftrightharpoons A + H_2O$
What is the compound [A] in the above reaction?
(1) CH_3-CH_2-O-CH_2-CH_3 (2) CH_3-CH_2-COO-CH_3
(3) H-COO-CH_2-CH_2-CH_3 (4) CH_3-COO-CH_2-CH_3 (4)

Q. If n = 3 in the alkene series, the common name of the alkene would be -
(1) Ethylene (2) Propylene
(3) Butylene (4) Acetylene (2)

Q. The presence of CO_2 in the atmosphere is-
(1) 0.02% (2) 0.03% (3) 0.05% (4) 0.06% (2)

Q. In the structure of graphite, each atom of carbon is bonded to how many other atoms of carbon-
(1) 2 (2) 5 (3) 4 (4) 3 (4)

Q. The hardest substance ever known is-
(1) Fullerene 2) Diamond
(3) Platinum (4) Gold (2)

Q. How are carbon atoms arranged in carbon compounds?
(1) Long straight chain of carbon
(2) Various branched chains of carbon
(3) Carbon chains arranged in rings
(4) All of the above (4)

Q. While cooking food, if the bottom of the utensil is getting black from the outside, it means that:
(1) The food is not yet fully cooked.
(2) Fuel is not burning completely.
(3) Fuel is humid.
(4) Fuel is burning completely. (2)

Q. The higher homologous of butane is-
(1) Propene (2) Pentene
(3) Pentane (4) Pentyne (3)

Q. Effective in hard water-
(1) Soap (2) Detergent
(3) Both (4) None (2)

Q. Used as a preservative in pickles-
(1) Acetic acid (2) Methanol
(3) Ethanol (4) Methanol (1)

Q. The main component of biogas is-
(1) Ethane (2) Ethene
(3) Methane (4) Propane (3)

Q. The valency of carbon is-
(1) 1 (2) 2 (3) 3 (4) 4 (4)

Q. Which catalyst is generally used in the hydrogenation of vegetable oils.
(1) Magnesium (2) Nickel
(3) Iron (4) Chromium (2)

Q. Which ion is present in hard water
(1) Potassium ion (2) Sodium ion
(3) Magnesium ion (4) Chloride ion (3)

Q. Those substances which change the rate of reaction, but themselves remain unchanged, are called-
(1)Reactant (2)Catalyst
(3)Preservative (4)Detergent (2)

Q. Detergents are generally -
(1)$RCOO^-Na^+$ (2)$RCOO^-K^+$
(3)$RSO_4^-Na^+$ (4)$RCOO^-R^+$ (3)

Q. The by-product in the process of making soap is-
(1) Glycerol (2) NaOH
(3) Fatty acid (4) Alcohol (1)

Q. When triple bond is present in organic compounds, it will be used in naming.
(1) Ane (2) Ene (3) Yne (4) All (3)

Q. Saturated hydrocarbons are called-
(1) Alkane (2) Alkene
(3) Alkyne (4) Alcohol (1)

Q. The molecular formula of an alkane is C_2H_6 in which has-
(1) 6 covalent bonds (2) 7 covalent bonds
(3) 8 covalent bonds (4) 9 covalent bonds (2)

Q. Butanone is a four-carbon compound whose functional group is-
(1)Carboxylic acid (2)Aldehyde
(3)Ketone (4)Alcohol (3)

Q. The general formula of alkyne is-
(1) C_nH_{2n+2} (2) C_nH_{2n}
(3) C_nH_{2n-2} (4) None of the above (3)

Q.The property of catenation is maximum found in
(1) H (2) C (3) O (4) Na (2)

Q. The general formula of butane is-
(1) C_4H_{10} (2) C_4H_8 (3) C_4H_6 (4) C_4H_4 (1)

Q. What is the functional group in butanone?
Ans- ketone (>C=O).

Q. What is the general formula of alkane?
Ans- C_nH_{2n+2}

Q. Write the general formula of alkene.
Ans- C_nH_{2n}

Q. What is the geometry (shape) of carbon atom in diamond?
Ans- tetrahedral

Q. What is hydrocarbon?
Ans- Those organic compounds which contain only carbon and hydrogen are called hydrocarbons.

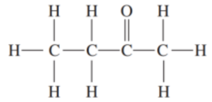
Q. What is the use of CH_4 (methane)?
Ans- Methane is used as a fuel and it is a major component of biogas and CNG.

Q. Due to the presence of which ions does soap fail to lather in hard water?
Ans- Due to calcium and magnesium salts present in hard water.

Q. Write the full name of CNG.
Ans- Compressed Natural Gas.

Q. Which oils should be used for cooking food?
Ans- Oils containing unsaturated fatty acids.
Q. What are soaps?
Ans- Soaps are sodium or potassium salts of long chain carboxylic acids.
Q. What is covalent bond?
Ans- The bond formed by the equal sharing of electron pairs between two atoms is called a covalent bond.

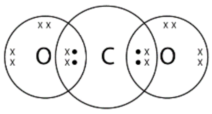
Q. Draw the structure of butanone.



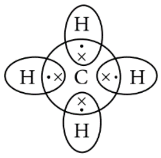
Q. Write a balanced equation for the combustion of methane.

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

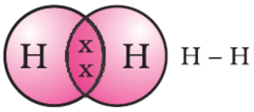
Q. Draw the electron dot structure of CO_2 (O=C=O).



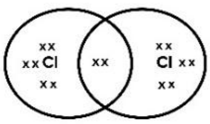
Q. Draw the electron dot structure of methane?



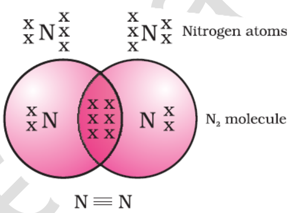
Q. Draw the structure of the following molecule?



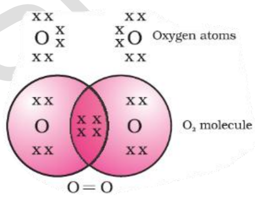
A molecule of hydrogen



A molecule of chlorine

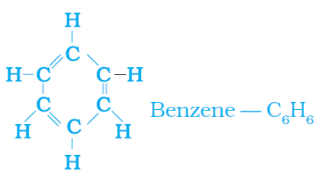


A molecule of nitrogen

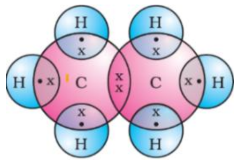


A molecule of oxygen

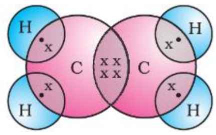
Q. Draw the formula and structure of benzene?
Ans- formula of benzene is C_6H_6



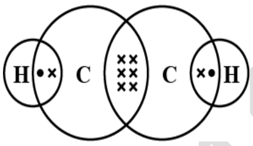
Q. Draw the dot structure of the following.
(A) ethane



(B) ethene



(C) ethyne

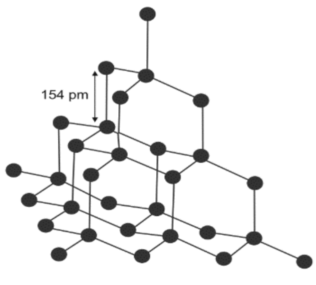


Q. What is called esterification reaction?
Ans- Ethanoic acid reacts with ethanol in the presence of an acid catalyst to form an ester, this reaction is called esterification reaction.

$CH_3-COOH + CH_3-CH_2OH \xrightarrow{Acid} CH_3-\underset{\|}{C}(=O)-O-CH_2-CH_3$

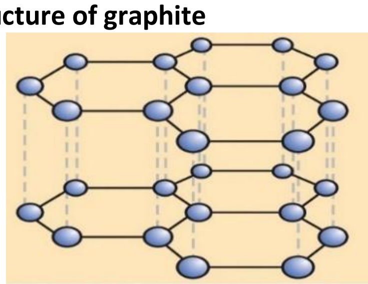
(Ethanoic acid) (Ethanol) (Ester)

Q. Draw the structure of the following.
Ans- (A) Structure of diamond



The structure of diamond

(B) Structure of graphite



structure of Graphite

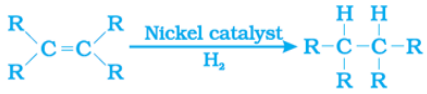
Q. Write the difference between soap and detergent.

Soap	Detergent
These are sodium or potassium salts of long chain carboxylic acids.	They are long chain sulphonic or ammonium salts.
Soaps are generally basic/alkaline in nature.	They are of neutral nature.
They do not work in hard water. Soaps do not form lather with hard water.	They work even in hard water. Detergents create lather even with hard water.
Soap is made from vegetable oil or animal fat.	Synthetic detergents are made from hydrocarbons of coal and petroleum.
It does not cause water pollution.	They are non-biodegradable and lead to water pollution.

Q. What is homologous series? Explain with example.
Ans- A homologous series is a series of organic compounds in which the same functional group replaces hydrogen in a carbon chain. The chemical properties of all members in the series are similar because they contain the same functional group. There is a difference of a $-CH_2-$ group and 14u in molecular mass between any two consecutive members. Example- The general formula of the alkane series is C_nH_{2n+2}. The members of this category are CH_4, C_2H_6, C_3H_8, C_4H_{10} etc.

Q. Why does diamond not conduct electricity?
Ans: In diamond, each carbon atom is bonded to four other carbon atoms, forming a rigid three-dimensional structure. As a result, there are no free electrons available. Therefore, diamond does not conduct electricity.

Q. What is hydrogenation? What is its industrial application?
Ans: Hydrogenation: It is the process of adding hydrogen to unsaturated hydrocarbons in the presence of catalysts like Nickel (Ni) or Palladium (Pd) to form saturated hydrocarbons.



Application: This process is used industrially to convert vegetable oils into vegetable ghee.

Q. What are saturated and unsaturated hydrocarbons? Explain with examples.
Ans: Saturated Hydrocarbons: Hydrocarbons in which carbon atoms are linked by only single bonds are called saturated hydrocarbons.Example: Alkanes (e.g., Propane: CH_3-CH_2-CH_3.)
Unsaturated Hydrocarbons: Hydrocarbons in which carbon atoms are linked by double or triple bonds are called unsaturated hydrocarbons.Example: Alkenes (e.g., Ethene: C_2H_4) and Alkynes (e.g., Ethyne: C_2H_2).

Q. Name the following compounds-

(1) CH_3-CH=CH_2	Propene
(2) CH_3-CHO	Ethanal
(3) CH_3-CH_2-Br	Bromoethane
(4) CH_3-CO-CH_3	Propanone
Q. CH3-CH2-CH2-OH	Propanol

Q. Which gas is obtained on the complete combustion of carbon?
Ans: CO_2 (Carbon dioxide) gas is obtained.

Q. Write the formula of acetic acid.
Ans: CH_3COOH (also known as Ethanoic acid).

Q. Write the full form of IUPAC.
Ans: International Union of Pure and Applied Chemistry.

Q. Why is soap not effective in hard water?
Ans: Soap is not effective because calcium and magnesium ions present in hard water react with soap to form an insoluble precipitate called scum, which prevents the formation of lather.

Q. An organic compound burns with a sooty flame. Is it a saturated or an unsaturated compound?
Ans: It is an unsaturated compound.

Q. Which was the first synthesized organic compound?
Ans: Urea. In 1828, Friedrich Wöhler prepared urea from ammonium cyanate, proving that organic compounds can be synthesized from inorganic materials.

Q. Why are covalent compounds poor conductors of electricity?
Ans: Covalent compounds are formed by the sharing of electrons; therefore, they do not have free ions or free electrons to carry an electric current.

Q. Why are there holes in the gas/kerosene stoves used in homes?
Ans: Gas or kerosene stoves have holes to ensure a sufficient supply of oxygen. This allows the fuel to undergo complete combustion, resulting in a clean blue flame without soot.

Q. Write the formulas of two successive members of ethane.
Ans: Propane – CH_3-CH_2-CH_3
Butane – CH_3-CH_2-CH_2-CH_3

Q Write the balanced equation of combustion of methane OR Hydrocarbon
Ans- $CH_4 + O_2 \rightarrow CO_2 + H_2O$ + Heat and light
When methane burns in the presence of oxygen, it produces carbon dioxide, water vapor, heat, and light.

Q. Explain heteroatoms by giving an example.
Ans: An atom other than carbon or hydrogen that replaces one or more hydrogen atoms in a hydrocarbon chain is called a heteroatom.Example: In ethanol (CH_3CH_2OH), the Oxygen (O) atom is a heteroatom.

Q. Select unsaturated hydrocarbons from C_2H_6, C_2H_4, C_3H_4, C_3H_8.
Ans - Unsaturated hydrocarbons –
Alkene (formula – C_nH_{2n})
Alkyne (formula - C_nH_{2n-2})
Therefore, C_2H_4 (alkene) and C_3H_4 (alkyne) are unsaturated hydrocarbons.

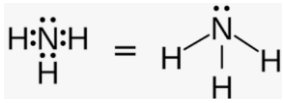
Q. What is denatured alcohol?
Ans: To prevent the misuse of industrial ethanol, it is made unfit for drinking by adding poisonous substances like methanol. Blue dyes are often added to identify it easily. This process is called denaturation, and the result is denatured alcohol.

Q. Why is pure acetic acid called glacial acetic acid?
Ans: The melting point of pure ethanoic acid is 290 K (17°C). Due to this relatively high melting point, it often freezes during winter in cold climates, taking on a glacier-like appearance. Hence, it is called glacial acetic acid.

Q. What are the molecular and structural formula of ammonia?

Ans: Molecular formula **NH_3**

Structure formula



Q. Write the names of the following compounds.

(A)CH_3-CH=CH-CH_3 But-2-ene

(B) CH_3-C(CH_3)=CH_2 2-Methylprop-1-ene

(C) CH_3-C(Cl)-CH_2-CH_3 2-Chlorobutane

Q. Write balanced equations for the chemical reactions of ethanol with the following reagents.

(i) Na (ii) Concentrated H_2SO_4 at 443 K,

Ans-

(i) $2CH_3\text{-}CH_2\text{-}OH + 2Na \rightarrow \underset{\text{Sodium ethoxide}}{2CH_3\text{-}CH_2\text{-}O^-Na^+} + H_2$

(ii) $CH_3\text{-}CH_2\text{-}OH \xrightarrow{Conc\ H2SO4\ at\ 443\ K} CH_2{=}CH_2 + H_2O$

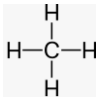
Q. Write the names of the following compounds.

(i) CH_3-CHCl-CHBr-CH_3 (ii) CH ≡ C-CH_3

Ans – (i) 2-Bromo-3-Chlorobutane (ii) propyne

Q. Write the structural formula of marsh gas.

Ans: Marsh gas is commonly known as Methane (CH_4). It is the simplest hydrocarbon and the first member of the alkane series. structural formula of marsh gas-



Q. What is the IUPAC name of

$$CH_3{-}CH(Cl){-}CH_2{-}CH{=}CH_2\ ?$$

Ans- 4-chloropent-1-ene.

Q. Fullerene is an allotrope of carbon, how did it get this name?

Ans: Fullerenes are a form of carbon allotropes. The first fullerene to be identified was C-60, which has carbon atoms arranged in the shape of a football. Because it resembled the geodesic dome designed by Buckminster Fuller, the molecule was named fullerene.

Q. Write two characteristics of carbon atom.

Ans: The two main characteristics of carbon that lead to a large number of compounds are: Catenation: Carbon has the unique ability to form bonds with other carbon atoms, giving rise to long chains, branched chains, or ring structures.Tetravalency: Since carbon has a valency of four, it can bond with four other atoms of carbon or other elements like oxygen, hydrogen, and nitrogen.

Q. Write the equation for the dehydration of ethanol.

Ans: Heating ethanol at 443 K with excess concentrated sulphuric acid results in its dehydration to form ethene:

$$CH_3{-}CH_2OH \xrightarrow[H_2SO_4]{\text{Hot conc.}} CH_2{=}CH_2 + H_2O$$

In this reaction, concentrated sulphuric acid acts as a dehydrating agent which removes water from ethanol.

Q. Define oxidising agents.

Ans: Substances that have the ability to oxidize other substances by adding oxygen or removing hydrogen are called oxidising agents (or oxidants).

Example: Alkaline $KMnO_4$ (Potassium Permanganate) and Acidified $K_2Cr_2O_7$ (Potassium Dichromate) are strong oxidising agents used to convert alcohols into carboxylic acids.

$$CH_3{-}CH_2OH \xrightarrow[\text{Or acidified } K_2Cr_2O_7 + \text{Heat}]{\text{Alkaline } KMnO_4 + \text{Heat}} CH_3COOH$$

Q. Why is consuming even a small amount of methanol fatal? / Two disadvantages of excessive alcohol consumption.

Ans: Ethanol Consumption: Large quantities of ethanol slow down metabolic processes and depress the central nervous system. This leads to a lack of coordination, mental confusion, drowsiness, and impaired judgement.

Methanol Fatality: Unlike ethanol, intake of even small amounts of methanol can be fatal. In the liver, methanol is oxidized to methanal. Methanal reacts rapidly with cell components, causing the coagulation of protoplasm (similar to how an egg coagulates when boiled). Additionally, methanol attacks the optic nerve, which can result in permanent blindness.

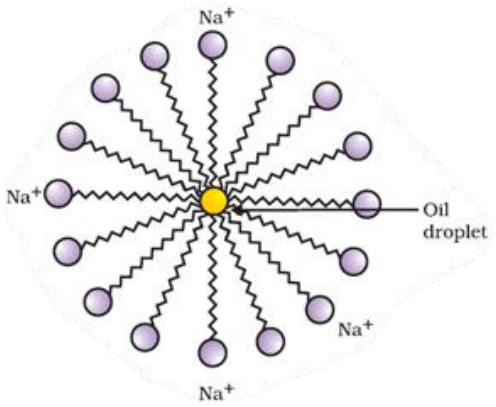
Q. Explain the mechanism of action of soap and draw the micelle structure.

Ans: Structure: Soap molecules have two ends with different properties: a hydrophilic (water-loving) ionic head and a hydrophobic (water-fearing) hydrocarbon tail.

Micelle Formation: When soap is added to water, the molecules arrange themselves into clusters called micelles. In a micelle, the hydrophobic tails point towards the center (to avoid water), while the hydrophilic heads face outwards (towards the water).

Cleaning Process: Oily dirt is hydrophobic and gets trapped in the center of the micelle. These micelles remain suspended in water as a colloid due to ion-ion repulsion, preventing them from settling. When the water is rinsed, the micelles carry the trapped dirt away with them.

Note: Soap solutions appear cloudy because micelles are large enough to scatter light.



Q. What is a substitution reaction?

Ans: Saturated hydrocarbons are generally unreactive and remain inert in the presence of most reagents. However, in the presence of sunlight, chlorine reacts with these hydrocarbons in a very fast reaction. Chlorine replaces the hydrogen atoms one by one.

It is called a substitution reaction because one type of atom (or a group of atoms) takes the place of another atom.

$$CH_4 + Cl_2 \xrightarrow{sunlight} CH_3Cl + HCl$$

Q. Coal burning in a fireplace glows red and gives heat without a flame. Why is this so?

Ans: This happens because a flame is only produced when gaseous substances burn. When wood or coal is first ignited, the volatile substances present in them vaporize and burn with a flame.

Once these volatile components are exhausted, the remaining carbon (coke or charcoal) simply glows red and gives off heat without a flame, as there are no more gases being released to create one.

Q. How will you Differentiateethanol and ethanoic acid on the basis of physical and chemical properties?

Ans-

(a) On the basis of physical properties -

Ethanol	**Ethanoic acid**
Ethanol has a distinct alcoholic smell.	Ethanoic acid has a pungent, vinegar-like smell.
The melting point and boiling point of ethanol are 156 K and 351 K respectively.	The melting point and boiling point of ethanoic acid are 290 K and 391 K respectively.

(b) On the basis of chemical properties.

Ethanol	**Ethanoic acid**
Ethanol does not affect blue litmus. It is neutral.	Ethanoic acid turns blue litmus red. It is acidic.
Ethanol does not react with Na_2CO_3 and $NaHCO_3$	Ethanoic acid reacts to produce brisk effervescence of CO_2 gas.

Q. Name four functional groups.

Ans- Functional Group: An atom or a group of atoms that replaces hydrogen in a carbon chain and determines the chemical properties of the organic compound is called a functional group.

Four examples of functional groups are:

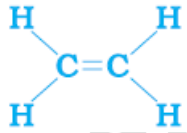
1. **Alcohol:** $-OH$
2. **Aldehyde:** $-CHO$
3. **Ketone:** $>C=O$
4. **Carboxylic Acid:** $-COOH$

Q. Which of the following is ethene? Write the number of double bonds present in it.

(i) C_2H_2 (ii) C_2H_4 (iii) C_2H_6

Ans- Ethene = Eth + ene
(2 carbon) alkene (C_nH_{2n})

So the formula of C_2H_4 is ethene.



1 double bonds & 4 single bonds present in it

Q. Why is the conversion of ethanol to ethanoic acid called an oxidation reaction?

Ans: The conversion of ethanol to ethanoic acid is an oxidation reaction because it involves the addition of oxygen and the removal of hydrogen from the ethanol molecule. This process is carried out using strong oxidising agents such as alkaline Potassium Permanganate $KmnO_4$ or acidified Potassium Dichromate $K_2Cr_2O_7$.

$$CH_3—CH_2OH \xrightarrow[\text{Or acidified } K_2Cr_2O_7 + \text{Heat}]{\text{Alkaline } KMnO_4 + \text{Heat}} CH_3COOH$$

5. Life Processes

Weightage: **8** Marks Question 4= Fill in the blanks-2, Very Short-1, Essay Type- 1.

Q. Fill in the Blanks-

1. The full name of ATP is **Adenosine Triphosphate.** (Model Paper 2026)
2. The chemical equation for photosynthesis is:
$6CO_2 + 12H_2O \xrightarrow{Chlorophyll\ \&\ Sunlight} \mathbf{C_6H_{12}O_6} + 6O_2 + 6H_2O$ (Model Paper 2026)
3. Saliva contains an enzyme called **salivary amylase**.
4. The complete digestion of food occurs in the **small intestine**.
5. The longest part of the human alimentary canal is the **small intestine**.
6. Absorbed fat is transported by **lymph** from the small intestine.
7. **Gastric glands** are found in the stomach.
8. **Hydrochloric acid** is found in gastric juice.
9. **30.5 kJ/mol** of energy is released upon the breakdown of one mole of ATP.
10. In our body, food is stored in the form of **glycogen**.
11. In plants, food is stored in the form of **starch**.
12. The enzyme that digests fat is **lipase**.
13. In the small intestine, protein is digested by the enzyme **trypsin**.
14. Both the **liver** and **pancreas** send their secreted juices to the small intestinal part of the alimentary canal.
15. In the stomach, partial digestion of protein occurs via the enzyme **pepsin**.
16. **Peristaltic movement** is necessary for the regular flow of food in every part of the food pipe.
17. Finger-like projections are found on the inner lining of the small intestine; they are called **villi**.
18. **Bile juice** is secreted by the liver.
19. In humans, the absorption of water and mineral salts from digested food occurs in the **large intestine**.
20. Biological catalysts are called **enzymes**.
21. Fungi, yeast, and mushrooms (fungi) break down food material outside the body and then perform its **absorption**.
22. In plants, food transport occurs via **phloem** tissue.
23. In plants, water transport occurs via **xylem** tissue.
24. The green colour of leaves is due to the **chlorophyll** pigment.
25. During photosynthesis, **oxygen** is released from water.
26. The opening and closing of **stomata** in leaves is the function of **guard cells**.
27. In plants, some waste products (resins and gums) are stored in old **xylem** parts.
28. In anaerobic respiration, the main product formed is **ethanol**.
29. Pain in muscles after excessive work is due to the accumulation of **lactic acid**.
30. The exchange of gases ($O_2$and CO_2) in the lungs takes place at the site called alveoli.
31. The smallest functional unit of the lungs is called the alveoli.
32. The breakdown of glucose into pyruvate in respiration occurs in the **cytoplasm** of the cell.
33. The breakdown of pyruvate forms CO_2, water, and energy, and this process takes place in the **mitochondria** of the cell.
34. The energy currency of the cell is called **ATP** (Adenosine Triphosphate).
35. Blood vessels that carry blood from the heart to the body organs are called **arteries**.
36. **Valves** are not found in artery vessels.
37. During contraction, the backward flow of blood inside the heart is prevented by **valves**.
38. The function of **platelets** is to stop bleeding by forming a blood clot.
39. The colour of blood is red due to the presence of the **haemoglobin** pigment.
40. Blood pressure is measured by a device called a **sphygmomanometer**. (BSER 2022)
41. The normal blood pressure of a healthy body (systolic/diastolic) is **120/80 mmHg**.
42. Fish hearts have **two** chambers.
43. The main excretory organ in humans is the **kidney**.
44. The microscopic unit of human excretion is called the **nephron**.
45. The main nitrogenous excretory substance in humans is **urea**.
46. Stomach is part of a system which is related to **Nutrition**.
47. Lungs in humans are part of a system which is related to **Respiration.** (BSER SUPP. 2024)
48. Kidney in humans is part of a system which is related to **Excretion.** (BSER 2025)
49. Alimentary canal in humans is part of a system which is related to **Digestion.** (BSER SUPP. 2025)
50. Heart in humans is part of a system which is related to **Transportation** (or blood Circulation) (BSER 2022, 2024)

Very Short Answer Type Questions

1. What is the function of the amylase enzyme found in saliva during food digestion?

Ans: The amylase enzyme works to convert complex starch into simple sugars.

2. Name the protein-digesting enzyme secreted by the pancreas. (BSER 2025)

Ans: Trypsin enzyme.

3. Name the protein-digesting enzyme secreted by the gastric gland in humans. (BSER 2025)
Ans: Pepsin.

4. Which gas do desert plants take in at night?
Ans: Carbon dioxide (CO_2). (BSER SUPP. 2025)

5. Name the liquid medium of blood.
Ans: Plasma. (BSER SUPP. 2025)

6. In which class of animals is a three-chambered heart found? (BSER SUPP. 2024, 2025)
Ans: In amphibians and many reptiles (cold-blooded animal).

7. Define life processes. (BSER 2023)
Ans: All those processes in living organisms that collectively perform the function of maintenance are called life processes.

8. In what form is energy from the food we eat stored? (BSER SUPP. 2025)
Ans: Energy is stored in the form of ATP (Adenosine Triphosphate).

9. Write the names of any two unicellular organisms.
Ans: Amoeba and Paramecium.

10. Why is nitrogen necessary for plants?
Ans: Nitrogen is an essential element for plants, which is used in the synthesis of proteins and other compounds.

11. What is the function of plasma in the blood?
Ans: The liquid medium of blood, plasma, transports food, CO_2, and nitrogenous waste materials in a dissolved form.

12. What is the main driving force for the movement of water in the xylem?
Ans: In plants during the daytime, transpiration acts as the main driving force for water movement in the xylem; during the night, root pressure is especially effective in water transport.

13. What are enzymes?
Ans: Enzymes are organic biocatalysts that increase the rate of various biochemical reactions.

14. What is the double circulation of blood called?
Ans: In humans, blood comes to the heart twice in each cycle of blood transport; this is called double circulation.

15. What is tooth decay?
Ans: Tooth decay is caused by the gradual softening of enamel and dentine due to the action of bacteria on sugar to produce acid.

16. What is the emulsification of fat?
Ans: The breaking down of large fat molecules into small globules is called emulsification.

17. Define digestion. (BSER 2023)
Ans: Digestion is the process of breaking down food into smaller, absorbable molecules that the body can use for energy, tissue growth, and repair.

18. Why is the length of the small intestine longer in herbivorous animals?
Ans: Herbivorous animals that eat grass require a long small intestine to digest cellulose. Meat is easier to digest, so the small intestine of carnivores like tigers is shorter.

19. Define respiration. (BSER 2025)
Ans: Respiration is the biochemical process by which an organism obtains energy from the oxidation of food (glucose).

Short Answer Type Questions

1. Explain the role of pancreatic juice in food digestion. (BSER 2023)
Ans: The pancreas secretes pancreatic juice which contains the enzyme trypsin for the digestion of protein and lipase for the digestion of emulsified fat. The food coming from the stomach into the small intestine is acidic, and the bile juice secreted from the liver makes it alkaline for the action of pancreatic enzymes.

2. Write the names of the different organs and associated glands of the digestive system.
Ans: Main organs of the digestive system:
(1) Mouth (2) Pharynx and Oesophagus
(3) Stomach (4) Small intestine
(5) Large intestine (6) Anus.
Associated glands: (1) Salivary glands
(2) Liver (3) Pancreas.

3. How does maintenance occur through platelets?
Ans: When blood flows out of the body, platelet cells form a net at the site of injury, clotting the blood, which stops the blood flow.

4. Where do plants obtain the raw materials necessary for photosynthesis from? (Model Paper 2026)
Ans: Plants obtain raw materials for photosynthesis from the following sources :
Carbon dioxide (CO_2): They take this from the atmosphere through their stomata.
Water (H_2O): Plant roots absorb this from the soil.
Sunlight: Chlorophyll present in the leaves absorbs sunlight.
Mineral salts: Roots absorb these from the soil, which helps in photosynthesis and other processes.

5. Explain two differences between autotrophic nutrition and heterotrophic nutrition.

OR (BSER SUPP. 2024)

Based on nutrition, how many types of organisms are there? Explain.

Ans: Based on nutrition, organisms are of two types: (1) Autotrophic (2) Heterotrophic.

	Autotrophic	**Heterotrophic**
1	Organisms that make their own food are called autotrophs. Plants make their own food from sunlight, CO_2 and water.	Organisms that directly or indirectly depend on autotrophs for their food. They obtain food from outside; they cannot make it themselves.
2	They have chlorophyll.	They do not have chlorophyll.
3	Ex: All green plants and some bacteria.	Ex: Animals and fungi.

6. How does nutrition occur in the body of plants? Write the reaction equation for this process.

Ans: Green plants (autotrophs) meet their carbon and energy requirements through the process of photosynthesis. In the process of photosynthesis, autotrophs synthesize food (carbohydrates) from carbon dioxide taken from outside and water, in the presence of sunlight and chlorophyll. Carbohydrates are used to provide energy to the plant. Carbohydrates that are not used immediately are stored in the form of starch. This reserved internal energy works as needed by the plant.

Reaction equation for photosynthesis:

$$6CO_2 + 12H_2O \xrightarrow{Chlorophyll\ \&\ Sunlight} C_6H_{12}O_6 + 6O_2 + 6H_2O$$

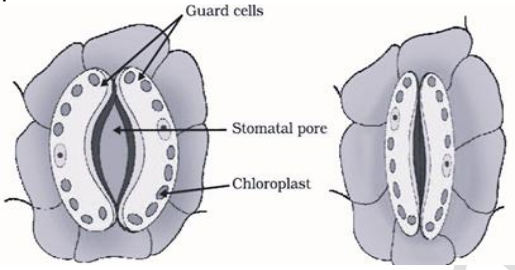
7. Explain the main events that occur during the process of photosynthesis. (BSER 2024) **OR Explain two events that occur in photosynthesis.** (BSER SUPP. 2025)

Ans: (1) Absorption of light energy by chlorophyll.
(2) Conversion of light energy into chemical energy.
(3) Splitting of H_2O molecules into H_2 and O_2.
(4) Reduction of CO_2 to carbohydrates.

8. What are stomata? Explain the mechanism of opening and closing of stomata in plants. OR Draw a labelled diagram of open and closed stomata. (BSER 2024)

Ans: Stomata are tiny pores on the surface of the leaf. Most of the exchange of gases for photosynthesis takes place through these stomata. Due to these pores, a significant amount of water is also lost, so when carbon dioxide is not needed for photosynthesis, the plant closes these pores.

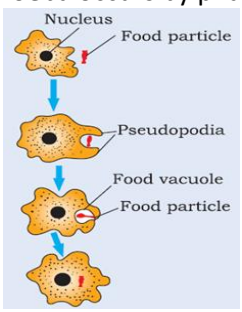
The opening and closing of stomata is a function of the guard cells. When water enters the guard cells, they swell, and the stomatal pore opens. Similarly, when the guard cells shrink, the pore closes.



9. Explain the method of nutrition in amoeba. (BSER 2025, BSER SUPP. 2024)

Draw a labelled diagram showing nutrition in amoeba. (BSER SUPP. 2024)

Ans: The unicellular organism amoeba takes in food with the help of temporary finger-like projections (pseudopodia or false feet) from its cell surface. These projections surround the food and form a food vacuole. Inside the food vacuole, complex substances are broken down into simple substances, which then diffuse into the cytoplasm. The remaining waste material moves to the surface of the cell and is expelled from the body. Nutrition in amoeba occurs by phagocytosis.



10. Explain the nutrition method in paramecium. (BSER 2025)

Ans: Paramecium is a unicellular organism; its cell has a definite shape and is fully covered by cilia. Food is taken in only from a specific spot. Food reaches this spot by the movement of the cilia.

11. Explain the digestion process in the small intestine.

Ans: The small intestine is the site for the complete digestion of carbohydrates, proteins, and fats. For this purpose, intestinal juice is secreted in the small intestine, and bile juice from the liver and pancreatic juice from the pancreas are received.

Bile juice makes the medium of food alkaline and emulsifies fat. The enzyme lipase digests the emulsified fat. The trypsin enzyme of pancreatic juice completely digests the protein. The enzymes present in intestinal juice finally convert proteins into amino acids, complex carbohydrates into glucose, and fats into fatty acids and glycerol.

12. Why is the length of the small intestine of a tiger less? Explain the reason. (BSER 2025)

Ans: Meat digestion is simple; meat is digested easily and quickly. Hence, the length of the small intestine of carnivorous animals like tigers is less.

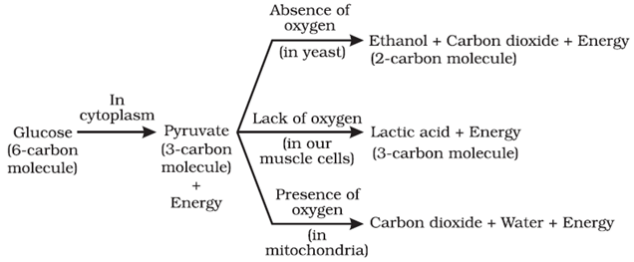
13. Explain the digestion of fat in our body. Where does this process occur?

Ans: In our body, fat digestion occurs in the small intestine. In the small intestine, fat is present in the form of large globules, which makes it difficult for enzymes to act on it. Bile salts secreted by the liver break down these fats into small globules and emulsify them, which increases the efficiency of the enzymes. The pancreatic juice secreted by the pancreas contains the enzyme lipase, which digests the emulsified fat. The lipase enzyme converts fat into fatty acids and glycerol.

14. Explain the function of villi found in the small intestine. OR (BSER 2025)
How is digested food absorbed in humans? Explain.

Ans: The wall of the small intestine absorbs the digested food. The inner lining of the small intestine has many finger-like projections called villi; these increase the surface area for absorption. The villi have an abundance of blood vessels that absorb the food and carry it to every cell of the body. Here, it is used to obtain energy, build new tissues, and repair old tissues. The undigested food is sent to the large intestine, where most of the villi absorb water from this material.

15. Explain the process of breakdown of glucose by different pathways (Draw a diagram).



16. Define aerobic respiration. (BSER 2023)

OR Explain the breakdown of glucose during aerobic respiration.

Ans: During aerobic respiration, the breakdown of glucose occurs in the presence of oxygen. In this process, glucose changes into energy; substances like carbon dioxide and water are also formed during aerobic respiration.

A molecule of glucose breaks down into two molecules of pyruvate in the cytoplasm of the cell. In aerobic respiration, pyruvate goes to the mitochondria of the cell in the presence of oxygen, producing energy along with carbon dioxide and water.

17. What is the difference between respiration and photosynthesis?

Ans: Photosynthesis and respiration are complementary and opposite processes to each other. In photosynthesis, glucose is formed from carbon dioxide and water, and oxygen is released. Whereas in respiration, energy is produced by the oxidation of glucose, along with carbon dioxide and water.

18. What is lymph? Write two functions of lymph.

Ans: Lymph is a type of fluid that helps in transport. Some plasma, protein, and blood cells exit through the pores present in the walls of the cells and come into the intercellular spaces of the tissue, forming tissue fluid or lymph.

Functions: The transport of digested fat absorbed by the small intestine occurs via lymph, and it takes the excess fluid back to the blood from the extracellular space.

19. Write the difference between aerobic respiration and anaerobic respiration. (BSER 2025)

Aerobic Respiration	Anaerobic Respiration
It occurs in the presence of O_2.	It occurs in the absence of O_2.
Products formed are CO_2 and water.	Products formed are ethanol and CO_2.
A high amount of energy is formed.	Comparatively less energy is formed.
It occurs in the mitochondria of organisms.	It occurs in some bacteria and yeast.

20. How do aquatic organisms respire?

Ans: Organisms that live in water use the dissolved oxygen in the water. Because the amount of dissolved oxygen in water is very low compared to the amount of oxygen in the air, the breathing rate of aquatic organisms is faster than that of terrestrial organisms. Fish take water through their mouth and force it to the gills, where the dissolved oxygen is taken up by the blood. Fish hearts have only two chambers. From here, the blood is sent to the gills where it is oxygenated and sent directly to the body. In this way, blood passes through the heart only once in each cycle in the body of fish.

21. What is transpiration? Write the importance of transpiration.

Ans: The loss of water in the form of vapour from the aerial parts of the plant is called transpiration. Importance of transpiration: Transpiration helps in the absorption of water and the upward movement of water and mineral salts dissolved in it from the root to the leaves. Transpiration also helps in regulating the temperature of plants. During the day when stomata are open, transpiration is the main driving force for the movement of water in the xylem.

22. Explain the mechanism of respiration in humans. OR Explain the air passage of the human respiratory system. (BSER 2023)

Ans: Air enters the body through the nostrils. In the nostrils, the air is filtered by fine hair, which ensures that the air going into the body is free from dust and other impurities. There is also a layer of mucus in this passage that helps in this process.

From here, the air flows from the pharynx through the trachea into the lungs. Rings of cartilage are present in the pharynx, which ensures that the air passage does not collapse. Inside the lungs, the respiratory passage (bronchi) divides into smaller and smaller tubes (bronchioles) that finally form balloon-like structures called alveoli. The walls of the alveoli contain a vast network of blood vessels.

When we breathe in, our ribs lift, and the diaphragm flattens, which enlarges the chest cavity. This causes air to fill the air sacs of the lungs. Blood brings CO_2 collected from the rest of the body to be released into the alveoli. Here, the exchange of O_2 and CO_2 takes place in the alveoli.

The respiratory pigment haemoglobin takes oxygen from the air in the lungs and transports it to those tissues where there is a deficiency of oxygen. Haemoglobin has a high affinity for oxygen. Haemoglobin is present in red blood cells. Carbon dioxide is more soluble in water and is therefore transported in our blood in a dissolved state.

Note: Alveoli maximise the area for gas exchange because their surface area is large, which makes gas exchange efficient.

23. What is the difference between veins and arteries?

Vein	Artery
Brings blood from organs to the heart.	Takes blood from the heart to organs.
Deoxygenated blood flows in veins. **exception:** pulmonary vein.	Oxygenated blood flows in arteries. **exception:** pulmonary artery.
Blood pressure is low in veins.	Blood pressure is high in arteries.
Valves are found in veins.	Valves are not found in arteries.
The walls of veins are thin.	The walls of arteries are thick.

24. What can be the consequences of a deficiency of haemoglobin in our bodies? (Model Paper 2026)

Ans: Due to haemoglobin deficiency, blood is unable to carry sufficient oxygen, leading to problems such as fatigue, weakness, dizziness, and shortness of breath. This condition is called anemia and reduces the body's efficiency.

25. How have the human lungs been designed to maximise the area for exchange of gases? (Model Paper 2026)

Ans: Human lungs have many small air sacs called alveoli. Due to the very large number of alveoli, a large surface area is created in the lungs. Their thin walls and surrounding capillaries help in the efficient exchange of gases.

26. What is blood pressure? What happens if blood pressure becomes high? Explain.

Ans: The pressure that blood exerts against the wall of a blood vessel is called blood pressure. This pressure is much higher in arteries than in veins. The pressure of blood inside the artery during ventricular contraction is called systolic pressure, and the pressure inside the artery during ventricular relaxation is called diastolic pressure. Normal systolic pressure is about 120 mmHg and diastolic pressure is about 80 mmHg. Blood pressure is measured with an instrument called a sphygmomanometer.

High blood pressure is also called hypertension and is caused by the narrowing of arteries. This increases resistance to blood flow and can lead to an artery bursting and internal bleeding.

27. Explain the transport of water and mineral salts in plants.

Ans: In xylem tissue, the vessels and tracheids of roots, stems, and leaves are connected to each other to form a continuous network of water-conducting channels that are connected to all parts of the plant. Root hair found on the surface of the root absorbs water from the soil by osmosis. The cells of the root actively take up ions from the soil. This creates a difference in ion concentration between the root and the soil. To eliminate this difference, water enters the root from the soil. In this way, water continuously moves into the xylem of the root, creating a column of water that is pushed upwards. Plants also use the strategy of transpiration to get water to the highest point in the plant via xylem. In fact, the evaporation of water molecules from the cell surface creates a suction that pulls water from the xylem cells present in the roots. Thus, transpiration helps in the absorption and upward movement of water and mineral salts dissolved in it from the root to the leaves.

Root pressure is especially effective in water transport during the night. During the day when stomata are open, transpiration pull is the main driving force for water movement in the xylem.

28. Explain the translocation of food materials in plants.

Ans: The products of metabolic activities, especially soluble products of photosynthesis, are transported, which is called translocation, and this occurs through the part of the vascular tissue called phloem. Besides the products of photosynthesis, phloem also transports amino acids and other substances. The translocation of food and other substances occurs in both upward and downward directions in the sieve tubes with the help of companion cells.

The translocation of food materials through phloem is achieved using energy. Substances like sucrose are transferred to the phloem tissue using energy obtained from ATP. This increases the osmotic pressure of the tissue, causing water to enter it. This pressure moves the food material through the phloem to the tissue where the pressure is low. This phloem tissue transports food materials according to the needs of the plant. For example, in spring, stored sugar in root and stem tissues is translocated to the buds, which need energy for growth.

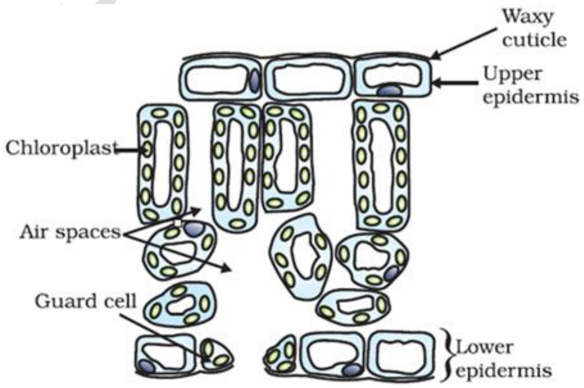
29. What is artificial kidney/dialysis? Explain its mechanism. Write its use.

Ans: Limited blood flow to the kidney, infection, or injury reduces the functioning of the kidney. Due to this, toxic wastes accumulate in the body, which can also cause death. In the condition of kidney failure, an artificial kidney can be used.

An artificial kidney is a device to remove nitrogenous waste products from the blood by dialysis. The artificial kidney contains many tubes with a semi-permeable lining. These tubes are fitted into a tank filled with dialysing fluid. The blood of the patient is passed through these tubes. In this passage, waste products from the blood move into the dialysing fluid by diffusion. The purified blood is pumped back into the patient's body. This is similar to the function of the kidney, but there is no reabsorption in it.

30. Draw a labelled diagram of the transverse section of a leaf. (BSER 2024)

Ans:

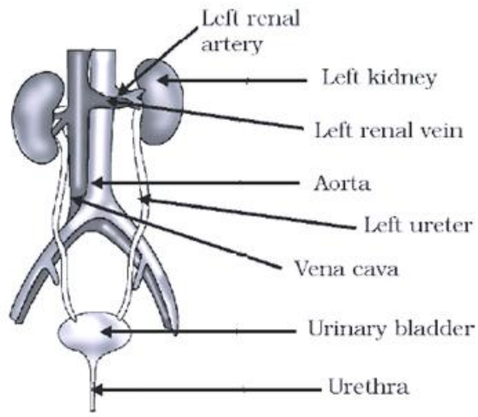


31. Explain the mechanism of human excretion. Draw a labelled diagram of the human excretory system. **OR**

Explain the mechanism of removing nitrogenous excretory substances from human blood.

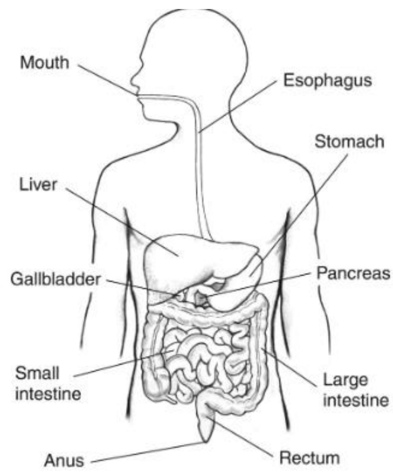
Ans: The human excretory system consists of a pair of kidneys, a ureter, a urinary bladder, and a urethra. After urine is formed in the kidney, it passes through the ureter into the urinary bladder and stays there until it is released through the urethra. Each kidney has many basic filtration units called nephrons. The nephron is the microscopic structural and functional unit of the kidney. In this nephron, nitrogenous waste products (urea or uric acid) are filtered from the blood.

In the initial filtrate, some substances like glucose, amino acids, salts, and a large amount of water remain. These substances are selectively reabsorbed.



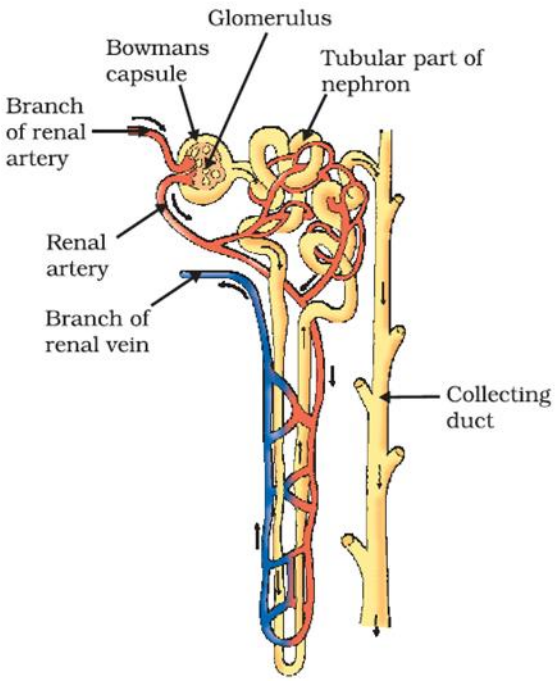
32. Draw a labelled diagram of the human digestive system. (BSER 2023, BSER SUPP. 2024)

Ans:

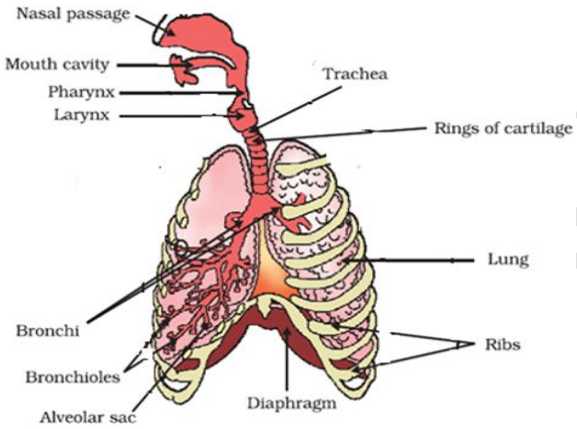


33. Draw a labelled diagram of the structure of a nephron.

Ans:

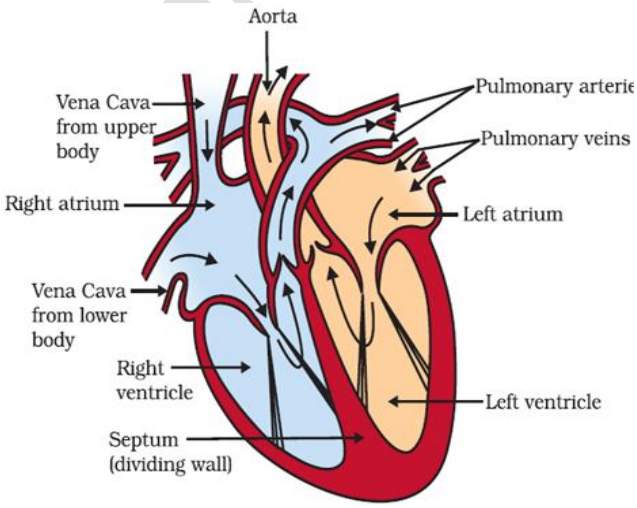


34. Draw a labelled diagram of the human respiratory system. (BSER 2023, Model Paper 2026)



35. Draw a labelled diagram of the human heart. (Model Paper 2026)

Ans:

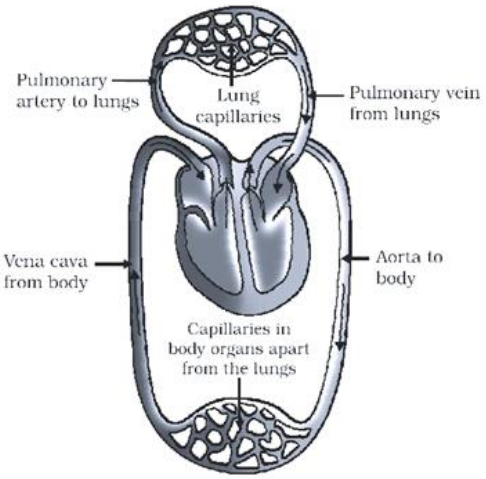


36. Explain the mechanism of blood circulation in humans. (BSER SUPP. 2025) **OR**

Explain the double blood circulation in humans. (Model Paper 2026) **OR**

Explain the process of oxygenated and deoxygenated blood flow in the human heart. OR How is oxygen and carbon dioxide transported in humans? (Model Paper 2026)

Ans: The human heart has four chambers: the right atrium, the left atrium, the right ventricle, and the left ventricle. Valves are located between the atria and ventricles. When the atrium or ventricle contracts, the valves prevent the blood from flowing in the opposite direction.



Oxygenated blood from the lungs comes to the left side of the heart, into the left atrium. Contraction in the left atrium pushes blood into the left ventricle. Contraction of the left ventricle pumps blood to various parts of the body. Oxygen is taken up by the cells from the blood, and this deoxygenated (impure) blood is collected from different parts of the body by the vena cava and poured into the right atrium. Contraction in this atrium makes the blood enter the right ventricle. When the right ventricle contracts, the blood is carried to the lungs by the pulmonary artery. Here the blood gets oxygenated (pure) again. In this way, blood enters the heart twice in each cycle, which is called double circulation.

6. Control and Coordination

(Marks Weightage = **6**) Question 5= MCQ.2, 1 very short-2, short-1

(1). Which of the following movements indicates growth?
(1) Running cat (2) Children playing on a swing
(3) Germination of a seed (4) Chewing cud (3)

(2). Involuntary actions like blood pressure, salivation, and vomiting are controlled by which part of the brain?
(1) Hypothalamus (2) Pituitary gland
(3) Forebrain (4) Medulla oblongata (4)

(3). Which of the following is an animal hormone?
(1) Auxin (2) Gibberellin
(3) Cytokinin (4) Insulin (4)

(4). The receptor for detecting smell is?
(1) Gustatory receptors (2) Olfactory receptors
(3) Auditory receptors (4) Touch receptors (2)

(5). The system responsible for control and coordination in animals is?
(1) Respiratory system (2) Excretory system
(3) Nervous system (4) Circulatory system (3)

(6). Reflex actions are controlled by?
(1) By the brain (2) By hormones
(3) By the spinal cord (4) None of these (3)

(7). Where are reflex arcs formed?
(1) Spinal cord (2)Stomach
(3) Brain (4) Lungs (1)

(8). The main coordination center of the human body is?
(1) Reproduction (2) Excretion
(3) Brain (4) Digestion (3)

(9). In which part of the brain are centers for hearing, smelling, seeing, and hunger found?
(1) Forebrain (2) Midbrain
(3) Hindbrain (4) None of these (1)

(10). Medulla oblongata is found in which part of the brain?
(1) Forebrain (2) Midbrain
(3) Hindbrain (4) All of the above (3)

(11). Cerebellum is found in which part?
(1) Forebrain (2) Midbrain
(3) Hindbrain (4) All of the above (3)

(12). Balance activities like walking in a straight line, cycling are controlled by which part of the brain?
(1) Forebrain (2) Midbrain
(3) Cerebellum (4) None of these (3)

(13). Centers for thinking, logic, memory are located in?
(1) Forebrain (2) Midbrain
(3) Hindbrain (4) None of these (1)

(14). The chemical substance secreted by endocrine glands is called?
(1) Enzyme (2) Hormone (3) Protein (4) Fat (2)

(15). The master gland of the body is?
(1) Pituitary (2) Hypothalamus
(3) Thyroid (4) Ovary (2)

(16). The male reproductive hormone is?
(1) Insulin (2) Thyroxine
(3) Growth hormone (4) Testosterone (4)

(17). The female reproductive hormone is?
(1) Testosterone (2) Estrogen
(3) Insulin (4) Growth hormone (2)

(18). The element responsible for thyroxine hormone is?
(1) Sodium (2) Iodine
(3) Potassium (4) Hydrogen (2)

(19). Which disease is caused by the deficiency of thyroxine hormone?
(1) Diabetes (2) Beriberi
(3) Goitre (4) Night blindness (3)

(20). Which disease is caused by the deficiency of insulin?
(1) AIDS (2) Beriberi
(3) Goitre (4) Diabetes (4)

(21). Which of the following is a plant hormone?
(1) Insulin (2) Thyroxine
(3) Estrogen (4) Cytokinin (4)

(22). The smallest unit of the nervous system is called?
(1) Nerve cell (2) Dendrite
(3) Neuron (4) Cell body (3)

(23). The empty space between two nerve cells (neurons) is called?
(1) Tail (2) Synapse
(3) Axon (4) Conduction (2)

(24). Which plant hormone is responsible for increasing the length of the stem?
(1) Auxin (2) Abscisic acid
(3) Gibberellin (4) Cytokinin (3)

1. **On which organ does the adrenaline hormone act directly?**
   Ans: The heart.
2. **What are the nerves arising from the brain called?**
   Ans: Cranial nerves.
3. **Which hormone is responsible for reducing blood sugar levels in the human body?**
   Ans: Insulin.
4. **Which hormone causes the plant stem to bend toward the light?**
   Ans: Auxin.
5. **Name the gland that functions as both endocrine and exocrine (mixed gland).**
   Ans: Pancreas.
6. **The growth of the pollen tube toward the ovule is an example of which process?**
   Ans: Chemotropism.
7. **The movement of plant roots downward is an example of what?**
   Ans: Positive geotropism.

8. **By which chemical substances does coordination take place in plants?**
   Ans: Phytohormones (Plant hormones).
9. **In which parts of the plant is auxin synthesized?**
   Ans: The apical parts (tips) of the shoot and root.
10. **Which is the largest endocrine gland in the human body?**
    Ans: Thyroid gland.
11. **Which two systems work together for coordination in the human body?**
    Ans: Nervous system and Endocrine system.
12. **Identify the three main regions of the human brain.**
    Ans: Forebrain, midbrain, and hindbrain.
13. **Which specific part of the forebrain contains the center for hunger?**
    Ans: Hypothalamus.
14. **Which part of the neuron (nerve cell) acquires sensory information?**
    Ans: Dendrite.
15. **What constitutes the organized network of nervous tissue?**
    Ans: Neurons.
16. **What is a rapid, automatic response to a sudden stimulus in the environment called?**
    Ans: Reflex action.
17. **What are the nerves arising from the spinal cord called?**
    Ans: Spinal nerves.
18. **Which structure protects the spinal cord?**
    Ans: Vertebral column (backbone).
19. **Which hormone is found in high concentrations in fruits and seeds?**
    Ans: Cytokinin.
20. **Which plant hormone is responsible for the wilting of leaves and inhibition of growth?**
    Ans: Abscisic acid.
21. **Which hormone is known as the "emergency hormone" or "fight-or-flight" hormone?**
    Ans: Adrenaline.
22. **Which gland secretes releasing hormones that stimulate the pituitary gland?**
    Ans: Hypothalamus.
23. **Provide examples of voluntary actions.**
    Ans: Writing, talking, and walking.
24. **Which is the main thinking part of the brain?**
    Ans: Forebrain (Cerebrum).
25. **Which hormone promotes cell division in plants?**
    Ans: Cytokinin.
26. **How does nervous tissue transmit information across the body?**
    Ans: Through electrical impulses.
27. **How do muscle cells change their shape to facilitate movement?**
    Ans: By rearranging special proteins within the cell.
28. **How do plant hormones reach their target sites from their point of synthesis?**
    Ans: Through the process of diffusion.

Q. How is the Central Nervous System (CNS) formed and what is its role

Ans- The brain and spinal cord constitute the **Central Nervous System**. They receive information from all parts of the body, integrate it, and coordinate responses.

Q. What is the Peripheral Nervous System (PNS)?

Ans- The communication between the CNS and the rest of the body is facilitated by the Peripheral Nervous System. it consists of: **Cranial nerves** arising from the brain. And **Spinal nerves** arising from the spinal cord.

Q. Which parts of the brain control involuntary actions?

Ans- Many involuntary actions are controlled by the mid-brain and hind-brain.

Medulla (Hind-brain): Specifically controls actions like blood pressure, salivation, and vomiting.

Mid-brain: Controls simple reflex actions like changes in the size of the pupil.

Q. What is the specific role of the Cerebellum?

Ans- The cerebellum (part of the hind-brain) is responsible for:

The precision of voluntary actions (e.g., walking in a straight line, picking up a pencil).

Maintaining the posture and balance of the body.

Q. How do plant cells change their shape?

Ans: Plant cells change their shape by varying the amount of water within them. When water enters the cell, it swells, and when water leaves, it shrinks. This change in cell volume results in a change of shape, leading to the movement of plant parts like leaves.

Q. How is the movement in a sensitive plant (Mimosa pudica) different from movement in animals?

Ans: Movement in animals is driven by specialised nervous and muscle tissues. In contrast, the sensitive plant lacks both nervous and muscle tissue. Instead, movement in the plant occurs due to changes in the water content (swelling or shrinking) of its cells in response to a stimulus.

Q. Describe the functions of the Fore-brain.

Ans- The fore-brain is the main thinking part of the brain. Its functions include:

Receiving sensory impulses from receptors (hearing, smell, sight, etc.).

Interpreting sensory information by combining it with stored information (memory).

Controlling voluntary muscle movements via motor areas.

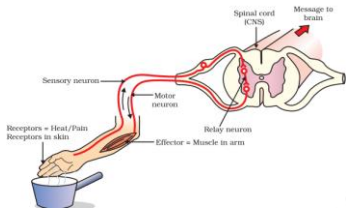
The sensation of feeling full (hunger center).

Q. What are reflex actions?

Ans- Suddenly, unconscious, and involuntary responses of the body to a specific stimulus are called reflex actions.

Q. What is a reflex arc? Draw a labeled diagram of reflex arc.

Ans- The sensory pathway that controls a reflex action is called a reflex arc. It involves detecting an input signal and performing an immediate output action. The reflex arc connects the sensory nerve and the motor nerve in the spinal cord. While the information also travels to the brain, the immediate response is generated in the spinal cord for a quicker reaction.



Q. How does chemical coordination take place in plants?

Ans- Chemical coordination in plants is achieved through plant hormones. Plant cells secrete these hormones to control growth, development, and responses to the environment. They coordinate in the following ways:

Auxin: Promotes cell elongation and growth at the shoot tips.

Gibberellins: Help in the growth of the stem.

Cytokinins: Promote rapid cell division.

Q. Write the names and functions of plant hormones that help in growth.

Ans-Auxin: It helps in increasing the length of cells. It causes the plant to bend towards light.

Gibberellins: Similar to auxin, they aid in the longitudinal growth of the stem.

Cytokinin: It induces cell division and is found in high concentrations in areas of rapid growth, such as fruits and seeds. **Cytokinins are found in higher concentrations in fruits and seeds.**

Q. Write the name and function of the plant hormone which inhibits growth.

Ans- Abscisic acid is a growth-inhibiting hormone. Its effects include the wilting and falling of leaves.

Q. When light comes from one side of the plant, how does the plant turn towards the light?

Ans- When a growing plant detects light, the hormone auxin is synthesized at the tip of the shoot. Auxin helps cells grow longer. When light comes from only one side, auxin diffuses towards the shady side of the shoot. The higher concentration of auxin on the shady side stimulates the cells there to grow longer than the cells on the lighted side. This uneven growth causes the plant to bend towards the light.

Q. Write the name of the hormone secreted by the adrenal gland. How does it function?

Ans- The adrenal gland secretes Adrenaline. It is released directly into the blood during "fight or flight" situations.

It increases the heartbeat to supply more oxygen to the muscles.

It reduces blood flow to the digestive system and skin by contracting muscles around small arteries, diverting blood to skeletal muscles.

The breathing rate increases due to the contraction of the diaphragm and rib muscles.

These responses together prepare the body to deal with emergency or adverse conditions.

Q. Explain the structure of a nerve cell (neuron) and its functions.

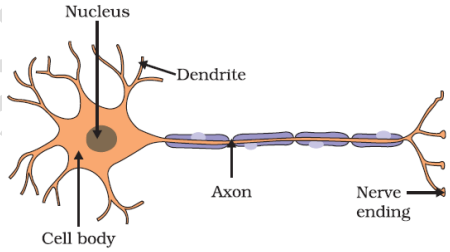
Ans- Structure: The neuron is the structural and functional unit of the nervous system. It consists-

(a) Cell Body (Cyton): Contains the nucleus and cytoplasm.

(b) Dendrites: Short, branched outgrowths that receive signals.

(c) Axon: The longest projection that carries impulses away from the cell body.

Function: Neurons exchange and analyze information using electrochemical signals (impulses) to coordinate body activities.



Q. What is tropic movement? Describe the various movements in plants.

Ans- The directional growth movement of a plant in response to a stimulus is called tropic movement.

1. Phototropism: This is the movement of plant parts in response to light. The stem moves towards the light, showing positive phototropism, while the roots move away from the light, showing negative phototropism.

2. Geotropism (Gravitropism): This is the movement of plant parts in response to gravity. The roots grow towards gravity (positive geotropism), while the stem grows upwards, away from gravity (negative geotropism).

3. Hydrotropism: This is the growth movement of plant parts in response to water. Roots grow towards water, showing positive hydrotropism, whereas the stem generally grows away from it, showing negative hydrotropism.

5. Chemotropism: Growth in response to a chemical substance is called chemotropism. Example- Growth of the pollentube towards the ovule during fertilization.

5. Thigmotropism (Tactile movement): This movement is induced by touch or contact. When a tendrilcomes in contact with a support, the part of the tendril not in contact with the object grows faster than the part in contact. This causes the tendril to circle the object and form a coil.

Q. Write the name of the hormone secreted by the thyroid gland, its function, the element required for its formation, and the deficiency disease.

Ans- The thyroid gland secretes Thyroxine hormone.

Function: It regulates the metabolism of carbohydrates, proteins, and fats for optimum growth.

Required Element: Iodine is essential for the synthesis of thyroxine hormone.

Deficiency Disease: A lack of iodine causes Goitre, which is characterised by a swollen neck

Q. Write the name of the hormone secreted by the pancreas. Write the function of this hormone. Which disease is caused by its deficiency?

Ans- The pancreas secretes the hormone Insulin.

Function: Insulin helps in regulating blood sugar levels by promoting the absorption of glucose by cells.

Deficiency Disease: Deficiency of insulin causes Diabetes. In this condition, the blood sugar level rises, leading to many harmful effects. This is why diabetic patients are often advised to take less sugar in their diet and, in severe cases, take insulin injections.

Q. Write the name of the hormone secreted by the pituitary gland. Write the function of this hormone. What is the effect of deficiency and excess of this hormone in childhood?

Ans- The pituitary gland secretes the Growth Hormone.

Function: It regulates the growth and development of the body.

Effects: If there is a deficiency of this hormone in childhood, it leads to Dwarfism (the person remains very short). If there is an excess secretion of this hormone, it leads to Gigantism (the person becomes extraordinarily tall).

Q. What is the function of receptors in our body? What problems can arise if receptors do not function properly?

Ans- Receptors are specialised tips of nerve cells, usually located in our sense organs (like eyes, ears, nose, tongue, and skin).

Function: They detect information from the environment and trigger an electrical impulse in the sensory neurons to send the message to the brain or spinal cord.

Problems: If receptors do not function properly, the body will not be able to perceive stimuli (like heat, pain, or taste). Consequently, the brain will not receive necessary information, and the body will fail to respond appropriately, which can lead to dangerous situations or injuries.

Q. "Movement in a sensitive plant does not occur at the point of touch but in another part." What is the reason for this?

Ans: This happens because the information of the touch is communicated from the point of contact to other parts of the plant via electrical-chemical signals. Because this information travels across cells, the actual movement (folding of leaves) can occur at a distance from where the plant was touched.

Q. Write the difference between involuntary actions and reflex actions.

Involuntary Action	Reflex Action
1. Controlled by the midbrain and hindbrain. 2. Occurs at a relatively slower speed. eg. heartbeat, breathing, digestion	1. Controlled mainly by the spinal cord. 2. Occurs instantaneously and suddenly. eg. sneezing, salivation, Withdrawing hand from a hot object.

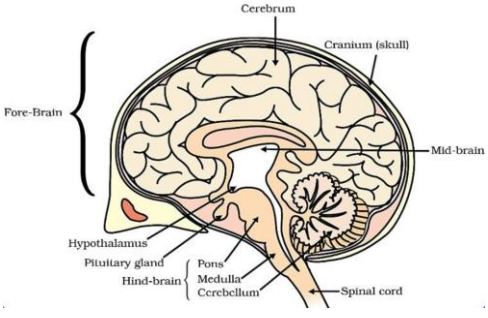
Q. Compare nervous and hormonal mechanism for control and coordination in animals.

Nervous System	Hormone System
The nervous system controls itself by receiving sensory information.	Hormones are secreted by endocrine glands, which control growth, development, reproduction etc.
Information is transmitted as electrical impulses.	Information is transmitted through chemical messengers (hormones).
Signals travel very fast along nerve fibers.	Signals travel slowly through the bloodstream.
Effects are generally short-lived.	Effects are often long-lasting.
The nervous system has its own network in the body. that exchanges information.	Hormones are transported throughout the body by the blood.

Q. Tabulate the secretions of the endocrine glands and their functions.

Endocrine Gland	Secrete Hormone	Function
Hypothalamus Gland	Releasing hormone	Stimulating hormone secretion from the pituitary gland.
Pituitary Gland	Growth hormone	Regulates growth and development of the body.
Thyroid Gland	Thyroxine	Regulation of metabolic activities of the body.
Adrenal Gland	Adrenaline	Prepares the body for emergency (Fight or Flight).
Pancreatic Gland	Insulin	Regulation of blood sugar level.
Testes Gland	Testosterone	Development of male secondary sexual characteristics.
Ovaries Gland	Estrogen, Progesterone	Development of female secondary sexual characteristics.

Q. Draw a labeled diagram of the brain.



7. How Do Organisms Reproduce?

(Marks Weightage = **7**) Q.-4= MCQ-2, short-1, long type-1

1. **The reproductive organ of angiosperm plants is:**
   (1) Leaf (2) Root (3) Flower (4) Stem (3)
2. **In which of the following organisms can a new organism be produced by regeneration?**
   (1) Planaria (2) Leishmania
   (3) Plasmodium (4) Earthworm (1)
3. **The thread-like structures on bread are the hyphae (web) of which fungus?**
   (1) Amoeba (2) Rhizopus
   (3) Spirogyra (4) Paramecium (2)
4. **In which reproduction method are variations produced?**
   (1)Sexual reproduction (2)Asexual reproduction
   (3) Cloning (4) None of these (1)
5. **Meiosis (reduction division) occurs in:**
   (1) Germ cells (2) Somatic cells
   (3) body cell (4) None of these (1)
6. **The method of reproduction in Amoeba is:**
   (1) Fission (Binary Fission) (2) Regeneration
   (3) Spore formation (4) Cutting (1)
7. **The causative agent of Kala-azar is:**
   (1) Fly (2) Mosquito
   (3) Leishmania (4) None of these (3)
8. **The method of reproduction in Leishmania is:**
   (1) Budding (2) Binary fission
   (3) Sexual reproduction (4) Regeneration (2)
9. **The name of the malaria parasite is:**
   (1) Fly (2) Mosquito
   (3) Plasmodium (4) Honeybee (3)
10. **The method of reproduction in Plasmodium is:**
    (1) Sexual reproduction (2) Regeneration
    (3) Multiple fission (4) Layering (3)
11. **Where does the implantation of the embryo take place?**
    (1) Vagina (2) Ovary
    (3) Uterus (4) Oviduct (Fallopian tube) (3)
12. **Which part is not used in vegetative propagation?**
    (1) Root (2) Stem
    (3) Leaf (4) Flower (4)
13. **Which of these is not a part of the Pistil ?**
    (1) Anther (2) Ovary
    (3) Style (4) Stigma (1)
14. **The male reproductive organ of a flower is:**
    (1) Pistil (2) Stamen
    (3) Both of the above (4) None of these (2)
15. **The female reproductive organ of a flower is:**
    (1) Pistil (2) Stamen
    (3) Both of the above (4) None of these (1)
16. **The full name of D.N.A is:**
    (1) Dextronucleic Acid (2) Dinucleic Acid
    (3) Deoxyribonucleic Acid (4) None of these (3)
17. **Asexual reproduction occurs by budding in:**
    (1) Amoeba (2) Yeast
    (3) Plasmodium (4) Leishmania (2)
18. **Which of the following is not a part of the female reproductive system?**
    (1) Ovary (2) Uterus
    (3) Vas deferens (4) Oviduct (3)
19. **The method of reproduction in Spirogyra is:**
    (1) Fission (2) Budding
    (3) Regeneration (4) Fragmentation (4)
20. **The techniques of vegetative propagation are:**
    (1) Layering (2) Cutting
    (3) Grafting (4) All of the above (4)
21. **Reproduction by leaves occurs in:**
    (1) Hydra (2) Yeast
    (3) Bryophyllum (4) Potato (3)
22. **Anther contains:**
    (1) Sepals (2) Ovary
    (3) Ovule (4) Pollen grains (4)
23. **Which part forms the fruit in plants?**
    (1) Pollen grain (2) Ovary
    (3) Sepals (4) Petals (2)
24. **Seeds are formed in plants from which part?**
    (1) From sepals (2) From petals
    (3) From ovule (4) From stamens (3)
25. **The site of fertilization in humans is:**
    (1) Fallopian tube (Oviduct) (2) Ovary
    (3) Uterus (4) Seminal vesicle (1)
26. **By which method does reproduction take place in Hydra?**
    (1) Multiple fission (2) Regeneration
    (3) Budding (4) Vegetative propagation (3)
27. **The method of reproduction in Rhizopus is:**
    (1) Budding (2) Regeneration
    (3) Fission (4) Spore Formation (4)

1. **Name the primary male hormone.**

Ans- Testosterone.

2. **Where is the information for protein synthesis located in a cell?**

Ans- In the DNA of the cell nucleus.

3. **What is the fundamental event of reproduction?**

Ans- DNA replication (creation of a DNA copy).

4. **What is considered the basis of biological evolution?**

Ans- Variation.

5. **Define tissue.**

Ans- A group of cells similar in structure that function together as a unit.

6. **What is the main genetic advantage of vegetative propagation?**

Ans- The offspring are genetically identical to the parent plant.

7. What is a mobile reproductive cell called?
Ans- Male gamete (Sperm).
8. Which reproductive cell contains the stored food for the embryo?
Ans- Female gamete (Germ-cell).
9. Name two unicellular organisms.
Ans- Amoeba and Paramecium.
10.Write the name of a female hormone.
Ans- Estrogen (or Progesterone).
11.Mention the mode of reproduction in Amoeba.
Ans- Binary fission.
12.Where does the implantation of the embryo occur in humans?
Ans- In the uterus.
13.Give one application of tissue culture.
Ans- Growing ornamental plants or producing disease-free plants.
14.List the parts of the female part (pistil) of a flower.
Ans- Stigma, style, and ovary.
15.Name the main parts of the human male reproductive system.
Ans- Testes, vas deferens, seminal vesicles, and penis.
16.Name the main parts of the human female reproductive system.
Ans- Ovaries, oviducts (Fallopian tubes), uterus, and vagina.
17.What is meiosis? Write its significance.
Ans- The division that occurs in the reproductive cells of organisms due to which the number of chromosomes is halved is called meiosis. Importance – In the formation of male and female gametes.

Q. What is germination?
Ans- The embryo present in the seed develops into a seedling under suitable conditions, this process is called germination.

Q. What is called male reproductive system? In which organ is sperm produced?
Ans- The organs that produce sperm and the organs that transport sperm to the place of fertilization, together form the male reproductive system. Sperm formation takes place in the testicles.

Q. Write the functions of testosterone hormone.
Ans- Testosterone is responsible for the development of male accessory sex organs, muscular growth, and secondary sexual characters. It regulates sperm production in males.

Q. Why are the testicles located outside the abdominal cavity in the scrotum?
Ans- Because the temperature required for sperm production is less than body temperature.

Q. What will happen if a man's vas deferens are blocked?
Ans- The transfer of sperms will stop due to which fertilization will not take place.

Q. Write the names of male and female genital organs of the flower.
Ans- Male genital organs is Stamens and Female genital organs is Pistil

Q. What is callus?
Ans- Callus is an unorganized mass of cells produced during tissue culture when cells are placed in an artificial medium.

Q. What is the work of prostate glands and the seminal vesicles.
Ans- Along the path of the vas deferens, these glands (prostate glands and seminal vesicles) add their secretions to make the transport of sperms easier by providing a fluid medium. This fluid also provides nutrition to the sperms.

Q. What is called 'embryo'
Ans- An embryo is the stage of development where the zygote begins to divide and undergoes further growth. It eventually implants in the lining of the uterus.

Q. What is called sexually transmitted disease? Write the name.
Ans- Diseases transmitted through sexual contact are called STDs.
Bacterial infections:- Gonorrhea and Syphilis;
Viral infections:- Warts and HIV-AIDS."

Q. Define unisexual and bisexual flower with examples.
Ans- Unisexual flower- When only one genital out of stamen or pistil is present in the flower, it is called unisexual flower. eg. Papaya and Watermelon.
Bisexual flower- When both the stamen and pistil are present in the flower, it is called bisexual flower. eg. Hibiscus and mustard.

Q. Write the difference between self pollination and cross pollination.
Ans- Self-pollination: In this, the transfer of pollen grains takes place from the anther to the stigma of the same flower or another flower of the same plant.
Cross-pollination: In this, the transfer of pollen grains takes place from the anther of one flower to the stigma of another flower on a different plant of the same species.

Q. What is called placenta? What is its function?
Ans- The embryo is connected to the mother's uterine wall through a specialized tissue called the placenta.
Function- The placenta provides nutrition and oxygen to the embryo from the mother's blood and excretes the waste products of the embryo.

Q. What happens when the egg is not fertilized. Or What is called menstruation?
Ans- If fertilization does not take place in the fallopian tubes, then the inner thick layer of the uterus breaks down along with the blood vessels and comes out in the form of bleeding, which is called menstruation, its duration is 2 to 8 days.

Q. What could be the reasons for adopting contraceptive methods?
Ans- 1. To prevent unwanted pregnancy. 2. To prevent sexually transmitted diseases. 3. To prevent fertilization.

Q. What are the contraceptive methods?

Ans- Mechanical Barriers: Using physical blocks like condoms (on the penis) or vaginal coverings to prevent sperm from reaching the egg.

Hormonal Methods: Taking oral pills that change the body's hormonal balance to stop the release of eggs.

Intrauterine Devices (IUDs): Placing devices like the loop or copper-T inside the uterus to prevent pregnancy.

Surgical Methods: Blocking the vas deferens in males or the fallopian tubes in females to prevent fertilization.

Note: Hormonal and IUD methods can have side effects, and surgery carries a risk of infection if not performed properly.

Q. Tell the benefits of vegetative propagation OR why vegetative propagation is used in growing some plants.

Ans- Plants raised by vegetative propagation can bear flowers and fruits earlier than those produced from seeds. It makes possible the propagation of plants such as banana, orange, rose, and jasmine that have lost the capacity to produce seeds. All plants produced are genetically similar enough to the parent plant to have all its characteristics.

Q. Briefly explain the different parts of the male reproductive system. Draw a labeled diagram of the human male reproductive system.

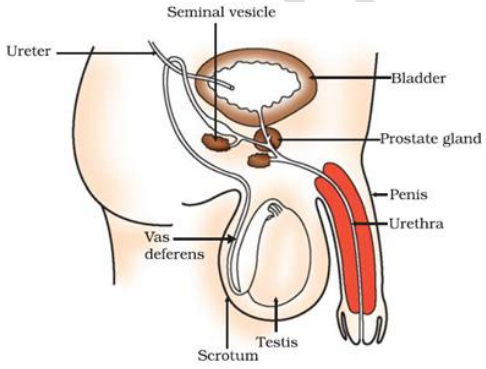
Ans- Testis– There are one pair outside the abdominal cavity. Sperms are produced in the testes. The male hormone testosterone is produced.

Epididymis- The tubular part that provides nutrition to the sperms and store the sperms.

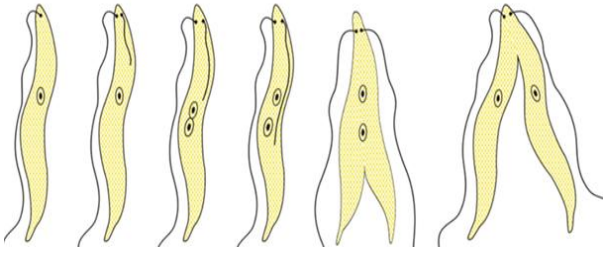
Vas deferens- tubular structure that transports Sperm.

Seminal Vesicles and Prostate Gland - Both glands secrete liquid which together with sperms makes semen.

Urethra - This is a common passage for both sperms and urine.



Q. Draw a labeled diagram of binary fission in Lesmania.



Q. Briefly explain the different parts of the female reproductive system. Draw a labeled diagram of the female reproductive system.

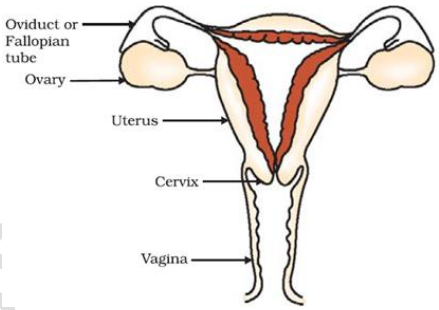
Ans- (1) Ovary: It is the primary female sex organ. A pair of ovaries is located on both sides of the lower abdomen.

Function: It produces the female gamete (germ-cell) called egg (ovum) and secretes hormones like estrogen and progesterone.

(2) Oviduct (Fallopian tube): It is a tube that carries the egg from the ovary to the uterus. Fertilization occurs here.

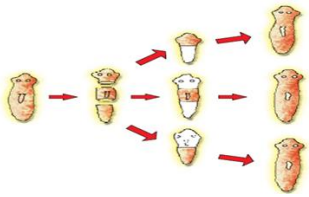
(3) Uterus: It is a pear-shaped, muscular, elastic bag-like structure where the embryo gets implanted and develops into a fetus.

(4) Vagina: The uterus opens into the vagina through the cervix. It receives the sperm and acts as the birth canal.



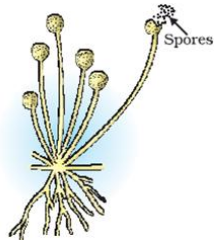
Q. Explain the process of regeneration in planaria? Draw a labeled diagram of regeneration in planaria.

Ans- Regeneration - If the individual is somehow cut or broken into many pieces, many of these pieces grow into separate individuals. Example: Planaria can be cut into any number of pieces and each piece grows into a complete organism.Regeneration is carried out by specialised cells that proliferate and make large numbers of cells.



Q. How does reproduction occur in Rhizopus fungus? Draw a labeled diagram of spore union in Rhizopus.

Ans- The thread-like structures that develop on the bread are the hyphae of the Rhizopus fungus.Rhizopus has the tiny blob-on-a-stick structures are sporangia in reproduction, which contain cells, or spores, that can eventually develop into new Rhizopus individuals. The spores are covered by thick walls that protect them until they come into contact with another moist surface and can begin to grow.

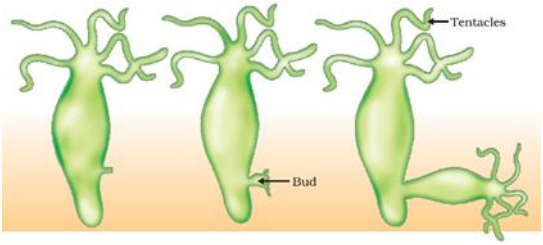


Q. Differentiatebetween sexual reproduction and asexual reproduction.

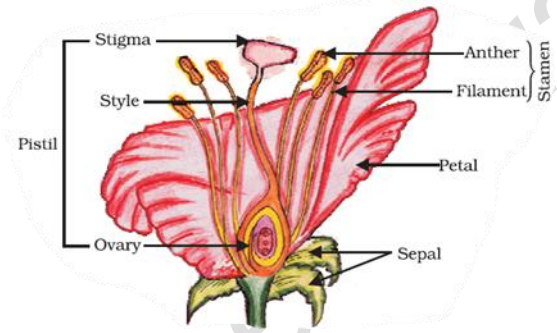
Asexual reproduction	Sexual reproduction
Only a single parent is involved.	Two parents (male and female) are involved.
New generations are created without the fusion of gametes.	It involves the fusion of male and female gametes.
The offspring are genetically identical to the parent.	Offspring show variations and are genetically diverse.
Limited role in evolution.	Plays a major role in evolution through variation.
eg. Amoeba, Hydra, Rhizopus.	eg. Flowering plants, Human beings.

Q. Explain budding in Hydra with illustration.

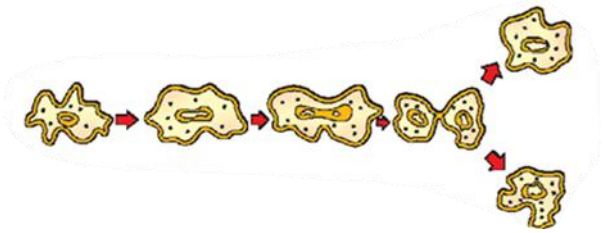
Ans- Hydra uses regenerative cells for reproduction in the process of budding. A bud develops as an outgrowth due to repeated cell division at one specific site. These buds develop into tiny individuals and, when fully mature, detach from the parent body to become new independent individuals.



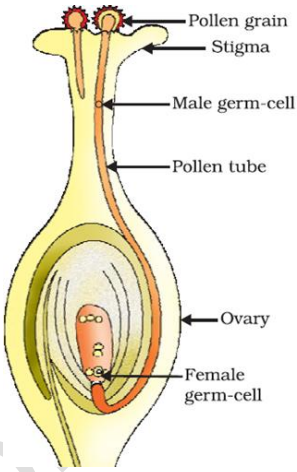
Q. Draw a labeled diagram of the longitudinal section of flower.



Q. Draw a labeled diagram of binary fission in Amoeba.



Q. Draw a labeled diagram of the Germination of pollen on stigma



Q: Name any two contraceptive devices placed in the uterus.

Ans: Loop, Copper-T

Q: How is pregnancy prevented through surgical methods?

Ans: Surgery is used to create blocks in the reproductive tracts:

In males: The vas deferens is blocked to prevent sperm transfer.

In females: The fallopian tube is blocked so the egg cannot reach the uterus.

Q: What are some potential problems associated with using contraceptive methods?

Ans: According to the text, the potential side effects are:

Hormonal pills can cause side effects by changing the body's hormonal balance.

Devices like the Loop or Copper-T can cause irritation of the uterus.

Surgical methods can cause infections and other problems if not performed properly.

8. Heredity

Weightage - 4 Marks

Q. 4 = fill in the blanks - 2, Very Short – 2.

Q. Fill in the blanks questions-

1. The father of heredity is **Gregor Johann Mendel**. (Model Paper 2026)
2. Animals like **snails** can change their sex. (Model Paper 2026)
3. Mendel conducted his experiments on the **garden pea** plant.
4. The carriers of hereditary traits are **genes**.
5. **23 pairs** of chromosomes are found in humans.
6. The number of autosomes in humans is **22 pairs**.
7. The number of sex chromosomes in humans is **one pair**.
8. Sex chromosomes in males are of the **XY** type. (BSER 2024)
9. Sex chromosomes in human females are of the **XX** type.
10. **Genes** are located on chromosomes.
11. **Genetic** variations are inherited in the next generation.
12. Variations are more pronounced in **sexual** reproduction.
13. The reason for new characteristics coming in the offspring is **variation**.
14. The transmission of traits from parents to offspring is called **heredity**.
15. Traits transferred from parents to offspring are called **hereditary traits**.
16. A trait expressed in the F_1 generation is called a **dominant trait**.
17. A trait that remains hidden in the F_1 generation is called a **recessive trait**.
18. The external appearance of the RRYY gene structure will be **round, yellow seed**.
19. The part of DNA that contains information for the synthesis of a protein is called a **gene**.
20. The ratio of offspring obtained from Tt X tt cross will be **1:1**.

Very short answer type questions-

Q. What kind of offspring will be obtained in the F_1 generation from the cross between pure tall plants (TT) and pure dwarf plants (tt)?
Ans- All tall plants

Q. A pure tall pea plant (TT) is crossed with a pure dwarf plant (tt). The ratio of pure tall and pure dwarf plants in the F_2 generation will be-
Ans- 1:1

Q. A pure tall pea plant (TT) is crossed with a pure dwarf plant (tt). The ratio of tall and dwarf plants in the F_2 generation will be-
Ans- 3:1

Q. What is the percentage probability of a third child being a boy after a couple has two daughters?
Ans- 50%

Q. What will be the external appearance of the RrYy gene structure? (BSER 2023)
Ans- Round, yellow seed

Q. How did Mendel obtain the parental plants and F_1 generation plants?
Ans- By self-pollination

Q. What is heredity called? (Model Paper 2026)
Ans- The characteristics and qualities of ancestors that pass from generation to generation in organisms are called heredity.

Q. What is the phenotypic ratio of the F_2 generation of a monohybrid cross?
Ans- 3:1 (3 tall: 1 dwarf)

Q. What is the genotypic ratio of the F_2 generation of a monohybrid cross? (BSER 2025)
Ans- 1:2:1

Q. What will be the gene structure of the length of the plants obtained in the F_2 generation in a monohybrid cross?
Ans- TT, 2Tt, tt

Q. What is the phenotypic ratio of the F_2 generation of a dihybrid cross?
Ans- 9:3:3:1

Q. What was the contrasting trait of the white flower of pea in Mendel's experiment? (BSER 2025)
Ans- The contrasting trait of the white flower of pea was the purple flower. The white flower is a recessive trait, while the purple flower is a dominant trait.

Q. What was the contrasting trait of the tall plant of pea in Mendel's experiment?
Ans- Dwarfism

Q. Write the external characteristics of the seeds with the genotypes given below.
i) Rryy ii) rrYY
Ans i) Round, green seed ii) Wrinkled yellow seed

Q. What is genotype called?
Ans- The genetic makeup of organisms is called genotype.

Q. What is a gene?
Ans- The unit of heredity of living beings is called a gene. A gene is that part of DNA which contains the information for the synthesis of a protein.

Q. What is a chromosome?
Ans- Chromosomes are thread-like bodies found in the cells of all living beings, which determine and transmit all hereditary traits. The number of chromosomes remains fixed in each species.

Q. Which chromosome is the smallest in size in humans?
Ans- The Y chromosome is the smallest in size.

Q. Which law is based on the monohybrid cross experiment?
Ans- Law of Dominance.

Q. Which variations are inherited in the next generation?
Ans- Genetic variations.
Q. What type of experiment did Mendel do to prove the law of independent assortment?
Ans- Dihybrid cross.

Q. In what type of reproduction are variations displayed?
Ans- Variations are relatively higher in sexual reproduction.

Q. What is a dominant trait called?
Ans- In sexually reproducing organisms, there are two copies of the gene for a trait. In the event that these copies are not the same, the copy that appears is called the dominant trait.

Q. In Mendel's experiment on the inheritance of traits, the ratio/percentage of tall plants obtained in the F_1 generation was.
Ans- 100 % tall plants.

Q. What is meant by variations?
Ans- Inequalities found in organisms with the same genetic makeup are called variations.

Q. What is the basis of the laws of inheritance?
Ans- The laws of inheritance are based on the fact that both mother and father transfer equal amounts of genetic material to the offspring.

Q. What is meant by pure line?
Ans- Such genes that produce organisms with traits similar to their own for many generations for a specific trait are called pure line.

Q. Why are traits acquired by a single organism not inherited in the next generation?
Ans- The effect of acquired traits is only on the somatic cells; their effect is not on the genetic material DNA. Whereas only the traits of the genetic material are inherited. Therefore, acquired traits are generally not inherited in the next generation.

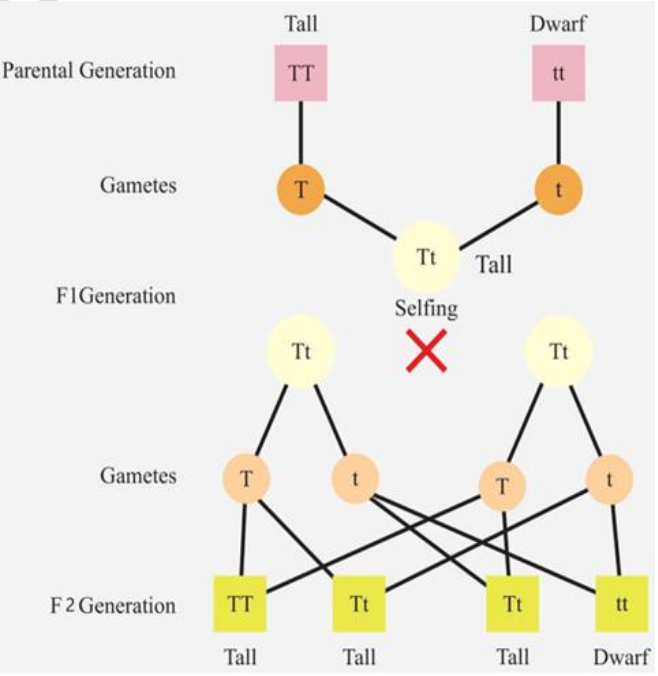
Q. How did Mendel succeed in propounding the laws of inheritance?
Ans- Many scientists before Mendel had also studied the hereditary traits of peas and other organisms. But Mendel combined his science and mathematical knowledge. Mendel was the first scientist who recorded and calculated the traits displayed by one plant of each generation. This helped him in propounding the laws of inheritance.

Q. Which contrasting (allelic) traits did Mendel study in the pea plant?

S. No.	Contrasting (allelic) trait	Dominant trait	Recessive trait
1.	Plant height	Tallness	Dwarfism
2.	Seed Shap	Round	Wrinkled
3.	Seed color	Yellow	Green
4.	Flower color	Purple	White

Q. Which plant did Mendel select for his experiments and why?
Ans- Mendel selected the garden pea plant for his experiments. Contrasting allelic traits are broadly visible in pea plants. Their lifespan is short. Generally self-pollination occurs, but cross-pollination can also be done artificially. It produces many seeds in a single generation.

Q. Explain the phenotypic ratio of the offspring obtained in the F_2 generation with a linear diagram when crossing tall (dominant) and dwarf (recessive) pea plants. **OR**
Draw a diagram showing the inheritance of traits up to the F_2 generation in pure tall (TT) and pure dwarf (tt) plants. (BSER 2024) **OR**
Explain the law of dominance with a diagram. Or explain the monohybrid cross experiment with a diagram. **OR**
Draw a diagram showing the inheritance of one pair of allelic (contrasting) traits up to two generations.
Ans- The cross between one pair of allelic (contrasting) traits between two pea plants is called a monohybrid cross. The trait that appears in the first generation is the dominant trait, the trait that does not appear is called the recessive trait. This law is called Mendel's law of dominance.



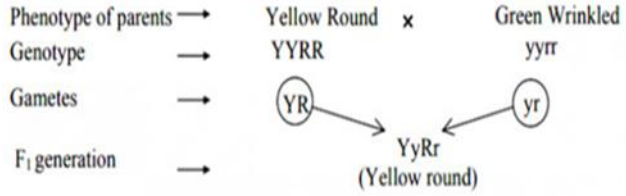
When pure tall (TT) and pure dwarf (tt) pea plants are crossed, all the plants of the F_1 generation will be of dominant trait (tall).

Whereas in the F_2 generation, the plants obtained will be 75 % tall and 25 % dwarf.

F_2 generation phenotypic ratio 3:1 (3 tall: 1 dwarf)
F_2 generation genotypic ratio 1:2:1
(1 pure tall, 2 impure tall, 1 dwarf)
TT Pure tall (25%) Tt Impure tall (50%)
tt Pure dwarf (25%)

Q. Explain with dihybrid cross how traits are inherited independently? Or explain Mendel's law of dihybrid cross.

Ans- In the dihybrid cross, Mendel selected two pairs of contrasting traits. Mendel saw that when yellow-round seed (RRYY) plants were crossed with wrinkled-green seed (rryy) plants, all the plants of the F_1 generation were round and yellow seed. When self-pollination was done between the F_1 generation plants, it was seen that four types of plants were produced in the F_2 generation.



Selfing of F_1 generation → YyRr × YyRr

Gametes → YR Yr yR yr YR Yr yR yr

F_2 generation →

♀ \ ♂	YR	Yr	yR	yr
YR	YYRR Yellow round	YYRr Yellow round	YyRR Yellow round	YyRr Yellow round
Yr	YYRr Yellow round	YYrr Yellow wrinkled	YyRr Yellow round	Yyrr Yellow wrinkled
yR	YyRR Yellow round	YyRr Yellow round	yyRR Green round	yyRr Green round
yr	YyRr Yellow round	Yyrr Yellow wrinkled	yyRr Green round	yyrr Green wrinkled

Result: Yellow round = 9 ;Yellow wrinkled = 3; Green round = 3; Green wrinkled = 1

Dihybrid ratio → 9 : 3 : 3 : 1

Round yellow seeds - 9
Round green seeds - 3
Wrinkled yellow seeds - 3
Wrinkled green seeds – 1

F_2 generation phenotypic ratio = 9:3:3:1

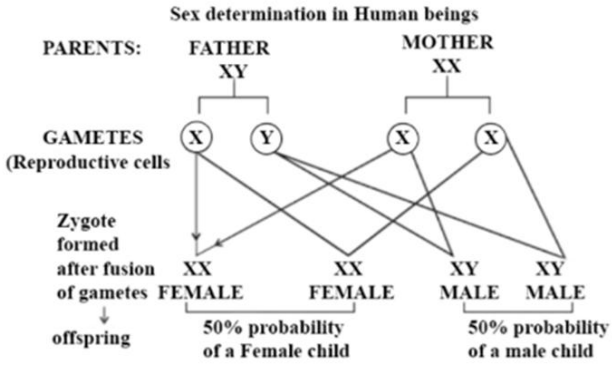
It is clear from the experiment that the inheritance of seed shape and color does not affect each other. Hence these traits are inherited independently.

Q. Is the sex determination of newborns the same for all living beings? Explain.

Ans- No. The sex determination of newborns is not the same for all living beings. Different species adopt different mechanisms for this. Some depend entirely on the environment. Therefore, in some animals (like some reptiles) sex determination depends on the incubation temperature of the fertilized egg (gamete) whether the offspring will be male or female. Some animals like snails can change their sex, which indicates that sex determination is not genetic in them. However, in humans, sex determination is based on genetics.

Q. How is sex determined in humans? OR Draw a diagram of sex determination in humans. (BSER 2025, Model Paper 2026)

Ans- Humans have 23 pairs of chromosomes. Out of which 22 pairs are autosomes. While the 23rd pair is called the sex chromosome. Sex determination in humans occurs through sex chromosomes. In the mother, both sex chromosomes of the 23rd pair are the same (XX), and in the father, one chromosome is X and the other is Y; the Y chromosome is the smallest in size. Hence females have XX and males have XY sex chromosomes. A boy or a girl always receives the X chromosome from their mother, so the sex of the children depends on what kind of chromosome is received from the father. If the X chromosome is inherited from the father, a girl will be born. Whereas if the Y chromosome is inherited, a boy will be born.



9. Light - Reflection and Refraction

(Mark weightage = 8) Questions 4 = very short 2, short-1,essay type-1

1. Which mirror and lens would you use to obtain an erect and magnified image of an object?
Ans- Concave mirror and convex lens
2. Write the lens and mirror formulas.
Ans- Lens formulAns- $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

Mirror formulAns- $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$
(Where (f) is focal length, (v) is image distance, (u) is object distance)
3. What is the magnification of a lens?
Ans- The ratio of the height of the image of an object to the actual height of the object is called the magnification of the lens.
4. What is Focal Length in a lens?
Ans- - It is the distance between the optical center of the lens and its principal focus.
5. The refractive index of water is 1.33, what will be the speed of light in water?
Ans- $\frac{3\ X\ 10^8\ m/s}{1.33}$ = 2.25×10$^8 m/s$
6. Which has the highest refractive index?
Ans- Diamond (2.42)
7. Which mirror is used in vehicle headlights?
Ans- Concave mirror
8. Which mirror is used as a rear-view mirror in vehicles?
Ans- Convex mirror
9. What are spherical mirrors?
Ans- A mirror whose reflecting surface is spherical.
10. Which lens always forms only a virtual image?
Ans- Concave lens
11. Whose focal length is negative?
Ans- Concave mirror and concave lens
12. Whose focal length is positive?
Ans- Convex mirror and convex lens
13. What is the modern quantum theory of light?
Ans- The modern quantum theory of light establishes harmony between the particle properties and the wave nature of light.
14. What is the main focus?
Ans- When the rays of light are incident on a spherical mirror, then the point at which they meet or appear to meet after reflection is called the main focus (focus point) of the mirror.
15. If a ray of light is incident normally on a glass slab, what will be the angle of refraction?
Ans- The angle of refraction will be zero.
16. What is diffraction?
Ans- If an opaque object placed in the path of light is very small, the tendency of light to bend around its edges instead of traveling in a straight line is called diffraction.
17. Which lens is used in a simple microscope?
Ans- convex lens
18. Write the name of the lens that spreads rays of light.
Ans- Concave lens (Diverging lens)
19. Name the lens that collects rays of light.
Ans- Convex lens (Converging lens)
20. Name the mirror used by dentists to see teeth?
Ans- Concave mirror
21. What is a lens?
Ans- Any transparent medium bounded by two surfaces, of which one or both surfaces are spherical, is called a lens.
22. What does a negative sign in the value of magnification indicate?
Ans- A negative sign in the value of magnification indicates that the image is real.
23. If the power of a lens is +4.0 D, find its focal length.
Ans- Given: P Lens power (P) = +4.0 D
From the formula $f = \frac{1}{P} = \frac{1}{4m}$ $f = 0.25m$
In centimeters: $0.25m$×100=$25cm$
Hence, the focal length of the lens will be 25cm.
24. If the radius of curvature of a spherical mirror is 14cm, find its focal length.
Ans- Given: R Radius of curvature R = 14 cm
Focal length is $f = \frac{R}{2} = \frac{14\ cm}{2} = 7cm$
25. Why is the velocity of light highest in a vacuum?
Ans- Light is an electromagnetic wave that does not require a medium to travel. In a vacuum, there are no particles to obstruct its path, allowing it to travel at its maximum speed of 3×10^8 m/s.
26. Why is the velocity of light minimum in glass compared to air?
Ans- Glass is an optically denser medium than air. When light enters a denser medium, its speed decreases due to the higher refractive index of the material.
27. What is the Principal Axis?
Ans- It is an imaginary straight line passing through the Pole and the Center of Curvature of a spherical mirror.
28. Define the unit of power of a lens.
Ans- The unit is Dioptre (D).
One dioptre is defined as the power of a lens whose focal length is exactly 1 meter ($1D$=$1m^{-1}$).
29. Why is a concave mirror preferred for shaving?
Ans- When the face is held between the pole and the focus of a concave mirror, it produces an erect, virtual, and magnified image, allowing for a better view.
30. Where should an object be placed to get a same-sized image using a convex lens?
Ans- The object must be placed at $2F_1$ (the center of curvature).The image will also be formed at $2F_2$ on the other side, being real, inverted, and of the same size.

31. Calculate the power of a convex lens with a focal length of 1 m.

Ans- Using the formula $P=\frac{1}{f}$, we get

$P = \frac{1}{1(m)}$ = +1 Dioptre.

The '+' sign indicates it is a convex lens.

32. Explain the bending of light when it moves from air to glass.

Ans- Since glass is optically denser than air, the speed of light slows down, causing the ray to bend towards the normal.

33. What happens to a ray incident at 90° to a surface?

Ans- When a ray is incident normally, the angle of incidence is 0° . According to Snell's law, the angle of refraction will also be 0°, so the ray passes without deviation.

34. What is lateral inversion in a plane mirror?

Ans- It is the phenomenon where the left side of an object appears as the right side in the image, and vice versa.

35. Describe the path of a ray parallel to the principal axis in a concave mirror.

Ans- After reflection, the ray will always pass through the principal focus (F) on the principal axis.

36. What are the characteristics of an image formed by a convex mirror?

Ans- A convex mirror always forms a virtual, erect, and diminished (smaller) image, regardless of the object's position.

37. Describe the image formed by a concave lens.

Ans- A concave lens always produces a virtual, erect, and diminished image on the same side as the object.

38. Which tools provide an erect and magnified image?

Ans- A concave mirror provides this when the object is very close (between P and F), and a convex lens provides this when used as a magnifying glass.

39. If focal length is 20 cm, find the radius of curvature.

Ans- Using $R = 2f$, R=2×20=40cm.

41. Why can soil not be used to make a lens?

Ans- A lens must be made of a transparent material to allow light to pass and refract. Soil is opaque and stops light completely.

42. Why is a convex mirror used as a rear-view mirror in vehicles?

Ans- Because- (i) A convex mirror always forms an erect image.

(ii) The field of view of a convex mirror is large, as a result of which it can show a wide area clearly.

43. State the law used to find the angle of reflection if the incidence is 30°.

Ans- According to the first law of reflection, the angle of incidence is always equal to the angle of reflection ($\angle i = \angle r$). Thus, the angle is 30°.

44. Why does a coin in water appear raised?

Ans- Light rays coming from the coin bend away from the normal as they move from water (denser) to air (rarer), making the coin appear at a shallower depth.

45. Define the Optical Center.

Ans- It is the central point of a lens. Any ray of light passing through the optical center does not suffer any deviation.

46. What is a Concave Mirror?

Ans- A spherical mirror in which the reflecting surface is curved inwards (towards the center of the sphere).

47. Why is the focal length of a convex lens positive?

Ans- According to the sign convention, the focal length is measured in the direction of incident light (to the right of the optical center), making it positive.

48. State the value of the speed of light in a vacuum.

Ans- It is a universal constant valued at approximately 3×10^8 meters per second.

49. What is the dual nature of light?

Ans- Light exhibits a dual nature; it behaves as a stream of particles (photons) and also travels as electromagnetic waves.

50. What is the relationship between the angle of incidence and reflection?

Ans- In every reflection, the angle of incidence is always exactly equal to the angle of reflection.

51. Why does Diamond have the highest refractive index?

Ans- Because light travels much slower in diamond than in any other common transparent material, resulting in a high refractive index of 2.42.

52. Why is the power of a convex lens positive?

Ans- Since power is the reciprocal of focal length ($P=\frac{1}{f}$) and the focal length of a convex lens is positive, its power is also positive.

53. Why is the power of a concave lens negative?

Ans- A concave lens has a virtual focus on the left side (negative focal length), therefore its power is always negative.

54. Define Center of Curvature.

Ans- It is the center of the hollow sphere of which the spherical mirror is a part. It is represented by the letter 'C'.

55. What is the difference between Real and Virtual images?

Ans- A real image is always inverted and can be taken on a screen, while a virtual image is always erect and cannot be taken on a screen.

56. State the refractive index of water.

Ans- The refractive index of water is 1.33, meaning light travels 1.33 times slower in water than in a vacuum.

57. What is the angle of incidence?

Ans- It is the angle between the incident ray of light and the normal at the point of incidence.

58. Why is the focal length of a concave lens negative?

Ans- Because its principal focus is virtual and located on the same side as the incident light, which is considered the negative direction.

59. Why are concave lenses called diverging lenses?

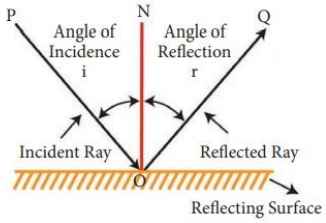
Ans- Because they cause parallel rays of light to spread out (diverge) after passing through them.

60. Define the Pole of a mirror.

Ans- The geometric center of the reflecting surface of a spherical mirror is called its Pole (P).

Q- What is the reflection of light?

Ans- When the rays of light are incident on the surface of a medium, then after being reflected from the surface, they return to the same medium again. This phenomenon of light is called reflection of light.



Q- Write the law of reflection.

Ans-(i) The incident ray, the reflected ray and the normal all lie in the same plane at the point of incidence of the mirror.

(ii) The angle of incidence is always equal to the angle of reflection. **∠i = ∠r**

Q- Write the characteristics of the image formed by a plane mirror.

Ans-(i) The image formed by a plane mirror is always virtual and erect.

(ii) The size of the image is equal to the size of the object.

(iii) The image is formed at the same distance behind the mirror as the object is in front of the mirror.

(iv) Its image is lateralised.

Q-What is the relation between the radius of curvature (R) and the focal length (F) of a spherical mirror.

Ans- The radius of curvature (R) of a spherical mirror is always twice the focal length (F).

i.e. **R = 2F**

(radius of curvature = 2 x focal length) **OR**

The focal length is half the radius of curvature. **F= R/2**

Q- Write the use of concave mirror?

Ans- (i) To obtain a powerful parallel beam of light in torches, searchlights and headlights of vehicles.

(ii) Forms of shaving mirrors for viewing a larger image of the face.

(iii) In dentistry by dentists.

(C) To concentrate sunlight in solar system.

Q- What is called the magnification of the mirror? Write the formula for magnification of mirror?

Ans- The ability of a mirror to magnify the image of an object is called magnification of the mirror.

Magnification of the mirror=

$$(M) = \frac{\text{height of the image } (\mathbf{h'})}{\text{height of the object } (\mathbf{h})} = -\frac{\mathbf{v}}{\mathbf{u}}$$

where v = distance of the image and

u = distance of the object.

Q- A person's face is at a distance of 10 cm from the shaving mirror, if the focal length of the shaving mirror is 40 cm, then find the position, nature and size of the image formed.

Ans- given- (i) focal length = 40 cm

A concave mirror is used as a shaving mirror.

The focal length of a concave mirror is negative,

so **f = -40 cm.**

(ii) distance of object = 10 cm Since the distance of the object is always negative,

so **u = -10 cm**.

(iii) distance of the image (v) = ? (to be known)

Hence, from the formula of mirror

$$\frac{\mathbf{1}}{\mathbf{f}} = \frac{\mathbf{1}}{\mathbf{u}} + \frac{\mathbf{1}}{\mathbf{v}} \qquad \frac{1}{-40} = \frac{1}{-10} + \frac{1}{v}$$

$$-\frac{1}{40} + \frac{1}{10} = \frac{1}{v} \qquad \frac{-1+4}{40} = \frac{1}{v}$$

$$\frac{3}{40} = \frac{1}{v} \qquad 3v = 40$$

$$v = \frac{40}{3} \qquad v = +13.33 \text{ cm}$$

Position:- Hence the image will be formed at 13.33 cm behind the mirror.

Nature:- The image will be virtual and erect.

Size:- $M = \frac{h'}{h} = -\frac{v}{u} = -\frac{13.33}{-10}$ M= 1.33

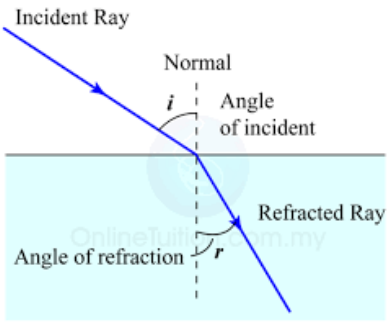
Hence the image is formed (1.33 times) larger than the object.

Q- What is refraction of light?

Ans- When a ray of light travels obliquely from one medium to another, then the ray of light gets deviated from its path on the surface separating both the media, this phenomenon is called refraction of light.

Example of refraction - (i) A coin placed in water appears to be raised above the bottom.

(ii) The appearance of a bent pencil immersed in water.



Q- Write the law of refraction.

Ans– First law– The incident ray, the refracted ray and the normal all three lie in the same plane.

Second law- The ratio of the sine of the angle of incidence and the sine of the angle of refraction remains constant for light of a certain color and a certain medium. The second law of refraction is also called **Snell's law.**

i.e. $\frac{\sin\angle i}{\sin\angle r} = \boldsymbol{\mu}$ (constant)

μ is called the relative refractive index of medium-2 to medium-1.

Q- What is the power (capacity) of the lens? Write the formula and unit of lens power?

Ans- The ability of a lens to diverge or converge light rays is called lens power.

The formula for the lens power $P = \frac{1}{f}$

(where f = focal length in meters)

Unit - Diopter (D)

Q- What is the power of a convex lens of 20 cm focus distance?

Ans – Lens power $P = \frac{1}{f}$ f = 20 cm

(since the focal length of a convex lens is positive)

(It is always necessary to convert the focal length to "meters" in order to find the lens power.)

Or $f = \frac{20}{100}$ meter = 0.20 meter,

so $P = \frac{1}{0.20}$ = 5 diopters

Q- What is called absolute refractive index? explain.

Ans- When a ray of light enters from one medium to another medium. Then the speed of light changes. Let the speed of light in medium 1 be v_1 and in medium 2 be v_2. The ratio between the speed of light in medium 1 and the speed of light in medium 2 is called the relative refractive index of medium 2 to that of medium 1.

It is often denoted by the symbol n_{21}. It can be expressed in the form of equation as follows-

$$n_{21} = \frac{\text{Speed of light in medium 1}}{\text{Speed of light in medium 2}} = \frac{v_1}{v_2}$$

If medium 1 is vacuum or air, then the refractive index of medium 2 is taken to be relative to vacuum. This is called the absolute refractive index of the medium.

$$\mathbf{n_m = \frac{\text{the speed of light in vacuum or air}}{\text{Speed of light in medium 2}} = \frac{c}{v}}$$

The absolute refractive index of the medium is also called the refractive index only.

Q- Find the focal length of a concave mirror of radius of curvature 10 cm?

Ans- Radius of curvature = 2 × focal length

$R = 2F$ $F = \frac{R}{2} = \frac{10}{2} =$ 5 cm

(Since the focal length of a concave mirror is negative)

So F = -5 cm

Q- The focal length of a convex lens is 50 cm, if a person is standing at a distance of 30 cm from it, then find the position and nature of the image?

Ans given:- Focal length (f) = 50 cm (Since the focal length of a convex lens is always positive.)

distance of the object (person) (u) = -30 cm

(since the distance of the object is always negative)

distance of the Image (v) = ?

So from the lens formula- $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$$\frac{1}{50} = \frac{1}{v} - \frac{1}{(-30)}$$

$$\frac{1}{50} = \frac{1}{v} + \frac{1}{30} \qquad \frac{1}{50} - \frac{1}{30} = \frac{1}{v}$$

$$\frac{3-5}{150} = \frac{1}{v} \qquad \frac{-2}{150} = \frac{1}{v}$$

$-2v = 150$ $v = \frac{150}{-2}$

v = -75 cm

Position- behind the object (person) (left side of the lens)

Nature - virtual and erect

Size = M = $\frac{V}{u} = \frac{-75}{-30} = \frac{25}{10} = 2.5$ times larger.

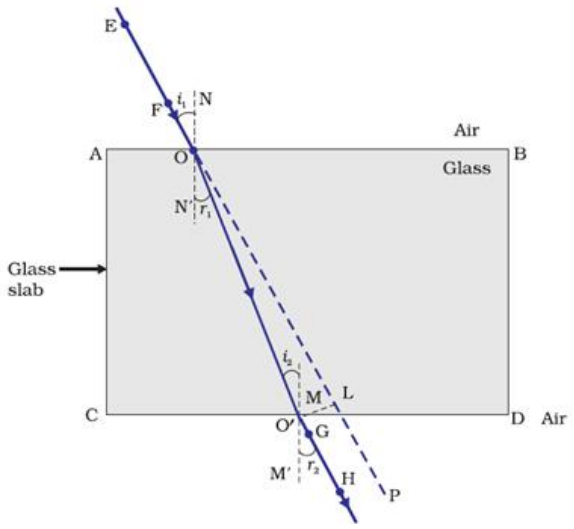
Q- If the refractive index of a medium is 1.5 and the speed of light in vacuum is 3×10^8 m/s. If so, find the speed of light in the medium?

Ans – Refractive index of the medium = $\frac{Speed\ of\ light\ in\ vacuum}{Speed\ of\ light\ in\ the\ medium.}$

Speed of light in a medium = $\frac{Speed\ of\ light\ in\ vacuum}{Refractive\ index\ of\ the\ medium}$

$= \frac{3\times10^8}{1.5} =$ 2×10^8 m/s.

Q- Draw a ray diagram of refraction of light by a rectangular slab of glass?



Q- If an object is placed at a distance of 15 cm in front of a concave lens of focal length 60 cm, then find the position, nature and magnification of the image formed?

Ans is given- Focal length of concave lens (f) = -60 cm

Distance of the object (u) = -15 cm (since the distance of the object is always negative)

distance of image = ?

Hence, from the lens formula- $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$$\frac{1}{-60} = \frac{1}{v} - \frac{1}{(-15)}$$

$$-\frac{1}{60} = \frac{1}{v} + \frac{1}{15} \qquad -\frac{1}{60} - \frac{1}{15} = \frac{1}{v}$$

$$\frac{-1-4}{60} = \frac{1}{v} \quad \frac{-5}{60} = \frac{1}{v} \qquad -5v = 60$$

$$v = \frac{60}{-5} \qquad = -12 \text{ cm}$$

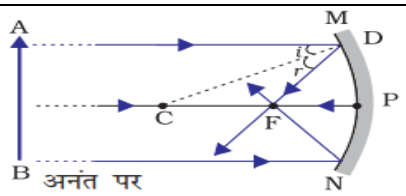
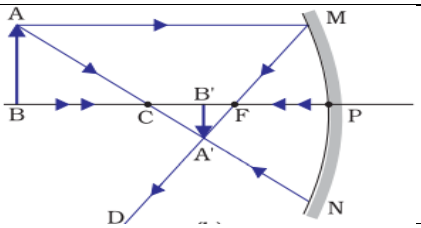
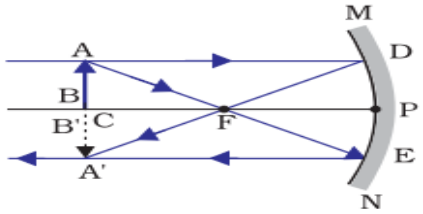
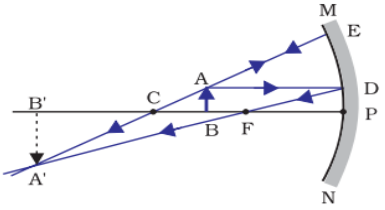
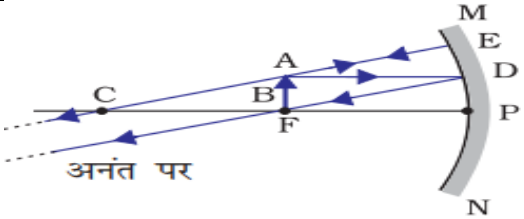
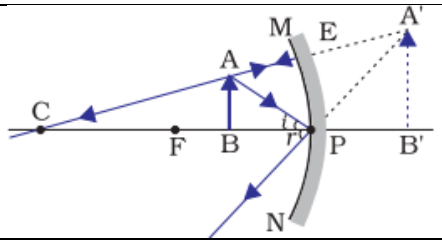
Position- The image will be formed at a distance of 12 cm to the left of the lens.

Nature - virtual and erect

Magnification (M) $= \frac{v}{u} = \frac{-12}{-15} = \frac{4}{5} = 0.8$

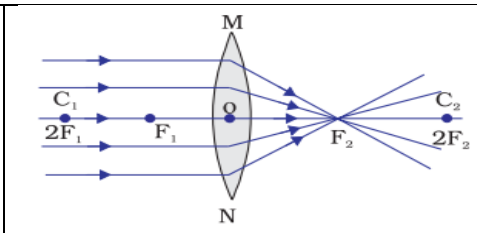
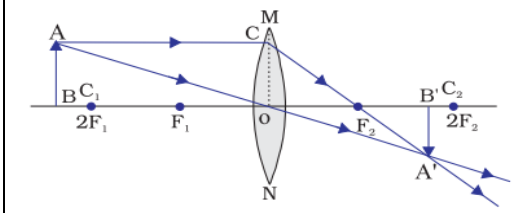
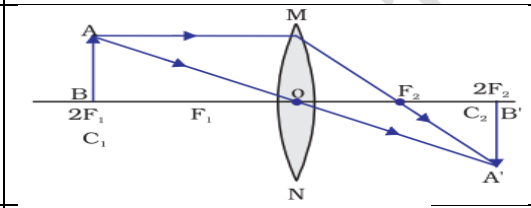
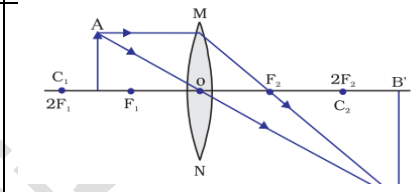
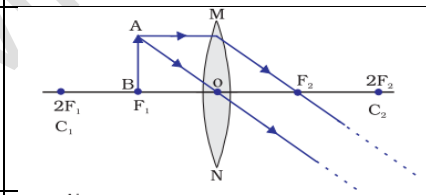
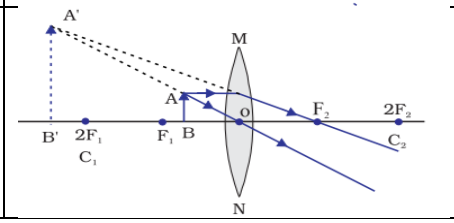
The image will be smaller than the object.

Q- Write the details of the ray picture position, nature and size of the image formed in different positions of the object in a concave mirror? Ans-

(1) When the position of object at infinity- position-at focus point nature - real and inverted size - Highly diminished than the object	
(2) When the position of object is between the center of curvature (C) and infinity- Position - between center of focus point (f) and center of curvature (C) nature - real and inverted size - diminished than the object	
(3) When the position of object at the center of curvature (C)- Position- at the center of curvature (c) is formed nature - real and inverted size - equal to the size of the object	
(4) When the position of object between the center of curvature (C) and the focus point (F) - Position- away from the center of curvature nature - real and inverted size - Enlarged than the object	
(5) When the position of object at F- Position- at infinity nature - real and inverted size - Highly enlarged than the object	
(6) When the position of object between the focus point (F) and the pole (P)- Position - behind mirror nature - virtual and erect size - Enlarged than the object	

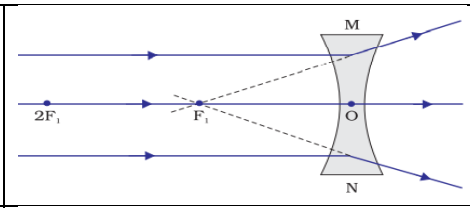
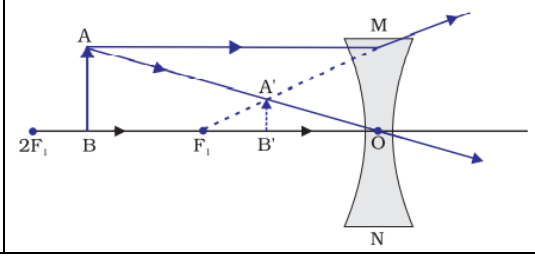
Q- Discuss the position, nature and size of the image formed by a convex lens at different positions of the object?

Ans-

(1) When the position of object at infinity- position - at focus (f_2) nature - real and inverted shape - Highly diminished, point sized	
(2) When the position of object between infinity and $2F_1$ Position- between F_2 and $2F_2$ nature - real and inverted size - diminished than the object	
(3) When the position of object at $2F_1$- Position- at $2F_2$ nature - real and inverted size - equal to object	
(4) When the position of object between $2F_1$ and F_1 Position- between $2F_2$ and infinite nature - real and reverse size - Enlarged than the object	
(5) When the position of object at F_1- position - at infinity nature - real and inverted size - Highly enlarged	
(6) When the position of object between F_1 and the optical centre- Position - behind the object (left side of the lens) nature - virtual and erect size - Enlarged than the object	

Q- Discuss the position, nature and size of the image formed by a concave lens in different positions of the object?

Ans-

1. When the position of object at infinity- Position - at F_1 Nature - virtual and erect Size - Highly diminished	
2. When the position of object between the optical center (O) and infinity Position - center of light center nature - virtual and direct size - diminished than the object	

Q- Write the details of the ray picture position, nature and size of the image formed in different positions of the object in a convex mirror? Ans-

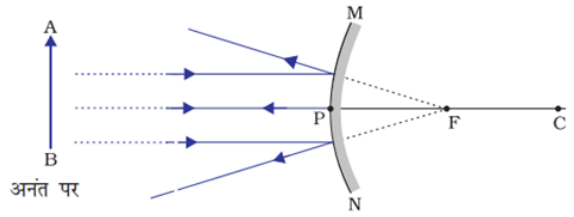
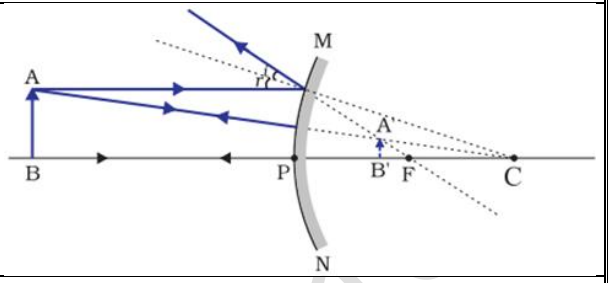
1. When the position of object at infinity- Position - behind mirror, at focus. nature - virtual and erect size - Highly diminished	
2. When the position of object is between the pole and infinity of a convex mirror, Position- Behind mirror, Between pole and focus nature - Virtual and erect size - Diminished than the object	

Image formation by a concave mirror for different positions of the object

Position of object	**Position of image**	**Size of image**	**Nature of image**
At infinity	At the focus F	Highly diminished, point-sized	Real and inverted
Beyond C	Between F and C	Diminished	Real and inverted
At C	**At C**	**Same size**	Real and inverted
Between C and F	Beyond C	Enlarged	Real and inverted
At F	At infinity	Highly enlarged	Real and inverted
Between P and F	Behind the mirror	Enlarged	**Virtual and erect**

Image formation by a convex lens for different positions of the object-

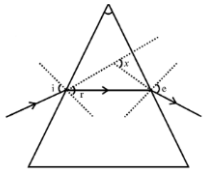
Position of object	**Position of image**	**Size of image**	**Nature of image**
At infinity	At focus F2	Highly diminished, point-sized	Real and inverted
Beyond 2F1	Between F2 and 2F2	Diminished	Real and inverted
At 2F1	**At 2F2**	**Same size**	Real and inverted
Between F1 and 2F1	Beyond 2F2	Enlarged	Real and inverted
At focus F1	At infinity	Highly enlarged	Real and inverted
Between focus F1 and optical centre O	On the same side of the lens as the object	Enlarged	**Virtual and erect**

10. The Human Eye and the Colourful World

(Marks Weightage- 4) Question-3= Objective-2, Short-1.

1. A beam of white light, after passing through a prism, disperses into its constituent colors. The light that bends (deviates) the least is - (Board Exam 2025)
(1) Red (2) Violet (3) Yellow (4) Green (1)

2. For the given triangular prism, the angle of deviation is –



(1) e (2) i (3) x (4) r (3)

3. What is the far point of the human eye?
(1) 25cm (2) 100cm (3) Infinity (4) 25m (3)

4. Which lens is used for the correction of hypermetropia (far-sightedness)?
(1) Concave lens (2) Convex lens
(3) Bifocal lens (4) Cylindrical lens (2)

5. If there were no atmosphere, how would the color of the sky appear?
(1) Blue (2) Red (3) Black (4) Deep Red (3)

6.Which part controls the amount of light entering the human eye?
(1) Cornea (2) Iris (3) Pupil (4) Lens (3)

7. In which direction does a rainbow always form?
(1) East direction (2) In the direction of the sun
(3) In the opposite direction of the sun
(4) South direction (3)

8. The time interval between actual sunset and apparent sunset is-
(1) 4min (2) 2min (3) 1min (4) 3minutes (2)

9. The part of the human eye on which the image of an object is formed is -
(1) Cornea (2) Iris (3) Pupil (4) Retina (4)

10. The least distance of distinct vision for a normal sighted adult is approximately – OR
What is the near point of a healthy eye?
(1) 25 cm (2) 2.5 cm (3) 25 m (4) 2.5 m (1)

11. The twinkling of stars is based on which phenomenon?
(1) Reflection (2) Dispersion
(3) Scattering (4)Atmospheric refraction (4)

12. The reason for advanced sunrise and delayed sunset is - (Board Exam 2024)
(1) Scattering (2) Atmospheric refraction
(3) Dispersion (4) Reflection (2)

13. Which lens is found in the human eye?
(1) Concave lens (2) Convex lens
(3) Both of the above (4) None (2)

14. The image formed on the retina is –
(1) inverted and real (2) virtual and erect
(3) inverted and virtual (4) real and erect (1)

15. Which lens is used for the correction of myopia (near-sightedness)?
(1) Convex (2) Concave
(3) Both of the above (4) None (2)

16. Which part of the eye is donated?
(1) Retina (2) Cornea (3) Lens (4) Iris (2)

17. Light enters the eye through a thin membrane called:
(1) Cornea (2) Retina (3) Iris (4)Vitreous fluid (1)

18. The twinkling of stars is based on which phenomenon?
(1) Reflection (2) Dispersion
(3) Scattering (4) Atmospheric refraction (4)

19. Due to which phenomenon does the colour of the sky appear blue?
(1) Refraction (2) Reflection
(3) Scattering (4) Polarization (3)

20. Adjusting the focal length of the lens in the human eye is called:
(1) Presbyopia (2) Accommodation
(3) Myopia (4) Hypermetropia (2)

21. The focal length of the eye lens can be changed by:
(1) Pupil (2) Retina (3) Ciliary muscles (4) Iris (3)

22. Due to which optical phenomenon does a pencil placed in water appear bent?
(1) Reflection (2) Scattering
(3) Refraction (4) Dispersion (3)

23. Which part of the human eye provides colour to the eye?
(1) Eye lens (2) Iris (3) Pupil (4) Retina (2)

24. What do the muscles of the iris control?
(1) Light channel (2) Focal distance of eye lens
(3) Size of the pupil (4) Shape of the crystalline lens (3)

25. Which part protects the eyes from external shocks?
(1) Cornea (2) Iris (3) Choroid (4) Sclera (4)

26. Focal length of the eye lens, when the lens is thick:
(1) Decreases (2) Increases
(3) No effect (4) None (1)

27. The number of colours in the visible spectrum of light is:
(1) 1 (2) 5 (3) 7 (4) 6 (3)

Q- What is the angle of the prism?
Ans: The angle between the two lateral faces of a prism is called the angle of the prism.

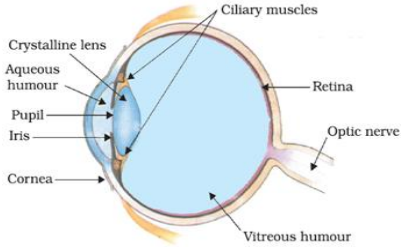
Q- Explain Cataract.
Ans- The crystalline lens of the eye in some people of old age becomes milky and cloudy; this condition is called a cataract. A cataract is treated surgically by implanting an intraocular lens.

Q- What is the power of accommodation?

Ans- The ability of the eye lens to adjust its focal length is called the power of accommodation. The minimum distance at which objects can be seen most distinctly without strain is called the least distance of distinct vision. It is also called the near point of the eye. For a young adult with normal vision, the near point is about 25 cm. The farthest point up to which the eye can see objects clearly is called the far point of the eye. It is infinity for a normal eye. A normal eye can see objects clearly that are between 25 cm and infinity.

Q- Explain the human eye and its different parts.

Ans- The parts of the eye are as follows:



Cornea- The cornea is the transparent membrane on the front part of the eye. This is where most of the refraction of light entering the eye takes place.

(ii) **Lens-** The convex lens in the eye which focuses the light on the retina.

(iii) **Iris-** The iris is a dark muscular diaphragm behind the cornea that controls the size of the pupil.

(iv) **Pupil-** The pupil regulates and controls the amount of light entering the eye.

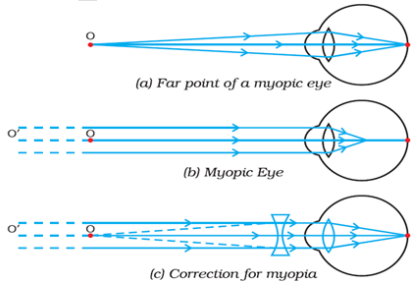
(v) **Retina-** The lens forms an image on a light-sensitive screen called the retina. The retina transmits the information of the image to the brain through the optic nerves.

Q- What is near-sightedness or Myopia? Write its causes and Correction.

Ans- Myopia is also known as near-sightedness. A person with myopia can see nearby objects clearly but cannot see distant objects distinctly.

Causes- This defect may arise due to (i) excessive curvature of the eye lens, or (ii) elongation of the eyeball.

Correction- This defect can be corrected by using a concave lens of suitable power.



Q- What is dispersion?

Ans- When the white light of the sun passes through a prism, it gets separated into its constituent colours. The splitting of light into its component colours is called dispersion. White light is dispersed into its seven-colour components by a prism.

Q- What is Presbyopia? Also, write its solution.

Ans- The power of accommodation of the eye usually decreases with ageing. For most people, the near point gradually recedes. They find it difficult to see nearby objects comfortably and distinctly without corrective eye-glasses. This defect is called Presbyopia.

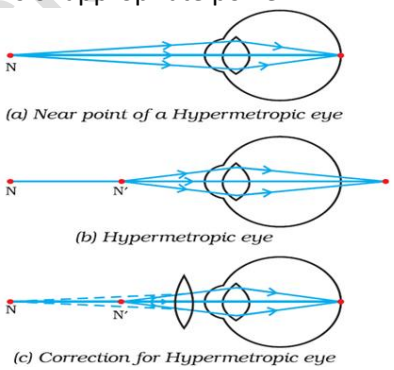
It arises due to the gradual weakening of the ciliary muscles and diminishing flexibility of the eye lens. Sometimes, a person may suffer from both myopia and hypermetropia. Such people often require bifocal lenses. A common type of bifocal lens consists of both concave and convex lenses.

Q- What is far-sightedness or Hypermetropia? Write the causes and remedies of the defect.

Ans- Hypermetropia is also known as far-sightedness. A person with hypermetropia can see distant objects clearly but cannot see nearby objects distinctly.

Causes- This defect arises either because (i) the focal length of the eye lens is too long, or (ii) the eyeball has become too small.

Correction- This defect can be corrected by using a convex lens of appropriate power.



Q- Why do stars twinkle?

Ans- The twinkling of a star is due to the atmospheric refraction of starlight. The starlight, on entering the earth's atmosphere, undergoes refraction continuously before it reaches the earth. Atmospheric refraction occurs in a medium of gradually changing refractive index. Since the atmosphere bends starlight towards the normal, the apparent position of the star is slightly different from its actual position. The star appears slightly higher than its actual position when viewed near the horizon.

Q- Give examples of the Scattering of Light.

Ans- Tyndall Effect, the blue colour of the sky, the colour of water in the deep sea, and the reddening of the sun at sunrise and sunset.

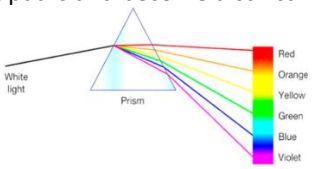
Q- Why don't the planets twinkle?

Ans- Planets are much closer to the earth and are thus seen as extended sources. If we consider a planet as a collection of a large number of point-sized sources of light, the total variation in the amount of light entering our eye from all the individual point-sized sources will average out to zero, thereby nullifying the twinkling effect.

Q- What is a spectrum?

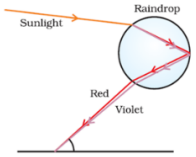
Ans- A prism splits incident white light into a band of colours. This band of coloured components of a light beam is called its spectrum.

In a spectrum, the sequence of colours seen is Violet, Indigo, Blue, Green, Yellow, Orange, and Red. The acronym VIBGYOR helps to remember the sequence. Different colours of light bend through different angles with respect to the incident ray as they pass through a prism. Red light bends the least, while violet bends the most. Thus, the rays of each colour emerge along different paths and become distinct.



Q- How is a rainbow formed? Why do we see a rainbow in the sky only after rain?

Ans- A rainbow is a natural spectrum appearing in the sky after a rain shower. It is caused by the dispersion of sunlight by tiny water droplets present in the atmosphere. A rainbow is always formed in the direction opposite to that of the Sun. The water droplets act like small prisms. They refract and disperse the incident sunlight, then reflect it internally, and finally refract it again when it leaves the raindrop. Due to the dispersion of light and internal reflection, different colours reach the observer's eye.



Q- What is the Tyndall effect? Explain.

Ans- When a beam of light passes through a colloidal solution, the path of that beam becomes visible. This phenomenon is called the Tyndall effect. For example, this phenomenon occurs when a beam of light enters a smoke-filled room through a microscopic hole.

Q- What is the vision range (range of sight)?

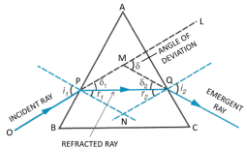
Ans- The distance between the near point and the far point of the eye is called the vision range.

Q- Why does the colour of a clear sky appear blue?

Ans- There are innumerable dust and water particles available in the atmosphere, which scatter blue-coloured light because the wavelength of this colour is the shortest. Hence, the colour of the sky appears blue.

Q- What is the angle of deviation?

Ans- The angle that the emergent ray makes with the direction of the incident ray (due to the specific characteristics of the prism) is called the angle of deviation.

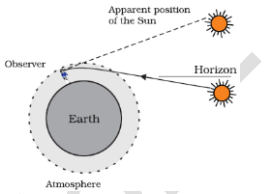


Q- Explain the dispersion of white light through a glass prism.

Ans- The splitting of light into its component colours is called dispersion. White light is dispersed into its seven constituent colours by a prism. After passing through a prism, the colours of light bend at different angles with respect to the incident ray. Red light bends the least, and violet light bends the most. Therefore, the rays of each colour emerge along different paths and are clearly visible. This band of colours appears to us as a spectrum. White light is composed of this homogeneous spectrum.

Q- Explain advanced sunrise and delayed sunset.

Ans- Due to atmospheric refraction, the sun appears visible to us 2 minutes before the actual sunrise and continues to be visible for 2 minutes after the actual sunset.



Q- What happens to the image distance in the eye when we increase the distance of an object from the eye? (Model Paper - 2026)

Ans- When the distance of an object from the human eye is increased, there is no effect on the image distance; it remains fixed because the eye lens adjusts its focal length to always form the image on the retina. When the object moves further away, the lens becomes thinner, and the focal length increases.

Q- Why are danger signals red in color?

Ans- Danger signals are red in color because red light is scattered the least by atmospheric particles like fog, smoke, or dust. The wavelength of red light is significantly longer (about 1.8 times greater than blue light), which allows it to penetrate haze and travel a greater distance without significant scattering. This ensures the signal is visible in the same clear color from far away, even in adverse weather conditions, providing maximum visibility and safety.

Q. What is the role of the cornea and the lens in the human eye?

Ans: Role of the Cornea: The cornea is the transparent front part of the eye. Its primary role is to act as the eye's outermost lens. It functions like a window that controls and focuses the entry of light into the eye. Most of the refraction (bending) of light rays entering the eye occurs at the outer surface of the cornea.

Role of the Lens: The eye lens is a transparent, flexible, and crystalline structure. Its role is to provide the finer adjustment of focal length required to focus objects at different distances sharply onto the retina. By changing its shape (becoming thicker or thinner), it ensures a clear image is formed regardless of the object's position.

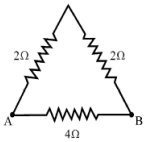
11. Electric Current

Weightage - 7 Marks

Question-4 = Objective-2, Short- 1, long ans–1

Physical Quantity	Unit
Current	Ampere
Potential difference	Volt
Electrical power	Watt
Specific resistance or resistivity	Ohm **X** meter
Commercial unit of electrical energy	Unit **(kWh)**
Resistance	Ohm (**Ω**)
Charge	Coulomb
Work	Joulee
Time	Second

1. The equivalent resistance between points A and B in the given circuit is-



(A) 2Ω (B) 3Ω (C) 4Ω (D) 8Ω (D)

2. How many Joulees represent 1 unit (kWh)?
(A) 3.6×10^{6}J (B) 36×10^{5}J
(C) 3.6×10^{5}J (D) Both A and B (D)

3. What is the number of electrons in one coulomb of charge?
(A) 1.6×10^{-19} (B) 6×10^{18}
(C) 3.6×10^{6} (D) 6.25×10^{20} (B)

4. **What is the charge of a single electron?**
(A) 1.6×10^{-19}C (B) 1.6×10^{19}C
(C) 6×10^{18}C (D) 9.1×10^{-31}C (A)

5. Of which metal is the filament of electric bulb made?
(A) Iron (B)Tungsten
(C)Copper (D)Gold (B)

6. The S.I. unit of electric current is-
(A) watt (B) volt
(C) ohm (D)ampere (D)

7. The metal with highest conductivity is-
(A) Iron (B) Tungsten
(C) Copper (D)Silver (D)

8. S.I. unit of energy is-
(A) Calorie (B) Joulee
(C) Heat (D) None of these (B)

9. The direction of current in an electric circuit is considered to be-
(A) in the opposite direction of flow of electrons
(B) in the direction of flow of electrons
(C) the direction perpendicular to the flow of electrons
(D) any direction. (A)

10. The S.I. unit of charge is –
(A) Volt (B) Ohm
(C) Joulee (D) Coulomb (D)

11. Which of the following relation is true?
(A) V= 1/R (B) V= R
(C) V = IR (D) $V= IR^2$ (C)

12. What is the unit of resistance?
(A) joulee (B) volt
(C) ohm (D) ampere (C)

13. Volt/ampere represents-
(A) ampere (B) volt
(C) ohm (D) watt (C)

14. Which of the following terms represents the electric power in an electric circuit?
(A) I^2R (B) IR^2
(C) V^2I (D) VI^2 (A)

15. If 1 Ohm, 2 Ohm and 3 Ohm are connected in series, the equivalent resistance will be-
(A) 1 ohm (B) 2 ohm
(C) 3 ohm (D) 6 ohm (D)

16. What is the unit of potential or potential difference?
(A) joulee (B) watt
(C) ampere (D) volt (D)

17. What will be the resistance of the filament of 100 W -220 V electric bulb?
(A) 900 ohm (B) 484 ohm
(C) 220 ohm (D) 100 ohm (B)

18. Ohm's law is
(A) V= IR (B) V = R
(C) V = I (D) V = I + R (A)

19. What is the commercial unit of electrical energy?
(A) watt-hour (B) watt
(C) kWh (D) joulee/hour (C)

20. What is the unit of resistance?
(A) Volt (B) Ampere
(C) Ohm (Ω) (D) Watt (C)

21. Among conductors of the same size, which one is considered a better conductor?
(A) One with high resistance
(B) One with low resistance
(C) One with high melting point
(D) One that is heavier (B)

22. If 1 coulomb of charge flows in a circuit for 1 second, the current will be:
(A) 1 Volt (B) 1 Ohm
(C) 1 Watt (D) 1 Ampere (D)

23. A continuous and closed path of an electric current is called:
(A) Electric Field (B) Electric Circuit
(C) Electric Potential (D) Rheostat (B)

24. Which device is used to change the resistance in an electric circuit?
(A) Ammeter (B) Voltmeter
(C) Rheostat (D) Galvanometer (C)

25.What is the unit of specific resistance or resistivity?
(A) Ohm (B) Ohm-meter (Ω X m)
(C) Volt-meter (D) Ohm/meter (B)

26.Materials which have high resistivity possess which property?
(A) High conductivity (B) Low conductivity
(C) Zero resistance (D) Infinite current (B)

27.In an electric circuit, a Voltmeter is always connected in:
(A) Parallel (B) Series
(C) Both (D) None of these (A)

28.In an electric circuit, an Ammeter is always connected in:
(A) Parallel (B) Series
(C) Mixed (D) Any direction (B)

29.How are electrical instruments connected in a home's electric circuit?
(A) Series (B) Parallel
(C) Mixed (D) Randomly (B)

30.By which instrument is the measurement of electric current done?
(A) Voltmeter (B) Ammeter
(C) Thermometer (D) Rheostat (B)

31.Which instrument is used to measure the electric potential difference?
(A) Ammeter (B) Galvanometer
(C) Voltmeter (D) Anemometer (C)

32.What is the unit of electric potential difference?
(A) Ampere (B) Ohm
(C) Volt (or Joulee/Coulomb) (D) Watt (C)

33.What is the commercial unit of electrical energy?
(A) Joulee (B) Watt
(C) Kilowatt-hour (kWh) (D) Calorie (C)

34.What is the correct formula for Joulee's heating law?
(A) $H=IRt$ (B) $H=I^2Rt$
(C) $H=VIt$ (D)$H=V^2/R$ (B)

35.What is the S.I. unit of electric power?
(A) Volt (B) Watt
(C) Ohm (D) Coulomb (B)

36.What is the S.I. unit of electric charge?
(A) Joulee (B) Coulomb
(C) Ampere (D) Volt (B)

Q- What is called electric current?

Ans- The rate of flow of charges (electrons) in an electrical conductor is called electric current.

Electric current **(I)** = $\frac{\text{Charge (Q)}}{\text{time (t)}}$

Q- Define one ampere.

Ans- If one coulomb of charge flows through a point in an electric circuit in one second, then the electric current in that circuit will be one ampere.

One ampere = $\frac{one\ coulomb}{one\ second}$

Q- Calculate the number of joulees in 1 kwh?

Ans– 1kwh = 1000 watts X 60 X 60 seconds = 36 X 10^5 joulees = 3.6 X 10^6 joulees

Q- From which side is the direction of electric current in the electric circuit?

Ans- In the circuit, the electric current flows from the positive terminal to the negative terminal of the cell. That is, the opposite direction of flow of electrons is considered to be the direction of electric current.

Q- What is variable resistance?

Ans- Sometimes it becomes necessary to increase or decrease the current in an electric circuit. A device used to control the current in a circuit without any change in the voltage of the source is called a variable resistance.

Q- What is called electric potential difference?

Ans- The work done in moving a unit positive charge from one point to another in an electric circuit is called the potential difference between those two points.

potential difference = $\frac{work}{charge}$

Q- Define one volt.

Ans- If the work done in moving a coulomb charge from one point to another in an electric circuit is one joulee, then the potential of the second point will be one volt.

1 volt = $\frac{1\ joule}{1\ coulomb}$

Q- Write the Ohm's law.

Ans- According to Ohm's law, if the physical condition of a conducting wire such as length, width, temperature, nature etc. remain the same, then the potential difference generated between the ends of the conducting wire is proportional to the current flowing in it. $V \propto I$

$V = IR$ where R is a constant called the resistance of the conductor.

Q- What is called resistance?

Ans- That property of a substance which resists the flow of charge flowing through it. That property is called resistance (R), the unit of resistance is Ohm, it is denoted by **Ω.**

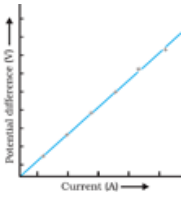
Q- Define one Ohm.

Ans- If the potential difference generated across a conducting wire when one ampere current flows through it is one volt, then the resistance of that wire will be one ohm.

one ohm = $\frac{one\ volt}{one\ ampere}$

Q- Make a graph according to Ohm's law, between potential difference(V) and electric current (I).

Ans- According to Ohm's law, if a graph is drawn between V and I, then a straight line is obtained.



Q- An electric current of 0.5A flows through a filament of an electric bulb for 15 minutes. Find the value of electric charge flowing through this electric circuit.

Ans- Has Given, I = 0.5 A; t = 15 min = 900 s

Electric current (I) = $\frac{charge\ (Q)}{time\ (t)}$ Therefore

charge (Q) = electric current (I) **X** time (t)

= 0.5 A x 900 s = 450 C coulomb charge.

Q- How much work is done in moving a charge of 2C between two points of 6V potential difference?

Ans – Potential difference V = $\frac{(Work\ \ W)}{(Charge\ \ Q)}$

Therefore

Work = Potential difference X charge

W = V Q = 6 V × 2 C = 12 joule

Q- On what factors does the resistance of a conducting wire depend?

Ans- 1. <u>On length-</u> The resistance of the conducting wire is proportional to the length of the conducting wire. That is, resistance increases with increase in length and resistance decreases with decrease in length. $\boldsymbol{R \propto l}$

2. <u>Area of cross-section</u> - Resistance of a conducting wire is inversely proportional to the area of cross-section. That is, increasing the area of cross-section decreases the resistance and decreasing the area of cross-section increases the resistance. $\boldsymbol{R \propto \frac{1}{A}}$

3. On the nature of conductor material

4. On temperature.

Q- What is electrical resistivity? On what factors does it depend?

Ans- We know that $\boldsymbol{R \propto l}$ and $\boldsymbol{R \propto \frac{1}{A}}$

On combining both the above equations- $\boldsymbol{R \propto \frac{l}{A}}$ or

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

$\boldsymbol{\rho = R \frac{A}{l}}$ here $\boldsymbol{\rho}$ (Rho) is called the resistivity or specific resistance of the conductor.

If $l = 1m$ and $A = 1m^2$ then $R = \rho$

That is, the resistance of a wire of length one meter and cross section of one square meter is called specific resistance. Its unit is **ohm-meter.** The electrical resistivity depends on the nature of the material and the temperature.

The resistivity of metals and alloys is very low, ranging from 10^{-8} Ωm to 10^{-6} Ωm. They are good conductors of electricity. The resistivity of insulating materials (rubber, glass) is of the order of 10^{12} to 10^{17} Ωm.

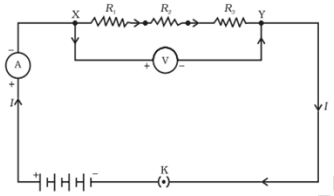
Q- What is the heating effect of electric current?

Ans- When electric current is passed through a resistance wire, then the resistance wire gets very hot and produces heat. This is called the heating effect of electric current. In this effect, electrical energy is converted into heat energy. Electric heater, electric iron etc. devices work on this effect.

Q- Explain the series combination of resistors.

Ans- Series Combination- Such a combination of resistors in which the value of current passing through all the resistors is same but the electric potential difference generated across the resistors is different, is called a series combination.

Let three resistors R_1, R_2, R_3 are connected in series as shown in figure. The current **I** flowing in it.



The total potential difference between the ends of R_1, R_2, R_3 is V,

So $\boldsymbol{V = V_1 + V_2 + V_3}$

$IR = IR_1 + IR_2 + IR_3$

$IR = I(R_1 + R_2 + R_3)$

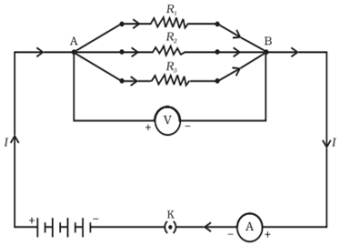
$\boldsymbol{R_S = R_1 + R_2 + R_3}$ Here R_S is the equivalent resistance of the series combination.

If n resistors are connected in series with each other, then the equivalent resistance is

$R_S = R_1 + R_2 + R_3 + \ldots\ldots\ldots\ldots + R_n$

Q- Explain the parallel series combination of resistors.

Ans- Such a combination of resistors in which the value of the current flowing through all the resistors is different but the potential difference generated across all the resistors is the same, then such a sequence of resistors is called a parallel sequence combination. Let three resistances R_1, R_2, R_3 are connected in parallel order as shown in figure.



The current flowing in these are respectively I_1, I_2, I_3 and if the potential difference is V then the total electric current-

$\boldsymbol{I = I_1 + I_2 + I_3}$ (from Ohm's law $I = \frac{V}{R}$)

$\frac{V}{R} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$

$\frac{V}{R} = V\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right)$

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

Here $\mathbf{R_p}$ is the equivalent resistance of the parallel series combination.

If n resistors are connected in parallel with each other, then the equivalent resistance is-

$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots\ldots + \frac{1}{R_n}$

Q- Why are alloys used in the manufacture of electrical heating devices like electric iron, toaster?

Ans- The resistivity of alloys is higher than that of their constituent metals. Alloys do not get oxidised (combusted) quickly at high temperature. This is the reason that alloys are used in the manufacture of common electrical heating devices like electric irons, toasters etc. Nichrome (made of Ni, Cr, Mn and Fe metals) is an alloy.

Q- Explain Joulee's heating law.

Ans- If there is a flow of Q charge in a wire in t time and the generated potential difference is V, then the work done is

$W = VQ$ (Since $Q = It$)

$W = VIt$

That is, the input energy VIt will be converted into heat energy, so the heat generated-

$H = VIt$ (Since $V = IR$)

$H = I\text{R } It$

$\boldsymbol{H = I^2Rt}$ **This is called Joulee's law of heating.**

It is clear from the above formula that the heat generated is- 1. Is proportional to the square of electric current. $\boldsymbol{H \propto I^2}$

2. Is proportional to resistance. $\boldsymbol{H \propto R}$

3. Is proportional to time. $\boldsymbol{H \propto t}$

Q- What is called electrical power? explain.

Ans- The work done per second on the flow of current in an electric circuit is called electric power.

Electric power (P) = $\frac{\textbf{Total work done } (W)}{\textbf{Total time } \quad (t)}$

Work (energy) invested in electrical resistance

W = VIt

The unit of electrical power is the watt.

1 kilowatt (KW) = 1000 watts (W)

Consumption of electrical energy in homes - Electrical energy is the multiplication of power and time, so its unit is watt-hour or bigger unit is kilowatt-hour (kWh) or unit.

1 KWH = 3.6 X10^6 joulees.

Q- On connecting an electric bulb to a 220 volt source, the current flowing in it is 0.5 ampere, then find the power of the bulb.

Ans– Electric power = Potential difference X Current $P = VI$

$P = 220 \times 0.5$ ($V = 220V$, I = $0.5A$)

P = 110 watt

Q- Calculate the resistance of a filament of a 110 watt bulb connected at 220 volts and the value of the flowing current.

Ans- Since $\boldsymbol{P = VI}$ therefore **I = P/V**

current flowing = 110W/220V = 0.5 ampere

From ohm's law $\boldsymbol{V = IR}$ So **R = V/I**

resistance = 220 volts /0.5 ampere = 440 ohm

Q- Calculate the total energy consumed in units in 30 days by running a 100 watt refrigerator for 10 hours per day.

Ans- The energy consumed by the refrigerator in 30 days is 100w × 10h × 30 = 30,000 wh

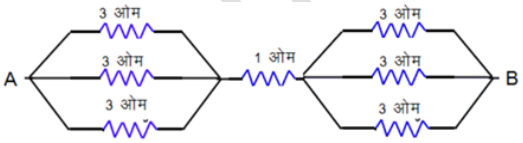
Energy spent in units (kwh) = $\frac{30000}{1000}$ = 30 units

Q- Explain why when the resistance of a circuit is doubled, the amount of current in it remains half?

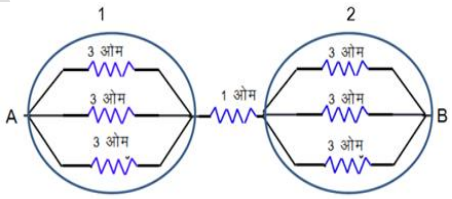
Ans- It is clear from Ohm's law $\boldsymbol{V}$**=IR** or **I=** $\frac{\boldsymbol{V}}{\boldsymbol{R}}$

That the current in the circuit is proportional to the potential difference and inversely proportional to the resistance. That is why when the resistance of a circuit is doubled, the amount of current in it is halfed. And on halfing the resistance, the amount of electric current doubles.

Q- In the given circuit diagram. Find the equivalent resistance of the between.



Ans -

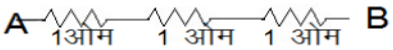


Equivalent resistance of circle 1 and 2 –

$I/R = 1/R_1 + 1/R_2 + 1/R_3$

$= 1/3 + 1/3 + 1/3 = 3/3$ = 1 ohm

Equivalent circuit



$R = R_1 + R_2 + R_3$ = 1 + 1 + 1 = 3 ohm

Q- A 24Ω nichrome resistance coil is connected to a 12 volt battery and current is passed through it for 10 minutes. Find the value of heat generated in the coil.

Ans- From Joulee's law of heating $\boldsymbol{H = I^2Rt}$

(from ohm's law $\boldsymbol{V = IR}$ or **I = V/R** put the value)

heat generated H = $\frac{V^2}{R}$ t

= $\frac{(12)^2 \text{ volt}}{24 \text{ ohm}}$ X 600 seconds

= 3600 joule

Q- There are three rooms in a house. Each room has a 100 watt bulb and a 40 watt tube light. Bulb in each room works for one hour and tube light for 4 hours daily. Find the value of the total cost unit in 30 days.

Ans- Due to the bulb in the house,

the daily electrical energy consumed

= 3 × 100 × 1 = 300 watt-hour

Due to tubelight in the house, daily electrical energy consumption

= 3 × 40 × 4 = 480 watt-hours

Total daily electrical energy consumption in the house

= 300 + 480 = 780 watt-hours

Total electrical energy consumption in the house in 30 days =

780 X 30 = 23400 watt-hour = 23.4 kWh (unit)

Q- The thickness of a wire of a fixed volume of 4 ohm resistance is doubled. Calculate the new resistance of the wire.

Ans- Is given R= 4 ohm

When the thickness of the wire is doubled, its length is halved and the cross-sectional area of the wire is doubled. That is, the wire of length l and area of cross-section A is of length l/2 and area of cross-section is 2A is converted to strings.

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

The new resistance of the wire

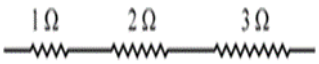
$\mathbf{R_1 = \rho \frac{l/2}{2A}}$ $\qquad \frac{R_1}{R} = \frac{\rho\frac{l/2}{2A}}{\rho\frac{l}{A}}$

$\frac{R_1}{R} = \frac{1}{4}$

$R_1 = R/4$

$R_1 = 4/4 = 1\ \Omega$

Q- Write the equivalent resistance of the given circuit.



Ans: Since the above circuit is in series,

Equivalent resistance in series-

$\mathbf{R_S = R_1 + R_2 + R_3 + \ldots\ldots\ldots\ldots + R_n}$

Equivalent resistance = 1 + 2 + 3 = 6 ohm

Q- The values of three resistors R_1, R_2 and R_3 connected in parallel are 5 Ω, 10 Ω and 30 Ω respectively and they are connected to a 12V battery. (A) The current flowing through each resistor (B) Calculate the total current flowing in the circuit.

Ans- In parallel series combination, the value of current flowing through all the resistors is different but the potential difference generated across all the resistors is same.

(A) The current flowing through each resistor will be-

From ohm's law $V = IR$ or I = V/R

So Current flowing through R_1 = $\mathbf{I_1 = V/ R_1}$

$\mathbf{I_1}$ = 12 V/5 Ω = 2.4 A

Current flowing through R_2 = $\mathbf{I_2 = V/ R_2}$

$\mathbf{I_2}$ = 12 V/10 Ω = 1.2 A

Current flowing through R_3 = $\mathbf{I_3 = V/R_3}$

$\mathbf{I_3}$ = 12 V/30 Ω = 0.4 A

(B) Total current flowing in the circuit

$\mathbf{I = I_1 + I_2 + I_3}$

= (2.4 + 1.2 + 0.4) A

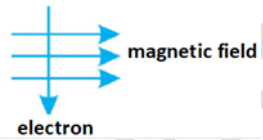
= 4 A

12. Magnetic Effects of Electric Current

Weightage - 6 Marks

Question- 5 = Objective - 2, Very Short - 2, Short – 1.

1. **The effect of magnetic field is maximum at?**
   (1) In the middle of the magnet
   (2) At the poles of the magnet
   (3) Outside the magnet
   (4) Is uniform around the magnet. (2)
2. **In a domestic electric circuit, the flow of current is controlled by which device?**
   (1) Switch (2) Battery
   (3) Voltmeter (4) Bulb (3)
3. **What is the risk due to overloading?**
   (1) Only increase in voltage
   (2)Burning of electrical appliances or blowing of a fuse
   (3) Malfunctioning of the electricity meter
   (4) Breaking of the circuit (2)
4. **Who first discovered the magnetic effect of electric current?**
   (1) Einstein (2) Oersted
   (3) Faraday (4) Newton (3)
5. **What is the main function of an electric fuse?**
   (1) To start an electrical appliance.
   (2) To protect an electric circuit.
   (3) To measure electrical energy
   (4) Controlling the electric current (2)
6. **An electromagnet can be made of?**
   (1) Hard iron (2) Soft iron
   (3) Any type of iron can be used
   (4) None of the above (2)
7. **As shown in the figure, an electron enters a magnetic field perpendicular to the field, then what will be the direction of the force acting on the electron?**

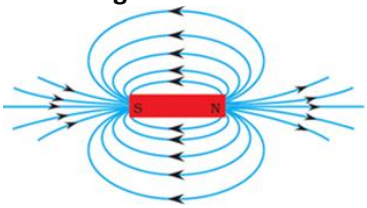


   (1) To the right (2) To the left
   (3) Coming out of the page.
   (4) Going into the page. (4)
8. **What is the unit of magnetic field intensity?**
   (1) Decibel (2) Weber
   (3) Newton (4) Oersted (4)
9. **A positively charged particle projected towards the west is deflected towards the north by a magnetic field. What is the direction of the magnetic field?**
   (1) Upward (2) Downward
   (3) Towards the south (4) Towards the east (1)
10. **Within a current-carrying straight long solenoid, the magnetic field –**
    (1) is zero.
    (2) increases on moving towards its end.
    (3) is the same at all points.
    (4) decreases on moving towards its end. (1)
11. **In our country, the potential difference between the live wire and the neutral wire is.**
    (1) 260V (2) 220V
    (3) 200V (4) 240V (2)
12. **At the time of a short circuit, the current in the circuit -**
    (1) reduces heavily. (2) does not change.
    (3) increases heavily. (4) changes continuously. (3)
13. **Which of the following correctly describes the magnetic field near a long straight current carrying wire?**
    (1) The magnetic field lines are perpendicular to the wire.
    (2) The magnetic field lines are parallel to the wire.
    (3) The magnetic field lines are radial, originating from the wire.
    (4) The magnetic field lines are concentric circles whose centre is the wire. (4)
14. **The direction of the magnetic field inside a solenoid is.**
    (1) North to south (2) South to north
    (3) East to west (4) West to east (2)
15. **When electric current flows through a conducting wire, which particles are present in motion?**
    (1) Electrons (2) Atoms
    (3) Ions (4) Protons (1)
16. **The direction of electric current is to the direction of electrons?**
    (1) Same (2) Perpendicular
    (3) Opposite (4) All of the above (3)

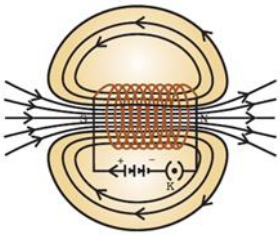
<u>Very Short Answer Type Questions</u>

1. **Name the two poles of a magnet.**
   Ans- North Pole and South Pole
2. **What is the current rating (amperage) of the high power appliance circuit in a domestic circuit?**
   Ans- 15 A
3. **What is the voltage and frequency of the electric current in a domestic circuit?**
   Ans- 220 V voltage, 50 Hz frequency
4. **Mention the direction of magnetic field lines outside and inside a magnet?**
   Ans- Outside the magnet: North to South (N→S)
   Inside the magnet: South to North (S→N)
5. **On what does the intensity of the magnetic field of a straight current-carrying conductor depend?**
   Ans- Current intensity (I),
   Distance from the conductor (r)
6. **If the current in the conductor is doubled, what will happen to the magnetic field?**
   Ans- The intensity of the magnetic field will also double.

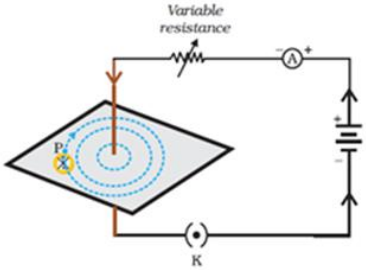
7. **Which appliances use the magnetic effect of electric current?**
   Ans- Electric bell, electric motor, electric crane, MRI
8. **Write the full form of MRI.Ans-**
   Magnetic Resonance Imaging
9. **Display the magnetic lines for a bar magnet.**



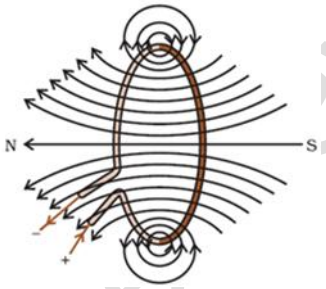
10. Draw a diagram to display the magnetic field lines inside and around a current-carrying solenoid.



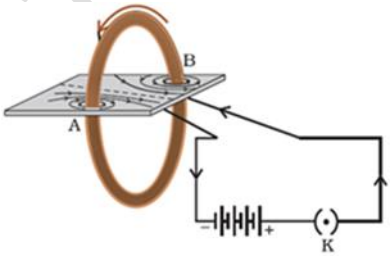
11.Draw a pattern of concentric circles that represents the magnetic field lines around a straight current-carrying conductor.



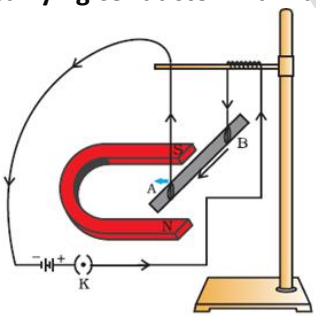
12.Draw the magnetic field lines produced by a current-carrying loop.



13.Draw the magnetic field lines produced by a current-carrying circular coil.

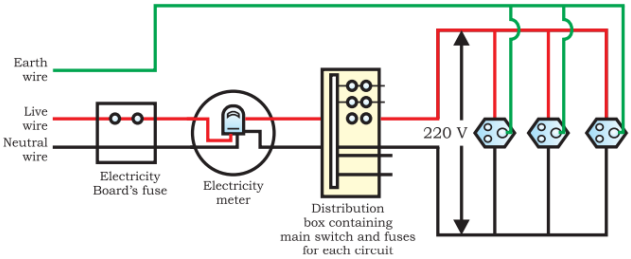


14.Name two safety measures generally used in electric circuits and appliances.
Ans- 1. Electric Fuse 2. Earth wire
15. By which rule can the direction of the force acting on a current-carrying conductor in a magnetic field be known?
Ans- By Fleming's Left-Hand Rule.
16. How does a short circuit occur?
Ans- By direct contact of live and neutral wires.
17. What happens when an electric current is passed through a conducting wire?
Ans- A magnetic field is produced around the wire.
18. What is meant by magnetic field?
Ans- The region around a magnet in which the force of the magnet can be detected. That region is called the magnetic field of that magnet.
19. Which rule is used to find the direction of the magnetic field associated with a current-carrying conductor?
Ans- Right-Hand Thumb Rule.
20. Draw a diagram of the force acting on a current-carrying conductor in a magnetic field.



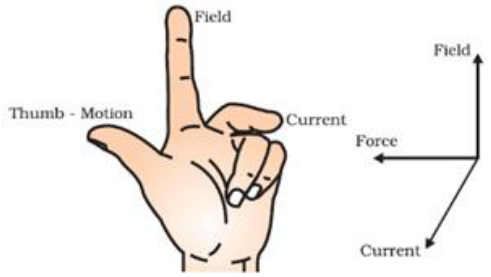
Short Answer Type Questions

1. **What is an electromagnet?**
   Ans- When an electric current is passed through a piece of soft iron, it behaves like a magnet; this is called an electromagnet.
2. **List two ways to produce a magnetic field.**
   Ans- (i) Magnetic field produced due to current flowing in a circular loop of wire.
   (ii) Magnetic field produced due to electric current flowing in a cylindrical shape of wire (solenoid).
3. **Draw a schematic diagram of a common domestic electric circuit.**

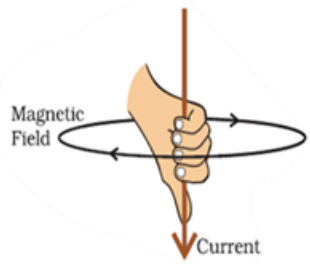


4. **What is a fuse?**
   Ans - A safety device that protects an electric circuit from short circuits and overloading is called a fuse.
5. **What is a solenoid?**
   Ans- A coil of many circular turns of wire wound in a cylindrical shape is called a solenoid. It is like a spring. When current is passed through it, it behaves like a magnet.
6. **What is a magnetic field? What is its unit?**
   Ans- The region around a magnet where an attraction or repulsion force is felt on another magnet.
   Its SI unit is Tesla (T).

7. **Why do magnetic field lines not intersect each other?**
   Ans- Magnetic field lines do not intersect each other because if they do, there will be two directions of the magnetic field at the point of intersection, which is not possible?
8. **How can the magnetic field inside a solenoid be increased?**
   Ans- (i) By increasing the number of turns
   (ii) By increasing the value of the current
   (iii) By using soft iron in the core
9. **Write the rule for determining the direction of the force acting on a current-carrying conductor in a magnetic field.** OR
   Write Fleming's Left-Hand Rule.
   Ans- If we stretch the forefinger, middle finger, and thumb of our left hand mutually perpendicular to each other, if the forefinger indicates the direction of the magnetic field and the middle finger indicates the direction of the current flowing in the conductor, then the thumb will indicate the direction of the force exerted on the conductor. This is called Fleming's Left-Hand Rule.



10. **Why does the compass needle deflect when brought near a magnet?**
    Ans- When the compass is brought near a magnet, a couple acts on the compass needle due to the magnetic field of the magnet, due to which the compass needle deflects.
11. **Write the properties of magnetic field lines.**
    Ans- (1) Magnetic field lines emerge from the north pole and enter the south pole outside the magnet. Whereas inside the magnet, their direction is from the south pole to the north pole.
    (2) Magnetic field lines form a closed curve.
    (3) Magnetic field lines never intersect each other because two directions of the magnetic field are not possible at one point.
12. **A current-carrying solenoid behaves like a bar magnet. How?**
    Ans- (1) On suspending a current-carrying solenoid freely, its axis rests in the north and south directions.
    (2) The compass needle deflects near the current-carrying solenoid.
    (3) Repulsion is found between like poles and attraction between unlike poles of a current-carrying solenoid.
    From the above reasons, it is clear that a current-carrying solenoid behaves like a bar magnet.
13. **What is a short circuit? What losses can it cause?**
    Ans- When the live wire and the neutral wire come in direct contact, the value of the current in the circuit becomes very high. This is called a short circuit.
    Losses due to short circuit: Due to a short circuit, more current flows in the circuit due to which the circuit can burn and fire can occur.
14. **What is an earth wire? Why is it necessary to earth electrical appliances with metal casings?**
    Ans- Earth wire: In a domestic electric circuit, a third wire is also connected along with the live and neutral wires. This wire is connected to a metal plate in the ground near the house. This wire is called the earth wire.
    When appliances with metal casings like refrigerators, toasters, irons, etc. are connected to the earth wire, if the current leaks to the casing, the potential of the casing becomes equal to the potential of the earth. Due to this, the person using the appliance is saved from a severe electric shock.
15. **Which rule will be used to find the direction of the magnetic field inside and outside the loop? Mention the rule with a diagram.**
    OR
    Explain the Right-Hand Thumb Rule with a diagram
    Ans- The direction of the magnetic field inside and outside the loop can be found only by the Right-Hand Thumb Rule.



    According to this rule, if you hold a current-carrying conductor in your right hand in such a way that your thumb points in the direction of the electric current, then your curled fingers will wrap around the conductor in the direction of the magnetic field lines.
16. **A horizontal power transmission line carries current from east to west direction. What is the direction of the magnetic field at a point directly below it and at a point directly above it?**
    Ans- The current is flowing from east to west. Applying the Right-Hand Thumb Rule, when observing from the eastern end, the direction of the magnetic field (at any point above or below the wire) will be clockwise in the plane perpendicular to the wire. Similarly, when observing from the western end of the wire, the direction of the magnetic field will be anticlockwise.

17. **Suppose you are sitting in a chamber with your back against one wall. An electron beam moves horizontally from the back wall to the front wall and is deflected to your right by a strong magnetic field. What is the direction of the magnetic field?**
    Ans- The direction of the magnetic field is vertically downward. The direction of the electric current is from the front wall to the back wall, as negatively charged electrons move from the back wall to the front wall. The direction of the magnetic force is to the right. Thus, using Fleming's Left-Hand Rule, it is concluded that the direction of the magnetic field in a chamber is downward.
18. **What precautions should be taken to prevent overloading in domestic electric circuits?**
    Ans- (1) More than one appliance should not be connected to the same socket.
    (2) Many appliances should not be used at the same time.
    (3) Defective appliances should not be connected to the circuit.
    (4) A fuse should be connected in the electric circuit.
19. **Write any three precautions to be taken while using electricity.**
    Ans-(1) The phase wire should always be under the control of the switch
    (2) Electrical tools should have insulating covers.
    (3) The fuse should be of appropriate capacity and material.

13. Our Environment

Marks Allotted – 5 Question - 4 = Objective-2, Very Short-1, Short Ans-1

(1). Which of the following stabilises solar energy and makes it available for heterotrophs?
(1) Primary consumers (2) Secondary consumers
(3) Tertiary consumers (4) Producers (4)

(2). Which of the following is a biotic component?
(1) Soil (2) Air (3) Plants (4) Water (3)

(3). The pyramid of energy is –
(1) Always inverted (2) Always upright
(3) Inverted and upright (4) All of the above (2)

(4). An example of a decomposer is –
(1) Tiger (2) Fungi (3) Plants (4) Cow (2)

(5). Which of the following is an example of an artificial ecosystem?
(1) Forest (2) Desert (3) Lake (4) Aquarium (4)

(6). Which of the following groups contains only biodegradable substances?
(1) Grass, flowers and leather
(2) Grass, wood and plastic
(3) Fruit peels, cake and lemon juice
(4) Cake, wood and grass (3)

(7). The name of the scientist who gave the ecological principles is –
(1) K. R. Watson (2) A. G. Tansley
(3) J. D. Watson (4) F. H. C. Crick (2)

(8). Which components are included in the ecosystem?
(1) Biotic components (2) Abiotic components
(3) Both biotic and abiotic (4) None (3)

(9). The first trophic level of the food chain is –
(1) Producer (2) Consumer
(3) Carnivore (4) Decomposer (1)

(10). Autotrophs absorb the energy contained in solar light and convert it into which energy? (Board Ex2023)
(1) Physical energy (2) Chemical energy
(3) Thermal energy (4) Magnetic energy (2)

(11). How much energy is transferred from one trophic level to another trophic level in a food chain?
(1) 50% (2) 5% (3) 10% (4) 100% (3)

(12). Which type of food chain is considered best in a food web?
(1) Straight food chain (2) Branched food chain
(3) Both 1 and 2 (4) Neither 1 nor 2 (2)

(13). What percentage of solar energy received by the green leaves of plants in a terrestrial ecosystem is converted into food energy? (Board Exam 2025)
(1) 1% (2) 5% (3) 6% (4) 3% (1)

(14). How does energy flow in a food web?
(1) Quadrilateral (2) Trilateral
(3) Bilateral (4) Unidirectional (4)

(15). Which of the following forms a food chain?
(1) Producer→Carnivore→Herbivore→Decomposer
(2) Producer→Herbivore→Carnivore→Decomposer
(3) Decomposer → Producer→Carnivore→Herbivore
(4) Herbivore →Carnivore → Producer→Decomposer (2)

(16). Consumers are mainly classified into –
(1) Herbivores (2) Carnivores
(3) Omnivores (4) All of the above (4)

(17). Which gas do green plants use to prepare food in the presence of light?
(1) O_2 (2) CFC (3) CO_2 (4) N_2 (3)

(18). How many oxygen atoms are there in one molecule of ozone?
(1) 1 (2) 2 (3) 3 (4) 4 (3)

(19). In which year was a rapid decline in the amount of ozone in the atmosphere observed?
(1) 1980 (2) 1981 (3) 1982 (4) 1983 (1)

(20). At which level is maximum energy stored in the food chain?
(1) In decomposers (2) In carnivores
(3) In herbivores (4) In producers (4)

(21). Which of the following forms a food chain? (Board Exam 2023)
(1) Grass, wheat, mango (2) Grass, goat and human
(3) Goat, cow and elephant (4) Grass, fish and goat (2)

(22). Which substance causes biomagnification?
(1) Pesticide (2) D. D. T.
(3) Herbicide (4) All of the above (4)

(23). What is the function of decomposers?
(1) Food production (2) Air purification
(3) Air pollution (4) Cycling of substances(4)

(1). Write the full form of CFC? (Board Exam - 2022)
Ans- Chloro Fluoro Carbon

(2). Write the main function of the ozone layer? (Board Exam - 2024)
Ans-To stop the ultraviolet rays coming from the sun.

(3). Write the names of two abiotic components of the ecosystem?
Ans- Soil, water

(4). Primary consumers form which trophic level?
Ans- Second trophic level.

(5). In which part of the atmosphere is the ozone layer found?
Ans- In the stratosphere

(6). Organisms that eat both plants and animals are called?
Ans- Omnivorous animals

(7). Which chemical is used in refrigerators?
Ans- CFC (Chloro Fluoro Carbon)

(8). What is called biodegradation?
Ans- The substances which are decomposed by biological process are called biodegradable.
(9). Write two examples of an artificial ecosystem?
Answer Garden and field
(10). Write the names of any 3 natural ecosystems?
Ans- 1. Pond 2. Lake 3. Forest
(11). Write the full form of UNEP?
Ans- United Nations Environment Programme
(12). What is a non-biodegradable substance called?
Ans- The substances which are not easily decomposed by micro-organisms are called non-biodegradable. E.g. Plastic, glass, rubber

(13). What is a trophic level? (Model Paper-2026)
Ans- The various steps of the food chain in which food/energy transfer takes place are called trophic levels. E.g. Producers, primary consumers, secondary consumers, decomposers.

(14). What is an ecosystem called?
Ans- The biotic components and the abiotic components (physical environment) together form a system that functions, which is called an ecosystem.

(1). What will happen if all producers are removed from the ecosystem?
Ans- Since all organisms directly or indirectly depend on producers, if all producers are removed from the ecosystem, all consumers will die, and all ecosystems will cease to exist.

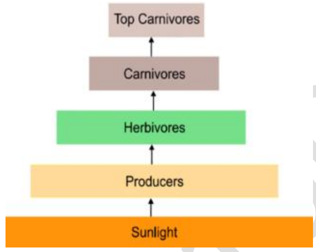
(2). It is necessary to have decomposers in the ecosystem, why? Give reason.
Ans- Because decomposers decompose the complex compounds of dead bodies into simple compounds which reach the environment again and are available to the plants again, so that new protoplasm can be formed again.

(3). No ecosystem can continue without the availability of CO_2. Why?
Ans- Because green plants use CO_2 gas to make food in the presence of light. If there is no CO_2, food production will not take place.

(4). Explain two measures to reduce the problem of waste disposal. (Board Exam - 2024)
Ans- (1) Biodegradable waste materials should be reused after recycling.
(2) Biodegradable waste materials like kitchen waste, leftover food, leaves etc. can be buried in a pit in the ground to prepare compost.

(5). Why are polythene bags banned?
Ans- Polythene is a non-biodegradable substance. Which is not decomposed. After use, they are thrown away, which creates many serious problems. Like -
(i) Due to being non-biodegradable, they are not decomposed, due to which their quantity is increasing, due to which their disposal is becoming difficult.
(ii) They are eaten by stray animals along with food items, but due to not being digested, they cause the death of the animals.

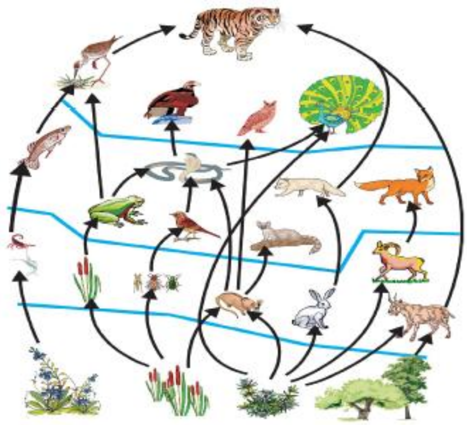
(6). Draw a diagram of the flow of energy in an ecosystem? (Model Paper - 2026)



(energy flow:- Sunlight -> Producer -> Herbivore -> Carnivore -> Top Carnivore)

(7). Define ecosystem. Describe its components.
Ans- The unit formed by the complete balance of all living and non-living components of the environment is called an ecosystem.
There are two main components of an ecosystem -
(1) Biotic components - All living beings come under this category like green plants, animals and human beings
(2) Abiotic components - All non-living things come under this category. Like air, water, soil, light etc.

(8). Explain food chain and food web with examples.
Ans- Food chain- A chain of organisms which depend on each other for food and form different biological levels is called a food chain. Like-
(1)Greenplants→rabbit→dog→Tiger
(2) Green plants→ grasshopper→ frog→snake→ eagle
(3) Aquatic plants → aquatic micro-organisms → fish → eagle
Food web - Many food chains combine to form a web which is called a food web.



(9). Explain the biotic trophic levels in the ecosystem. (Board Exam 2024)

Ans- Every ecosystem has many trophic levels. Which are as follows.

(1) Producers - The living beings who make their own food are called producers, such as all green plants.

(2) Consumers - The living beings who depend directly or indirectly on plants for food are called consumers.

Consumers are of the following types.

(A) Primary consumers - The organisms who get their food directly from green plants. E.g. Herbivores - cow, buffalo, rat, rabbit

(B) Secondary consumers - The organisms who get their food by eating other animals. All carnivores - E.g. dog, cat, fish.

(C) Tertiary consumers or top consumers - Such carnivorous animals who get their food from other carnivorous animals but cannot be eaten by other animals like lion, tiger, eagle etc.

(3) Decomposers- The micro-organisms who decompose the top consumers after their death. E.g. Bacteria, fungi.

(10). Write the difference between biodegradable and non-biodegradable substances?

Biodegradable substances	**Non-biodegradable substances**
1. The substances which are easily decomposed by micro-organisms.	1. The substances which are not decomposed by micro-organisms.
2. They are recycled in nature.	2. These substances are not recycled in nature.
3. These substances do not accumulate in nature.	3. These substances accumulate in nature.
4. These substances do not show biomagnification.	4. These substances show biomagnification.
5. Their origin is biological.	5. They are man-made.
6. E.g. - Vegetables, fruits, paper, faeces, clothes etc.	6. E.g. plastic, glass, D.D.T. etc.

(11). Write a note on the following (A) Depletion of ozone layer (B) Waste management.

(A) Depletion of ozone layer - Ozone is formed from three atoms of oxygen which is written as O_3. The ozone layer protects the earth by blocking the ultraviolet radiation coming from the sun. These ultraviolet radiation are very harmful to living beings and cause skin cancer in humans.

But CFC (chloro fluoro carbon) released from refrigerating machines destroys this ozone layer. Due to which the amount of ozone has started declining. And the harmful ultraviolet rays of the sun have started reaching the earth. Due to which skin cancer has become more common in humans.

(B) Waste management - Nowadays, on visiting any city, heaps of garbage are visible all around. With the improvement in our lifestyle, the amount of waste generated is also increasing very much. Due to changes in packaging methods, there has been a sufficient increase in the waste of non-biodegradable items. Which is having a negative impact on our environment. Thus, the disposal of waste generated by us is becoming a serious environmental problem.

(12). What are the advantages of using paper cups over disposable plastic cups?

Ans- Disposable plastic cups are non-biodegradable substances which remain in the environment and pollute the environment, while paper cups are biodegradable substances which do not pollute the environment.

(13). Explain the flow of energy in an ecosystem?

Ans- The flow of energy in an ecosystem has two main characteristics -

(i) The flow of energy is unidirectional. The energy absorbed by autotrophs is not converted back into solar energy, and the energy transferred to herbivores is not available to plants again.

(ii) 10% law of energy - Due to 90% loss of energy at each trophic level, only 10% energy is transferred from one trophic level to another trophic level.