RANKERS

A COMPLETE GUIDE
for
10th STD - SCIENCE

BASED ON
SAMACHEER KALVI TEXT BOOK

RANKERS EDUCATION

TRICHY

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Textbook questions

PART – A

1. A true solution is a homogeneous mixture of solute and solvent. Chalk powder in water is a heterogeneous mixture. Is it a true solution?
   Ans: No. It is a suspension
2. Solution that contains water as the solvent is called aqueous solution. If carbon disulphide is a solvent in a given solution, then the solution is called ----------
   Ans: Non-aqueous solution
3. Solubility of common salt in 100g water is 36g. If 20g of salt is dissolved in it how much more is required to attain saturation.
   Ans: 16 g
4. If two liquids are mutually soluble, they are called ---------- liquids. (miscible, immiscible)
   Ans: miscible
5. When sunlight passes through window of the classrooms its path is visible. This is due to ---------- of light. (reflection, scattering)
   Ans: scattering
6. The particles in various forms are visible only under ultra microscope. A solution containing such particles is called ---------- (True solution / colloidal solution)
   Ans: Colloidal solution
7. The mixture of gases used by deep sea divers is ---------- (Helium-oxygen, oxygen-nitrogen)
   Ans: Helium-oxygen
8. Earth soil cannot store more nitrogen than it can hold. Hence earth soil is referred to be in a state of ---------- (saturation, unsaturation)
   Ans: saturation
9. In an endothermic process, solubility increases with ------- in temperature. (increase, decrease)
   Ans: increase

PART – B

1.

Substance	**Solubility** at 25˚C
NaCl	36 g
NaBr	95 g
NaI	184 g

From the table given above, furnish your points of inferences.

1. At 25˚C, 36 g of NaCl dissolves in 100 g water to give saturated solution
2. At 25˚C, 95 g of NaBr dissolves in 100 g water to give saturated solution
3. At 25˚C, 184 g of NaI dissolves in 100 g water to give saturated solution
4. NaI is more soluble in water where as NaCl is less soluble

2. Distinguish between the saturated and unsaturated solution using the data given below at a temperature of 25°C

A. 16g NaCl in 100g water

B. 36g NaCl in 100g water

Note : Solubility of NaCl is 36g

Saturated solution	Unsaturated solution
A solution in which no more solute can be dissolved in a definite amount of solvent at a given temperature is called a saturated solution	A solution in which the solute is in lesser amount in comparison with the solvent is called unsaturated solution. In this, addition of solute is possible till the solution reaches the point of saturation
36g NaCl in 100g water at room temperature is a saturated solution	16g NaCl in 100g water at room temperature is unsaturated solution

3. You have prepared a saturated solution of sugar. Is it possible to add some more grams of sugar to this solution? Justify your stand

No, it is not possible to dissolve some more amount of sugar in the saturated solution at the given temperature. But if the temperature of the solution is increased, we can dissolve some more amount of sugar.

4. Find the concentration of solution in terms of weight percent if 20 gram of common salt is dissolved in 50 gram of water.

$$\text{Weight percent} = \frac{\text{weight of the solute}}{\text{Wt. of solute} + \text{Wt. of solvent}} \times 100$$

$$= \frac{20}{20+50} \times 100 = \frac{20}{70} \times 100 = 28.57\ \%$$

Additional questions

1 MARK

1. Salt solution containing common salt in water is an example for

   a) binary solution b) trinary solution c) Suspension d) Colloidal solution

2. The number of components in a binary solution is ----------

   a) one **b) two** c) three d) four

3. Particles of a true solution are

   a) visible to the naked eye b) visible under ultra microscope

   c) not visible even under ultra microscope d) none of these

4. Which of the following is a true solution?

   a) sugar in water b) milk powder in water c) chalk powder in water d) all of these

True solution	Sugar in water
Colloidal solution	Milk powder in water
suspension	Chalk powder in water

5. Size of particle in colloidal solution is.
a) 1 Å to 10 Å **b) 10 Å to 2000 Å** c) 10 Å to 100 Å d) more than 2000 Å

True solution	1 Å to 10 Å
Colloidal solution	10 Å to 2000 Å
Suspension	more than 2000 Å

6. Which is correct regarding colloidal solutions?
a) translucent b) scatter light c) heterogeneous **d) all are correct**

7. In which of the following the particles diffuse readily?
a) True solution b) Colloidal solution c) suspension d) none of these

8. Which of the following scatters light?
a) Sugar in water b) Chalk powder in water **c) Milk powder in water** d) all of these

9. Which is a non-aqueous solution?
a) Sugar in water b) Common salt in water **c) sulphur in carbondisulphide** d) none

10. Non-aqueous solvent is / are
a) benzene b) ether c) CS_2 **d) all the above**

11. Which of the following is a saturated solution?
a) 5 g NaCl in 100 g water b) 10 g NaCl in 100 g water
c) 20 g NaCl in 100 g water **d) 36 g NaCl in 100 g water**

12. In which of the following solutions, both solute and solvent are solids?
a) cork b) cheese **c) alloys** d) smoke

13. An example for a solution containing liquid solute in gas solvent is ----------
a) soda water **b) cloud** c) cork d) smoke

Solute	Solvent	Example
Solid	Solid	Alloys
Solid	Liquid	Sugar solution
Solid	Gas	Smoke
Liquid	Solid	Cheese
Liquid	Liquid	Milk
Liquid	Gas	Cloud
Gas	Solid	Cork
Gas	Liquid	Soda water
Gas	Gas	Helium-oxygen mixture (for deep sea diving)

14. Scattering of light by colloidal particles is known as ----------
a) Tyndall effect b) Brownian motion c) Zeeman effect d) none

15. Robert Brown observed the motion of the particles in
a) solution of sugar in water b) solution of salt in water
c) suspension of pollen grains in water d) suspension of chalk powder in water

16. Which of the following factors affect solubility?
a) temperature b) pressure c) nature of solute and solvent **d) all the above**

17. Solubility of KNO_3 ---------- with the increase in temperature
a) increases b) decreases c) remains constant d) none of these

18. Solubility of CaO ---------- with the increase in temperature
a) increases **b) decreases** c) remains constant d) none of these

19. Solubility of CO_2 gas in water ---------- with the increase in pressure
a) increases b) decreases c) remains constant d) none of these

20. At 20˚C the solubility of $CuSO_4$ in water (100 g) is
a) 36 g **b) 20.7 g** c) 10 g d) 92 g

Substance	**Solubility** at 25˚C (g per 100 g water)
NaCl	36 g
NaBr	95 g
NaI	184 g
$NaNO_3$	92 g

21. Which of the following is a dehydrating agent (absorbs moisture)?
a) Sodium hydroxide **b) anhydrous calcium chloride** c) sugar d) none of these

2 MARK

Fill up the blanks

1. Salt solution containing common salt in water is a suitable example for ----------
(Non aqueous solution / binary solution)
Ans: binary solution

2. CO_2 gas is filled in soft drinks using the effect of ---------- (Pressure / Temperature)
Ans: Pressure

3. Colloidal solution is ---------- (Transparent / Translucent)
Ans: Translucent

4. Solubility of $CuSO_4$ in H_2O is ---------- at 20^oC (20.7g / 36g)
Ans: 20.7g

Spot the error

1. The substance distributed as particles is called dispersed phase. The continuous phase in which the colloidal particles are dispersed is called dispersion medium.
Ans:
The substance distributed as particles is called **dispersed phase.** The continuous phase in which the colloidal particles are dispersed is called **dispersion medium.**

2. Suspension is a homogeneous mixture of small soluble particles in a solvent.
Ans: Suspension is a **heterogeneous** mixture of small **insoluble** particles in a solvent.

3. Solubility of KNO_3 decreases with the increase in temperature.
Ans: Solubility of KNO_3 **increases** with the increase in temperature.

4. Solubility of CaO increases with increase in temperature.
Ans: Solubility of CaO **decreases** with increase in temperature.

5. An increase in temperature increases the solubility of a gas in a liquid.
Ans: An increase in **pressure** increases the solubility of a gas in a liquid.

Find the odd one out

1. Benzene, ether, water, CS_2
Ans: Water
(Water = aqueous solvent, others = non aqueous solvents)

2. 5g NaCl in 100g water, 10g NaCl in 100g water, 36g NaCl in 100g water
Ans: 36g NaCl in 100g water
(36g NaCl in 100g water = saturated solution, others = unsaturated solution)

3. Sugar in water, Common salt in water, milk powder in water
Ans: milk powder in water
(milk powder in water = colloidal solution, others = True solution)

4. Sodium chloride, sulphur, sugar, carbon disulphide
Ans: carbon disulphide
(carbon disulphide = Solvent, others = solute)

Assertion and Reason

1. *Assertion*: **(A)** Nitrogen in earth soil is an example for saturated solution in nature.
Reason: **(R)** Earth soil cannot store more nitrogen than it can hold
(i) Both (A) and (R) are correct (ii) (A) is wrong but (R) is correct
(iii) Both (A) and (R) are wrong (iv) (A) is correct but (R) is wrong

Ans: (i) Both (A) and (R) are correct

2. *Assertion*: **(A)** True solution does not show Tyndall effect
Reason: **(R)** The particles in true solution absorb the light.
Does the reason satisfy the assertion? If not, give correct reason.

Ans: No, the reason does not satisfy the assertion.
The correct reason is that the particles in true solution are not large enough to scatter the light.

Answer the following

1. Define solution, solute and solvent

A **solution** is a homogeneous mixture of two (or) more substances.

In a solution, the component present in lesser amount by weight is called **solute** and the component present in a larger amount by weight is called **solvent**.

Solute + Solvent $\longrightarrow$ Solution

2. What is a binary solution?

If a solution contains two components, then it is called a **Binary Solution**.

Salt solution containing common salt in water is a suitable example for binary solution.

3. What is a true solution?

True solution is a homogeneous mixture that contains small solute particles that are dissolved throughout the solvent.

Eg. Sugar in water.

4. What is a colloidal solution?

Colloidal Solutions is a heterogeneous mixture made up of two phases namely, dispersed phase and dispersion medium.

Dispersed phase + Dispersion medium → Colloidal solution

Eg. A Mixture of Milk Powder and Water forming colloid

5. Define dispersed phase and dispersion medium.

In a colloidal solution the substance distributed as particles is called dispersed phase.

The continuous phase in which the colloidal particles are dispersed is called dispersion medium.

6. What is a suspension?

Suspension is a heterogeneous mixture of small insoluble particles in a solvent. In a suspension the particles of solid stay in clusters that are large enough to be seen.

Eg. Chalk powder in water

7. What is Tyndal effect?

If a beam of light is passed through a colloid, the light is scattered by the colloidal particles and the beam becomes visible. This phenomenon by which colloidal particles scatter light is called Tyndal effect.

8. What is Brownian motion?

The phenomenon by which the colloidal particles are in continuous random motion is called Brownian motion.

9. Compare the properties of true solution, colloidal solution and suspension (Any 2**)**

Property	True Solution	Colloidal Solution	Suspension
Particle size	1Å to 10 Å	10Å to 2000 Å	More than 2000 Å
Appearance	Transparent	Translucent	Opaque
Visibility of particles	Not visible even under ultra microscope	Visible Under ultra microscope	Visible to naked eye
Nature	Homogeneous	Heterogeneous	Heterogeneous
Diffusion of particles	diffuses rapidly	diffuses slowly	Diffusion does not occur
Scattering effect	Does not scatter light	It scatters light	It does not scatter light

10. What is aqueous solution?
The solution in which water acts as a solvent, is called aqueous solution.
Eg. Sugar dissolved in water

11. What is non-aqueous solution?
The solution in which any liquid other than water acts as a solvent is called non-aqueous solution.
Eg. Solution of sulphur in carbon disulphide is a a non-aqueous solution

12. Give examples for non-aqueous solvents
Benzene, ether and carbondisulphide (CS_2)

13. What is unsaturated solution?
A solution in which the solute is in lesser amount in comparison with the solvent is called unsaturated solution. In this, addition of solute is possible till the solution reaches the point of saturation.
Eg. 16g NaCl in 100g water at room temperature is unsaturated solution

14. What is a saturated solution?
A solution in which no more solute can be dissolved in a definite amount of solvent at a given temperature is called a saturated solution
Eg. 36g NaCl in 100g water at room temperature is a saturated solution

15. What is a super saturated solution?
A solution which has more of solute at a given temperature than that of saturated solution is called super saturated solution.

16. Define concentration of a solution
Concentration of a solution is the amount of solute dissolved in a given amount of solvent.

17. What are dilute and concentrated solutions?
A solution containing low concentration of solute is known as dilute solution whereas a solution containing high concentration of solute is known as concentrated solution.

18. Define solubility of a solute
Solubility of a solute in a given solvent at a particular temperature is defined as the number of grams of solute necessary to saturate 100g of the solvent at that temperature.
Eg. Solubility of $CuSO_4$ in H_2O is 20.7g at 20˚C

19. Mention the factors which affect solubility

1. Temperature
2. Nature of solute and solvent
3. Pressure

20. What is the effect of temperature on solubility?

In endothermic process, solubility increases with increase in temperature.
Eg. Solubility of KNO_3 increases with the increase in temperature.
In Exothermic process, solubility decreases with increase in temperature.
Eg. Solubility of CaO decreases with increase in temperature

21. What is the effect of nature of solute and solvent on solubility?

Solubility of a solute in a solvent depends on the nature of both solute and solvent.
A polar compound dissolves in polar solvent.
Eg. Common salt dissolves in water.
A polar compound is less soluble (or) insoluble in a non polar solvent.

22. What is the effect of pressure on solubility?

Effect of pressure is observed only in the case of gases. An increase in pressure increase the solubility of a gas in a liquid.
Eg. CO_2 gas is filled in soft drinks using the effect of pressure

23. State Henry's law

At a given temperature, the mass of gas dissolved in a fixed volume of liquid is directly proportional to the pressure of the gas on the surface of the liquid. This is called Henry's Law.

24. Find the concentration of solution in terms of weight percent if 10 gram of common salt is dissolved in 40 gram of water.

$$\text{Weight percent} = \frac{\text{weight of the solute}}{\text{Wt. of solute} + \text{Wt. of solvent}} \times 100$$

$$= \frac{10}{10+40} \times 100 = \frac{10}{50} \times 100 = 20\ \%$$

25. 2g of potassium sulphate was dissolved in 12.5 mL of water. On cooling, the first crystals appeared at 60°C. What is the solubility of potassium sulphate in water at 60°C?

Weight of potassium sulphate = 2 g
Weight of water = 12.5 g { $\because$ density of water = 1 and so, 12.5 mL = 12.5 g }

$$\text{Solubility} = \frac{\text{weight of the solute}}{\text{Wt. of solvent}} \times 100$$

$$\text{Solubility} = \frac{2}{12.5} \times 100$$

$$= 16 \text{ g}$$

$\therefore$ Solubility of potassium sulphate in water at 60°C = 16 g

26. 50g of saturated solution of NaCl at 30˚C is evaporated to dryness when 13.2 g of dry NaCl was obtained. Find the solubility of NaCl at 30˚C in water.

Wt. of solution = Wt. of solvent + Wt. of solute
50 g = Wt. of solvent + 13.2 g

$\therefore$ Wt. of solvent = 50 – 13.2 = 36.8 g

$$\text{Solubility} = \frac{\text{weight of the solute}}{\text{Wt. of solvent}} \times 100$$

$$\text{Solubility} = \frac{13.2}{36.8} \times 100$$

$$= 35.87 \text{ g} \approx 36 \text{ g}$$

$\therefore$ Solubility of NaCl in water at 30˚C = 36 g

27. An empty evaporating dish weighs 20.0g in the addition of saturated solution of $NaNO_3$, the dish weighs 66.0g. When evaporated to dryness, the dish with Crystals weighs 41.5g Find the solubility of $NaNO_3$ at 20˚C.

Wt. of empty dish = 20 g
Wt. of dish with saturated solution of $NaNO_3$ = 66 g
$\therefore$ Wt. of saturated solution = 66 – 20 = 46 g

Wt. of dish with $NaNO_3$ = 41.5 g
$\therefore$ Wt. of $NaNO_3$ (solute) = 41.5 – 20 = 21.5 g

Wt. of solution = Wt. of solvent + Wt. of solute
46 = Wt. of solvent + 21.5
$\therefore$ Wt. of solvent = 46 – 21.5 = 24.5 g

$$\text{Solubility} = \frac{\text{weight of the solute}}{\text{Wt. of solvent}} \times 100$$

$$\text{Solubility} = \frac{21.5}{24.5} \times 100$$

$$= 87.7 \text{ g}$$

$\therefore$ Solubility of $NaNO_3$ in 100 g water at 20˚C = 87.7 g

Textbook questions

PART – A

1. From the given examples, form the pair of isotopes and the pair of isobars

$_{18}Ar^{40}$, $_{17}Cl^{35}$, $_{20}Ca^{40}$, $_{17}Cl^{37}$

Ans:

Isotopes : $_{17}Cl^{35}$, $_{17}Cl^{37}$ Isobars: $_{18}Ar^{40}$, $_{20}Ca^{40}$

2. Molecular mass of nitrogen is 28. Its atomic mass is 14. Find the atomicity of nitrogen.

Ans:

$$\text{Atomicity} = \frac{\text{Molecular mass}}{\text{Atomic mass}} = \frac{28}{14} = 2$$

So, nitrogen is a diatomic molecule and are written as N_2

3. Gram molecular mass of oxygen is 32g. Density of oxygen is 1.429g/cc. Find the gram molecular volume of oxygen.

$$\text{Gram molar volume of oxygen} = \frac{\text{Gram molar mass}}{\text{Density of oxygen}}$$

$$= \frac{32}{1.429} = 22.4 \text{ litre}$$

4. 'Cl' represents chlorine atom, 'Cl_2' represents chlorine molecule. List out any two differences between atoms and molecules.

Atom	Molecule
An atom is the smallest particle of an element	A molecule is the smallest particle of an element or a compound
An atom is a non bonded entity	A molecule is a bonded entity
An atom may or may not exist freely	A molecule can exist freely

5. Calculate the gram molecular mass of water from the values of gram atomic mass of hydrogen and of oxygen.

Gram atomic mass of hydrogen = 1g, Gram atomic mass of oxygen = 16g

Ans:

Water H_2O

2 (H) = 2 x 1 = 2

1 (O) = 1 x 16 = 16

18

Gram molecular mass of water = 18 g

6. One mole of any substance contains 6.023×10^{23} particles. If 3.0115×10^{23} particles are present in CO_2. Find the number of moles.

$$\text{Number of moles} = \frac{\text{Number of molecules}}{\text{Avogadro number}}$$

$$= \frac{3.0115 \times 10^{23}}{6.023 \times 10^{23}}$$

$$= 0.5$$

PART – B

1. Modern atomic theory takes up the wave concept, principle of uncertainty and other latest discoveries to give a clear cut picture about an atom. State the findings of modern atomic theory.

1. Atom is considered to be a divisible particle.
2. Atoms of the same element may not be similar in all respects.eg: Isotopes ($_{17}Cl^{35}$, $_{17}Cl^{37}$)
3. Atoms of different elements may be similar in some respects eg. Isobars ($_{18}Ar^{40}$, $_{20}Ca^{40}$)
4. Atom is the smallest particle which takes part in chemical reactions.
5. The ratio of atoms in a molecule may be fixed and integral but may not be simple e.g., $C_{12}H_{22}O_{11}$ is not a simple ratio (Sucrose)
6. Atoms of one element can be changed into atoms of other element by transmutation.
7. The mass of an atom can be converted into energy. This is in accordance with Einstein's equation $E = mc^2$

2. You are given the values of mass of one volume of oxygen gas and the mass of one volume of hydrogen. By applying Avagadro's law how will you establish the relation between vapour density and relative molecular mass of a gas?

Relative Molecular Mass:
It is defined as the ratio of the mass of 1 molecule of the gas or vapour to the mass of 1 atom of hydrogen.

$$\text{Relative molecular mass} = \frac{\text{Mass of 1 molecule of the gas or vapour}}{\text{Mass of 1 atom of hydrogen}}$$

Vapour Density (V.D):
It is defined as the ratio of the mass of a certain volume of the gas or vapour to the mass of the same volume of hydrogen at the same temperature and pressure.

$$\text{V.D} = \frac{\text{Mass of 1 volume of gas or vapour}}{\text{Mass of 1 volume of hydrogen}}$$

Applying Avogadro's Law,

$$\text{V.D} = \frac{\text{Mass of 1 molecule of gas or vapour}}{\text{Mass of 1 molecule of hydrogen}}$$

Since hydrogen is diatomic,

$$V.D = \frac{\text{Mass of 1 molecule of gas or vapour}}{2 \times \text{Mass of 1 atom of hydrogen}}$$

Multiplying both sides by 2, we get

$$2 \times V.D = \frac{\text{Mass of 1 molecule of gas or vapour}}{\text{Mass of 1 atom of hydrogen}}$$

$2 \times V.D$ = relative molecular mass of a gas

2 × Vapour density = Relative molecular mass

3. Calculate the number of moles in

a. 12.046×10^{23} atoms of copper

$$\text{Number of moles} = \frac{\text{Number of atoms}}{\text{Avogadro number}}$$

$$= \frac{12.046 \times 10^{23}}{6.023 \times 10^{23}} = 2$$

b. 27.95g of iron

$$\text{Number of moles} = \frac{\text{Mass}}{\text{Atomic mass}}$$

$$= \frac{27.95}{55.9} = 0.5$$

c. 1.51×10^{23} molecules of CO_2

$$\text{Number of moles} = \frac{\text{Number of molecules}}{\text{Avogadro number}}$$

$$= \frac{1.51 \times 10^{23}}{6.023 \times 10^{23}} = 0.25$$

Additional questions

2 MARK

1. State Avogadro's Law

Equal volumes of all gases under the same conditions of temperature and pressure contain the equal number of molecules.

2. Define atomicity of an element

The number of atoms present in one molecule of an element is called the atomicity of an element.

3. How will you deduce atomicity of homo atomic molecule?

For any homo atomic molecule atomicity can be deduced using the formula,

$$\text{Atomicity} = \frac{\text{Molecular mass}}{\text{Atomic mass}}$$

4. Depending upon the number of atoms in one molecule of an element, how are molecules classified? Give examples.

Depending upon the number of atoms in one molecule of an element, molecules are classified into monoatomic, diatomic, triatomic, and poly atomic molecules.

Atomicity	No. of atoms per molecule	Example
Monoatomic	1	Helium (He) Neon (Ne) Metals
Diatomic	2	Hydrogen H_2 Chlorine Cl_2
Triatomic	3	Ozone (O_3)
Polyatomic	> 3	Phosphorous P_4 Sulphur S_8

5. What are homo atomic and hetero atomic molecules?

Molecules are of two types, namely homo atomic molecules and hetero atomic molecules.

1. Homo atomic molecules

These are the molecules which are made up of atoms of the same element.

Most of the elementary gases consist of homo atomic molecules.

Example: Hydrogen H_2, Oxygen gas O_2

In accordance with the number of atoms present in these molecules they are classified as monoatomic, diatomic, triatomic or poly atomic molecules showing that they contain one, two, three, or more than three atoms respectively.

2. Hetero atomic molecules

These are the molecules which are made up of atoms of different elements. They are also classified as diatomic, triatomic, or polyatomic molecules depending upon the number of atoms present.

Example: H_2O, NH_3, CH_4

6. What are isotopes?

Isotopes are the atoms of same element with same atomic number but different mass number.

Example: $\left({}_{17}Cl^{35}, {}_{17}Cl^{37} \right)$

7. What are isobars?

Isobars are the atoms of the different element with same mass number but different atomic number.

Example: $\left({}_{18}Ar^{40}, {}_{20}Ca^{40} \right)$

8. What are isotones?

Isotones are the atoms of different elements with same number of neutrons.

Example: $\left({}_{6}C^{13}, {}_{7}N^{14} \right)$

Number of neutrons in ${}_{6}C^{13}$ = 13 – 6 = 7

Number of neutrons in ${}_{7}N^{14}$ = 14 – 7 = 7

9. State Gay-Lussac's law of combining volumes of gases

Whenever gases react, they do so in volumes which bear a simple ratio to one another, and to the volumes of the gaseous products, provided, all the volumes are measured under the same conditions of temperature and pressure.

10. Define atom and molecule

An atom is the ultimate particle of an element which may or may not have independent existence. The atoms of certain elements such as hydrogen, oxygen, nitrogen, etc. do not have independent existence whereas atoms of helium, neon, argon, etc. do have independent existence.

A molecule is the simplest structural unit of an element or a compound which contains one or more atoms.

11. Define Relative atomic mass (RAM)

Definition based on hydrogen scale:

The relative atomic mass of an element is the ratio of mass of one atom of the element to the mass of one atom of hydrogen.

$$\text{Relative atomic mass (RAM)} = \frac{\text{Mass of 1 atom of the element}}{\text{Mass of 1 atom of hydrogen}}$$

Definition based on carbon scale:

Relative atomic mass of an element is the ratio of mass of one atom of element to the $1/12^{th}$ part of mass of one atom of carbon.

$$\text{Relative atomic mass (RAM)} = \frac{\text{Mass of 1 atom of the element}}{\frac{1}{12}\text{th of the mass of } C^{12} \text{ isotope}}$$

12. What is gram atomic mass?

If the atomic mass of an element is expressed in grams, it is known as gram atomic mass.

Example:

Gram atomic mass of hydrogen = 1g

Gram atomic mass of carbon = 12g

13. Define atomic mass unit (amu)

Atomic mass is expressed in atomic mass unit (amu).

One atomic mass unit is defined as $1/12^{th}$ part of the mass of one atom of carbon.

14. Define Relative molecular mass (RMM)

Definition based on hydrogen scale:

The relative molecular mass of an element or a compound is the ratio of mass of one molecule of the element or a compound to the mass of one atom of hydrogen.

$$\text{Relative molecular mass (RMM)} = \frac{\text{Mass of 1 molecule of an element or compound}}{\text{Mass of 1 atom of hydrogen}}$$

Definition based on carbon scale:

The relative molecular mass of an element or a compound is the ratio of mass of one molecule of the element or a compound to the mass of 1/12 th part of mass of one atom of carbon.

$$\text{Relative molecular mass (RMM)} = \frac{\text{Mass of 1 molecule of an element or compound}}{\frac{1}{12}\text{th of the mass of } C^{12} \text{ isotope}}$$

15. What is gram molecular mass?

If the molecular mass of a given substance is expressed in gram, it is known as gram molecular mass of that substance.

16. Define mole

Mole is defined as the amount of substance that contains as many specified elementary particles as the number of atoms in 12g of carbon-12 isotope.

One mole is also defined as the amount of substance which contains Avogadro number (6.023×10^{23}) of particles.

17. Define Avogadro number

Number of atoms or molecules or ions present in one mole of a substance is called Avogadro number. Its value is 6.023×10^{23}

18. Define molar volume

Volume occupied by one mole of any gas at STP is called molar volume. Its value is 22.4 litres

Problems

1. Find the gram molecular mass of carbon dioxide (CO_2)

$CO_2 = 1(C) + 2(O) = 1(12) + 2(16) = 12 + 32 = 44$

Gram molecular mass of CO_2 = 44 g

2. Find the atomicity of chlorine if its atomic mass is 35.5 and its molecular mass is 71

$$\text{Atomicity} = \frac{\text{Molecular mass}}{\text{Atomic mass}} = \frac{71}{35.5} = 2$$

So, chlorine is a diatomic molecule and are written as Cl_2

3. Find the atomicity of ozone if its atomic mass is 16 and its molecular mass is 48

$$\text{Atomicity} = \frac{\text{Molecular mass}}{\text{Atomic mass}} = \frac{48}{16} = 3$$

So, ozone is a triatomic molecule and are written as O_3

4. Calculate the number of moles in 81g of aluminium

$$\text{Number of moles} = \frac{\text{Mass}}{\text{Atomic mass}}$$

$$= \frac{81}{27}$$

$$= 3$$

5. Calculate the number of moles in 4.6g sodium

$$\text{Number of moles} = \frac{\text{Mass}}{\text{Atomic mass}}$$

$$= \frac{4.6}{23}$$

$$= 0.2$$

6. Calculate the number of moles in 5.1g of Ammonia

$$\text{Number of moles} = \frac{\text{Mass}}{\text{Molecular mass}}$$

$$= \frac{5.1}{17}$$

$$= 0.3$$

7. Calculate the number of moles in 90g of water

$$\text{Number of moles} = \frac{\text{Mass}}{\text{Molecular mass}}$$

$$= \frac{90}{18}$$

$$= 5$$

8. Calculate the number of moles in 2g of NaOH

$$\text{Number of moles} = \frac{\text{Mass}}{\text{Molecular mass}}$$

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

$$= 0.05$$

9. Calculate the mass of 0.5 mole of iron

$$\text{Number of moles} = \frac{\text{Mass}}{\text{Atomic mass}}$$

$$\therefore \text{Mass} = \text{Number of moles} \times \text{Atomic mass}$$

$$= 0.5 \times 55.9$$

$$= 27.95 \text{ g}$$

10. Find the mass of 2.5 mole of oxygen atoms

$$\text{Number of moles} = \frac{\text{Mass}}{\text{Atomic mass}}$$

$$\therefore \text{Mass} = \text{Number of moles} \times \text{Atomic mass}$$
$$= 2.5 \times 16$$
$$= 40 \text{ g}$$

11. Calculate number of moles in 12.046×10^{22} atoms of copper

$$\text{Number of moles} = \frac{\text{Number of atoms}}{\text{Avogadro number}}$$
$$= \frac{12.046 \times 10^{22}}{6.023 \times 10^{23}}$$
$$= 0.2$$

12. Calculate the number of moles in 24.092×10^{22} molecules of water

$$\text{Number of moles} = \frac{\text{Number of molecules}}{\text{Avogadro number}}$$
$$= \frac{24.092 \times 10^{22}}{6.023 \times 10^{23}}$$
$$= 0.4$$

13. Calculate the number of moles in 3.0115×10^{23} molecules of CO_2

$$\text{Number of moles} = \frac{\text{Number of molecules}}{\text{Avogadro number}}$$
$$= \frac{3.0115 \times 10^{23}}{6.023 \times 10^{23}}$$
$$= 0.5$$

14. Calculate the number of molecules in 11g of CO_2

Gram molecular mass of CO_2 = 44g

Number of molecules present in 44g of $CO_2 = 6.023 \times 10^{23}$

$$\therefore \text{Number of molecules present in 11g of } CO_2 = \frac{6.023 \times 10^{23}}{44} \times 11$$
$$= 1.51 \times 10^{23} \text{ molecules}$$

15. Calculate the number of molecules in 360g of glucose

Gram molecular mass of glucose ($C_6H_{12}O_6$) = 6 (C) + 12 (H) + 6 (O)
= 6 (12) + 12 (1) + 6 (16)
= 72 + 12 + 96 = 180 g

Number of molecules present in 180 g of glucose = 6.023×10^{23}

$$\therefore \text{Number of molecules present in 360 g of glucose} = \frac{6.023 \times 10^{23}}{180} \times 360$$
$$= 12.046 \times 10^{23} \text{ molecules}$$

16. Calculate the mass of 18.069×10^{23} molecules of SO_2

Gram molecular mass SO_2 = 2 (O) + 1 (S)

= 2 (16) + 1 (32)

= 32 + 32 = 64 g

Mass of 6.023×10^{23} molecules of SO_2 = 64 g

$\therefore$ Masss of 18.069×10^{23} molecules of $SO_2 = \frac{64}{6.023 \times 10^{23}} \times 18.069 \times 10^{23}$

= 192 g

17. Calculate the mass of glucose in 2×10^{24} molecules

Gram molecular mass of glucose ($C_6H_{12}O_6$) = 6 (C) + 12 (H) + 6 (O)

= 6 (12) + 12 (1) + 6 (16)

= 72 + 12 + 96 = 180 g

Mass of 6.023×10^{23} molecules of glucose = 180 g

$\therefore$ Mass of 2×10^{24} molecules of glucose $= \frac{180}{6.023 \times 10^{23}} \times 2 \times 10^{24}$

= 597.7g

18. Calculate the mass of 12.046×10^{23} molecules in CaO

Gram molecular mass of CaO = 1 (Ca) + 1 (O)

= 1 (40) + 1 (16)

= 56 g

Mass of 6.023×10^{23} molecules of CaO = 56 g

$\therefore$ Mass of 12.046×10^{23} molecules of glucose $= \frac{56}{6.023 \times 10^{23}} \times 12.046 \times 10^{23}$

= 112 g

5 MARK

1. Using Avogadro's Law, how would you deduce atomicity of gases?

Consider the reaction between nitrogen and oxygen.

$$N_2 + O_2 \longrightarrow 2\,NO$$

Nitric oxide

(1 Vol) (1 Vol) (2 Vols)

According to Avogadro's law, equal volumes of all gases under the same conditions of temperature and pressure contain the equal number of molecules.

After applying Avogadro's law, the equation becomes

$$N_2 + O_2 \longrightarrow 2\,NO$$

1 Molecule 1 Molecule 2 Molecules

It is found that two molecules of nitric oxide contain 2 atoms of nitrogen and 2 atoms of oxygen. These two atoms of nitrogen and the two atoms of oxygen should have come from 1 molecule of nitrogen and 1 molecule of oxygen, respectively.

Hence, nitrogen and oxygen are called **diatomic molecules** and are written as N_2 and O_2.

This proves that, atomicity of nitrogen is 2 and the atomicity of oxygen is 2.

Thus Avogadro's hypothesis is used in the deduction of atomicity of elementary gases.

2. Write the applications (*or* importance) of Avogadro's law

1. It is used to determine the atomicity of gases.
2. It is helpful in determining the molecular formula of gaseous compound.
3. It establishes the relationship between the vapour density and molecular mass of a gas.
4. It gives the value of molar volume of gases at STP.
   Molar Volume of a gas at STP = 22.4 lit (or) 22400 cm^3.
5. It explains Gay Lussac's law effectively.

Textbook questions

PART – A

1. $Zn + 2HCl \longrightarrow ZnCl_2 + H_2 \uparrow$
The above reaction is an example of
a) Combination reaction
b) Double displacement reaction
c) Displacement reaction
d) Decomposition reaction.

2. A reddish brown coloured element 'X' on heating in air becomes black coloured compound 'Y'. X and Y are ---------- and ---------- (Cu, CuO / Pb, PbO).
Ans: Cu, CuO

3. A student tested the pH of pure water using a pH paper. It showed green colour. If a pH paper is used after adding lemon juice into water, what color will he observe? (Green / Red / Yellow)
Ans: Red

4. Chemical volcano is an example of (combination reaction / decomposition reaction)
Ans: decomposition reaction

5. When crystals of lead nitrate on heating strongly produces a ---------- gas and the colour of the gas is ----------
Ans: Nitrogen dioxide (NO_2) gas, Reddish brown

6. When aqueous solution of silver nitrate and sodium chloride are mixed ---------- precipitate is immediately formed (white / yellow / red).
Ans: White

7. Zinc can displace aluminium metal from aquous solution of aluminium sulphate (zinc is more reactive than aluminium / aluminium is more reactive than zinc).
Ans: zinc is more reactive than aluminium

8. To protect tooth decay, we are advised to brush our teeth regularly. The nature of the tooth paste commonly used is ---------- in nature.
Ans: basic

9. Vinegar is present in acetic acid. Curd contains ---------- acid (Lactic acid / Tartaric acid).
Ans: Lactic acid

10. $pH = -\log_{10}[H^+]$. The pH of a solution containing hydrogen ion concentration of 0.001M solution is ---------- (3 / 11 / 14)
Ans: 3

PART – B

11. What type of chemical reaction takes place when i) limestone is heated ii) a magnesium ribbon is burnt in air?

i) When limestone is heated **decomposition reaction** takes place

$$CaCO_3 \xrightarrow{\Delta} CaO + CO_2$$

ii) When a magnesium ribbon is burnt in air **combination reaction** takes place.

$$2Mg + O_2 \longrightarrow 2MgO$$

12. The pH values of certain familiar substances are given below.

Substance	pH value
Blood	7.4
Baking soda	8.2
Vinegar	2.5
Household ammonia	12

analyse the data in the table and answer the following questions
a) Which substance is acidic in nature?
Ans: Vinegar

b) Which substances are basic in nature?
Ans: Blood, Baking soda and Household ammonia

13. Why does the colour of copper sulphate change when an iron nail is kept in it? Justify your answer.

- Iron is more reactive than copper.
- So, iron displaces copper from copper sulphate solution
- Blue colour of the copper sulphate solution changes into green colour and the iron nail acquires a brownish look

$$Fe + CuSO_4 \longrightarrow FeSO_4 + Cu$$

14. The hydroxyl ion concentration of a solution is 1.0×10^{-8}M. What is the pH of the solution?

$$\begin{aligned} pOH &= -\log_{10}[OH^-] \\ &= -\log_{10} 1.0 \times 10^{-8} \\ &= -\log_{10} 10^{-8} \\ &= 8 \log_{10} \\ &= 8 \end{aligned}$$

$$\begin{aligned} pH + pOH &= 14 \\ pH &= 14 - pOH \\ pH &= 14 - 8 \\ &= 6 \end{aligned}$$

15. Equal lengths of magnesium ribbons are taken in test tubes A and B. Hydrochloric acid is added to test tube A, while acetic acid is added to test tube B. Amount and concentration taken for both the acids are same. In which test tube reaction occurs more vigorously and why?

Ans: The reaction occurs more vigorously in test tube A, because hydrochloric acid is stronger and more reactive than acetic acid.

Additional questions

1 MARK

1. The lustrous white colour of the silver anklet slowly changes into slightly black colour. This is called tarnishing of silver. This is due to the formation of
a) Silver sulphide (Ag_2S) b) Silver oxide (Ag_2O) c) Silver carbonate d) Silver nitrate

2. Tarnishing of silver is due the reaction between silver and
a) oxygen **b) hydrogen sulphide** c) carbon dioxide d) nitrogen

3. Quick lime is
a) calcium hydroxide b) sodium hydroxide **c) calcium oxide** CaO d) sodium carbonate

4. Slaked lime is
a) calcium hydroxide $Ca(OH)_2$ b) sodium hydroxide c) calcium oxide d) sodium carbonate

5. When dilute hydrochloric acid is added to calcium carbonate, brisk effervescence is produced. This is due to the evolution of ---------- gas
a) CO_2 b) O_2 c) H_2 d) Cl_2

6. Which of the following is used for white washing?
a) sodium hydroxide **b) calcium hydroxide** c) sodium chloride d) washing soda

7. Chemical formula for marble is
a) $CaCO_3$ b) CaO c) Na_2CO_3 d) $Ca(OH)_2$

8. When copper carbonate is heated, colour is changed from
a) blue to white **b) green to black** c) green to red d)blue to black

9. Which is less reactive?
a) Fe b) Zn c) Pb **d) Cu**

10. Which of the following reaction does not occur?
a) $Fe + CuSO_4 \longrightarrow FeSO_4 + Cu$ b) $Pb + CuCl_2 \longrightarrow PbCl_2 + Cu$
c) $Zn + CuSO_4 \longrightarrow ZnSO_4 + Cu$ **d) $Cu + ZnSO_4 \longrightarrow CuSO_4 + Zn$**

11. The catalyst used in the decomposition of potassium chlorate is ----------
a) manganese dioxide b) magnesium oxide c) Nitrogen dioxide d) none of these

12. $2Mg + O_2 \longrightarrow 2MgO$. This is an example for ---------- reaction
a) combination b) decomposition c) displacement e) elimination

Combination reaction	$2Mg + O_2 \longrightarrow 2MgO$ $C + O_2 \longrightarrow CO_2$ $2H_2 + O_2 \longrightarrow 2H_2O$
Decomposition reaction	$CuCO_3 \xrightarrow{\Delta} CuO + CO_2$ $2Pb(NO_3)_2 \xrightarrow{\Delta} 2PbO + 4NO_2 + O_2$ $CaCO_3 \xrightarrow{\Delta} CaO + CO_2$ $(NH_4)_2Cr_2O_7 \xrightarrow{\Delta} Cr_2O_3 + N_2 + 4H_2O$
Double decomposition reaction	$Na_2SO_4 + BaCl_2 \longrightarrow BaSO_4 + 2\ NaCl$ $CuSO_4 + H_2S \longrightarrow CuS + H_2SO_4$
Displacement reaction	$Fe + CuSO_4 \longrightarrow FeSO_4 + Cu$ $Pb + CuCl_2 \longrightarrow PbCl_2 + Cu$
Oxidation	$2Mg + O_2 \longrightarrow 2MgO$ $H_2S + Br_2 \longrightarrow 2HBr + S$ $Fe^{2+} \longrightarrow Fe^{3+} + e^-$
Reduction	$2Na + H_2 \longrightarrow 2NaH$ $CuO + H_2 \longrightarrow Cu + H_2O$ $Fe^{3+} + e^- \longrightarrow Fe^{2+}$

13. Our body metabolism is carried out by means of ---------- secreted in our stomach.
a) hydrochloric acid b) sulphuric acid c) nitric acid d) formic acid

14. Substances with 'sour taste' are
a) acids b) bases c) salts d) none of these

15. Which of the following is weak acid?
a) HCl b) HNO_3 c) H_2SO_4 **d) CH_3COOH**

16. Formic acid (HCOOH) is
a) mineral acid b) strong acid **c) weak acid** d) dibasic acid

17. Acetic acid (CH_3COOH) is
a) mineral acid b) tetrabasic acid **c) monobasic acid** d) dibasic acid

18. The acid present in grape is
a) acetic acid b) malic acid **c) tartaric acid** d) lactic acid

Source	**Acid present**
Apple	Malic acid
Lemon	Citric acid
Grape	Tartaric acid
Tomato	Oxalic acid
Vinegar (food preservative)	Acetic acid
Curd	Lactic acid

19. ---------- gas burns with a 'pop'ing sound
a) Hydrogen b) Oxygen c) Nitrogen d) Chlorine

20. Tribasic acid is
a) H_2SO_4 b) CH_3COOH **c) H_3PO4** d) H_3PO3

Monobasic acid	HCl, HNO_3, CH_3COOH
Dibasic acid	H_2SO_4 , H_2CO_3
Tribasic acid	H_3PO4

Organic acids (Weak acids)	HCOOH, CH_3COOH
Inorganic acids or Mineral acids (Strong acids)	HCl, HNO_3, H_2SO_4

21. Which of the following does not liberate hydrogen gas on reaction with acids?
a) Zn b) Mg **c) Ag** d) all the above

Note: Ag & Cu do not liberate hydrogen gas on reaction with acids

22. Lime stone, chalk and marble are different physical forms of
a) calcium carbonate b) sodium carbonate c) potassium carbonate d) none of these

23. Washing soda is
a) Na_2CO_3 b) $NaHCO_3$ c) CaO d) $CaCO_3$

24. Baking soda is
a) Na_2CO_3 **b) $NaHCO_3$** c) CaO d) $CaCO_3$

25. The gas which turns lime water milky is
a) H_2S b) O_2 c) SO_2 **d) CO_2**

26. Metal carbonates, metal bicarbonates and metal oxides are
a) acidic **b) basic** c) neutral d) none of these

27. King of chemicals is
a) Sulphuric acid b) Nitric acid c) Hydrochloric acid d) Tartaric acid

28. Which is used as a cleansing agent in toilet?
a) Sulphuric acid b) Nitric acid **c) Hydrochloric acid** d) Tartaric acid

Acid	Use
Sulphuric acid	Car battery
Hydrochloric acid	Cleansing agent in toilet
Nitric acid	Production of ammonium nitrate(fertilizer)
Tartaric acid	Constituent of baking powder
Carbonic acid	Aerated drinks
Salt of benzoic acid (sodium benzoate)	Food preservation

29. The atmosphere of Venus is made up of thick white and yellowish clouds of ----------
a) Sulphuric acid b) Nitric acid c) Hydrochloric acid d) Tartaric acid

30. Caustic soda is
a) NaOH b) KOH c) $Ca(OH)_2$ d) H_2SO_4

31. Caustic potash is
a) NaOH **b) KOH** c) $Ca(OH)_2$ d) H_2SO_4

32. Which of the following is a weak base?
a) NaOH b) KOH **c) NH_4OH** d) All of these

Strong bases	NaOH, KOH
Weak bases	NH_4OH, $Ca(OH)_2$

Monoacidic base	NaOH, KOH
Diacidic base	$Ca(OH)_2$, $Mg(OH)_2$
Triacidic base	$Al(OH)_3$, $Fe(OH)_3$

33. Which of the following does not react with NaOH?
a)Al b) Zn **c) Cu** d) All of these

Note: Al & Zn react with NaOH
Cu, Ag, & Cr do not react with NaOH

34. Which is used as a medicine for stomach troubles?
a) NaOH b) $Ca(OH)_2$ c) $Al(OH)_3$ **d) $Mg(OH)_2$**

Base	Use
Sodium hydroxide	manufacture of soap
Calcium hydroxide	white washing the buildings
Magnesium hydroxide	medicine for stomach troubles
Ammonium hydroxide	used to remove grease stains from clothes

35. pH scale was introduced by
a) S.P.L. Sorenson b) J.J.Thomson c) Kelvin d) Rutherford

36. pH of an acidic solution is
a) < 7 b) > 7 c) = 7 d) = 14

Acidic solution	$[H^+] > 10^{-7}$ M	pH < 7
Basic solution	$[H^+] < 10^{-7}$ M	pH > 7
Neutral solution	$[H^+] = 10^{-7}$ M	pH = 7

37. pH of a solution is 10. What is the pOH?
a) 10 b) 7 c) 0 **d) 4**

38. pH + pOH =
a) 14 b) 7 c) 0 d) 5

39. pH of lemon juice is
a) 4.1 **b) 2.2 – 2.4** c) 6.5 – 7.5 d) 4.4 – 5.5

Solution	**Approximate pH**
Lemon juice	2.2 – 2.4
Tomato juice	4.1
Coffee	4.4 - 5.5
Human saliva	6.5 - 7.5
House hold ammonia	12.0

40. Human body becomes prone to viral infections like colds, cough and flu at a pH of
a) 14 b) 0 c) 9.6 **d) 6.9**

41. Cancer cells thrive inside the body at a pH of
a) 14 b) 0 c) 9.6 **d) 5.5**

42. The pH of a normal, healthy human skin is
a) 4.5 to 6 b) 6.6 to 7.7 c) 2-4 d) 7

43. pH of stomach fluid is approximately
a) 0 b) 7 **c) 2** d) 10

44. Human blood pH range is
a) 7.35 to 7.45 b) 4.35 to 4.45 c) 8.35 to 8.45 d) 2.35 to 2.45

45. The ideal pH for blood is
a) 7.4 b) 2.4 c) 7 d) 14

46. pH of normal saliva ranges between
a) 4.5 to 5.5 b) 5.5 to 5.5 c) 7.5 to 8.5 **d) 6.5 to 7.5**

47. White enamel coating in our teeth is
a) calcium phosphate b) calcium chloride c) calcium carbonate d) calcium oxide

48. pH of rain water is approximately
a) 0 b) 14 **c) 7** d) 5

49. Rain water is
a) acidic b) basic **c) neutral** d) alkaline

50. If rain water is polluted by ---------- acid rain occurs
a) SO_2 and NO_2 b) CO_2 and CO c) CaO and Na_2O d) none of these

51. Which is normal salt?
a) NaCl b) $NaHSO_4$ c) Pb(OH)Cl d) Potash alum

Normal salt	NaCl
Acid salt	$NaHSO_4$
Basic salt	Pb(OH)Cl
Double salt	Potash alum

52. Which of the following is used in softening hard water?
a) $NaHCO_3$ **b) Na_2CO_3** c) $CaCO_3$ d) K_2CO_3

Salt	Uses
Common salt NaCl	• in our daily food • as preservative
Washing soda Na_2CO_3	• used in softening hard water. • cleaning agent for domestic purposes
Baking soda $NaHCO_3$	• used in making baking powder • ingredient in antacid
Bleaching powder $CaOCl_2$	• disinfecting drinking water • bleaching cotton and linen in the textile industry
Plaster paris $CaSO_4$. ½ H_2O	• for plastering fractured bones • in making casts for statues

2 MARK

1. The lustrous white colour of the silver anklet slowly changes into slightly black colour. Give reason for the tarnishing of silver.

Tarnishing of silver is due to the formation of silver sulphide (Ag_2S), as a result of the reaction between silver and hydrogen sulphide in the air.

2. What happens when potassium iodide solution is slowly added to lead nitrate solution?

When potassium iodide solution is slowly added to lead nitrate solution, a deep yellow precipitate of lead iodide is formed.

3. What happens when water is added to quick lime or calcium oxide?

When water is added to quick lime or calcium oxide, calcium hydroxide (slaked lime) is formed. This reaction is exothermic and will be accompanied by hissing sound and bubbles leading to the release of considerable amount of heat.

4. What is the chemistry behind white washing?

A solution of slaked lime (Calcium hydroxide) is used for white washing. Calcium hydroxide reacts slowly with carbon dioxide in air to form a thin layer of calcium carbonate on the walls. Calcium carbonate is formed after two to three days of white washing and gives a shiny finish to the walls.

5. What is combination reaction?

Reaction in which a single product formed from two or more reactants is known as combination reaction.

$$A + B \longrightarrow AB$$

$$2Mg + O_2 \longrightarrow 2MgO$$

6. What is decomposition reaction?

Reaction in which a single compound breaks down to produce two or more substances is called decomposition reaction.

$$AB \longrightarrow A + B$$

$$CaCO_3 \xrightarrow{\Delta} CaO + CO_2$$

7. What is displacement reaction?

The reaction in which, a more reactive element displaces a less reactive element from its compound is called displacement reaction.

$$A + BC \longrightarrow AC + B$$

$$Fe + CuSO_4 \longrightarrow FeSO_4 + Cu$$

8. What is double decomposition reaction *or* double displacement reaction?

Double decomposition reaction is any reaction in which exchange of ions between two reactants occur, leading to the formation of two different products.

$$AB + CD \longrightarrow AD + CB$$

$$Na_2SO_4 + BaCl_2 \longrightarrow BaSO_4 + 2NaCl$$

9. What is oxidation?

A chemical reaction which involves addition of oxygen or removal of hydrogen or loss of electron(s) is called as oxidation.

$$2Mg + O_2 \longrightarrow 2MgO$$

$$H_2S + Br_2 \longrightarrow 2HBr + S$$

$$Fe^{2+} \longrightarrow Fe^{3+} + e^-$$

10. What is reduction?

A chemical reaction which involves addition of hydrogen or removal of oxygen or gain of electron(s) is called as reduction.

$$2Na + H_2 \longrightarrow 2NaH$$

$$CuO + H_2 \longrightarrow Cu + H_2O$$

$$Fe^{3+} + e^- \longrightarrow Fe^{2+}$$

11. What is precipitation reaction?

Any reaction that produces a precipitate (insoluble substance) is called a precipitation reaction.

$$Na_2SO_4 + BaCl_2 \longrightarrow BaSO_4\downarrow + 2NaCl$$

White precipitate

12. What is redox reaction?

A chemical reaction in which oxidation and reduction take place simultaneously is called redox reaction.

$$Zn + CuSO_4 \longrightarrow Cu + ZnSO_4$$

13. What are endothermic reactions?

The chemical reactions which proceed with the absorption of heat energy are called endothermic reactions.

$$2NH_3 + Heat \longrightarrow N_2 + 3H_2$$

14. What are exothermic reactions?

The chemical reactions which proceed with the evolution of heat energy are called exothermic reactions.

$$N_2 + 3H_2 \longrightarrow 2NH_3 + \text{Heat}$$

15. Fill in the blanks:

a) All combustion reactions are ---------- (endothermic / exothermic)

Ans: exothermic

b) Reddish brown gas is ---------- (CO_2 / NO_2)

Ans: NO_2

16. What is chemical volcano?

At very high temperature, ammonium dichromate decomposes immediately to green vapours which gets released along with the steam. It seems as if a volcano erupts and is termed as chemical volcano.

$$(NH_4)_2Cr_2O_7 \xrightarrow{\Delta} Cr_2O_3 + N_2 + 4H_2O$$

17. Can copper displace zinc or lead from their salt solutions? Why?

No, copper cannot displace zinc or lead from their salt solutions because copper is less reactive than zinc and lead.

18. What is the damaging effect of oxidation on food and eatables?

Oxidation has damaging effects on food and eatables. When food containing fat and oil is left as such for a long time, it becomes stale. The stale food develops bad taste and smell. This is very common in curd or cheese particularly in summer. Oils and fats are slowly oxidised to certain bad smelling compounds.

19. Fill in the blanks:

a) When glucose is dissolved in water, heat is ---------- (Absorbed / Evolved) and the process is ---------- (Endothermic / Exothermic)

Ans: Absorbed, Endothermic

b) When detergent is dissolved in water, heat is ---------- (Absorbed / Evolved) and the process is ---------- (Endothermic / Exothermic)

Ans: Evolved, Exothermic

20. Define rate of the chemical reaction

Rate of the chemical reaction is defined as change in concentration of any one of the reactants or products per unit time.

Consider the reaction, $A \longrightarrow B$

Rate of the reaction is given by

$$\text{Rate} = -\frac{d[A]}{dt} = +\frac{d[B]}{dt}$$

[A] - concentration of reactant A

[B] - concentration of product B

- ve sign indicates decrease in con centration of A with time.

+ ve sign indicates increase in concentration of B with time.

21. Mention the factors influencing the rate of the chemical reaction

1. Nature of the reactants
2. Concentration of the reactants
3. Surface area of the reactants
4. Temperature
5. Catalyst

22. Explain any two factors which influence the rate of the chemical reaction

1. Nature of the reactants

Magnesium ribbon reacts with both hydrochloric acid and acetic acid but reaction is faster in hydrochloric acid than in acetic acid. This is because hydrochloric acid is more reactive than acetic acid. It shows that nature of the reactant influences the rate of the reaction.

2. Concentration of the reactants

Granulated zinc reacts with both 1M hydrochloric acid and 2M hydrochloric acid. The rate of evolution of hydrogen gas is more with 2M hydrochloric acid. This is because, 2M hydrochloric acid is more concentrated than 1M hydrochloric acid. That is, greater the concentration of the reactant, greater will be the rate of the reaction.

23. How does surface area of the reactants influence the rate of chemical reaction?

Powdered calcium carbonate reacts more quickly with hydrochloric acid than marble chips. This is because powdered calcium carbonate offers large surface area for the reaction to occur at a faster rate. This shows that greater the surface area, greater is the rate of the reaction.

24. How does temperature influence the rate of chemical reaction?

Calcium carbonate present in marble chips reacts slowly with hydrochloric acid at room temperature and evolves carbon dioxide at slower rate, whereas on heating, the evolution of carbon dioxide is made faster. This shows that increase in temperature increases the rate of the reaction.

25. How does catalyst influence the rate of chemical reaction?

When potassium chlorate is heated, oxygen is evolved very slowly whereas after the addition of manganese dioxide to the reactant, oxygen is liberated at a faster rate. This shows that manganese dioxide acts as a catalyst and increases the rate of the reaction.

26. Powdered calcium carbonate reacts more quickly with hydrochloric acid than marble chips. Why?

Powdered calcium carbonate offers large surface area for the reaction to occur at a faster rate. This shows that greater the surface area, greater is the rate of the reaction.

27. What is a catalyst?

A substance which alters the rate of the reaction without undergoing any change in mass and composition is known as catalyst.

28. Define acid

Acid is a substance which furnishes H^+ ions or H_3O^+ ions when dissolved in water. Acids have one or more replaceable hydrogen atoms.

Eg: HCl, H_2SO_4

29. Write the tests for acids

1. Acids change blue litmus to red.
2. Acids are colourless with phenolphthalein and pink with methyl orange.

30. Based on their sources, how are acids classified?

Based on their sources acids are classified into two types.
1. organic acids and 2. inorganic acids.

1. Organic acids:- Acids present in plants and animals (living beings) are organic acids.
eg. HCOOH, CH_3COOH (Weak acids).

2. Inorganic acids:- Acids from rocks and minerals are inorganic acids or **mineral acids**
eg. HCl, HNO_3, H_2SO_4 (Strong acids).

31. Based on their basicity, how are acids classified?

Monobasic acid: - It is an acid which gives one hydrogen ion per molecule of the acid in solution eg. HCl, HNO_3.

Dibasic acid:- It is an acid which gives two hydrogen ions per molecule of the acid in solution e.g., H_2SO_4, H_2CO_3.

Tribasic acid:- It is an acid which gives three hydrogen ions per molecule of the acid in solution. e.g.,H_3PO_4,

32. Based on ionization, how are acids classified?

Acids are classified into two types based on ionisation.

Strong acids:- These are acids which ionise completely in water eg.HCl

Weak acids:-These are acids which ionise partially in water eg. CH_3COOH

33. Based on concentration, how are acids classified?

Concentrated acid:- It is an acid having a relatively high percentage of acid in its aqueous solution.

Dilute acid:- It is an acid having a relatively low percentage of acid in aqueous solution.

34. While diluting concentrated acid, the acid must always be added slowly to water with constant stirring. Why?

Care must be taken while mixing any concentrated mineral acid with water. The acid must always be added slowly to water with constant stirring. If water is added to a concentrated acid the large amount of heat is generated which may cause burns. The mixture splashes out of the container.

35. What is meant by basicity of an acid?

The number of replaceable hydrogen atoms present in one molecule of an acid is called basicity of an acid.

36. What is the action of dilute HCl on zinc?

Zinc reacts with dilute hydrochloric acid to form zinc chloride and hydrogen gas.

$Zn + 2HCl \longrightarrow ZnCl_2 + H_2\uparrow$

37. What is the action of dilute H_2SO_4 on magnesium?

Magnesium reacts with dilute H_2SO_4 to form magnesium sulphate and hydrogen gas.

$Mg + H_2SO_4 \longrightarrow MgSO_4 + H_2\uparrow$

38. When carbon dioxide is passed through lime water, it turns milky. Why?

It is due to the formation of $CaCO_3$

$Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$

(milky)

39. What is the action of dilute hydrochloric acid on Na_2CO_3 and $NaHCO_3$?

Metal carbonates and metal bicarbonates are basic. So, they react with acids to give salt and water with the liberation of CO_2

$Na_2CO_3 + 2\ HCl \longrightarrow 2\ NaCl + H_2O + CO_2\uparrow$

$NaHCO_3 + HCl \longrightarrow NaCl + H_2O + CO_2\uparrow$

40. Complete and balance the following

a) $MgCO_3$ + HCl $\longrightarrow$ **b) $Mg(HCO_3)_2$ + HCl $\longrightarrow$**

a) $MgCO_3 + 2\ HCl \longrightarrow MgCl_2 + H_2O + CO_2\uparrow$

b) $Mg(HCO_3)_2 + 2\ HCl \longrightarrow MgCl_2 + 2H_2O + 2CO_2\uparrow$

41. What happens when dilute HCl is added to copper oxide?

When dilute HCl is added to copper oxide, the colour changes from black to green. This is due to the formation of copper (II) chloride in the reaction. Since metal oxides are basic, they react with acid to form salt and water.

$CuO + 2HCl \longrightarrow CuCl_2 + H_2O$

Black Green

42. What is the action of acids with water?

An acid produces hydrogen ions in water.

$HCl + H_2O \longrightarrow H_3O^+ + Cl^-$

Hydrogen ions cannot exist alone, but they exist in the form of hydronium (H_3O^+) ions with water.

43. Write two uses of acids

1. Sulphuric acid (King of chemicals) is used in car battery and in the preparation of many other compounds.
2. Hydrochloric acid is used as cleansing agent in toilet.

44. Complete and balance

a) $CaO + HCl \longrightarrow$

b) $Al + NaOH + H_2O \longrightarrow$

Ans:

a) $CaO + 2HCl \longrightarrow CaCl_2 + H_2O$

b) $2Al + 2NaOH + 2H_2O \longrightarrow 2\ NaAlO_2 + 3H_2\uparrow$

45. Define base

Base is a substance which releases hydroxide ions when dissolved in water. It is a substance which is bitter in taste and soapy to touch.

e.g. NaOH, KOH

46. Write the test for bases

1. Bases change red litmus to blue.
2. They are pink with phenolphthalein and yellow with methyl orange.

47. Based on ionization how are bases classified?

Strong bases:- These are bases which ionise completely in aqueous solution eg.NaOH, KOH.
Weak bases:- These are bases which ionise partially in aqueous solution eg. NH_4OH, $Ca(OH)_2$.

48. Based on acidity how are bases classified?

Monoacidic base:- It is a base which ionises in water to give one hydroxide ion per molecule eg.NaOH, KOH.
Diacidic base:- It is a base which ionises in water to give two hydroxide ions per molecule eg. $Ca(OH)_2$, $Mg(OH)_2$.
Triacidic base:- It is a base which ionises in water to give three hydroxide ions per molecule eg. $Al(OH)_3$, $Fe(OH)_3$.

49. Based on the concentration how are bases classified?

Concentrated alkali:- It is an alkali having a relatively high percentage of alkali in its aqueous solution.
Dilute alkali:- It is an alkali having a relatively low percentage of alkali in its aqueous solution.

50. Define acidity if a base

Acidity of a base is defined as the number replaceable hydroxyl groups present in one molecule of a base.

51. What are alkalies?

Bases which dissolve in water are called alkalies.
Eg: NaOH and KOH

52. Spot the error in the following statements:

a) All bases are alkalies, but not all alkalies are bases.
b) $Al(OH)_3$ and $Zn(OH)_2$ are alkalies

Ans:

a) All alkalies are bases, but not all bases are alkalis.
b) $Al(OH)_3$ and $Zn(OH)_2$ are bases

53. How does zinc react with NaOH?

Zinc reacts with sodium hydroxide to form sodium zincate with the liberation of hydrogen gas.

$Zn + 2NaOH \longrightarrow Na_2 ZnO_2 + H_2\uparrow$

54. What is the action of CO_2 on bases?

$2NaOH + CO_2 \longrightarrow Na_2CO_3 + H_2O$

$Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$

55. What is the action of bases with water?

Bases generate hydroxide (OH^-) ions when dissolved in water.

$NaOH \longrightarrow Na^+ + OH^-$

56. What is neutralisation reaction?

The reaction between an acid and a base is known as neutralisation reaction.

Acid + Base $\longrightarrow$ Salt + Water

$HCl + NaOH \longrightarrow NaCl + H_2O$

57. What colour is observed when phenolphthalein is added to 20 mL of 0.1N NaOH? What happens when 20 mL of 0.1N HCl is added to the above solution?

Pink colour is observed when phenolphthalein is added to 20 mL of 0.1N NaOH.

When 20 mL of 0.1N HCl is added to the above solution, colur is changed from pink to colourless.

58. Write the uses of bases

1. Sodium hydroxide is used in the manufacture of soap.
2. Calcium hydroxide is used in white washing the buildings.
3. Magnesium hydroxide is used as a medicine for stomach troubles.
4. Ammonium hydroxide is used to remove grease stains from clothes.

59. What change in colour do you observe for the following solution with red litmus, blue litmus, phenolphthalein and methyl orange?

Sample solution	Red litmus	Blue litmus	Phenolphthalein	Methyl orange
Lemon juice				
Washing soda solution				
Soap solution				
Soft drinks				

Ans:

Sample solution	**Red litmus**	**Blue litmus**	**Phenolphthalein**	**Methyl orange**
Lemon juice	No colour change	Red	Coloueless	Red
Washing soda solution	Blue	No colour change	Pink	Yellow
Soap solution	Blue	No colour change	Pink	Yellow
Soft drinks	No colour change	Red	Coloueless	Red

60. Define pH of a solution

pH stands for the power of hydrogen ion concentration in a solution.

$pH = -\log_{10}[H^+]$

pH values decide whether a solution is acidic or basic or neutral.

61. Define pOH of a solution

pOH stands for the power of hydroxyl ion concentration in a solution.

$pOH = -\log_{10}[OH^-]$

62. The hydrogen ion concentration of a solution is 0.001M. What is the pH of the solution?

$pH = -\log_{10}[H^+]$
$pH = -\log_{10}(0.001)$
$pH = -\log_{10}(10^{-3})$
$= -(-3)\log_{10}10$
$pH = 3$

63. The hydrogen ion concentration of a solution is 1.0×10^{-9} M. What is the pH of the solution? Predict whether the given solution is acidic, basic or neutral.

$pH = -\log_{10}[H^+]$
$pH = -\log_{10}(1\times 10^{-9})$
$pH = -\log_{10}(10^{-9})$
$= -(-9)\log_{10}10$
$pH = 9$

pH > 7. Therefore the given solution is basic.

64. The hydroxyl ion concentration of a solution is 0.001M. What is the pH of the solution?

$pOH = -\log_{10}[OH^-]$
$pOH = -\log_{10}[0.001]$
$pOH = -\log_{10}(10^{-3})$
$= -(-3)\log_{10}10$
$pOH = 3$

$pH + pOH = 14$
$pH = 14 - pOH$
$pH = 14 - 3 = 11$

65. The hydroxyl ion concentration of a solution is 1×10^{-9} M. What is the pH of the solution?

$pOH = -\log_{10}[OH^-]$
$pOH = -\log_{10}[1 \times 10^{-9}]$
$pOH = -\log_{10}(10^{-9})$
$= -(-9)\log_{10}10$
$pOH = 9$

$pH + pOH = 14$
$pH = 14 - pOH$
$pH = 14 - 9 = 5$

66. pH of a solution is 2. Calculate its hydrogen ion concentration

$[H^+] = 10^{-pH}$
$[H^+] = 10^{-2}$ M

67. Write note on pH paper

A more common method of measuring pH in a school laboratory is by using pH paper. pH paper contains a mixture of indicators, which gives different colours across the entire pH range.

68. Write any two importance of pH in everyday life

1. Using pH factor the healthiness of our body is predicted. At pH level 6.9, the body becomes prone to viral infections like colds, cough and flu.
2. In agriculture, the pH of soil is very important. Citrus fruits require slightly alkaline soil, while rice requires acidic soil and sugar cane requires neutral soil.

69. Explain the importance of pH in cleaning the teeth

White enamel coating in our teeth is calcium phosphate, hardest substance in our body. It does not dissolve in water. If pH of mouth falls below 5.5, the enamel gets corroded. Toothpastes are generally basic, and are used for cleaning the teeth, can neutralize the excess acid and prevent tooth decay.

70. Match the following

Citrus fruits	Acidic soil
Rice	Neutral soil
Sugar cane	Alkaline soil

Ans:

Citrus fruits	Alkaline soil
Rice	Acidic soil
Sugar cane	Neutral soil

71. What are salts?

- Salts are the products of the reaction between acids and bases
- Salts produce positive ions and negative ions when dissolved in water.

72. How are salts classified?

1. Normal salts — NaCl
2. Acid salts — $NaHSO_4$
3. Basic salts — Pb(OH)Cl
4. Double salts — Potash alum

73. What are normal salts?

A normal salt is obtained by complete neutralization of an acid by a base

$$NaOH + HCl \longrightarrow NaCl + H_2O$$

74. What are acid salts?

Acid salts are derived by the partial replacement of hydrogen ions of an acid by a metal. When a calculated amount of a base is added to a polybasic acid, acid salt is obtained.

$$NaOH + H_2SO_4 \longrightarrow NaHSO_4 + H_2O$$

75. What are basic salts?

Basic salts are formed by the partial replacement of hydroxide ions of a diacidic or triacidic base by an acid radical.

$$Pb(OH)_2 + HCl \longrightarrow Pb(OH)Cl + H_2O$$

76. What are double salts?

Double salts are formed by the combination of saturated solution of two simple salts in equimolar ratio followed by crystallization.
e.g. potash alum

77. Write the uses of common salt (NaCl)

1. It is used in our daily food
2. It is used as preservative.

78. Write the uses of washing soda (Na_2CO_3)

1. It is used in softening hard water.
2. It is used as a cleaning agent for domestic purposes.

79. Write the uses of baking soda ($NaHCO_3$)

1. It is used in making baking powder, which is the mixture of baking soda and tartaric acid. Baking powder is used to make cake and bread soft and spongy.
2. It is an ingredient in antacid. Being alkaline, it neutralises excess of acid in the stomach.

80. Write the uses of bleaching powder ($CaOCl_2$)

1. It is used for disinfecting drinking water to make it free from micro organisms.
2. It is used for bleaching cotton and linen in the textile industry

81. Write the uses of Plaster paris ($CaSO_4$. ½ H_2O)

1. It is used for plastering fractured bones
2. It is used in making casts for statues

82. What is baking powder? Write its use

Baking powder is the mixture of baking soda and tartaric acid.
Baking powder is used to make cake and bread soft and spongy.

83. Match the following

Solution	**Approximate pH**
Lemon juice	6.5 - 7.5
Coffee	12.0
Human saliva	2.2 – 2.4
House hold ammonia	4.4 - 5.5

Ans:

Solution	**Approximate pH**
Lemon juice	2.2 – 2.4
Coffee	4.4 - 5.5
Human saliva	6.5 - 7.5
House hold ammonia	12.0

12. PERIODIC CLASSIFICATION OF ELEMENTS

Textbook questions

PART – A

1. In the modern periodic table periods and groups are given. Periods and groups indicate ----------
a) Rows and Columns b) Columns and rows

Ans: a) Rows and Columns

- Horizontal rows called periods and vertical columns are called groups

2. Third period contains 8 elements, out of these elements how many elements are non-metals?

Ans: 5 elements are non-metals

- . First period contains 2 elements. Both are non-metals.
- Second period contains 8 elements, out of these elements 6 elements are non-metals & 2 elements are metals.

3. An element which is an essential constituent of all organic compounds belongs to--------- group. (14^{th} group / 15^{th} group)

Ans: 14^{th} group

4. Ore is used for the extraction of metals profitably. Bauxite is used to extract aluminium, it can be termed as---------- (ore / mineral)

Ans: ore

5. Gold does not occur in the combined form. It does not react with air (or) water. It is in ---------- (native state / combined state)

Ans: native state

PART – B

6. **Assertion:** Greenish layer appears on copper vessels if left uncleaned.
Reason: It is due to the formation of layer of basic copper carbonate
Give your correct option.
a) assertion and reason are correct and relevant to each other
b) assertion is true but reason is not relevant to the assertion

Ans: a) assertion and reason are correct and relevant to each other

7. A process employed for the concentration of sulphide ore is (froth floatation / gravity separation)
Ans: froth floatation

8. Coating the surface of iron with other metal prevents it from rusting. If it is coated with thin layer of zinc it is called ---------- (galvanization / painting / cathodic protection)
Ans: galvanization

9. Any metal mixed with mercury is called amalgam. The amalgam used for dental filling is -------- (Ag – Sn amalgam / Cu – Sn amalgam)
Ans: Ag – Sn amalgam

10. **Assertion:** In thermite welding, aluminium powder and Fe_2O_3 are used.
Reason: Aluminium powder is a strong reducing agent.
Does the reason satisfy the assertion?

Ans: Yes, the reason satisfies the assertion

11. Can rusting of iron nail occur in distilled water? Justify your answer.
Iron nail will not rust in distilled water because distilled water does not contain dissolved oxygen. Rusting occurs only in the presence of both water and oxygen.

12. Why cannot aluminium metal be obtained by the reduction of aluminium oxide with coke?
Reduction of aluminium oxide with coke (carbon) is not possible because aluminium is a stronger reducing agent than carbon.

13. Iron reacts with con. HCl and con. H_2SO_4. But it does not react with con. HNO_3. Suggest your answer with proper reason.
When iron is dipped in conc. HNO_3 it becomes chemically inert or passive due to the formation of a layer of iron oxide (Fe_3O_4) on its surface.

14. To design the body of the aircraft aluminium alloys are used. Give your reason.
Aluminium alloys are light, have high tensile strength, stronger than aluminium and are corrosion resistant. So, they are used to design the body of the aircraft.

15. X is a silvery white metal. X reacts with oxygen to form Y. The same compound is obtained from the metal on reaction with steam with the liberation of hydrogen gas. Identify X and Y.

X is a silvery white metal. It is aluminium.

$$4Al + 3O_2 \longrightarrow 2Al_2O_3$$
(X) (Y)

$$2Al + 3H_2O \longrightarrow Al_2O_3 + 3H_2$$

X	Aluminium (Al)
Y	Aluminium oxide (Al_2O_3)

Additional questions

1 Mark

1. As on date ---------- elements are known.
   a) 100 **b) 118** c) 218 d) 98

2. Henry Gwyn- Jeffreys Moseley used ---------- rays to determinethe atomic numbers of the elements.
   a) gamma rays b) UV rays **c) X-rays** d) none of these

3. Moseley suggested that ---------- should be the basis of the classification of the element.
   a) atomic number b) atomic mass c) mass number d) oxidation number

4. Modern periodic law was given by
   a) Mendeleev b) Newland c) Doberiner **d) Moseley**

5. Number of periods in modern periodic table is
   a) 18 b) 6 **c) 7** d) 8

6 Number of groups in modern periodic table is
   a) 18 b) 16 c) 7 d) 8

7. Number of elements present in the second period of modern periodic table is
   a) 2 **b) 8** c) 18 d) 32

Period	**Number of elements**	**Atomic number**
1st period Shortest period	**2** (Hydrogen & Helium)	1 and 2
2nd period Short period	**8** (Lithium to Neon).	3 to 10
3rd period short period	**8** (Sodium to Argon).	11 to 18
4th period Long period	**18** (Potassium to Krypton).	19 to 36
5th period Long period	**18** (Rubidium to Xenon).	37 to 54
6th period Longest period	**32** (Ceasium to Radon).	55 to 86
7th period	**32** (Till now only 26 elements have been authenticated by IUPAC)	87 to 118

- Fourth period contains 18 elements. This includes 8 normal elements and 10 **transition elements**.
- Fifth period contains 18 elements. This includes 8 normal elements and 10 **transition elements**.
- Sixth period contains 32 elements. This includes 8 normal elements, 10 **transition elements** and 14 inner transition elements (**lanthanides**).

8. Group 16 elements are called chalcogen family except ----------
a) sulphur b) oxygen **c) polonium** d) tellurium

- First group elements are called **alkali metals**.
- Second group elements are called **alkaline earth metals**.
- Groups three to twelve are called **transition elements**.
- Group 1, 2 and 13 - 18 are called **normal elements** or **main group elements** or **representative elements**.
- Group 16 elements are called **chalcogen** family (except polonium).
- Group 17 elements are called **halogen** family.
- Group 18 elements are called **noble gases** or **inert gases.**
- The lanthanides and actinides which form part of the group 3 are called **inner transition elements.**

9. ---------- was the first metal to be used for making utensils, weapons and for other works.
a) Copper b) silver c) Aluminium d) Nickel

10. Nuclear energy is obtained from ----------metal
a) uranium b) aluminum c) zirconium d) chromium

11. Pure gold is --------- carat gold
a) 22 b) 18 **c) 24** d) 20

12. Which of the following metals are found in a free state or in native state?
a) Gold b) Silver c) Platinum **d) All the above**

13. ---------- is the most abundant metal in the earth's crust.
a) Sodium b) Calcium **c) Aluminium** d) Iron

14. The chief ore of aluminium is
a) bauxite b) Cryolite c) Corundum d) clay

15. ---------- is used in thermite welding.
a) $Mg + Cr_2O_3$ b) $Fe + Al_2O_3$ **c) $Al + Fe_2O_3$** d) $Al_2O_3 + Fe_2O_3$

16. The chief ore of copper is
a) copper pyrite b) ruby copper c) cuprite d) copper sulphate

17. ---------- is the second most abundant metal after aluminium.
a) copper **b) Iron** c) silver d) platinum

18. Corrosion can be prevented by coating the metal surface with
a) paint b) oil c) grease **d) all of these**

19. ---------- can be magnetized
a) aluminium b) copper **c) iron** d) all of these

20. ---------- is a magnetic oxide
a) Fe_3O_4 b) Al_2O_3 c) Cu_2O d) CuO

21. Which of the following is a sulphide ore?
a) Bauxite b) Cryolite **c) Zinc blende** d) Rock salt

Oxide Ores	Carbonate Ores	Halide Ores	Sulphide Ores
Bauxite ($Al_2O_3.2H_2O$)	Marble ($CaCO_3$)	Cryolite (Na_3AlF_6)	Galena (PbS)
Cuprite (Cu_2O)	Magnesite ($MgCO_3$)	Fluorspar (CaF_2)	Iron pyrite (FeS_2)
Haematite (Fe_2O_3)	Siderite ($FeCO_3$)	Rock salt (NaCl)	Zinc blende (ZnS)

22. ---------- reacts with alkalis
a) aluminium b) copper **c**) iron d) all of these

23. ---------- is used in making springs, anchors and electromagnets.
a) Pig iron b) Steel **c) Wrought iron** d) none of these

24. Rusting of iron requires
a) air b) water **c) both air and water** d) none of these

25. Copper is not attacked by
a) Cl_2 b) con.H_2SO_4 **c) alkalis** e) conc. HNO_3

2 Mark

Fill up the blanks from the given pair of answers

1. The modern periodic table is divided into four blocks known as ----------
(s, p, d and f blocks / K, L, M and N blocks)
Ans: s, p, d and f blocks

2. The elements present in a ---------- have the same valency (group / period)
Ans: group

3. The elements present in a ---------- have identical chemical properties.(period / group)
Ans: group

4. Atomic size of the elements in a period ---------- from left to the right.(decreases / increases)
Ans: decreases

5. Atomic radii of the elements present in a group ---------- downwards (increases / decreases)
Ans: increases

6. Modern periodic table is based on ---------- (atomic number / atomic weight)
Ans: atomic number

7. Sulphide ores are concentrated by ---------- process (froth-floatation / gravity separation)
Ans: froth-floatation

8. Oxiide ores are concentrated by ---------- process (froth-floatation / gravity separation)
Ans: gravity separation

9. Haematite ore (Fe_2O_3) is concentrated by ---------- process (froth-floatation / gravity separation)
Ans: gravity separation

10. Copper pyrite ore ($CuFeS_2$) is concentrated by -------process (froth-floatation / gravity separation)
Ans: froth-floatation

11. Bauxite is converted into alumina by ---------- process (Baeyer's / Hall's)
Ans: Baeyer's process

12. Aluminium is produced by the electrolytic reduction of fused alumina by ---------- process (Baeyer's / Hall's)
Ans: Hall's process

13. In the production of aluminium by the electrolytic reduction of fused alumina by Hall's process, ---------- is used to lower the fusion temperature of electrolyte. (fluorspar / cryolite)
Ans: fluorspar

14. Matte is --------- (Cu_2S + FeS / Cu_2O + FeO)
Ans: Cu_2S + FeS

15. In the extraction of copper ----------is formed as slag.
(Iron silicate $FeSiO_3$ / Calcium silicate $CaSiO_3$)
Ans: Iron silicate $FeSiO_3$

16. Blister copper contains ----------
(95% pure copper and 5% impurities / 98% pure copper and 2% impurities)
Ans: 98% pure copper and 2% impurities

17. In the extraction of iron ----------is forms as the slag.
(Iron silicate $FeSiO_3$ / Calcium silicate $CaSiO_3$)
Ans: Calcium silicate $CaSiO_3$

18. Formula for rust is ---------- ($Al_2O_3.x\ H_2O$ / $Fe_2O_3.xH_2O$)
Ans: $Fe_2O_3.xH_2O$ Hydrated ferric oxide.

19. The last element authenticated by IUPAC is (Cn112 Copernicium / Cu 29 Copper)
Ans: Cn112 Copernicium

20. Smelting process involves ---------- (oxidation / reduction)
Ans: reduction

Spot the error in the given statements

1. The elements present in a period have the same number of electrons in the valence shell of their atoms.
   Ans:
   The elements present in a **group** have the same number of electrons in the valence shell of their atoms.

2. In a group, the electrons are filled in the same valence shell of all elements.
   Ans:
   In a **period**, the electrons are filled in the same valence shell of all elements

3. In a period, the metallic character of the element increases while their non-metallic character decreases.
   Ans:
   In a period, the metallic character of the element decreases while their non-metallic character increases.

4. The elements present in a group have identical physical properties and the chemical properties vary gradually.
   Ans:
   The elements present in a group have identical chemical properties and the physical properties vary gradually.

5. In modern periodic table, the metals are present in upper right corners of the periodic table.
   Ans:
   In modern periodic table, the **nonmetals** are present in upper right corners of the periodic table.

6. In modern periodic table, lanthanides and actinides are placed at the top of the periodic table.
   Ans:
   In modern periodic table, lanthanides and actinides are placed at the **bottom** of the periodic table.

7. Nearly 180 metallic elements are obtained from mineral deposits on or beneath the surface of the earth.
   Ans:
   Nearly **80** metallic elements are obtained from mineral deposits on or beneath the surface of the earth.

8. Metals which have high chemical reactivity are found in free state, or in native state.
   Ans:
   Metals which have **low** chemical reactivity are found in free state, or in native state.

9. Aluminium is a reactive metal and hence it occurs in the native state.
   Ans:
   Aluminium is a reactive metal and hence it occurs in the **combined** state.

10. Copper was named as ferrum by the Romans because they used to get it from the island of Cyprus.
    Ans:
    Copper was named as **cuprum** by the Romans because they used to get it from the island of Cyprus.

11. The chief ore of copper is copper glance. It yields nearly 96% of the world production of copper.
Ans:
The chief ore of copper is **copper pyrite**. It yields nearly **76%** of the world production of copper

12. Haematite ore is concentrated by froth floatation process. The concentrated ore is roasted in a blast furnace and smelting is carried out in reverberatory furnace.
Ans:
Haematite ore is concentrated by **gravity separation process**. The concentrated ore is roasted in **a reverberatory furnace** and smelting is carried out in **blast furnace.**

Find the odd one out

1. Froth floatation, Gravity separation, Electrolytic refining
Ans: Electrolytic refining
(Froth floatation & Gravity separation are the methods of concentration of the ore whereas Electrolytic refining is the method of purification of crude metal)

2. Galvanization, Electroplating, Sacrificial protection, Electrolytic refining
Ans: Electrolytic refining
(Electrolytic refining is the method of purification of crude metal whereas the other methods are used to prevent rusting)

3. Cryolite, Siderite, Fluorspar, Rock salt
Ans: Siderite
(Siderite is the carbonate ore whereas others are halide ores)

4. Gold, silver, platinum, aluminium
Ans: aluminium
(aluminium occurs only in combined state whereas other given metals occur in native state)

Match the following

1.

Fe	a constituent of vitamin B_{12}
Ca	constituent of chlorophyll
Co	a constituent of blood pigment (haemoglobin)
Mg	a constituent of bone and teeth

Ans:

Fe	a constituent of blood pigment (haemoglobin)
Ca	a constituent of bone and teeth
Co	a constituent of vitamin B_{12}
Mg	constituent of chlorophyll

2. Extraction of iron

Regions in blast furnace	Name of the zone
The lower region	Fusion zone
The middle region	Reduction zone
The upper region	Combustion zone

Ans:

Regions in blast furnace	Name of the zone
The lower region	Combustion zone
The middle region	Fusion zone
The upper region	Reduction zone

3.

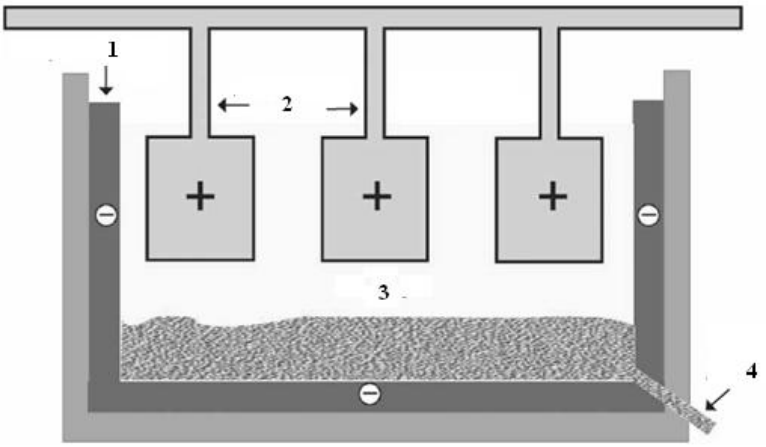
Metal	Electronic configuration	Valency
Aluminium	2, 8, 18, 1	1 & 2
Copper	2, 8, 14, 2	2 & 3
Iron	2, 8, 3	3

Ans:

Metal	Electronic configuration	Valency
Aluminium	2, 8, 3	3
Copper	2, 8, 18, 1	1 & 2
Iron	2, 8, 14, 2	2 & 3

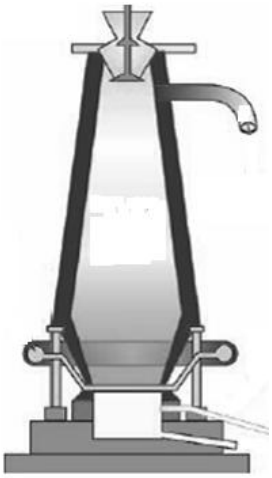
Label the parts in the given diagram

1. The diagram given below is for the production of aluminium by the electrolytic reduction of fused alumina by Hall's process. Label the parts.

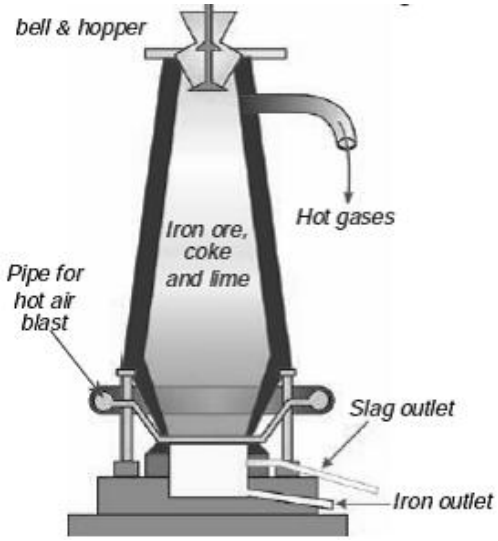


Ans:
1. Graphite lined iron tank 2. Graphite rods 3. Electorlyte 4. Refined aluminium

2. Copy the diagram and label the parts



Ans:



Assertion and Reason

1. **Assertion (A):** Magnalium alloy is used for the manufacture of aircraft & scientific instruments
Reason (R) : It is light, hard, tough and corrosion resistant.

a) **A** is correct & **R** is relevant
b) **A** is not correct & **R** is relevent
c) **A** is correct & **R** is not relevent
d) Both **A** & **R** are not correct

Ans: a) **A** is correct & **R** is relevant

2. **Assertion (A):** Zinc is used for galvanization
Reason (R) : Zinc is more reactive than iron and hence it forms a protective layer of zinc carbonate on the surface of iron. This prevents corrosion.
a) **A** is correct & **R** is relevant
b) **A** is not correct & **R** is relevant
c) **A** is correct & **R** is not relevant
d) Both **A** & **R** are not correct

Ans: a) **A** is correct & **R** is relevant

3. **Assertion (A):** Aluminium powder & Fe_2O_3 are used in thermite welding
Reason (R) : Aluminium powder is a strong reducing agent and reduces Fe_2O_3 to iron.
a) **A** is correct & **R** is relevant
b) **A** is not correct & **R** is relevent
c) **A** is correct & **R** is not relevent
d) Both **A** & **R** are not correct

Ans: a) **A** is correct & **R** is relevant

4. **Assertion (A):** Gold**,** silver and platinum occur in free state
Reason (R): Metals with low chemical reactivity are found in free state or native state.
Does the reason satisfy the assertion?

Ans: Yes

5. **Assertion (A):** Bauxite is an ore of aluminium and clay is its mineral.
Reason (R): Aluminium can be profitably extracted only from bauxite.
Does the reason satisfy the assertion?

Ans: Yes

6. **Assertion (A):** Aluminium occurs in the combined state.
Reason (R): Aluminium is a reactive metal.
Does the reason satisfy the assertion?

Ans: Yes

7. **Assertion (A):** Aluminium metal is used for the manufacture of household utensils.
Reason (R): It is light, cheap, corrosion resistant, and good conductor of heat.
Does the reason satisfy the assertion?

Ans: Yes

To calculate the required value

1. A reddish brown metal (A) on heating at different temperatures in the presence of oxygen it forms two types of oxides (B) and (C). The metal reacts with conc.H_2SO_4 to give the salt (D) with the liberation of SO_2 gas. Identify A, B, C & D.

- Reddish brown metal is copper.
- On heating at different temperatures in the presence of oxygen it forms two types of oxides CuO, Cu_2O.

$$\underset{(A)}{2Cu} + O_2 \xrightarrow{\text{Below 1370K}} \underset{(B)}{2CuO} \text{ (copper II oxide –black)}$$

$$4Cu + O_2 \xrightarrow{\text{Above 1370K}} \underset{(C)}{2Cu_2O} \text{ (copper I oxide-red)}$$

- Copper reacts with con. H_2SO_4 to give copper sulphate salt with the liberation of sulphur dioxide gas.

$$Cu + 2H_2SO_4 \longrightarrow \underset{(D)}{CuSO_4} + SO_2\uparrow + 2H_2O$$

A	Cu	Copper
B	CuO	Copper II oxide
C	Cu_2O	Copper I oxide
D	$CuSO_4$	Copper sulphate

2. (A) is the most abundant metal on the earth crust. It reacts with strong caustic alkalis to form (B) with the liberation of hydrogen gas. On heating at 800°C, aluminium burns very brightly forming its oxide (C) and nitride (D). Identify A, B, C & D.

- The most abundant metal on the earth crust is Aluminium.
- It reacts with strong caustic alkalis forming aluminates.

$$\underset{\textbf{(A)}}{2Al} + 2NaOH + 2H_2O \longrightarrow \underset{\text{Sodium meta aluminate } \textbf{(B)}}{2NaAlO_2} + 3H_2\uparrow$$

- On heating at 800°C, aluminium burns very brightly forming its oxide and nitride.

$$4Al + 3O_2 \longrightarrow \underset{\textbf{(C)}}{2Al_2O_3}$$

$$2Al + N_2 \longrightarrow \underset{\textbf{(D)}}{2AlN}$$

A	Al	Aluminium
B	$NaAlO_2$	Sodium meta aluminate
C	Al_2O_3	Aluminium oxide
D	AlN	Aluminium nitride

3. (A) is the second most abundant metal on the earth crust. It is a lustrous metal and greyish white in colour. On heating in air, it forms magnetic oxide (B). When (A) is exposed to moist air, it forms a layer of brown hydrated ferric oxide (C) on its surface. Identify A, B & C.

- The second most abundant metal on the earth crust is iron.
- On heating in air, iron forms magnetic oxide.

$$3Fe + 2O_2 \longrightarrow Fe_3O_4 \text{ (black)}$$
(A) (B)

- When iron is exposed to moist air, it forms a layer of brown hydrated ferric oxide on its surface. This compound is known as rust.

$$4Fe + 3O_2 + 3H_2O \longrightarrow 2Fe_2O_3.3H_2O \text{ (Rust)}$$
(Moisture) **(C)**

A	Fe	Iron
B	Fe_3O_4	Magnetite (magnetic oxide)
C	$Fe_2O_3.3H_2O$	hydrated ferric oxide (Rust)

Answer the following

1. State 'Modern periodic law'

Modern periodic law states that "the physical and chemical properities of elements are the periodic function of their atomic numbers."

2. What is modern periodic table?

The periodic table which is based upon the electronic configuration of elements is called the long form of the periodic table. This is called the modern periodic table.

3. Write the characteristics of Periods

1. In a period, the electrons are filled in the same valence shell of all elements.
2. As the electronic configuration changes along the period, the chemical properties of the elements also change.
3. Atomic size of the elements in a period decreases from left to the right.
4. In a period, the metallic character of the element decreases while their non-metallic character increases.

4. What are transition elements? Why are they called so?

The elements present in groups 3 to 12 are called transition elements because their properties are intermediate between left portion and right portion elements of the periodic table.

5. What are the defects in the Modern Periodic Table?

1. Position of hydrogen is not fixed till now.
2. Position of lanthanides and actinides has not been given inside the main body of periodic table.
3. It does not reflect the exact distribution of electrons of some of transition and inner transition elements.

6. What are strategic metals ?

Metals like titanium, chromium, manganese, zirconium etc. find their applications in the manufacture of defense equipments. These are called strategic metals.

7. What are coinage metals?

Copper, silver and gold are called coinage metals as they are used in making coins, jewellery etc.

8. Write note on purity of gold

Purity of gold is expressed in carat.

24 carat gold = pure gold.

For making ornaments 22 carat gold is used which contains 22 parts of gold by weight and 2 parts of copper by weight.

The percentage of purity is = $\frac{100}{24} \times 22 = 91.6\%$ **(916 Make gold)**

9. What are minerals and ores?

A mineral may be a single compound or complex mixture of various compounds of metals which are found in earth.

The mineral from which a metal can be readily and economically extracted on a large scale is said to be a ore.

For example, clay ($Al_2O_3.2SiO_2.2H_2O$) and bauxite ($Al_2O_3.2H_2O$) are the two minerals of aluminium. But aluminium can be profitably extracted only from bauxite. Hence bauxite is an ore of aluminium and clay is its mineral.

10. Write the differences between minerals and ores

No.	Minerals	Ores
1	Minerals contain a low percentage of metal	Ores contain a large percentage of metal.
2	Metals cannot be extracted easily from mineral	Ores can be used for the extraction of metals
3	All minerals cannot be called as ores	All ores are minerals

11. What is mining & metallurgy?

The process of extracting the ores from the earth crust is called mining.

Various steps involved in the extraction of metals from their ores as well as refining of crude metal are collectively known as metallurgy.

12. Define gangue or matrix

The rocky impurity, associated with the ore is called gangue or matrix.

13. What is flux?

It is a compound added to the ore to remove its impurities by fusion.eg.CaO

14. What is slag?

It is the fusible product formed when flux reacts with gangue during the extraction of metals.

$$\text{Flux} + \text{Gangue} \longrightarrow \text{Slag}$$

15. What is smelting?

Smelting is the process of reducing the roasted oxide to metals in the molten condition.

16. What is calcination?

It is a process in which ore is heated in the absence of air. As a result of calcination the carbonate ore is converted into its oxide.

17. What is roasting?

It is a process in which ore is heated in the presence of excess of air. As a result of roasting the sulphide ore is converted into its oxide.

18. Write ores of aluminium

Name of the ore	Formula
Bauxite	$Al_2O_3.2H_2O$
Cryolite	Na_3AlF_6
Corundum	Al_2O_3

19. In the production of aluminium by the electrolytic reduction of fused alumina (Al_2O_3) by Hall's process,

a) Cathode is ---------- b) Anode is ---------- c) Electrolyte is ----------

Ans:

a) Cathode: Iron tank lined with graphite

b) Anode: A bunch of graphite rods suspended in molten electrolyte

c) Electrolyte: Pure alumina + molten cryolite + fluorspar

20. What is the action of air on aluminium?

Aluminium is not affected by dry air. On heating at 800°C, aluminium burns very brightly forming its oxide and nitride.

$$4Al + 3O_2 \longrightarrow 2Al_2O_3 \text{ (Aluminium Oxide)}$$

$$2Al + N_2 \longrightarrow 2AlN \text{ (Aluminium Nitride)}$$

21. What is the action of water on aluminium?

Water has no reaction on aluminium due to the layer of oxide on it. When steam is passed over red hot aluminium, hydrogen is produced.

$$2Al + 3H_2O \longrightarrow Al_2O_3 + 3H_2\uparrow$$

22. What is the action of alkalis on aluminium?

It reacts with strong caustic alkalis forming aluminates.

$$2Al + 2NaOH + 2H_2O \longrightarrow 2NaAlO_2 + 3H_2\uparrow$$

Sodium meta aluminate

23. What is the action of dilute and con. HCl on aluminium?

With dilute and con. HCl it liberates H_2 gas.

$$2Al + 6HCl \longrightarrow 2AlCl_3 + 3H_2\uparrow$$

24. What is the action of dilute H_2SO_4 on aluminium?

Aluminium liberates hydrogen on reaction with dilute sulphuric acid.

$$2Al + 3H_2SO_4 \longrightarrow Al_2(SO_4)_3 + 3H_2\uparrow$$

25. What is the action of conc.H_2SO_4 on aluminium?

Sulphur dioxide is liberated with hot concentrated sulphuric acid.

$$2Al + 6H_2SO_4 \xrightarrow{\text{hot \& conc.}} Al_2(SO_4)_3 + 6H_2O + 3SO_2\uparrow$$

26. Write note on aluminothermic process. *Or* **Show that aluminium is a powerful reducing agent.**

Aluminium is a powerful reducing agent. When a mixture of aluminium powder and iron oxide is ignited, the latter is reduced to metal. This process is known as aluminothermic process.

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

27. Dilute or concentrated nitric acid does not attack aluminium. But it renders aluminium passive. Why?

Dilute or concentrated nitric acid does not attack aluminium. But it renders aluminium passive due to the formation of an oxide film on its surface.

28. Duralumin is used for making aeroplanes. Give reason

Duralumin (Al,Cu,Mg,Mn) is an alloy of aluminium.It is light, has high tensile strength and is corrosion resistant. So, duralumin is used for making aeroplanes.

Uses of Aluminium

No.	Uses	Form	Reason
1	Household utensils	Aluminium metal	Aluminium is light, cheap, corrosion resistant, and good conductor of heat.
2	Electrical cable industry	Aluminium wires	Aluminium is a good conductor of electricity.
3	Aeroplanes and other industrial parts	Duralumin (Al,Cu,Mg,Mn) Magnalium (Al,Mg)	Aluminium alloys are light, have high tensile strength and are corrosion resistant.
4	Thermite welding	Al powder and Fe_2O_3	Aluminium powder is a strong reducing agent and reduces Fe_2O_3 to iron.

29. Write ores of copper

Ores of copper	Formula
Copper pyrite	$CuFeS_2$
Cuprite **or** ruby copper	Cu_2O
Copper glance	Cu_2S

30. Heating the concentrated ore in excess of air is called roasting. Write the changes that occur during the roasting of copper pyrite ore.

a) Moisture and volatile impurities are removed.

b) Copper pyrite is partly converted into sulphides of copper and iron.

$$2CuFeS_2 + O_2 \longrightarrow Cu_2S + 2FeS + SO_2$$

31. Explain electrolytic refining of copper

This method is used to get metal of high degree of purity.

Cathode: A thin plate of pure copper metal.

Anode: A block of impure copper metal.

Electrolyte: Copper sulphate solution added with sulphuric acid.

When electric current is passed through the electrolytic solution pure copper gets deposited at the cathode, impurities settled at the bottom of the anode in the form of sludge called anode mud.

32. What is the action of air and moisture on copper?

Copper gets covered with a green layer of basic copper carbonate in the presence of CO_2 and moisture.

$$2Cu + O_2 + CO_2 + H_2O \longrightarrow CuCO_3.Cu(OH)_2$$

33. What is the action of heat on copper?

On heating at different temperatures in the presence of oxygen it forms two types of oxides CuO, Cu_2O.

$$2Cu + O_2 \xrightarrow{\text{Below } 1370K} 2CuO \text{ (copper II oxide –black)}$$

$$4Cu + O_2 \xrightarrow{\text{Above } 1370K} 2Cu_2O \text{ (copper I oxide-red)}$$

34. What is the action of dil. HCl on copper?

Dilute HCl has no action on copper in the absence of air. Copper dissolves in dilute HCl in the presence of air.

$$2Cu + 4HCl + O_2 \text{ (air)} \longrightarrow 2CuCl_2 + 2H_2O$$

35. What is the action of dil. H_2SO_4 on copper?

Dilute H_2SO_4 has no action on copper in the absence of air. Copper dissolves in dilute H_2SO_4 in the presence of air.

$$2Cu + 2H_2SO_4 + O_2 \text{ (air)} \longrightarrow 2CuSO_4 + 2H_2O$$

36. What is the action of dil. HNO_3on copper?

Copper reacts with dil.HNO_3 with the liberation of Nitric Oxide gas.

$$3Cu + 8HNO_3\,(dil) \longrightarrow 3Cu(NO_3)_2 + 2NO\uparrow + 4H_2O$$

37. What is the action of con. HNO_3 on copper?

Copper reacts with con. HNO_3 with the liberation of nitrogen dioxide.

$$Cu + 4HNO_3 \longrightarrow Cu(NO_3)_2 + 2NO_2\uparrow + 2H_2O$$

38. What is the action of con. H_2SO_4 on copper?

Copper reacts with con. H_2SO_4 with the liberation of sulphur dioxide.

$$Cu + 2H_2SO_4 \longrightarrow CuSO_4 + SO_2\uparrow + 2H_2O$$

39. What is the action of chlorine on copper?

Chlorine reacts with copper, resulting in the formation of copper (II) chloride.

$$Cu + Cl_2 \longrightarrow CuCl_2$$

40. Write the uses of copper

1. It is extensively used for making electric cables and other electric appliances.
2. It is used for making utensils, containers, calorimeters, coins.
3. It is used in electroplating.
4. It is alloyed with gold and silver for making coins and jewels.

41. Write ores of copper

Ores of iron	Formula
Haematite	Fe_2O_3
Magnetite	Fe_3O_4
Iron pyrites	FeS_2

42. Write note on gravity separation process

The powdered ore is washed with stream of water. As a result, the lighter sand particles and other impurities are washed away and heavier ore particles settle down.

43. Write the reactions that occur in the lower region of blast furnace in the extraction of iron.

The lower region (**combustion zone**): Temperature is at 1500° C.
In this region, coke burns with oxygen to form CO_2 when the charge comes in contact with the hot blast of air.

$$C + O_2 \longrightarrow CO_2 + \text{heat}$$

It is an exothermic reaction since heat is liberated.

44. Write the reactions that occur in the middle region of blast furnace in the extraction of iron.

The middle region (**fusion zone**)-The temperature prevails at 1000°C.
In this region CO_2 is reduced to CO.

$$CO_2 + C \longrightarrow 2CO$$

Limestone decomposes to calcium oxide and CO_2.

$$CaCO_3 \longrightarrow CaO + CO_2$$

These two reactions are endothermic due to the absorption of heat.
Calcium oxide combines with silica to form calcium silicate slag.

$$CaO + SiO_2 \longrightarrow CaSiO_3$$

45. Write the reactions that occur in the upper region of blast furnace in the extraction of iron.

The upper region (reduction zone)- temperature prevails at 400°C.
In this region carbon monoxide reduces ferric oxide to form a fairly pure spongy iron.

$$Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$$

The molten iron is collected at the bottom of the furnace after removing the slag.

The iron thus formed is called **pig iron**. It is remelted and cast into different moulds. This iron is called **cast iron**.

46. Depending upon the carbon content how is iron classified?

1. Pig iron (carbon content = 2- 4.5%)
2. Wrought iron (carbon content < 0.25%)
3. Steel (carbon content = 0.25-2%.)

47. What is the action of air or oxygen on iron?

On heating in air, iron forms magnetic oxide.

$$3Fe + 2O_2 \longrightarrow Fe_3O_4 \text{ (black)}$$

48. What is the action of moist air on iron?

When iron is exposed to moist air, it forms a layer of brown hydrated ferric oxide on its surface. This compound is known as rust and the phenomenon of forming this rust is known as rusting.

$$4Fe + 3O_2 + 3H_2O \longrightarrow 2Fe_2O_3.3H_2O \text{ (Rust)}$$
(Moisture)

49. What is the action of steam on iron?

When steam is passed over red hot iron, magnetic oxide of iron is formed.

$$3Fe + 4H_2O \text{ (steam)} \longrightarrow Fe_3O_4 + 4H_2\uparrow$$

50. What is the action of chlorine on iron?

Iron combines with chlorine to form ferric chloride.

$$2Fe + 3Cl_2 \longrightarrow 2FeCl_3 \text{(ferric chloride)}$$

51. What is the action of dil. HCl on iron?

With dilute HCl it evolves H_2 gas.

$$Fe + 2HCl \longrightarrow FeCl_2 + H_2\uparrow$$

52. What is the action of dil. H_2SO_4 on iron?

With dilute H_2SO_4 it evolves H_2 gas.

$$Fe + H_2SO_4 \longrightarrow FeSO_4 + H_2\uparrow$$

53. What is the action of con. H_2SO_4 on iron?

With conc. H_2SO_4 it forms ferric sulphate

$$2Fe + 6H_2SO_4 \longrightarrow Fe_2(SO_4)_3 + 3SO_2 + 6H_2O$$

54. What is the action of dil. HNO_3 on iron?

With dilute HNO_3 in cold condition it gives ferrous nitrate

$$4Fe + 10HNO_3 \longrightarrow 4Fe(NO_3)_2 + NH_4NO_3 + 3H_2O$$

55. When iron is dipped in conc. HNO_3 it becomes chemically inert or passive. Why?

When iron is dipped in conc. HNO_3 it becomes chemically inert or passive due to the formation of a layer of iron oxide (Fe_3O_4) on its surface.

56. Write the uses of iron

1. Pig iron is used in making stoves, radiators, railings, man hole covers and drain pipes.
2. Steel is used in the construction of buildings, machinery, transmission and T.V towers and in making alloys.
3. Wrought iron is used in making springs, anchors and electromagnets.

57. What is an alloy?

An alloy is a homogeneous mixture of a metal with other metals or with non-metals that are fused together. Alloys are solid solutions. Alloys can be considered as solid solutions in which the metal with high concentration is solvent and the metal with low concentration is solute. For example, brass is an alloy of zinc(solute) in copper(solvent).

58. Write the methods of making alloys

1. By fusing the metals together.
2. By compressing finely divided metals one over the other.

59. What is amalgam? Mention the use of silver-tin amalgam

An amalgam is an alloy of mercury with metals such as sodium, gold, silver, etc.

Dental Amalgam

It is an alloy of mercury with silver and tin metals. It is used in dental filling.

60. Write the composition and uses of copper alloys

No.	Name of the alloy	Reason for alloying	Uses
1	Brass (Cu, Zn)	Lusturous, easily cast, malleable, ductile, harder than Cu.	Electrical fittings, medals, hardware, decorative items.
2	Bronze (Cu, Sn, Zn)	Hard, brittle, takes up polish.	Statues, coins, bells, gongs

61. Write the composition and uses of aluminium alloys

No.	Name of the alloy	Reason for alloying	Uses
1	Duralumin (Al,Mg,Mn,Cu)	Light, strong, resistant to corrosion, stronger than aluminium.	Aircraft, tools, Pressure cookers
2	Magnalium (Al, Mg)	Light, hard, tough, corrosion resistant.	Aircraft, scientific instrument

62. Write the composition and uses of iron alloys

No.	Name of the alloy	Reason for alloying	Uses
1	Stainless steel (Fe, C, Ni, Cr)	Lusturous, corrosion resistant, high tensile strength.	Utensils, cutlery, automobile parts.
2	Nickel steel (Fe, C, Ni)	Hard, corrosion resistant, elastic.	Cables, aircraft parts, propeller

63. What is rusting?

When iron is exposed to moist air, it forms a layer of brown hydrated ferric oxide on its surface. This compound is known as rust and the phenomenon of forming this rust is known as rusting.

$$4Fe + 3O_2 + 3H_2O \longrightarrow 2Fe_2O_3.3H_2O \text{ (Rust)}$$

.64. Define corrosion

Corrosion is defined as the slow and steady destruction of a metal by the environment. It results in the deterioration of the metal to form metal compounds by means of chemical reactions with the environment.

65. How is corrosion prevented by galvanization?

This is a process of coating zinc on iron sheets by using electric current. In this zinc forms a protective layer of zinc carbonate on the surface of iron. This prevents corrosion.

66. What is electroplating?

It is a method of coating one metal with another by passing electric current. Example: silver plating, nickel plating. This method not only lends protection but also enhances the metallic appearance.

67. What is meant by sacrificial protection?

Magnesium is more reactive than iron. When it is coated on the articles made of steel it sacrifices itself to protect the steel.

Textbook questions

PART – A

1. **Assertion:** Chemical bonds in organic compounds are covalent in nature.
Reason: Covalent bond is formed by the sharing of electrons in the bonding atoms.
Does the reason satisfy the given assertion?

   Ans: Yes the reason satisfies the assertion.

2. **Assertion:** Diamond is the hardest crystalline form of carbon
Reason: Carbon atoms in diamond are tetrahedral in nature.
Verify the suitability of reason to the given Assertion mentioned above.

   Ans: The reason explains the assertion.
In diamond each carbon atom is bonded to four other carbon atoms (tetrahedral) forming a rigid three dimensional structure, accounting for its hardness and rigidity.

3. **Assertion:** Due to catenation a large number of carbon compounds are formed.
Reason: Carbon compounds show the property of allotropy.
Is the reason holding good for the given Assertion.

   Ans: No, the reason is not relevant to the assertion.

4. Buckminster Fullerene is the allotropic form of (Nitrogen / Carbon / Sulphur)

   Ans: Carbon

5. Eventhough it is a non metal, graphite conducts electricity. It is due to the presence of ……(free electrons / bonded electrons)

   Ans: Free electrons

6. Formula of methane is CH_4 and its succeeding member ethane is expressed as C_2H_6. The common difference of succession between them is (CH_2 / C_2 H_2)

   Ans: CH_2

7. IUPAC name of first member of alkyne is …… (ethene / ethyne)

   Ans: Ethyne

8. Out of ketonic and aldehydic group which is the terminal functional group?

   Ans: Aldehydic group

9. Acetic acid is heated with a solid 'X' kept in a test tube. A colourless and odourless gas (Y) is evolved. The gas turns lime water milky when passed through it. Identify X and Y.

Ans: **X** is Sodium carbonate (Na_2CO_3) or Sodium bicarbonate ($NaHCO_3$)
Y is Carbon dioxide (CO_2)

10. **Assertion:** Denaturation of ethyl alcohol makes it unfit for drinking purposes.
Reason: Denaturation of ethyl alcohol is carried out by methyl alcohol.
Check whether the reason is correct for assertion.

Ans: Yes, the reason is correct for assertion.

PART – B

11. Write down the possible isomers and give their IUPAC names using the formula C_4H_{10}.

S.No	Isomers	IUPAC Names
1	CH_3-CH_2-CH_2-CH_3	Butane
2	CH_3-CH(-CH_3)-CH_3	2-methyl propane

12. Diamond is the hardest allotrope of Carbon. Give reason for its hardness.
In diamond each carbon atom is bonded to four other carbon atoms forming a rigid three dimensional structure, accounting for its hardness and rigidity.

13. An organic compound (A) is widely used as preservatives in pickles and has a molecular formula $C_2H_4O_2$. This compound reacts with ethanol to form a sweet smelling compound (B).
i) Identify the compound A and B.
Compound **A** is used as preservatives in pickles. So, it is acetic acid or Ethanoic acid (vinegar).
Compound B is sweet smelling. So, it is ethyl ethanoate.

ii) Name the process and write corresponding chemical equation.
The process is called esterification**.**

$$\underset{\text{Ethanoic acid}}{CH_3\text{-}COOH} + \underset{\text{Ethanol}}{C_2H_5\text{-}OH} \xrightarrow{\text{conc.}H_2SO_4} \underset{\text{Ethyl ethanoate}}{CH_3\text{-}COO\,C_2H_5} + H_2O$$

A	CH_3-$COOH$	Ethanoic acid
B	CH_3-$COOC_2H_5$	Ethyl ehanoate

14. An organic compound (A) of molecular formula C_2H_6O on oxidation with alkaline $KMnO_4$ solution gives an acid (B) with the same number of carbon atoms. Compound A is used as an antiseptic to sterilize wounds in hospitals. Identify A and B. Write the chemical equation involved in the formation of B from A.

Compound **A** is used as an antiseptic to sterilize wounds in hospitals. So, it is ethyl alcohol or ethanol.

$$\underset{\text{Ethanol}}{CH_3\text{-}CH_2\text{-}OH} \xrightarrow{\text{Alkaline } KMnO_4} \underset{\text{Ethanoic acid}}{CH_3\text{-}COOH}$$

Compound **B** is ethanoic acid.

A	$CH_3\text{-}CH_2\text{-}OH$	Ethanol
B	$CH_3\text{-}COOH$	Ethanoic acid

PART – C

15. Fill in the blanks using suitable formula in the given table

No	Alkane	Alkene	Alkyne
1	C_2H_6 Ethnae	-------- Ethene	C_2H_2 Ethyne
2	-------- Propane	C_3H_6 Propene	-------- Propyne
3	C_4H_{10} Butane	-------- Butene	-------- Butyne

Ans:

No	Alkane	Alkene	Alkyne
1	C_2H_6 Ethnae	C_2H_4 Ethene	C_2H_2 Ethyne
2	C_3H_8 Propane	C_3H_6 Propene	C_3H_4 Propyne
3	C_4H_{10} Butane	C_4H_8 Butene	C_4H_6 Butyne

16. Homologous series predict the properties of the members of hydrocarbon. Justify this statement through its characteristics.

A homologous series is a group or a class of organic compounds having similar structure and similar chemical properties in which the successive compounds differ by a CH_2 group.

Characteristics of homologous series:

1. Each member of the series differs from the preceeding or succeeding member by a common difference of CH_2 and by a molecular mass of 14 amu (amu = atomic mass unit).
2. All members of homologous series contain same elements and the same functional groups.
3. All members of homologous series have same general molecular formula.
   e.g Alkane = C_nH_{2n+2}
   Alkene = C_nH_{2n}
   Alkyne = C_nH_{2n-2}
4. The members in homologous series show a regular gradation in their physical properties with respect to increase in molecular mass.
5. The chemical properties of the members of the homologous series are similar.
6. All members of homologous series can be prepared by using same general method.

17. Write the common name and IUPAC name of the following.

Compound	Common name	IUPAC Name
CH_3-CH_2-CHO	Propionaldehyde	Propanal
CH_3-CO-CH_3	Dimethyl ketone **or** Acetone	Propanone
CH_3-CH(OH)-CH_3	Isopropyl alcohol	2-propanol
CH_3-COOH	Acetic acid	Ethanoic acid
HCHO	Formaldehyde	Methanal

Additional questions

1 MARK

1. The organic compound synthesized by Wohler from inorganic compound (ammonium cyanate) is
a) methane **b) urea** c) sucrose d) acetic acid

2. Kohinoor diamond is a
a) 105 carat diamond b) 24 carat diamond c) 100 carat diamond d) 18 carat diamond

3. Valency of carbon is
a) 1 b) 2 c) 3 **d) 4**

4. Ground state electronic configuration of carbon is
a) $1s^2\ 2s^2\ 2p^1$ b) $1s^2\ 2s^2\ 2p^3$ **c) $1s^2\ 2s^2\ 2p^2$** d) $1s^2\ 2s^2\ 2p^6$

5. Which is the hardest substance?
a) graphite **b) diamond** c) coke d) charcoal

6. Which of the following is the conductor of electricity?
a) graphite b) diamond c) coke d) charcoal

7. Free electrons are present in
a) graphite b) diamond c) coke d) charcoal

8. Ethyl alcohol is isomeric with
a) dimethyl ether b) diethyl ether c) Ethylmethyl ether d) Ethanal

9. Methane undergoes ----------reaction in the presence of sunlight
a) addition **b) substitution** c) decarboxylation d) dehydration

10. Unsaturated carbon compounds undergo ---------- reaction with hydrogen in the presence of palladium or nickel catalyst.
a) addition b) substitution c) decarboxylation d) dehydration

11. Successive members of a homologous series differ by a
a) CH_3 group b) CH_4 group c) CH group **d) CH_2 group**

12. Successive members of a homologous series differ in molecular mass by
a) 12 amu b) 13 amu **c) 14 amu** d) 16 amu

13. General molecular formula of alkanes is
a) C_nH_{2n+2} b) C_nH_{2n} c) C_nH_{2n-2} d) C_nH_{n+2}

14. General molecular formula of alkenes is
a) C_nH_{2n+2} **b) C_nH_{2n}** c) C_nH_{2n-2} d) C_nH_{n+2}

15. General molecular formula of alkynes is
a) C_nH_{2n+2} b) C_nH_{2n} **c) C_nH_{2n-2}** d) C_nH_{n+2}

16. Ethanol is used as
a) an anti-freeze in automobile radiators b) a preservative for biological specimen
c) an antiseptic to sterilize wounds **d) all the above**

17. ---------- is used in cough and digestive syrups
a) methanol **b) ethanol** c) methanal d) ethanoic acid

18. Fruity smelling compound is
a) methanol b) vinegar **c) ethyl ethanoate (ester)** d) ethyl alcohol

19. Ethanol reacts with sodium metal to liberate --------- gas
a) hydrogen b) carbon dioxide c) oxygen d) carbon monoxide

20. Sour taste of fruits is due to the presence of
a) ethyl alcohol b) methyl alcohol c) formaldehyde **d) acetic acid**

21. Ethanoic acid is a
a) weak acid b) strong acid c) weak base d) strong base

22. Which of the following turns blue litmus to red?
a) ethanol b) sodium hydroxide **c) ethanoic acid** d) ethanol

23. Which is used for making vinegar?
a) Ethanol **b) Ethanoic acid** c) Formaldehyde d) Methanol

24. Which is used as a preservative in food and fruit juices?
a) Ethanol **b) vinegar** c) Formaldehyde d) Methanol

25. Which is used for coagulating rubber from latex?
a) Ethanol **b) Ethanoic acid** c) Methanal d) Methanol

26. Removal of CO_2 is known as
a) carboxylation b) dehydration c) esterification **d) decarboxylation**

27. Intake of ---------- in very small quantities can cause death
a) methanol b) ethanol c) ethanoic acid d) vinegar

28. Soda lime is the solid mixture of

a) 1 part of NaOH and 3 parts of CaO
b) 3 parts of NaOH and 1 part of CaO
c) 1 part of NaCl and 3 parts of CaO
d) 3 parts of NaCl and 1 part of $CaCO_3$

2 MARK

1. What are the purest form of carbon?

In nature, carbon occurs in its pure form as diamond and graphite.

2. What is carbon cycle?

Carbon circulates through air, plants, animals and soil by means of complex reactions. This is called carbon cycle.

3. Why is carbon chemistry called as living chemistry?

All living organisms are made of carbon atoms. This means that, carbon atoms form the building blocks for living organisms. These carbon atoms, in combination with other atoms decide life on earth. Hence carbon chemistry is also called as living chemistry.

4. What is meant by tetra valency of carbon?

The characteristic of carbon atom by virtue of which it forms four covalent bonds is generally referred as tetra valency of carbon.

5. Define allotropy

Allotropy is defined as the property by which an element can exist in more than one form that are physically different but chemically similar.

6. What are the allotropic forms of carbon?

Carbon exists in three allotropic forms. They are:

1. Crystalline form (diamond and graphite)
2. Amorphous form (coke, charcoal)
3. Fullerene.

7. Fill in the blanks

a) Diamond and graphite are ---------- form of carbon. (crystalline / amorphous)
Ans: crystalline

b) Coke and charcoal are ---------- form of carbon. (crystalline / amorphous)
Ans: amorphous

8. Correct the mistakes in the following statements:

a) In graphite, the hexagonal layers are held together by strong Vander waals forces
b) Buck Minster Fullerene consists of 90 carbons

Ans:

a) In graphite, the hexagonal layers are held together by **weak** Vander waals forces
b) Buck Minster Fullerene consists of **60** carbons

9. Fill in the blanks

a) Carbon compounds have low melting and boiling points because of their ---------- nature (ionic / covalent)

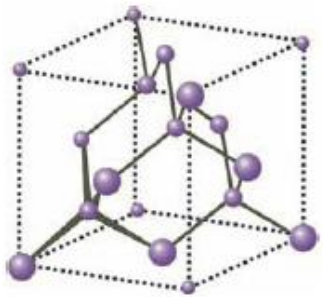
Ans: Covalent

b) Alkaline potassium permanganate and acidified potassium dichromate are --------- agents (oxidizing / reducing)

Ans: oxidising

10. Explain the structure of diamond

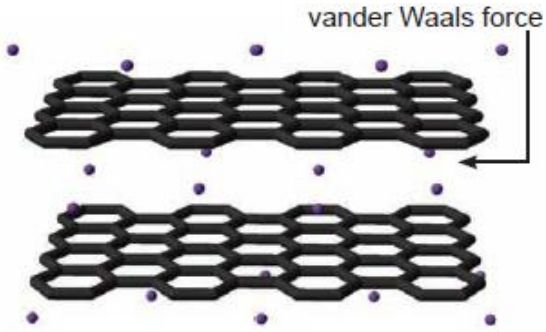
In diamond each carbon atom is bonded to four other carbon atoms forming a rigid three dimensional structure, accounting for its hardness and rigidity.



11. Explain the structure of graphite

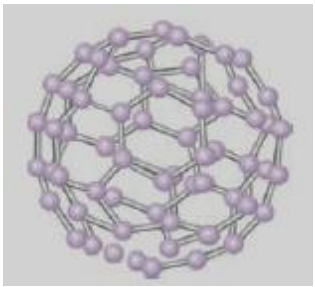
In graphite each carbon atom is bonded to three other carbon atoms in the same plane giving hexagonal layers held together by weak **vander Waals forces** accounting for its softness.

Graphite is a good conductor of electricity since it has free electrons in it.



12. Explain the structure of Fullerene

Fullerenes form another type of carbon allotropes. The first one was identified to contain 60 carbon atoms in the shape of a football (C-60). Since this looks like the geodesic dome designed by the US architect Buck Minster Fuller, it is named as Buck Minster Fullerene.



13. Write the differences between graphite and diamond

No	Graphite	Diamond
1	In graphite each carbon atom is bonded to three other carbon atoms.	In diamond each carbon atom is bonded to four other carbon atoms
2	It conducts electricity	It does not conduct electricity
3	It is a hexagonal layer structure	It is a rigid three dimensional structure
4	It is soft	It is very hard

14. What is catenation?

Carbon has the ability to form covalent bonds with other atoms of carbon giving rise to large number of molecules through self linking property. This property is called catenation.

15. What is isomerism? Give examples

The phenomenon by which two or more compounds to have same molecular formula but different structural formula with difference in properties is known as isomerism.

Eg. The molecular formula C_2H_6O represents two different compounds namely ethyl alcohol (C_2H_5OH) and dimethyl ether (CH_3OCH_3).

16. What is the reason for the stability of carbon compounds?

The stability of carbon compounds is due to the small size of carbon which enables the nucleus to hold on to the shared pair of electrons strongly.

17. Carbon compounds have low melting and boiling points. Why?

Carbon compounds have low melting and boiling points because of their covalent nature.

18. Write the importance of homologous series

1. It helps to predict the properties of the members of the series that are yet to be prepared.
2. Knowledge of homologous series gives a systematic study of the members.
3. The nature of any member of the family can be ascertained if the properties of the first member are known.

19. Alkanes were previously called as paraffins. Why?

Alkanes were earlier named as paraffins (Latin : meaning little affinity) due to their least chemical reactivity.

20. Alkenes were previously called as olefins. Why?

Alkenes were previously called olefins (Greek: olefiant –oil forming) because the lower gaseous members of the family form oily products when treated with chlorine.

21. Write a test for saturated and unsaturated hydro carbons

Bromine test:
Saturated hydro carbons do not decolourise bromie.
Unsaturated hydrocarbons decolourise bromine.

22. Write the isomers of molecular formula C_2H_6O

No	Compound	Common name
1	CH_3-CH_2-OH	Ethyl alcohol
2	CH_3-O-CH_3	Dimethyl ether

23. Write the isomers of molecular formula C_4H_8

No	Compound	Common name	IUPAC name
1	CH_3-CH_2-CH = CH_2	α-butylene	But-1-ene
2	CH_3-CH = CH-CH_3	β-butylene	But-2-ene

24. Write the isomers of molecular formula C_4H_6

No	Compound	Common name	IUPAC name
1	CH_3-CH_2-C ≡ CH	Ethyl acetylene	But-1-yne
2	CH_3-C ≡ C-CH_3	Dimethyl acetylene	But-2-yne

25. Write the isomers of molecular formula C_3H_8O

No	Compound	Common name	IUPAC name
1	CH_3-CH_2- CH_2-OH	n-propyl alcohol	1-Propanol
2	CH_3-CH(OH)-CH_3	Isopropyl alcohol	2-Propanol

26. Write two isomers of molecular formula $C_4H_{10}O$

No	Compound	Common name	IUPAC name
1	CH_3-CH_2- CH_2- CH_2-OH	n-butyl alcohol	1-Butanol
2	CH_3-CH(CH_3)-CH_2-OH	Isobutyl alcohol	2-methyl-1-propanol

27. Define functional group.

Functional group may be defined as an atom or group of atoms or reactive part which is responsible for the characteristic properties of the compounds.

The chemical properties of organic compounds are determined by the functional groups while their physical properties are determined by the remaining part of the molecule.

Example: -OH => Alcohol C=O => Ketone
CHO => Aldehyde COOH => Carboxylic acid

28. What are alcohols?

Alcohols are carbon compounds containing –OH group attached to alkyl group. The general formula of alcohol is R-OH where 'R' is an alkyl group and –OH is the functional group.

29. What are aldehydes?

Aldehydes are carbon compounds containing -CHO group attached to alkyl group or hydrogen atom. The general formula of aldehydes is R – CHO where 'R' is an alkyl group or hydrogen atom and – CHO is the functional group.

30. What are ketones?

Ketones are carbon compounds containing carbonyl – CO – group attached to two alkyl groups. The general formula of ketone is R-CO-R' where R and R' are alkyl groups and – CO – is the functional group.

31. What are carboxylic acids?

Carboxylic acids are carbon compounds containing –COOH group attached to a hydrogen atom or alkyl group. The general formula of acid is R-COOH where 'R' is a hydrogen atom or alkyl group and –COOH is the functional group.

32. Spot the error in the following statements

a) Ethanol is a clear liquid with sour taste
b) Ethanol is immiscible with water

Ans:
a) Ethanol is a clear liquid with **burning** taste
b) Ethanol is **miscible** with water

33. What is meant by fermentation?

The slow chemical change taking place in an organic compound by the action of enzymes leading to the formation of smaller molecules is called fermentation.

34. Fill in the blanks (from the given pair of answers)

a) In the manufacture of ethanol from molasses, ammonium sulphate and ammonium phosphate act as (catalyst / food for yeast)
Ans: food for yeast

b) Molasses contain (30% sucrose / 90% sucrose)
Ans: 30% sucrose

35. What is glacial acetic acid? Why?

- Pure ethanoic acid is called as glacial acetic acid.
- On cooling, pure ethanoic acid is frozen to form ice like flakes. They look like glaciers, so it is called glacial acetic acid.

36. Write the preparation of ethanoic acid *or* acetic acid

Ethanol on oxidation in the presence of alkaline potassium permanganate or acidified potassium dichromate gives ethanoic acid.

$$\underset{\text{Ethanol}}{CH_3\text{-}CH_2\text{-}OH} \xrightarrow[\text{Alkaline } KMnO_4]{\text{Oxidation}} \underset{\text{Ethanoic acid}}{CH_3\text{-}COOH} + H_2O$$

37. Write the uses of ethanoic acid *or* acetic acid

Ethanoic acid is used

1. For making vinegar which is used as a preservative in food and fruit juices.
2. As a laboratory reagent.
3. For coagulating rubber from latex.
4. In the preparation of dyes, perfumes and medicine.

38. Spot the error in the following statements

a) Soda lime is used for dehydrartion reaction

b) Ethanoic acid reacts with carbonates and bicarbonates and produces brisk effervescence due to the evolution of hydrogen gas

Ans:

a) Soda lime is used for **decarboxylation** reaction

b) Ethanoic acid reacts with carbonates and bicarbonates and produces brisk effervescence due to the evolution of **carbon dioxide** gas

39. Spot the error in the following statements

a) Ethanoic acid is a colourless liquid and has a bitter taste

b) Ethanoic acid is immiscible with water

Ans:

a) Ethanoic acid is a colourless liquid and has a **sour** taste

b) Ethanoic acid is **miscible** with water

40. Fill in the blanks (from the given pair of answers)

a) ---------- causes the protoplasm to get coagulated (Ethanoic acid / Methanal)

Ans: Methanal

b) ---------- affects the optic nerve, causing blindness (Methanol / Acetic acid)

Ans: Methanol

41. Match the following

1	Mixture of 95% ethanol and 5% methanol	Power alcohol
2	Mixture of 95.5% ethanol and 4.5% water	Absolute alcohol
3	Mixture of petrol and ethanol	Methylated spirit
4	Mixture of ethanol and pyridine	Rectified spirit
5	100% pure ethanol	Denatured spirit

Ans:

1	Mixture of 95% ethanol and 5% methanol	Methylated spirit
2	Mixture of 95.5% ethanol and 4.5% water	Rectified spirit
3	Mixture of petrol and ethanol	Power alcohol
4	Mixture of ethanol and pyridine	Denatured spirit
5	100% pure ethanol	Absolute alcohol

42. How will you convert ethane into ethane?

Ethene undergoes addition reactions with hydrogen in the presence of palladium or nickel catalyst

$$\underset{\text{Ethene}}{CH_2 = CH_2} + H_2 \xrightarrow{Ni-Catalyst} \underset{\text{Ethane}}{CH_3\text{-}CH_3}$$

43. Write on intramolecular dehydration

Ethanol, when heated with excess conc. H_2SO_4 at 443 K undergoes intra molecular dehydration (i.e. removal of water within a molecule of ethanol).

$$\underset{\text{Ethanol}}{CH_3\text{-}CH_2\text{-}OH} \xrightarrow[443\ K]{\text{Conc. } H_2SO_4} \underset{\text{Ethene}}{CH_2 = CH_2} + H_2O$$

44. Write on intermolecular dehydration

When excess of alcohol is heated with conc. H_2SO_4 at 413K two molecules condense by losing a molecule of water to form ether (i.e. removal of water from two molecules of ethanol).

$$\underset{\text{Ethanol}}{C_2H_5\text{-}O\boxed{H + HO}\text{-}C_2H_5} \xrightarrow[413\ K]{\text{Conc. } H_2SO_4} \underset{\text{Diethyl ether}}{C_2H_5\text{-}O\text{-}C_2H_5} + H_2O$$

45. Give a test to identify alcohols

Ethanol is oxidized to ethanoic acid with alkaline $KMnO_4$ or acidified $K_2Cr_2O_7$

$$\underset{\text{Ethanol}}{CH_3\text{-}CH_2\text{-}OH} \xrightarrow[\text{Alkaline } KMnO_4]{\text{Oxidation}} \underset{\text{Ethanoic acid}}{CH_3\text{-}COOH} + H_2O$$

During this reaction, orange colour of $K_2Cr_2O_7$ changes to green. Therefore, this reaction can be used for the **identification of alcohols**.

46. Write a note on dehydrogenation reaction

When the vapour of ethanol is passed over reduced copper catalyst at 573 K, it is dehydrogenated to acetaldehyde.

$$\underset{\text{Ethanol}}{CH_3\text{-}CH_2\text{-}OH} \xrightarrow[573\ K]{Cu} \underset{\text{Acetaldehyde}}{CH_3\text{-}CHO} + H_2$$

47. Write on esterification reaction

Ethanol reacts with ethanoic acid in the presence of conc.H2SO4 (catalyst) to form ethyl ethanoate and water. The compound formed by the reaction of an alcohol with carboxylic acid is known as ester (fruity smelling compound) and the reaction is called esterification.

$$\underset{\text{Ethanoic acid}}{CH_3\text{-}CO\boxed{OH}} + \underset{\text{Ethanol}}{H\boxed{O}\text{-}C_2H_5} \xrightarrow{\text{Conc. } H_2SO_4} \underset{\text{Ethyl ethanoate}}{CH_3\text{-}COO\text{-}C_2H_5} + H_2O$$

48. Write on decarboxylation reaction

When sodium salt of ethanoic acid is heated with soda lime (Solid mixure of 3 parts of NaOH and 1 part of CaO) methane gas is formed.

$$CH_3COONa \xrightarrow{NaOH\ /\ CaO} \underset{\text{Methane}}{CH_4 \uparrow} + Na_2CO_3$$

This reaction is called **decarboxylation reaction.** (Removal of CO_2)

5 MARK

1. Discuss the chemical properties of carbon and its compounds.

1. Carbon and its compounds burn in oxygen to give carbon dioxide along with heat and light.

$$C + O_2 \longrightarrow CO_2 + \text{heat} + \text{light}$$
$$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O + \text{heat} + \text{light}$$
$$C_2H_5OH + 3O_2 \longrightarrow 2CO_2 + 3H_2O + \text{heat} + \text{light}$$

2. Carbon compounds can be easily oxidized using suitable oxidizing agent (Alkaline potassium permanganate) to form carboxylic acids.
3. Unsaturated carbon compounds undergo addition reactions with hydrogen in the presence of palladium or nickel catalyst.

$$\underset{\text{Ethene}}{CH_2 = CH_2} + H_2 \xrightarrow{Ni-\text{Catalyst}} \underset{\text{Ethane}}{CH_3\text{-}CH_3}$$

4. Carbon compounds undergo substitution reactions in the presence of either sunlight or any other reagents
   E.g methane undergoes substitution reaction to form different types of products.
5. Carbon compounds such as alcohols react with sodium to liberate hydrogen gas.

$$2CH_3CH_2OH + 2Na \longrightarrow 2CH_3CH_2ONa + H_2$$

2. What are hydrocarbons? How are they classified?

The simplest organic compounds containing only carbon and hydrogen are called hydrocarbons. Hydro carbons are classified into two types: *saturated and unsaturated hydrocarb*ons.

Saturated hydrocarbons – Alkanes

These are the organic compounds which contain carbon – carbon single bond. These were earlier named as paraffins(Latin : meaning little affinity) due to their least chemical reactivity.

General formula of alkanes: C_nH_{2n+2}

Unsaturated hydrocarbons:

These are hydrocarbons which contain carbon to carbon double bonds or carbon to carbon triple bonds in their molecules. These are further classified into two types: alkenes and alkynes.

i)**Alkenes**:

The hydrocarbons containing atleast one carbon to carbon double bond are called alkenes. These were previously called olefins (Greek: olefiant –oil forming) because the lower gaseous members of the family form oily products when treated with chlorine.

General formula of alkenes: C_nH_{2n}

ii) **Alkynes**:

The hydrocarbons containing carbon to carbon triple bond are called alkynes.

General formula of alkynes: C_nH_{2n-2}

3. How is ethanol manufactured from molasses?

Molasses is a dark coloured syrupy liquid left after the crystallization of sugar from the concentrated sugar cane juice. Molasses still contain about 30% of sucrose which cannot be separated by crystallization. It is converted into ethanol by the following steps:

i) Dilution

Molasses is first diluted with water to bring down the concentration of sugar to about 8 to 10%

ii) Addition of ammonium salts

Molasses usually contains enough nitrogenous matter to act as food for yeast during fermentation. If the nitrogen content of the molasses is poor, it may be fortified by the addition of ammonium sulphate or ammonium phosphate.

iii) Addition of yeast

The solution from step (ii) is collected in large 'fermentation tanks' and yeast is added to it. The mixture is kept at about 303K for a few days.During this period, the enzymes invertase and zymase present in yeast, bring about the conversion of sucrose into ethanol.

$$\underset{\text{Sucrose}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow{\text{Invertase}} \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Fructose}}{C_6H_{12}O_6}$$

$$\underset{\text{Glucose } or \text{ Fructose}}{C_6H_{12}O_6} \xrightarrow{\text{Zymase}} \underset{\text{Ethanol}}{2\,C_2H_5OH} + 2\,CO_2\uparrow$$

The fermented liquid is technically called wash.

iv) Distillation of wash

The fermented liquid containing 15 to 18 percent alcohol and the rest of the water, is now subjected to fractional distillation. The main fraction drawn, is an aqueous solution of ethanol which contains 95.5% of ethanol and 4.5% of water. This is called rectified spirit. This mixture is then heated under reflux over quicklime for about 5 to 6 hours and then allowed to stand for 12 hours. On distillation of this mixture, pure alcohol (100%) is obtained. This is called absolute alcohol.

4. Discuss the chemical properties of ethanol.

(i) Dehydration

(a) Intra molecular dehydration:

Ethanol, when heated with excess conc. H_2SO_4 at 443 K undergoes intra molecular dehydration (i.e. removal of water within a molecule of ethanol).

$$\underset{\text{Ethanol}}{CH_3\text{-}CH_2\text{-}OH} \xrightarrow[443\ K]{\text{Conc. } H_2SO_4} \underset{\text{Ethene}}{CH_2 = CH_2} + H_2O$$

(b) Inter molecular dehydration:

When excess of alcohol is heated with conc. H_2SO_4 at 413K two molecules condense by losing a molecule of water to form ether (i.e. removal of water from two molecules of ethanol).

$$C_2H_5\text{-}OH + HO\text{-}C_2H_5 \xrightarrow[413\ K]{\text{Conc. } H_2SO_4} C_2H_5\text{-}O\text{-}C_2H_5 + H_2O$$

Ethanol — Diethyl ether

(ii) Reaction with sodium:

Ethanol reacts with sodium metal to form sodium ethoxide and hydrogen gas.

$$2\ C_2H_5OH + 2Na \longrightarrow \underset{\text{sodium ethoxide}}{2\ C_2H_5ONa} + H_2\uparrow$$

(iii) Oxidation:

Ethanol is oxidized to ethanoic acid with alkaline $KMnO_4$ or acidified $K_2Cr_2O_7$

$$CH_3\text{-}CH_2\text{-}OH \xrightarrow[\text{Alkaline } KMnO_4]{\text{Oxidation}} CH_3\text{-}COOH + H_2O$$

Ethanol — Ethanoic acid

During this reaction, orange colour of $K_2Cr_2O_7$ changes to green. Therefore, this reaction can be used for the **identification of alcohols**.

(iv) Esterificaiton :

Ethanol reacts with ethanoic acid in the presence of conc.H2SO4 (catalyst) to form ethyl ethanoate and water. The compound formed by the reaction of an alcohol with carboxylic acid is known as ester (fruity smelling compound) and the reaction is called esterification.

$$CH_3\text{-}CO\text{-}OH + H\text{-}O\text{-}C_2H_5 \xrightarrow{\text{Conc. } H_2SO_4} CH_3\text{-}COO\text{-}C_2H_5 + H_2O$$

Ethanoic acid — Ethanol — Ethyl ethanoate

(v) Dehydrogenation:

When the vapour of ethanol is passed over reduced copper catalyst at 573 K, it is dehydrogenated to acetaldehyde.

$$CH_3\text{-}CH_2\text{-}OH \xrightarrow[573\ K]{Cu} CH_3\text{-}CHO + H_2$$

Ethanol — Acetaldehyde

5. Write the uses of ethanol

Ethanol is used

1. As an anti-freeze in automobile radiators.
2. As a preservative for biological specimen.
3. As an antiseptic to sterilize wounds in hospitals.
4. As a solvent for drugs, oils, fats, perfumes, dyes, etc.
5. In the preparation of methylated spirit (mixture of 95% of ethanol and 5% of methanol), rectified spirit (mixture of 95.5% of ethanol and 4.5% of water), power alcohol (mixture of petrol and ethanol) and denatured spirit (ethanol mixed with pyridine).
6. In cough and digestive syrups.

6. Write the evil effects of consuming alcohol

1. If ethanol is consumed, it tends to slow down metabolism of our body and depresses the central nervous system.
2. It causes mental depression and emotional disorder.
3. It affects our health by causing ulcer, high blood pressure, cancer, brain and liver damage.
4. Nearly 40% accidents are due to drunken drive.
5. Unlike ethanol, intake of methanol in very small quantities can cause death.
6. Methanol is oxidized to methanal (formaldehyde) in the liver and methanol reacts rapidly with the components of cells.
7. Methanal causes the protoplasm to get coagulated, in the same way an egg is coagulated by cooking. Methanol also affects the optic nerve, causing blindness.

7. How does ethanoic acid react with the following?

1. Sodium

$$2CH_3COOH + 2Na \longrightarrow \underset{\text{Sodium ethanoate}}{2CH_3COONa} + H_2 \uparrow$$

2. Zinc

$$2CH_3COOH + Zn \longrightarrow \underset{\text{Zinc ethanoate}}{(CH_3COO)_2 Zn} + H_2 \uparrow$$

3. Sodium carbonate

$$2CH_3COOH + Na_2CO_3 \longrightarrow \underset{\text{Sodium ethanoate}}{2CH_3COONa} + CO_2 \uparrow + H_2O$$

Ethanoic acid reacts with sodium carbonate and produces brisk effervescence due to the evolution of carbon dioxide.

4. Sodium bicarbonate

$$CH_3COOH + NaHCO_3 \longrightarrow \underset{\text{Sodium ethanoate}}{CH_3COONa} + CO_2 \uparrow + H_2O$$

Ethanoic acid reacts with sodium bicarbonate and produces brisk effervescence due to the evolution of carbon dioxide.

5. Base NaOH

$$CH_3COOH + NaOH \longrightarrow \underset{\text{Sodium ethanoate}}{CH_3COONa} + H_2O$$

6. Sodalime

When sodium salt of ethanoic acid is heated with soda lime (Solid mixure of 3 parts of NaOH and 1 part of CaO) methane gas is formed.

$$CH_3COONa \xrightarrow{NaOH / CaO} \underset{\text{Methane}}{CH_4} \uparrow + Na_2CO_3$$

This reaction is called **decarboxylation reaction.** (Removal of CO_2)

Alkanes

Compound	Common name	IUPAC name
CH_4	Methane	Methane
CH_3-CH_3	Ethane	Ethane
CH_3-CH_2-CH_3	Propane	Propane
CH_3-CH_2-CH_2-CH_3	n-Butane	Butane

Alkenes

Compound	Common name	IUPAC name
$CH_2 = CH_2$	Ethylene	Ethene
CH_3-$CH = CH_2$	Propylene	Propene
CH_3-CH_2-$CH = CH_2$	α-Butylene	But-1-ene
CH_3-$CH = CH$-CH_3	β-Butylene	But-2-ene

Alkynes

Compound	Common name	IUPAC name
$CH \equiv CH$	Acetylene	Ethyne
CH_3-$C \equiv CH$	Methyl acetylene	Propyne
CH_3-CH_2-$C \equiv CH$	Ethyl acetylene	But-1-yne
CH_3-$C \equiv C$ - CH_3	Dimethyl acetylene	But-2-yne

Alcohols

Compound	Common name	IUPAC name
CH_3OH	Methyl alcohol	Methanol
CH_3-CH_2-OH	Ethyl alcohol	Ethanol
CH_3-CH_2- CH_2-OH	n-propyl alcohol	1-Propanol
CH_3-CH(OH)-CH_3	Isopropyl alcohol	2-Propanol
CH_3-CH_2- CH_2- CH_2-OH	n-Butyl alcohol	1-Butanol
CH_3-CH(CH_3)-CH_2-OH	Iso butyl alcohol	2-Methyl-1-propanol

Aldehydes

Compound	Common name	IUPAC name
H-CHO	Formaldehyde	Methanal
CH_3-CHO	Acetaldehyde	Ethanal
CH_3-CH_2-CHO	Propionaldehyde	Propanal
CH_3-CH_2-CH_2-CHO	n-Butyraldehyde	Butanal

Ketones

Compound	Common name	IUPAC name
CH_3-CO-CH_3	Dimethyl ketone (Acetone)	propanone
CH_3-CO-CH_2-CH_3	Ethyl methyl ketone	2-Butanone
CH_3-CH_2-CO-CH_2-CH_3	Diethyl ketone	3-Pentanone

Carboxylic acids

Compound	Common name	IUPAC name
H-COOH	Formic acid	Methanoic acid
CH_3- COOH	Acetic acid	Ethanoic acid
CH_3-CH_2- COOH	Propionic acid	Propanoic acid
CH_3-CH_2-CH_2- COOH	n-Butyric acid	Butanoic acid

Textbook questions

PART – A

1. The acceleration in a body is due to
   a) balanced force **b) un-balanced force** c) electro static force d) none of these

2. The physical quantity which is equal to rate of change of momentum is
   a) displacement b) acceleration **c) force** d) impulse

3. The momentum of a massive object at rest is
   a) very large b) very small **c) zero** d) infinity

   Momentum = mass × velocity

   Velocity = 0 for an object at rest ∴Momentum = 0

4. The weight of 50 kg person at the surface of earth is
   a) 50 N b) 35 N c) 380 N **d) 490 N**

   $w = mg = 50 \times 9.8 = 490$ N

5. The freezing of biotechnology products like vaccines require ---------- freezing systems.
   a) Helium **b) Nitrogen** c) Ammonia d) Chlorine

PART – B

1. From the following statements write down that which is not applicable to mass of an object
a) It is a fundamental quantity
b) It is measured using physical balance.
c) It is measured using spring balance

Statement **c) it is measured using spring balance** is not applicable to mass of an object.
(Mass is measured using physical balance)

2. Fill in the blanks.
a) Force = mass × acceleration, then momentum = ---------- × ----------
Ans: Momentum = mass × velocity

b) Liquid hydrogen is for rocket, then ---------- for MRI.
Ans: Liquid helium

3. The name of some organisations which are associated with Chandrayan-I mission are given below. but some of them are not. List out the wrong ones.
(ISRO, BARC, NASA, ESA, WHO, ONGC)
Wrong ones: BARC, WHO and ONGC

4. Correct the mistakes, if any, in the following statements.

a. One newton is the force that produces an acceleration of 1 ms^{-2} in an object of 1 gram mass.

b. Action and reaction is always acting on the same body.

Corrected statements

a. One newton is the force that produces an acceleration of 1 ms^{-2} in an object of kilo gram mass. 1

b. Action and reaction is always acting on two different bodies (objects)

5. The important use of cryogenics is cryogenic fuels. What do you mean by cryogenic fuels?

Cryogenic fuels are fuels that require storage at extremely low temperatures in order to maintain them in a liquid state. Cryogenic fuels mainly liquid hydrogen has been used as rocket fuel.

6. As a matter of convention, an anticlockwise moment is taken as ---------- and a clockwise moment is taken as ----------

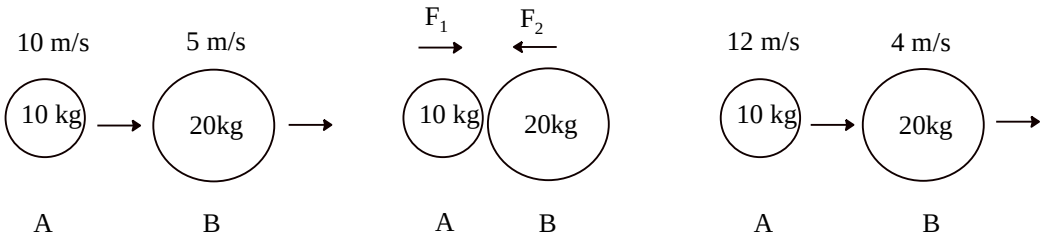
As a matter of convention, an anticlockwise moment is taken as **positive** and a clockwise moment is taken as **negative**

PART – C

1. a) Newton's first law of motion gives a qualitative definition of force. Justify.

Newton's first law of motion gives a qualitative definition of force stating that all objects resist a change in their state of rest or in motion. The tendency of undisturbed objects to stay at rest or to move with same velocity is called inertia. Greater the inertia of an object greater is the force applied to change its state of rest or uniform motion in a straight line.

b) The following figure represents two bodies of masses 10 kg and 20 kg and moving with an initial velocity of 10 ms^{-1} and 5 ms^{-1} respectively. They are colliding with each other. After collision they are moving with velocities 12 ms^{-1} and 4 ms^{-1} respectively. The time of collision be 2 s. Then calculate F_1 and F_2.



According to Newton second law of motion,

The force acting on B (action) F_1 = mass of B × acceleration on B.

$$F_1 = m_2 \times \frac{(v_2 - u_2)}{t}$$

$$F_1 = 20 \times \frac{(4-5)}{2}$$

$$F_1 = 10 \text{ N}$$

The force acting on A (reaction) F_2 = mass of A × acceleration on A.

$$F_2 = m_1 \times \frac{(v_1 - u_1)}{t}$$

$$F_2 = 10 \times \frac{(12-10)}{2}$$

$$F_2 = 10 \text{ N}$$

2. a) Space stations are used to study the effects of long-space flight on the human body. Justify.

When the human body is in space for long periods of time, it experiences health problems because there is no gravity in space. Space stations provide platforms for greater number and length of scientific studies than available on other space vehicles. The Space Stations are provided with the laboratories that can be used to study the changes that occur in space on the human body. This research will give us a better understanding of the human body.

b) $F = \frac{G m_1 m_2}{d^2}$ is the mathematical form of Newton's law of gravitation, G - gravitational constant, m_1 m_2, are the masses of two bodies separated by a distance d, then give the statement of Newton's law of gravitation.

Every object in the universe attracts every other object with a force which is directly proportional to the product of their masses and inversely proportional to the square of the distance between them. The force acts along the line joining the centers of two objects.

Additional questions

1 MARK

1. Force is a
   a) scalar quantity **b) vector quantity** c) fundamental quantity d) none of these

2. SI unit of force is
   a) joule b) calorie **c) newton** or **kg ms^{-2}** d) henry

3. Newton's first law of motion is also known as
   a) the law of conservation of mass b) the law of gravitation
   c) the law of inertia d) the law of conservation of momentum

4. The impact produced by an object depends on its
   a) mass b) velocity **c) both mass and velocity** d) none

5. Momentum is a
   a) scalar quantity **b) vector quantity** c) fundamental quantity d) none of these

6. SI unit of momentum is
   a) kg ms^{-1} b) N c) kg ms^{-2} d) kg ms

7. Acceleration is inversely proportional to the ---------- of the object
   a) mass b) volume c) height d) none of these

8. The value of G (Universal gravitation constant) is
a) 6.673×10^{-11} N m^2 kg^{-2} b) 9.8 m s^{-2} c) 6.673×10^{11} N m^2 kg^{-2} d) 8.9 m s^{-2}

9. Unit of weight is
a) kilogram **b) newton** c) Kg m^{-3} d) kg m

10. Unit of mass is
a) kilogram b) newton c) Kg m^{-3} d) kg m

11. Mass is a
a) derived quantity b) vector quantity **c) fundamental quantity** d) none of these

12. Weight is a
a) derived quantity b) vector quantity c) fundamental quantity d) none of these

13. ---------- was the first to make a systematic study of the motion of a body under the gravity of the Earth
a) Newton b) Kelvin **c) Galileo** d) Faraday

14. The value of g at sea-level is ----------
a) 8.8 m s^{-2} b) 8.9 m s^{-2} c) 6.8 m s^{-2} **d) 9.8 m s^{-2}**

15. Mass of earth is
a) 5.98×10^{24} kg b) 5.98×10^{23} kg c) 6×10^{23} kg d) 59800 kg

16. Momentum was introduced by
a) Galileo **b) Newton** c) Kelvin d) Avogadro

17. The inertia of an object is measured by its
a) mass b) volume c) shape d) none

18. Massive objects offer ---------- inertia
a) larger b) smaller c) zero d) none of these

19. Moment of the force = ----------
a) F × d b) F + d c) F / d d) d / F

20. The unit of moment of the force is
a) N / m **b) N m** c) N m^{-1} d) N

21. The rate of change of velocity is
a) momentum b) speed **c) acceleration** d) force

22. Which of the following is not a space station?
a) Almaz and Salyut series b) Sky lab c) Mir **d) Chandrayaan**

23. Radiation Dose Monitor (RADOM) was
a) ISRO payload b) NASA payload **c) Bulgarian payload** d) ESA payload

24. The last military-use space station was
a) Salyut 5 b) Sky lab c) Mir d) Salyut 7

25. The People's Republic of China is expected to launch its space station named
a) Tiangong 1 b) Mir 5 c) Salute 8 d) none of these

26. The word cryogenics means
a) the production of freezing cold b) the production of hot objects
c) the production of iron d) the production of carbon

27. A person who studies elements under extremely cold temperature is called a
a) mendeleev b) alchemist **c) cryogencist** d) none of these

28. Cryogenics use the ---------- scale of temperature.
a) Celsius **b) Kelvin** c) Fahrenheit d) none of these

29. The cryogen which is used for specially chilling and freezing application is ----------
a) Liquid nitrogen b) Liquid hydrogen c) Liquid oxygen d) Liquid ammonia

30. Cryogenic liquids are held in special containers called
a) Dewar flasks b) barometer c) parchment bag d) none of these

31. The commercial cryogenic processing industry was founded in 1966 by
a) Ed Busch b) Flemming c) Christopher d) Galileo

2 MARK

1. Define force
Force is one which changes or tends to change the state of rest or of uniform motion of a body. Force is a vector quantity. Its SI unit is newton.

2. What are balanced forces?
Forces acting on an object which do not change the state of rest or of uniform motion of it are called balanced forces.

3. What are imbalanced forces?
The resultant of two forces acts on an object and brings it to motion. These opposite forces are called imbalanced (or unbalanced) forces.

4. If a boy pushes a box with a smaller force, the box does not move. Why?
If a boy pushes a box with a smaller force, the box does not move because of friction acting in a direction opposite to the push. It balances the pushing force and therefore the box does not move.

5. If a boy pushes a box with a greater force, the box starts to move. Why?
If a boy pushes the box with a greater force, the pushing force becomes bigger than the frictional force. There is an unbalanced force. So, the box starts moving.

6. State Newton's first law of motion
An object remains in the state of rest or of uniform motion in a straight line unless compelled to change that state by an applied unbalanced force.

7. Newton's first law of motion is also known as the law of inertia. Why?

According to Newton's first law of motion,

An object remains in the state of rest or of uniform motion in a straight line unless compelled to change that state by an applied unbalanced force.

The tendency of undisturbed objects to stay at rest or to keep moving with the same velocity is called inertia. This is why, the first law of motion is also known as the law of inertia.

8. While travelling in a motor car, we tend to move forward when break is applied. Give reason

When break is applied, the car slows down but our body tends to continue in the same state of motion because of inertia. A sudden application of brakes may thus cause injury to us by collision with panels in front.

9. When we are standing in a bus which begins to move suddenly we tend to fall backwards. Give reason

When we are standing in a bus which begins to move suddenly we tend to fall backwards. This is because a sudden start of the bus brings motion to the bus as well as to our feet in contact with the floor of the bus. But the rest of our body opposes this motion because of its inertia.

10. When a motor car makes a sharp turn at a high speed, we tend to get thrown to one side. Give reason

When a motor car makes a sharp turn at a high speed, we tend to get thrown to one side. This can be explained on the basis of the law of inertia. We tend to continue in our straight line motion. When an unbalanced force is applied by the engine to change the direction of motion of the motor car, we move to one side of the seat due to the inertia of our body.

11. Define inertia

Inability of a body to change its state of rest or of uniform motion by itself is called inertia.

12. Assertion: If we kick a foot ball, it flies away. But if we kick a stone of the same size with equal force, it hardly moves.

Reason: This is because; the stone has more inertia than the ball. More massive objects offer larger inertia.

Does the reason satisfy the assertion?

Ans: Yes, the reason satisfies the assertion

13. A force, that is just enough to cause a small carriage to pick up a large velocity, will produce a negligible change in the motion of a train. Give reason

A force, that is just enough to cause a small carriage to pick up a large velocity, will produce a negligible change in the motion of a train. This is because; the train has more inertia than the carriage. More massive objects offer larger inertia.

14. If a tennis ball hits a player, it does not hurt him. On the other hand, when fast moving cricket ball hits a spectator, it may hurt him. Why?

The impact produced by an object depends on its mass and velocity. Since the mass of cricket ball is greater than tennis ball, its momentum ($p = m v$) is very high and hence the impact is more. So, fast moving cricket ball hurts a spectator if it hits him.

15. A truck at rest does not require any attention when parked along a roadside. But a moving truck, even at a very low speed, may kill a person standing in its path. Why?

The impact produced by an object depends on its mass and velocity. The momentum of moving truck (p = m v) is very high and hence the impact is more. So, moving truck, even at a very low speed, may kill a person standing in its path.

16. Mass of a bullet is very low but it may kill a person when fired from a gun. Why?

The impact produced by an object depends on its mass and velocity. When a bullet is fired from a gun its velocity is increased. The momentum of the bullet (p = m v) is very high and hence the impact is more.

17. Define momentum

The momentum 'p' of an object is defined as the product of its mass 'm' and velocity 'v'. That is, p = m v

Momentum has both direction and magnitude. It is a **vector quantity**.

The SI unit of momentum is kg ms^{-1}

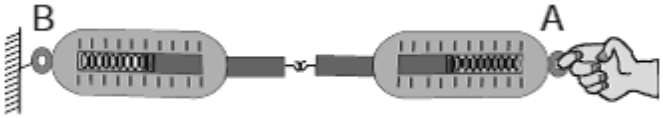
18. State Newton's second law of motion

Rate of change of momentum of an object is proportional to the applied unbalanced force in the direction of force.

19. Define one unit of force or **1 N**

One unit of force (1N) is defined as the amount of force that produces an acceleration of 1 ms^{-2} in an object of 1 kg mass.

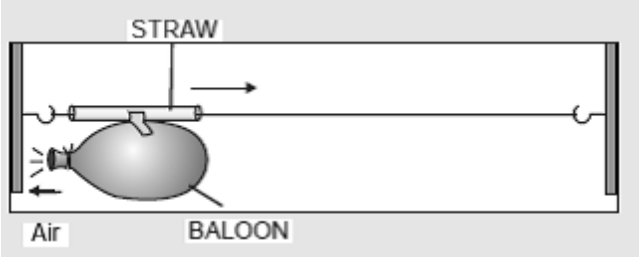
20. State the law involved in the given figure



Newton's third law of motion

For every action there is an equal and opposite reaction.

21. Observe the figure given below and answer the questions



a) What happens when the thread tied on the neck of the balloon is removed?

When the thread tied on the neck of the balloon is removed, the air inside the balloon escapes. As a result the balloon and the straw which is attached move in opposite direction.

b) Name the law involved

Newton's third law of motion

22. Why does a gun recoil when it is fired?

When a gun is fired it exerts forward force on the bullet. The bullet exerts an equal and opposite reaction force on the gun. This results in the recoil of the gun.

23. The acceleration of the gun is much less than the acceleration of the bullet. Why?

Acceleration is inversely proportional to the mass of the object.

Since the gun has a much greater mass than the bullet, the acceleration of the gun is much less than the acceleration of the bullet.

24. Define law of conservation of momentum

The law of conservation of momentum states that, in the absence of external unbalanced force the total momentum of a system of objects remains unchanged or conserved by collision.

25. Define the moment of force

The magnitude of the moment of force about a point is defined as the product of the magnitude of force and the perpendicular distance of the point from the line of action of the force.

Moment of force = $F \times d$

The unit of moment of the force is N m

26. What is meant by clockwise moment and anti clockwise moment?

If the force acting on a body rotates the body in anticlockwise direction then the moment is called anticlockwise moment. On the other hand, if the force rotates the body in clockwise direction then the moment is said to be clockwise moment.

27. What is meant by turning effect of a force?

A force which tends to rotate the body about any axis which does not intersect the line of action of the force and also not parallel to it. This tendency of rotation is called turning effect of a force.

28. What is meant by couple?

Two equal and opposite forces whose lines of action do not coincide are said to constitute a couple in mechanics.

29. What is meant by gravitational force?

All objects in the universe attract each other. This force of attraction between objects is called the gravitational force.

30. State Newton's law of gravitation.

Every object in the universe attracts every other object with a force which is directly proportional to the product of their masses and inversely proportional to the square of the distance between them. The force acts along the line joining the centers of two objects.

31. Define mass

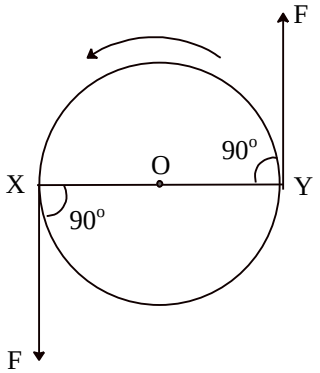
Mass is the amount of matter present in a body.

32. Define weight

Weight is the gravitational pull acting on the body.

33. Explain couple with an example

Suppose two strings are tied to a wheel at the points X and Y, and two equal and opposite forces, 'F' are exerted tangentially to the wheels as shown in the figure. If the wheel is pivoted at its centre O it begins to rotate about O in an anticlockwise direction.



Two equal and opposite forces whose lines of action do not coincide are said to constitute a couple in mechanics.

34. In Moon, weight of a person is less than that on earth but mass remains constant. Why?

In moon, weight of a person would change because the gravitational pull is weaker there than on the earth, but mass would stay the same because the person is still made up of the same amount of matter.

35. Write on Galileo's experiment on the motion of a body under the gravity of the Earth

Galileo was the first to make a systematic study of the motion of a body under the gravity of the Earth. He dropped various objects from leaning tower of Pisa and made analysis of their motion under gravity. He came to the conclusion that "in the absence of air, all bodies will fall at the same rate". It is the air resistance that slows down a piece of paper or a parachute falling under gravity. If a heavy stone and a parachute are dropped where there is no air, both will fall together at the same rate.

36. What is meant by acceleration due to gravity?

The acceleration produced in a body on account of the force of gravity is called acceleration due to gravity. It is denoted by g.

37. Correct the following statements

i. At a given place, the value of g (acceleration due to gravity) is not the same for all bodies

ii. The value of g at sea-level and at a latitude of 90° is taken as the standard free -fall acceleration.

Corrected statements

i. At a given place, the value of g (acceleration due to gravity) is the same for all bodies irrespective of their masses

ii. The value of g at sea-level and at a latitude of 45° is taken as the standard free -fall acceleration.

38. What is Chandrayaan-1?

Chandrayaan-1 is a moon-traveler or moon vehicle. It was Indian's first unmanned lunar probe. It was launched by Indian Space Research Organization.

39. Pick out the incorrect statements about Chandrayaan-1

1. Chandrayaan-1 is a moon-traveler or moon vehicle.
2. It was launched by Indian Space Research Organization in October 2010 from Srihari Kota
3. It carried five ISRO payloads and six payloads from other space agencies including NASA, European Space Agencies(ESA), and the Bulgarian Aerospace Agency
4. Chandrayaan-1 operated for 365 days and achieved 100 % of its planned objectives

Incorrect statements are 2 and 4

Corrected statements:

2. It was launched by Indian Space Research Organization in October 2008 from Srihari Kota
4. Chandrayaan-1 operated for 312 days and achieved 95% of its planned objectives

40. What is a space station?

A space station is an artificial structure designed for humans to live and work in outer space for a period of time.

Almaz and Salyut series, Sky lab and Mir are the space stations.

41. What are the issues of the space stations that limit their long-term habitability?

The space stations have various issues that limit their long-term habitability, such as very low recycling rates, relatively high radiation levels and a lack of gravity. Some of these problems cause discomfort and long-term health effects.

42. What is cryogenics?

Cryogenics is the study of the production of very low temperature (below 123K); and the behaviour of materials at those temperature.

43. What is cryogenic hardening?

Cryogenic hardening is a cryogenic heat treating process where the metal is cooled to very low temperature using liquid nitrogen. Metals frozen to low temperature show more resistance to wear.

44. Name the gases used in cryogenic applications

i. Liquid nitrogen ii. Liquid helium

45. Spot the error

Action and reaction always act on same object.

Ans: Action and reaction always act on **two different** objects.

46. It is difficult to transmit power by over head cables in cities. So, underground cables are used. But underground cables get heated and the resistance of the wire increases leading to wastage of power. How can you solve this problem?

This can be solved by cryogenics. Liquefied gases are sprayed on the cables to keep them cool and reduce their resistance.

47. How is mass of the Earth calculated?

From the expression $g = \frac{GM}{R^2}$ the mass of the Earth can be calculated as follows:

$$M = \frac{g R^2}{G}$$

$$M = \frac{9.8 \times (6.38 \times 10^6)^2}{6.67 \times 10^{-11}}$$

$$M = 5.98 \times 10^{24} \text{ kg.}$$

48. Mass of an object is 5 kg. What is its weight on the earth?

Mass, $m = 5$ kg

Acceleration due to gravity, $g = 9.8 \text{ m s}^{-2}$

Weight, $w = m \times g$

$w = 5 \text{ kg} \times 9.8 \text{ m s}^{-2} = 49 \text{ N}$

Thus the weight of the object is, **49 N**

49. A constant force acts on an object of mass 10 kg for a duration of 4 s. It increases the objects velocity from 2 ms $^{-1}$ to 8 ms $^{-1}$. Find the magnitude of the applied force.

Mass of the object $m = 10$ kg

Initial velocity $u = 2 \text{ ms}^{-1}$

Final velocity $v = 8 \text{ ms}^{-1}$

We know, force $F = \frac{m(v-u)}{t}$

$$F = \frac{10(8-2)}{4}$$

$$F = 15 \text{ N}$$

50. Which would require a greater force for accelerating a 2 kg of mass at 4 m s $^{-2}$or a 3 kg mass at 2 m s $^{-2}$?

We know, force $F = ma$

Given, $m_1 = 2$ kg $\quad a_1 = 4 \text{ m s}^{-2}$

$m_2 = 3$ kg $\quad a_2 = 2 \text{ m s}^{-2}$

Thus, $F_1 = m_1 a_1 = 2 \text{ kg} \times 4 \text{ m s}^{-2} =$ **8 N**

$F_2 = m_2 a_2 = 3 \text{ kg} \times 2 \text{ m s}^{-2} =$ **6 N**

$\Rightarrow F_1 > F_2$

Thus, accelerating a 2 kg mass at 4m s^{-2} would require a greater force.

5 MARK

1. Derive the equation F = ma

Suppose an object of mass 'm' is moving along a straight line with an initial velocity 'u'. It is uniformly accelerated to velocity 'v' in time 't' by the application of constant force, 'F' throughout the time, 't'.

Initial momentum of the object = mu

Final momentum of the object = mv

The change in momentum = mv – mu

= m(v - u)

Rate of change of momentum $= \frac{\text{Change of momentum}}{\text{Time}}$

$= \frac{m(v-u)}{t}$

According to Newton II law of motion, this is nothing but applied force.

Therefore the applied force, $F \propto \frac{m(v-u)}{t}$

But the acceleration, $a = \frac{(v-u)}{t}$

The applied force, $F \propto ma$

$F = K\,ma$

'K' is known as the constant of proportionality. The SI unit of mass and acceleration are kg and m s^{-2} respectively. The unit of force is so chosen that the value of the constant 'K' becomes one.

Therefore, F = ma

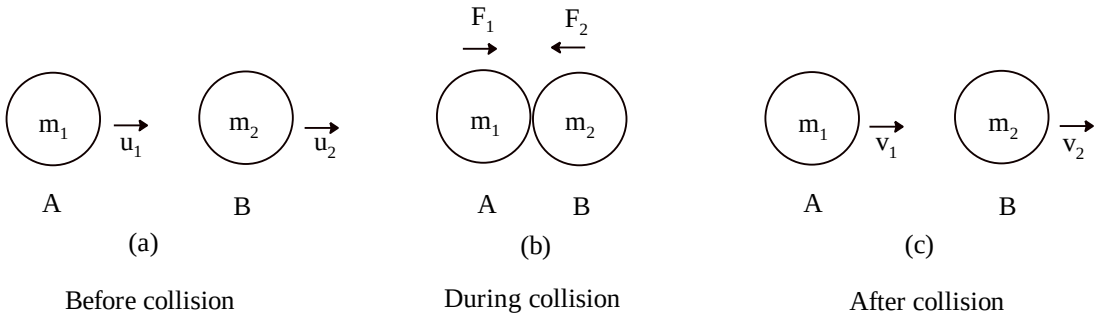
2. Write the differences between mass and weight

No	Mass	Weight
1	Fundamental quantity.	Derived quantity
2	It is the amount of matter contained in a body.	It is the gravitational pull acting on the body.
3	Its unit is kilogram.	Its unit is newton.
4	Remains the same.	Varies from place to place.
5	It is measured using physical	It is measured using spring

	balance.	balance.

3. State and prove the law of conservation of momentum

The law of conservation of momentum states that, in the absence of external unbalanced force the total momentum of a system of objects remains unchanged or conserved by collision.
Consider two objects (two balls) A and B of masses 'm_1' and 'm_2' are traveling in the same direction along a straight line at different velocities 'u_1' and 'u_2' respectively.
There are no other external unbalanced forces acting on them. Let $u_1 > u_2$ and the two balls collide with each other as shown in Fig.



During collision which last for time't' , the ball A exerts a force F_1 on ball B , and the ball B exerts a force F_2 on ball A. Let v_1 and v_2 be the velocities of two balls A and B after collision respectively in the same direction as before collision.

According to Newton second law of motion,
The force acting on B (action) F_1 = mass of B × acceleration on B.

$$F_1 = m_2 \times \frac{(v_2 - u_2)}{t} \quad \text{---------- (1)}$$

The force acting on A (reaction) F_2 = mass of A × acceleration on A.

$$F_2 = m_1 \times \frac{(v_1 - u_1)}{t} \quad \text{---------- (2)}$$

According to Newton's third law of motion, $F_1 = -F_2$

From equation (1) and (2)

$$m_2 \times \frac{(v_2 - u_2)}{t} = - m_1 \times \frac{(v_1 - u_1)}{t}$$

$$m_2 (v_2 - u_2) = - m_1 (v_1 - u_1)$$

$$m_2v_2 - m_2u_2 = -m_1v_1 + m_1u_1$$

$$m_1v_1 + m_2v_2 = m_1u_1 + m_2u_2$$

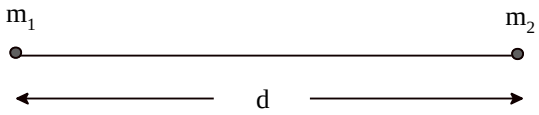
Therefore,

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$

The total momentum before collision is equal to the total momentum after collision. The total momentums of two objects remain unchanged due to collision in the absence of external force. This law holds good for any number of objects.

4. State Newton's law of gravitation. Using this law calculate the value of Universal gravitation constant

Every object in the universe attracts every other object with a force which is directly proportional to the product of their masses and inversely proportional to the square of the distance between them. The force acts along the line joining the centers of two objects.



Let two objects A and B of masses m_1, m_2 respectively lie at a distance'd' from each other as shown in Fig. Let the force of attraction between two objects is 'F'.

According to Newton's law of gravitation,

$$F \propto m_1 m_2 \qquad \text{---------- (1)}$$

$$F \propto \frac{1}{d^2} \qquad \text{---------- (2)}$$

Combining (1) and (2)

$$F \propto \frac{m_1 m_2}{d^2} \qquad \text{---------- (3)}$$

Or

$$F = \frac{G m_1 m_2}{d^2} \qquad \text{---------- (4)}$$

Where G is the constant of proportionality and is called the Universal gravitation constant. From eqn (4)

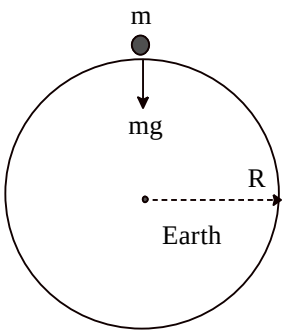
$$G = \frac{F d^2}{m_1 m_2}$$

Substituting the S.I units in this equation the unit of G is found to be $N\ m^2\ kg^{-2}$

The value of G is $6.673 \times 10^{-11}\ N\ m^2\ kg^{-2}$

5. Derive the equation for acceleration due to gravity at the surface of earth

Consider a body of mass 'm' on the surface of the earth as shown in Fig.



Its distance from the centre of the Earth is R (radius of the Earth).

The gravitational force experienced by the body is

$$F = \frac{G M m}{R^2}$$ where M is the mass of the earth.

From Newton's second law of motion,

Force, $F = m\,g$

Equating the above two forces,

$$F = \frac{G\,M\,m}{R^2} = m\,g$$

Therefore, $$g = \frac{G\,M}{R^2}$$

This equation shows that 'g' is independent of the mass of the body 'm' but, it varies with the distance from the centre of the Earth. If the Earth is assumed to be a sphere of radius R, the value of 'g' on the surface of the Earth is given by

$$g = \frac{G\,M}{R^2}$$

6. What are the achievements of Chandrayaan-1?

1. The discovery of wide spread presence of water molecules in lunar soil.
2. Chandrayaan's Moon Mineralogy Mapper has confirmed that moon was once completely molten.
3. European Space Agency payload-Chandrayaan-1 imaging X-ray spectrometer (CIXS)-detected more than two dozen weak solar flares during the mission.
4. The Terrain mapping camera on board Chandrayaan-1 has recorded images of the landing site of US space craft Apollo-15, Apollo-11.
5. The Terrain Mapping Camera acquired images of peaks and Craters. The moon consists of mostly of Craters.
6. Lunar Laser Ranging Instrument (LLRI) covered both the Lunar Poles and additional lunar region of interest.
7. The X-ray signatures of aluminum, magnesium and silicon were picked up by the CIXS X-ray camera
8. Chandrayaan-1 has discovered large caves on the lunar surface that can act as human shelter on the moon.

7. Write the applications of cryogenic techniques

1. Rocket

The important use of cryogenics is cryogenic fuels. Cryogenic fuels mainly liquid hydrogen has been used as rocket fuel.

2. Magnetic Resonance Imaging (MRI)

MRI is used to scan inner organs of human body by penetrating very intense magnetic field. The magnetic field is generated by super conducting coils with the help of liquid helium. It can reduce the temperature of the coil to around 4K. At this low temperature very high resolution images can be obtained.

3. Power transmission in big cities

It is difficult to transmit power by over head cables in cities. So, underground cables are used. But underground cables get heated and the resistance of the wire increases leading to wastage of

power. This can be solved by cryogenics. Liquefied gases are sprayed on the cables to keep them cool and reduce their resistance.

4. Food Freezing

Cryogenic gases are used in transportation of large masses of frozen food, when very large quantity of food must be transported to regions like war field, earthquake hit regions etc., they must be stored for.

5. Vaccines

The freezing of biotechnology products like vaccines require nitrogen freezing systems.

8. Write note on space station

1. A space station is an artificial structure designed for humans to live and work in outer space for a period of time.
2. The space stations are Almaz and Salyut series, Sky lab and Mir
3. Space stations are used to study the effects of long-space flight on the human body.
4. It provides platforms for greater number and length of scientific studies than available on other space vehicles.
5. Space stations have been used for both military and civilian purposes.
6. The space stations so for launched are of two types.

   i) Monolithic:

   Salyut and Skylab are "monolithic." They were constructed and launched in one piece, and then manned by a crew later. As such, they generally contained all their supplies and experimental equipment when launched, and were considered "expended", and then abandoned, when these were used up.

   ii) Modular:

   Mir and the International Space Station (ISS) are modular. A core unit was launched, and additional modules, generally with a specific role, were later added to that. This method allows for greater flexibility in operation. It removes the need for a single immensely powerful launch vehicle. These stations are also designed from the outset to have their supplies provided by logistical support, which allows for a longer lifetime at the cost of requiring regular support launches.
7. The space stations have various issues that limit their long-term habitability, such as very low recycling rates, relatively high radiation levels and a lack of gravity. Some of these problems cause discomfort and long-term health effects.

8. Future space habitats may attempt to address these issues, and are intended for long-term occupation. Some designs might even accommodate large number of people, essentially "cities in space" where people would make their homes.

9. A bullet of mass 15g is horizontally fired with a velocity 100 m s^{-1} from a pistol of mass 2 kg what is the recoil velocity of the pistol?

The mass of bullet, $m_1 = 15\ g = 0.015\ kg$

Mass of the pistol, $m_2 = 2\ kg$

Initial velocity of the bullet, $u_1 = 0$

Initial velocity of the pistol, $u_2 = 0$

Final velocity of the bullet, $v_1 = +\ 100\ m\ s^{-1}$

(The direction of bullet is taken from left to right-positive, by convention)

Recoil velocity of the pistol $= v$

Total momentum of the pistol and bullet before fire,

$$= (0.015 \times 0 + 2 \times 0)\ kg\ m\ s^{-1}$$

$$= 0\ kg\ m\ s^{-1}$$

Total momentum of the pistol and bullet after fire,

$$= (0.015 \times 100 + 2 \times v)$$

$$= (1.5 + 2v)\ kg\ m\ s^{-1}$$

According to the law of conservation of momentum,

Total momentum after fire = total momentum before fire

$$1.5 + 2v = 0$$

$$2v = -1.5$$

$$v = -0.75\ m\ s^{-1}$$

Negative sign indicates that the direction in which the pistol would recoil is opposite to that of the bullet, that is, right to left. .

Textbook questions

PART – A

1. The potential difference required to pass a current 0.2 A in a wire of resistance 20 ohm is ----- (100 V, 4 V, 0.01 V, 40 V)
Ans: 4 V

According to Ohm's law, $I = \frac{V}{R}$

$\therefore V = I R = 0.2 \times 20 = 4$ V

2. Two electric bulbs have resistances in the ratio 1 : 2. If they are joined in series, the energy consumed in these are in the ratio ---------- (1 : 2, 2 : 1, 4 : 1, 1 : 1)
Ans: 1 : 2

3. Kilowatt-hour is the unit of ----------
(potential difference, electric power, electric energy, charge)
Ans: electric energy

4. ---------- surface absorbs more heat than any other surface under identical conditions.
(White, rough, black, yellow)
Ans: black

5. The atomic number of natural radioactive element is ----------
(greater than 82, less than 82, not defined, atleast 92)

Ans: greater than 82

PART – B

1. From the following statements write down that which does not represent ohm's law.

a) current / potential difference = constant
b) potential difference / current = constant
c) current = resistance × potential difference

Ans: c) current = resistance × potential difference

2. Fill in the blanks
a) Potential difference : voltmeter, then: current ----------
b) power plant : conventional source of energy then solar energy----------

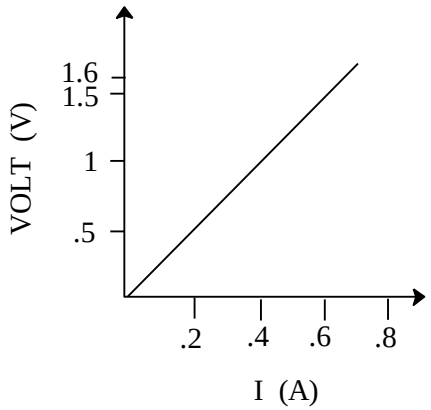
Ans: a) ammeter b) non-conventional source of energy

3. In the list of non-conventional sources of energy given below, some of them are wrong. List out the wrong ones. (Wind energy, solar energy, hydro electric power, nuclear energy, tidal energy, wave energy, geothermal energy.)
Ans: Wind energy, hydro electric power

4. Correct the mistakes, if any, in the following statements.
a) A good source of energy would be one which would do a small amount of work per unit volume of mass.
b) Any source of energy we use to do work is consumed and can be used again.
Ans:
a) A good source of energy would be one which would do a **large** amount of work per unit volume of mass.
b) Any source of energy we use to do work is consumed and **cannot** be used again.

5. The schematic diagram, in which different components of the circuit are represented by the symbols conveniently used, is called a circuit diagram. What do you mean by the term components?
Ans: Component means element. An element is an electrical device with two terminals to connect it to the other electrical devices.
Eg: battery, electric bulb

6. Following graph was plotted between V and I values. What would be the values of V / I ratios when the potential difference is 0.8 V and 1.2 V.



Ans:
From the graph, the values of V and I are as follows:

V	0.5	0.6	0.7	0.8	0.9	1	1.1	1.2
I	0.20	0.24	0.28	0.32	0.36	0.40	0.44	0.48

1) If V = 0.8, then I = 0.32 $\quad \therefore \frac{V}{I} = \frac{0.8}{0.32} = 2.5$

2) If V = 1.2, then I = 0.48 $\quad \therefore \frac{V}{I} = \frac{1.2}{0.48} = 2.5$

Since $\frac{V}{I}$ is constant, Ohm's law is verified.

7. We know that γ – rays are harmful radiations emitted by natural radioactive substances.
a) Which are other radiations from such substances?
b) Tabulate the following statements as applicable to each of the above radiations

They are electromagnetic radiation.
They have high penetrating power.
They are electrons. They contain neutrons.

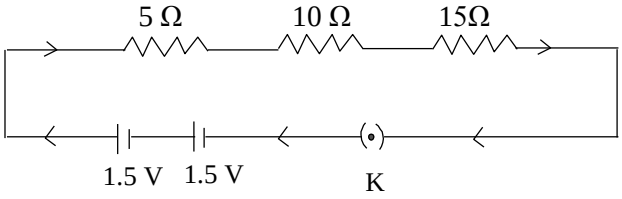
Ans:
a) α (alpha) and β (beta)

b)

Alpha (α)	Beta (β)	Gamma (γ)
They contain neutrons	They are electrons.	They are electromagnetic radiation. They have high penetrating power.

8. Draw the schematic diagram of an electric circuit consisting of a battery of two cells of 1.5V each, three resistance of 5 ohm, 10 ohm and 15 ohm respectively and a plug key all connected in series.

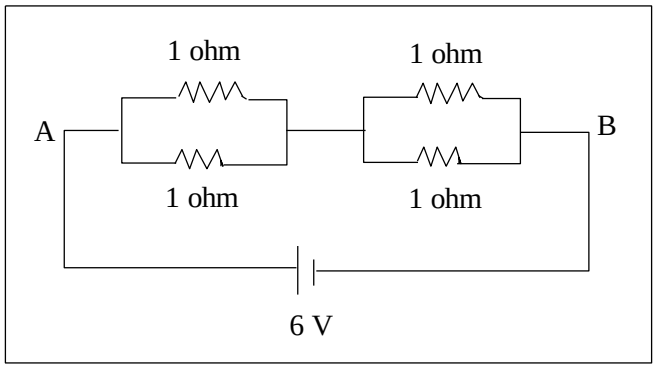
Ans:



9. Fuse wire is made up of an alloy of ---------- which has high resistance and ----------

Ans: a) 37% Lead & 63% Tin b) Low melting point

10. Observe the circuit given below and find the resistance across AB.



Ans:

1) For parallel combination of resistors: $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}$

a) $\frac{1}{R_p} = \frac{1}{1} + \frac{1}{1} = 2$

$\therefore R_p = \frac{1}{2}\ \Omega$

b) $\frac{1}{R_p} = \frac{1}{1} + \frac{1}{1} = 2$

$\therefore R_p = \frac{1}{2}\ \Omega$

2) For series combination of resistors: $R_s = R_1 + R_2$

$R_s = \frac{1}{2} + \frac{1}{2} = 1\ \Omega$

Therefore, the total resistance across AB = 1 Ω

11. Complete the table choosing the right terms from within the brackets. (zinc, copper, carbon, lead, leadoxide, aluminium.)

+ ve electrode	Daniel cell	
–ve electrode	Leclanche cell	

Ans:

+ ve electrode	Daniel cell	**Copper**
– ve electrode	Leclanche cell	**Zinc**

Additional questions

1 MARK

1. If a net charge Q, flows across a conductor in time t, then the current I is

a) I = $\frac{Q}{t}$ b) I = $\frac{t}{Q}$ c) I = Q × t d) I = Q + t

Important formulae

1. Current (I) = $\frac{\text{charge (Q)}}{\text{time (t)}}$
2. Potential difference (V) = $\frac{\text{work done (W)}}{\text{charge (Q)}}$
3. Current (I) = $\frac{V}{R}$
4. Electric power (P) = $V\left(\frac{Q}{t}\right)$ **or** $P = VI$ **or** $P = I^2 R$ **or** $P = \frac{V^2}{R}$
5. Heat produced in a resistor (H) = V I t **or** $H = I^2 R t$
6. Resistors in series

   $R_s = R_1 + R_2 + R_3$

   $V = V_1 + V_2 + V_3$

   Current (I) remains the same.
7. Resistors in parallel

   $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

   $I = I_1 + I_2 + I_3$

   Potential difference (V) remains the same.

2. S.I unit of electric charge is

a) ampere **b) coulomb** c) volt d) ohm

Electrical quantity	**S.I Unit**
Electric charge	coulomb
Electric current	ampere
Potential difference	Volt
Resistance	ohm
Electric power	watt
Electric energy	watt hour

3. The commercial unit of electric energy is kilowatt hour (kWh). This is known as
a) unit b) faraday c) coulomb d) none of these

4. 1 kWh **or** 1 unit is equal to ---------- watt second **or** joule
a) 6.3×10^{6} b) 6.0232×10^{6} **c) 3.6×10^{6}** d) 4.2×10^{6}

5. The charge contained in 6×10^{18} electrons is equivalent to
a) 1 ampere b) 1 volt **c) 1 coulomb** d) 1 ohm

6. Metals conduct electricity due to the flow of
a) electrons b) protons c) neutrons d) ions

7. ---------- is an instrument which is used to measure current in a circuit
a) voltmeter b) capacitor c) barometer **d) ammeter**

8. ---------- is an instrument which is used to measure potential difference
a) voltmeter b) capacitor c) barometer d) ammeter

9. 1 joule / 1 coulomb =
a) 1 volt b) 1 ampere c) 1 ohm d) 1 Faraday

10. 1volt / 1 ampere =
a) 1 watt b) 1 coulomb **c) 1 ohm** d) 1 Faraday

11. 1volt × 1 ampere =
a) 1 watt b) 1 coulomb c) 1 ohm d) 1 Faraday

12. Fuse used in electric circuits is based on the application of
a) Joules law of heating b) Ohm's law c) Faraday's law d) all of these

13. In our country, the potential difference between the wires in domestic electric circuits is
a) 120 V **b) 220 V** c) 240 V d) 100 V

14. For geysers and air coolers the circuit of 15A current is used and for bulbs and fans the circuit of ---------- current is used
a) 5A b) 10A c) 15A d) 220A

15. 1 kilowatt is equal to
a) 10 watt `b) 100 watt **c) 1000 watt** d) 10000 watt

16. The emf of voltaic cell is
a) 1.5 V b) 2.5 V **c) 1.08 V** d) 2.08 V

17. The emf of Leclanche cell is
a) 1.5 V b) 2.5 V c) 1.08 V d) 2.08 V

18. The emf of Lead-acid accumulator is
a) 1.5 V **b) 2.2 V** c) 1.08 V d) 2.08 V

19. Fossil fuels are ---------- sources of energy
a) renewable **b) non-renewable** c) non-conventional d) none of these

Conventional sources of energy	• Fossil fuels (coal, petroleum) • Thermal power plant • Hydro power plants • Bio-mass • Wind energy
Non-conventional sources of energy	• Solar energy • Nuclear energy
Renewable sources of energy	• Hydro power plants • Wind energy
Non-renewable sources of energy	• Fossil fuels (coal, petroleum) • Nuclear energy
Energy from seas	• Tidal energy • Wave energy • Ocean thermal energy

20. The fuel gas obtained from cow-dung is
a) Indane b) LPG **c) Gobar gas** d) CO_2

21. Which of the following heavy atoms produce nuclear energy during nuclear fission?
a) uranium b) plutonium c) thorium **d) all of these**

22. Nuclear fission occurs when heavy atoms (U, Pu, Th) are bombarded with low-energy
a) protons b) electrons **c) neutrons** d) X-rays

23. The fission of an atom or uranium produces ---------- times the energy produced by the combustion of an atom of carbon from coal.
a) 10 million b) 1 million c) 5 million d) 2 million

24. The phenomenon of radioactivity was discovered by ----------
a) Henri Becquerel b) Otto Hahn c) Marie Curie d) Pierre Curie

25. Henri Becquerel found that a photographic plate wrapped in a black paper was affected by certain penetrating radiations emitted by
a) sodium salt **b) uranium salt** c) calcium salt d) all of these

26. ---------- showed that the radiations from the uranium salt were capable of ionizing a gas.
a) Rutherford b) Marie Curie c) Otto Hahn d) Pierre Curie

27. Madam Marie Curie and her husband Pierre Curie discovered the highly radioactive elements
a) thorium and curium **b) radium and polonium** c) radon and argon d) none of these

28. Heavy elements having atomic number greater than 82 are called
a) Noble elements b) halogens **c) radioactive elements** d) chalcogens

29. The radioactivity is unaffected by
a) temperature b) pressure c) electric and magnetic fields **d) all the above**

30. Nuclear fission was discovered by
a) Henri Becquerel / **b) Otto Hahn & Strassman** c) Marie Curie d) Pierre Curie

31. Nuclear fission is accompanied by the release of
a) X-rays b) electrons **c) neutrons** d) protons

32. Fission of an atom of U^{235} releases ---------- million volts of energy
a) 100 **b) 200** c) 1 d) 10

33. Nuclear fusion can be carried out only at a extremely high temperature of the order of
a) 10^7 K b) 10^3 K c) 10^4 K d) 10 K

34. The nuclear fusion reactions are known as
a) combustion reactions b) decomposition reactions
c) thermo nuclear reactions d) thermo chemical reactions

35. Which of the following is / are ionizing radiation(s)?
a) α b) β c) γ **d) all the above**

36. The radiation exposure is measured by the unit called
a) roentgen b) electron volt c) ampere d) coulomb

37. The quantity of radiation which produces 1.6×10^{12} pairs of ion in 1 gram of air is
a) one curie b) one ampere **c) one roentgen** d) one Faraday

38. Safe limit of receiving the radiation is about ---------- milli roentgen per week.
a) 520 b) 1000 **c) 250** d) 100

39. Radioactive materials are kept in thick-walled ---------- container
a) iron **b) lead** c) copper d) steel

40. ---------- Tidal energy is based on the gravitational pull of the moon on the spinning earth.
a) Wave energy b) Ocean thermal energy **c) Tidal energy** d) Wind energy

41. In Ocean thermal energy plants, the vapors of ---------- is used to run the turbine of generator
a) water b) ethanol **c) ammonia** d) benzene

42. ---------- built the first battery (electrochemical cell)
a) Daniel b) Ampere **c) Volta** e) Faraday

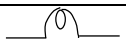
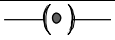
43. Inventor of the first dynamo
a) Michael Faraday b) Volta c) Daniel d) Ampere

Michael Faraday	Inventor of the first dynamo
Volta	Built the first battery
Otto Hahn & Strassman	Discovered nuclear fission
Rutherford	Showed that the radiations from uranium salts can ionize a gas
Henri Becquerel	Discovered radioactivity
Marie Curie & Pierre Curie	Discovered radium & Polonium

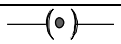
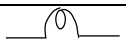
2 MARK

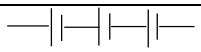
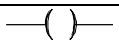
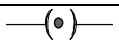
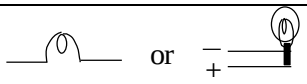
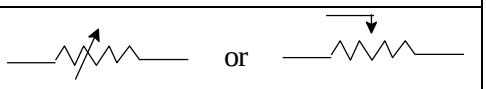
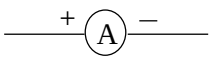
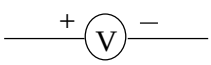
Match the following

1.

1	Switch (closed)	
2	Wires crossing without joining	
		

Ans:

1	Switch (closed)	
2	Wires crossing without joining	
3	Electric bulb	

Components	Symbols
An electric cell	
A battery or a combination of cells	
Plug key or switch (open)	
Plug key *or* switch (closed)	
A wire joint	
Wires crossing without joining	
Electric bulb	
A resistor of resistance R	
Variable resistance *or* rheostat	
Ammeter	
Voltmeter	

2.

Michael Faraday	Discovered nuclear fission
Volta	Discovered radioactivity
Otto Hahn & Strassman	Inventor of the first dynamo
Henri Becquerel	Built the first battery

Ans:

Michael Faraday	Inventor of the first dynamo
Volta	Built the first battery
Otto Hahn & Strassman	Discovered nuclear fission
Henri Becquerel	Discovered radioactivity

3.

Electrical quantity	**S.I Unit**
Electric charge	watt
Electric current	watt hour
Electric power	coulomb
Electric energy	ampere

Ans:

Electrical quantity	**S.I Unit**
Electric charge	coulomb
Electric current	ampere
Electric power	watt
Electric energy	watt hour

4.

Coal & Petroleum	Bio-mass
Hydro power	Nuclear energy
Uranium	Renewable source of energy
Cow -dung	Fossil fuels

Ans:

Coal & Petroleum	Fossil fuels
Hydro power	Renewable source of energy
Uranium	Nuclear energy
Cow -dung	Bio-mass

5.

Red wire	Neutral wire (negative)
Black wire	Earth wire
Green wire	Live wire (positive)

Ans:

Red wire	Live wire (positive)
Black wire	Neutral wire (negative)
Green wire	Earth wire

6.

Nuclear reactivity	**State of the reactor**
Zero	Sub critical
Positive	Exactly critical
Negative	Super critical

Ans:

Nuclear reactivity	**State of the reactor**
Zero	Exactly critical
Positive	Super critical
Negative	Sub critical

Spot the error in the following statements

1. A resistor makes a conducting link between the cell and the bulb.
   Ans:
   A **switch** makes a conducting link between the cell and the bulb.

2. Heat produced in a resistor is inversely proportional to the square of current
   Ans:
   Heat produced in a resistor is directly proportional to the square of current

3. The fuse is connected parallel to the device.
   Ans:
   The fuse is connected **in series with** the device.

4. In order that each appliance has equal potential difference, they are connected in series with each other.
   Ans:
   In order that each appliance has equal potential difference, they are connected **parallel to** each other.

5. In wind mill, the wind speed should be higher than 50 km per hour to maintain the required speed of the turbine.
Ans:
In wind mill, the wind speed should be higher than **15** km per hour to maintain the required speed of the turbine.

6. In nuclear fusion the mass of the product is always greater than the sum of the masses of the individual lighter nuclei.
Ans:
In nuclear fusion the mass of the product is always **less** than the sum of the masses of the individual lighter nuclei.

7. According to Einstein's mass energy relation $E = m^2c$, the difference in mass is converted into volume in nuclear fusion.
Ans:
According to Einstein's mass energy relation $\mathbf{E = mc^2}$, the difference in mass is converted into **energy** in nuclear fusion.

8. A suitable assembly of neutron, proton and positron is arranged at the sight of the explosion of the atom bomb.
Ans:
A suitable assembly of neutron, **deuteron and triton** is arranged at the sight of the explosion of the atom bomb.

9. Nylon aprons and Nylon gloves are used while working in nuclear hazardous area.
Ans:
Lead aprons and **lead** gloves are used while working in nuclear hazardous area.

10. The cell from which heat energy is derived by reversible chemical reaction is called primary cell
Ans:
The cell from which **electrical energy** is derived by **irreversible** chemical reaction is called primary cell

11. The difference in pressure is exploited to obtain energy in ocean-thermal-energy conversion plants.
Ans:
The difference in **temperature** is exploited to obtain energy in ocean-thermal-energy conversion plants.

12. Ocean-thermal-energy conversion plants can operate if the temperature difference between the water at the surface and water at depths up to 2 kilometers is 393 K (120° C) or more .
Ans:
Ocean-thermal-energy conversion plants can operate if the temperature difference between the water at the surface and water at depths up to 2 kilometers is **293 K (20° C)** or more .

13. Primary cells can be recharged
Ans:
Primary cells **cannot** be recharged

14. The advantage of secondary cell is that they are rechargeable. The chemical reactions that take place in secondary cells are irreversible.
Ans:
The advantage of secondary cell is that they are rechargeable. The chemical reactions that take place in secondary cells are **reversible.**

15. When wood is burnt in excess supply of oxygen, charcoal is produced. Charcoal burns with flames, is comparatively smokeless and has higher heat generation efficiency.
Ans:
When wood is burnt in a **limited** supply of oxygen, charcoal is produced. Charcoal burns **without** flames, is comparatively smokeless and has higher heat generation efficiency.

16. Cow-dung, vegetable wastes and sewage are decomposed in the presence of oxygen to give bio-gas.
Ans:
Cow-dung, vegetable wastes and sewage are decomposed in the **absence** of oxygen to give bio-gas.

Reason and Assertion

1. **Assertion**: An alloy of lead and tin is used as a fuse wire for protecting the circuit and appliances
Reason: It has high resistance and low melting point
Does the reason satisfy the given assertion? If not, give the correct reason.

Ans:
Yes the reason satisfies the given assertion.

2. **Assertion:** The earth wire which has insulation of green color is usually connected to a metal plate deep in the earth near the house.
Reason: During the flow of any unduly high electric current the fuse wire melts and protects the circuits and appliances.
Does the reason satisfy the given assertion? If not, give the correct reason.

Ans:
No, the reason does not satisfy the given assertion.
The correct reason is as follows:
The earth wire is connected to a metal plate deep in the earth near the house. This is used as a safety measure, especially for those appliances that have a metallic body, for example, electric press, toaster, table fan, refrigerator, etc. The metallic body is connected to the earth wire, which provides a low-resistance conducting path for the current. Thus, it ensures that any leakage of current to the metallic body of the appliance keep its potential to that of the earth, and the user may not get a severe electric shock.

3. **Assertion:** Solar cookers and solar water heaters are coated black
Reason: A black surface absorbs more heat than any other surface under identical conditions.
Does the reason satisfy the given assertion? If not, give the correct reason.

Ans:
Yes the reason satisfies the given assertion.

4. **Assertion:** The fusion process can be carried out only at a extremely high temperature of the order of 10^7 K
Reason: Only at these very high temperatures the nuclei are able to overcome their mutual repulsion.
Does the reason satisfy the given assertion? If not, give the correct reason.

Ans:
Yes the reason satisfies the given assertion.

5. **Assertion:** Burning of fossil fuels has disadvantages
Reason: It leads to air pollution, acid rain and production of green house gases.
Does the reason satisfy the given assertion? If not, give the correct reason.

Ans:
Yes the reason satisfies the given assertion.

6. **Assertion:** Fire-wood and cow-dung are called bio-mass
Reason: These fuels are plant and animal products
Does the reason satisfy the given assertion? If not, give the correct reason.

Ans:
Yes the reason satisfies the given assertion

To raise questions

1. Fuse is an important component in all domestic circuits. Put forth questions to show the importance of fuse.
a) ---------- b) ----------

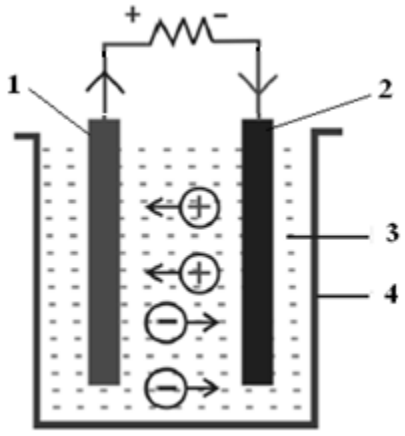
Ans:
a) Why do we use fuse in a circuit?
b) What is the composition of fuse wire?

2. The fossil fuels are non-renewable sources of energy. Put forth two questions.
a) ---------- b) ----------

Ans:
a) What are non-renewable sources of energy?
b) What are the disadvantages of burning fossil fuels?

Label the parts in the given diagram

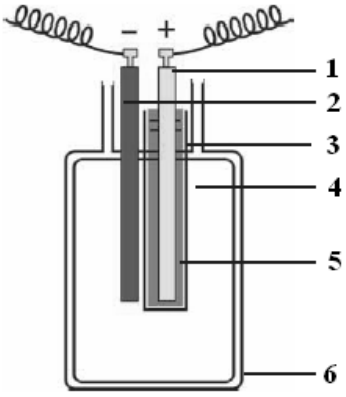
1. Voltaic cell



Ans:

1. Copper (Positive pole)
2. Zinc (Negative pole)
3. Dilute H_2SO_4
4. Glass vessel

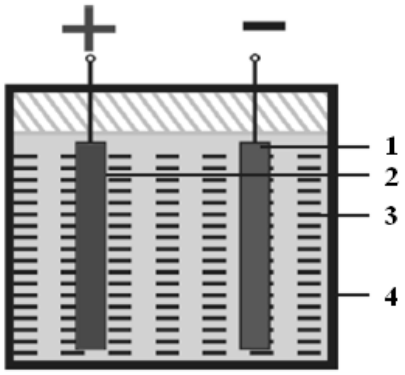
2. Laclanche cell



Ans:

1. Carbon rod (Positive pole)
2. Zinc rod (Negative pole)
3. Porous pot
4. Ammonium chloride solution (Electrolyte)
5. Mixture of carbon & Manganese dioxide
6. Glass vessel

3. Lead-acid accumulator

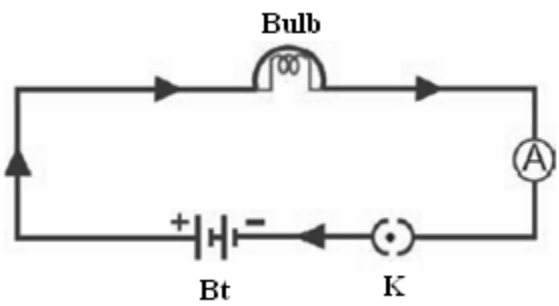


Ans:

1. Pb (Cathode) 2. Lead dioxide PbO_2 (Anode)
3. dilute H_2SO_4 (Electrolyte) 4. Glass / rubber container

4. Draw the schematic diagram of an electric circuit comprising of battery, bulb, ammeter and a plug key.

Ans:



Problems

1. A current of 0.75 A is drawn by a filament of an electric bulb for 10 minutes. Find the amount of electric charge that flows through the circuit.

Solution:
Given, I = 0.75 A, t = 10 minutes = 10 × 60 = 600 seconds

We know, Q = I × t
= 0.75 A × 600 s
Q = 450 C

2. How much work is done in moving a charge of 5 C across two points having a potential difference 10 V ?

Solution:
Given charge Q = 5 C, Potential difference V = 10 V

The amount of work done in moving the charge, W = V × Q
W = 10 V × 5C **= 50 J**

3. The potential difference between the terminals of an electric heater is 60 V when it draws a current of 5 A from the source. What current will the heater draw if the potential difference is increased to 120 V?

Solution:

Given the potential difference V = 60 V, Current I = 5 A

According to ohm's law, $R = \frac{V}{I}$

$$= \frac{60}{5} = 12\ \Omega$$

When the potential difference is increased to 120 V, the current is given by,

$$I = \frac{V}{R} = \frac{120}{12} = \mathbf{10\ A}$$

4. Two resistances 18 Ω and 6 Ω are connected to a 6 V battery in series. Calculate (a) the total resistance of the circuit, (b) the current through the circuit.

Solution:

(a) Given the resistance, $R_1 = 18\ \Omega$, $R_2 = 6\ \Omega$

The total resistance of the circuit $R_S = R_1 + R_2$

$$R_S = 18\ \Omega + 6\ \Omega = \mathbf{24\ \Omega}$$

(b) The potential difference across the two terminals of the battery V = 6 V

Now the current through the circuit, $I = \frac{V}{R_s} = \frac{6}{24} = \mathbf{0.25\ A}$

5. Three resistances having the values 5Ω, 10Ω, 30Ω are connected parallel with each other. Calculate the total circuit resistance.

Solution:

Given, $R_1 = 5\ \Omega$, $R_2 = 10\ \Omega$, $R_3 = 30\ \Omega$. These resistances are connected parallel

Therefore, $$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\frac{1}{R_p} = \frac{1}{5} + \frac{1}{10} + \frac{1}{30}$$

$$\frac{1}{R_p} = \frac{10}{30}$$

$$\therefore R_p = \mathbf{3\ \Omega}$$

6. A potential difference 20 V is applied across a 4 Ω resistor. Find the rate of production of heat.

Solution:
Given potential difference V = 20 V , The resistance R = 4 Ω, The time, t = 1 s

According to ohm's law, $I = \frac{V}{R}$

$$I = \frac{20}{4} = 5\,A$$

The rate of production of heat, $H = I^2 R\,t$

$$H = 5^2 \times 4 \times 1 = \mathbf{100\ J}$$

7. An electric bulb is connected to a 220 V generator. The current is 0.50 A. what is the power of the bulb?

Solution:
Electric generator
Voltage V = 220 V, the current I = 0.50 A

The power of the bulb, P = VI

$$= 220 \times 0.50 = \mathbf{110\ W}$$

8. Calculate the energy produced when 1 kg of substance is fully converted into energy.

Solution:
Mass, m = 1 kg, Velocity of light, $c = 3\times10^8\ m\ s^{-1}$

Energy produced, $E = mc^2$

$$E = 1 \times (3\times10^8)^2$$

$$\mathbf{E = 9 \times 10^{16}\ J}$$

Fill up the blanks from the given pair of answers

1. The cells in which the electrical energy is derived from the chemical reaction are called --------- (Electrolytic cells / Electrochemical cells)
Ans: Electrochemical cells

2. The rate of doing work is ---------- (Power / Acceleration)
Ans: Power

3. Solutions which conduct current are ---------- (Electrolytes / Non-electrolytes)
Ans: Electrolytes

4. ---------- energy of the wind can be used to do work (Potential / Kinetic)
Ans: Kinetic

5. Hydro power plants convert the ---------- energy of falling water into electricity. (Potential / Kinetic)
Ans: Potential

6. Wave energy plants converts the --------- energy possessed by huge waves near the sea-shore into electricity. (Potential / Kinetic)
Ans: Kinetic

7. Nuclear energy is generated during nuclear fission, when the nucleus of a heavy atom (such as uranium, plutonium or thorium) is bombarded with low-energy ---------- (neutrons / protons)
Ans: neutrons

8. Hydrogen bomb is based on the principle of ---------- (Nuclear fission / Nuclear fusion)
Ans: Nuclear fusion

9. Energy from nuclear reactor is due to ---------- (Nuclear fission / Nuclear fusion)
Ans: Nuclear fission

10. A fuse is connected in ---------- to the live wire (series / parallel)
Ans: series

Find the odd one out

1. Electric laundry iron, electric toaster, electric oven, electric bell, electric heater
Ans: electric bell
(Except electric bell other appliances are based on heating effect of electric current)

2. Daniel cell, Leclanche cell, Lead-acid accumulator
Ans: Lead-acid accumulator
(Daniel cell and Leclanche cell are primary cells, while Lead-acid accumulator is a secondary cell)

3. Tidal energy, wave energy, wind energy, ocean thermal energy
Ans: wind energy
(Except wind energy other energies are obtained from sea)

4. Hydro power plants, Wind energy, wave energy, Fossil fuels
Ans: Fossil fuels
(Fossil fuels are non-renewable sources of energy)

5. Fossil fuels, Thermal power plant, Hydro power plants, Solar energy
Ans: Solar energy
(Solar energy is a non-conventional source of energy)

Answer the following

1. What is an electric circuit?

A continuous and closed path of an electric current is called an electric circuit.

2. How do we express electric current?

Electric current is expressed by the amount of charge flowing through a particular area of cross section of a conductor in unit time.

3. Define ampere

When one coulomb of charge flows in one second across any cross section of a conductor, the current in it is one ampere.

4. Define the electric potential difference

The electric potential difference between two points in an electric circuit carrying current is defined as the work done to move a unit charge from one point to the other.

5. Define Volt

One volt is the potential difference between two points in a current carrying conductor when 1 joule of work is done to move a charge of 1 coulomb from one point to the other.

6. State Ohm's law

Ohm's law states that at constant temperature the steady current (I) flowing through a conductor is directly proportional to the potential difference (V) between its ends.

$$V \propto I \quad \text{(or)} \quad \frac{V}{I} = \text{constant.}$$

7. Define resistance

It is the property of a conductor to resist the flow of charges through it.

8. What is meant by heating effect of electric current?

If the electric circuit is purely resistive, the source energy continuously gets dissipated entirely in the form of heat. This is known as heating effect of electric current.

Heating effect of electric current has many useful appliances. The electric laundry iron, electric toaster, electric oven and electric heater are some of the familiar devices which use this effect.

9. State joules law of heating

$H=I^2 Rt$.

This is known as joules law of heating.

The law implies that heat produced in a resistor is

1) directly proportional to the square of current for a given resistance
2) directly proportional to the resistance for a given current, and
3) directly proportional to the time for which the current flows through the resistor.

10. What is the role of fuse?

A common application of joules heating is the fuse used in electric circuits. It consists of a piece of wire made of metal or an alloy (37% lead, 63% tin). It has high resistance and low melting point.

The fuse is connected in series with the device. During the flow of any unduly high electric current the fuse wire melts and protects the circuits and appliances.

11. What is meant by 'short circuiting?'

Over loading can occur when the live wire and the neutral wire come onto direct contact. In such a situation the current in the circuit abruptly increases. This is called short circuiting. The use of an electric fuse prevents the electric circuit and appliance from a possible damage by stopping the flow of unduly high electric current.

12. Define electric power

The rate of consumption of energy is termed as electric power.

The power P is given by, $P = VI$ **or** $P = I^2 R$ **or** $P = \frac{V^2}{R}$

The SI unit of electric power is watt (W).

13. Define watt

It is the power consumed by a device that carries 1 A of current when operated at a potential difference of 1 V. Thus,

1 W = 1 volt × 1 ampere

14. What is electrolysis?

The phenomenon of the conduction of electricity through electrolytes and chemical decomposition is called electrolysis.

15. What are primary cells?

The cells from which the electric energy is derived by irreversible chemical reaction are called primary cells.

16. What is the advantage of secondary cell?

The advantage of secondary cell is that they are rechargeable. The chemical reactions that take place in secondary cells are reversible.

17. What is meant by discharge and charging?

The chemical process of obtaining current from a secondary cell is called discharge. The process of reproducing active materials is called charging.

18. What are the qualities of good source of energy?

A good source of energy would be one

- Which would do a large amount of work per unit volume of mass
- Be easily accessible.
- Be easy to store and transport and
- Be economical.

19. What are disadvantages of burning fossil fuels?

Burning fossil fuels has disadvantages like air pollution, acid rain and production of green house gases.

20. What are the advantages of solar cell?

The principal advantages associated with solar cells are that they have no moving part, require little maintenances. Another advantage is that they can be set up in remote areas in which laying of power transmission line may be expensive.

21. Define radioactivity

The phenomenon of spontaneous emission of highly penetrating radiations such as α, β, and γ rays by heavy elements having atomic number greater than 82 is called radioactivity and the substances which emit these radiations are called radioactive elements.

22. What is nuclear fission?

The process of breaking up of the nucleus of a heavier atom into two fragments with the release of large amount of energy is called nuclear fission. The fission is accompanied of the release of neutrons.

The fission reaction with $_{92}U^{235}$ is represented as

$$_{92}U^{235} + {}_{0}n^{1} \rightarrow {}_{56}Ba^{141} + {}_{36}Kr^{92} + 3{}_{0}n^{1} + 200 \text{ Me V}$$

23. What is nuclear fusion?

Nuclear fusion is a process in which two or more lighter nuclei combine to form a heavier nucleus.

24. The fusion process can be carried out only at a extremely high temperature. Why?

The fusion process can be carried out only at a extremely high temperature of the order of 10^7 K because, only at these very high temperatures the nuclei are able to overcome their mutual repulsion. So, the nuclear fusion reactions are known as **thermo nuclear reactions**.

25. Write note on hydrogen bomb

A suitable assembly of neutron and deuteron and triton is arranged at the sight of the explosion of the hydrogen bomb. Favorable temperature initiates the fusion of light nuclei in an uncontrolled manner. This releases enormous amount of heat energy. This is the hydrogen bomb.

The fusion reaction in the hydrogen bomb is

$$_{1}H^{2} + {}_{1}H^{3} \rightarrow {}_{2}He^{4} + {}_{0}n^{1} + \text{Energy}$$

26. Write note on hazards of nuclear energy

α, β and γ radiations are all ionizing radiations. These radiations cause a change in the structure of molecules in cells, disturbs the normal functioning of the biological system.

The extent to which the human organism is damaged depends upon

1. The dose and the rate at which the radiation is given and
2. The part of the body exposed to it. The damage may be either pathological or genetic.

27. What are the precautions to be taken for those, who are working in radiation laboratories?

1. Radioactive materials are kept in thick-walled lead container.
2. Lead aprons and lead gloves are used while working in hazardous area.
3. A small micro-film badge is always worn by the person and it is checked periodically for the safety limit of radiation.
4. Nuclear devices can be operated using remote control system.
5. Clean up contamination in the work area promptly.

28. What is meant by tidal energy?

Due to the gravitational pull of mainly the moon on the spinning earth, the level of the water in the sea rises and falls. The phenomenon is called high and low tides and the difference in sea-levels gives us tidal energy.

29. What is meant by wave energy?

The waves are generated by strong winds blowing across the sea. The kinetic energy possessed by huge waves near the sea-shore can be trapped to generate electricity.

30. What is meant by ocean thermal energy?

The water at the surface of the sea or ocean is heated by the sun while the water in deeper sections is relatively cooled. This difference in temperature is exploited to obtain energy in ocean-thermal-energy conversion plants.

31. How is bio-gas produced?

Cow-dung, various plant materials like the residue after harvesting the crops, vegetable wastes and sewage are decomposed in the absence of oxygen to give bio-gas.

Since the starting material is mainly cow-dung, it is popularly known as '**gobar-gas'.**

17. MAGNETIC EFFECT OF ELECTRIC CURRENT AND LIGHT

Textbook questions

PART – A

1. The magnification produced by a mirror is 1/3, then the type of mirror is (concave, convex, plane)
   Ans: convex

2. An electric current through a metallic conductor produces ---------- around it.
   (heat, light, magnetic field, mechanical force)
   Ans: magnetic field

3. The field of view is maximum for (plane mirror, concave mirror, convex mirror)
   Ans: convex mirror

4. An object is placed 25 cm from a convex lens whose focal length is 10 cm. The image distance is ---------- (50 cm, 16.66 cm, 6.66 cm, 10 cm)
   Ans: 16.66 cm

PART – B

1. From the following statement write down that which is applicable to a commutator.
   a) galvanometer uses commutator for deadbeat
   b) transformer uses commutator to step up voltage
   c) mototr uses commutator to reverse the current

   Ans: mototr uses commutator to reverse the current

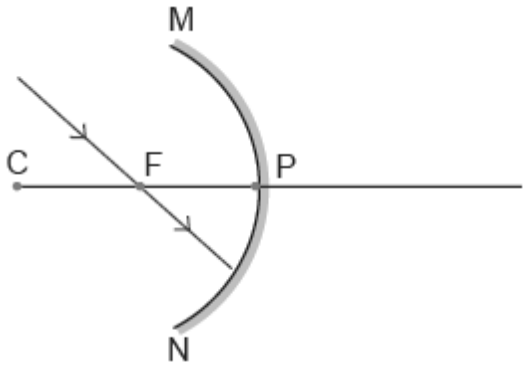
2. Fill in the blanks
   a) For a motor: a permanent magnet, then commercial motor : ----------
   b) Focal length of a lens; meter, then for power of a lens ----------

   Ans: a) Electromagnet b) Dioptre

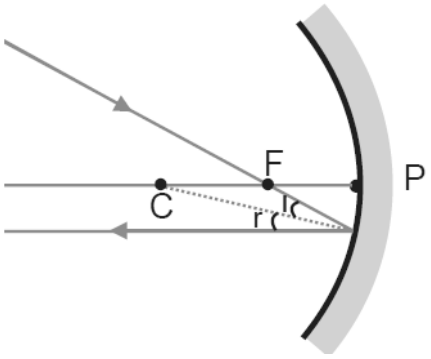
3. Correct the mistakes, if any, in the following statements.
   a) Magnetic field is a quantity that has magnitude only.
   b) The magnetic field lines emerge from the south pole and merge at the north pole.

   Ans:
   a) Magnetic field is a quantity that has **magnitude and direction**.
   b) The magnetic field lines emerge from the **north pole** and merge at the **south pole**.

4. The ray diagram shown below is introduced to show how a concave mirror forms an image of an object.
a) identify the mistake and draw the correct ray diagram.
b) Write the justifications for your corrections.



Ans:
a)



b) A ray passing through the principal focus of a concave mirror, after reflection, will emerge parallel to the principal axis. The emergent ray is not marked in the given diagram.

5. In traffic signals ---------- colour light is used to stop vehicles because it is having ---------- wave length.
Ans: Red, larger

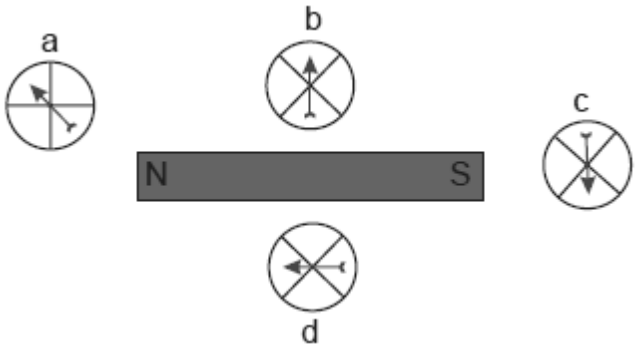
6. Considering this write down the names of the parts in human eye.
a) Dark muscular diaphragm that controls the pupil.
b) The screen at where the image is formed by eye lens.

Ans: a) Iris b) Retina

7. You know that myopia is a common refractive defects of vision. Person with this defect can see only nearby objects clearly. Using concave lens of suitable power this defect is corrected.
a) mention other two types of defects like this.
b) explain how can we correct it.

Ans: a) Hypermetropia or far sightedness and presbyopia
b) Hypermetropia is corrected by using convex lens. Presbyopia is corrected by using bifocal lens.

8. (a) Which of the compass needle orientations in the following diagram might correctly describe the magnet's field at that point?



Ans: a

(b) To an astronaut sky appears dark instead of blue. Give the reason.

Ans:

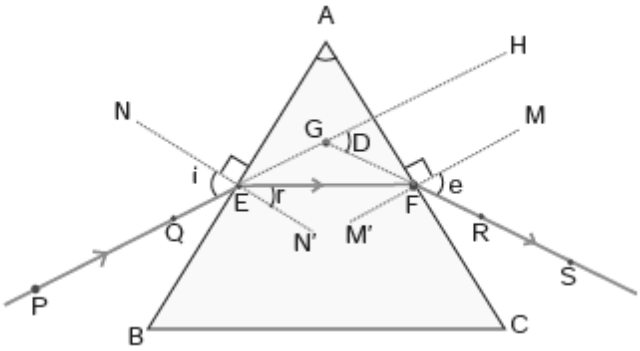
The sky appears dark instead of blue to an astronaut because there is no atmosphere containing air in the space to scatter sunlight. As there is no scattered light to reach eyes in outer space, the sky appears dark.

PART – C

1. (a) Label the following in the given diagram given below.

a) Incident ray b) Refracted ray c) Emergent ray d)Angle of refraction

e) Angle of deviation f) Angle of emergence



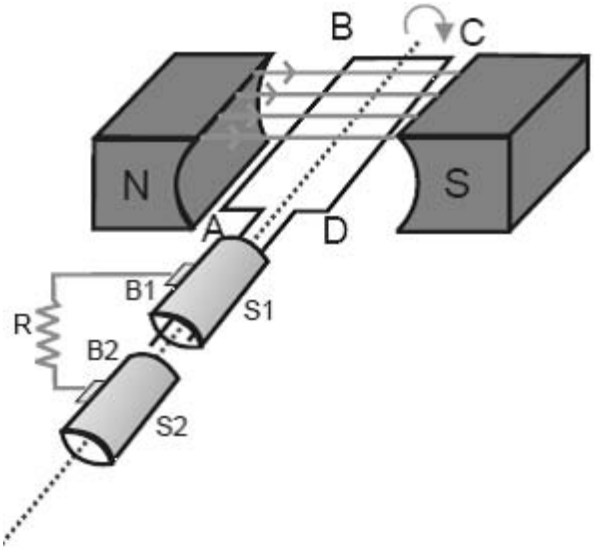
PE – Incident ray	∠ i – Angle of incident
EF – Refracted ray	∠ r – Angle of refraction
FS – Emergent ray	∠ e– Angle of emergence
	∠ A – Angle of the prism
	∠ D – Angle of deviation

(b) The refractive index of diamond is 2.42. What is the meaning of this statement in relation to speed of light?

Ans:

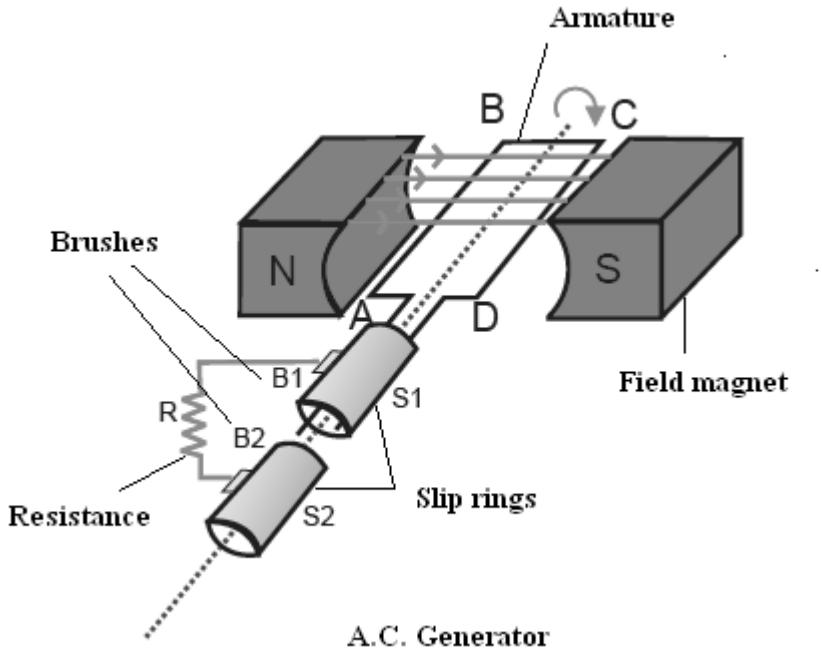
Refractive index of diamond is 2.42. This means that the speed of light in diamond is 2.42 times slower than the speed of light in air.

2.



a) Re draw the above diagram.
b) This diagram represents ----------
c) Label the parts of the diagram.
d) Write the principle of the device denoted by this diagram.

Ans:
a) & c)



b) A.C. Generator

d) Electromagnetic induction

Additional questions

1 MARK

1. The pattern of magnetic field lines due to a straight current carrying conductor is
   a) elliptical b) straight lines **c) concentric circles** d) none of these

2. ---------- is used for making armature
   a) soft iron b) steel c) aluminium d) copper

3. For spherical mirrors of small apertures the radius of curvature and focal length are related as
   a) R = 2f b) R = f / 2 c) R = 4 f d) none of these

4. The bottom of a tank or a pond containing water appears to be raised. This is due to
   a) reflection **b) refraction** c) dispersion d) none of these

   Examples for refraction:
   - When a thick glass slab is placed over some printed matter, the letters appear raised when viewed through the glass slab.
   - A pencil partially immersed in water in a glass tumbler appears to be displaced at the interface of air and water.
   - The apparent position of the coin as seen through water differ from its actual position.
   - A lemon kept in water in a glass tumbler appears to be bigger than its actual size, when viewed from the sides.

5. Light travels the fastest in vacuum with the highest speed of
   a) 3×10^8 m s^{-1} b) 3×10^{10} m s^{-1} c) 3×10^3 m s^{-1} d) 3×10^6 m s^{-1}

6. 1 dioptre is the power of a lens whose focal length is
   a) 1 cm **b) 1 meter** c) 10 cm d) 10 m

7. In human eye image is formed on a light sensitive screen called
   a) cornea **b) retina** c) iris d) none of these

8. Light enters the eye through the thin membrane called
   a) cornea b) retina c) iris d) none of these

9. ---------- forms the transparent bulge on the front surface of the eye ball
   a) cornea b) retina c) iris d) none of these

10. The human eye ball is approximately spherical in shape with a diameter of about ----------
    a) 3.2 cm **b) 2.3 cm** c) 4.3 cm d) 1.2 cm

11. ---------- provides the finer adjustment of focal length required to focus objects at different distances on the retina.
    a) iris b) cornea **c) crystalline lens** d) retina

12. ---------- is a dark muscular diaphragm that controls the pupil.
    a) Retina b) Cornea **c) Iris** d) none of these

13. ---------- regulates and controls the amount of light entering the eye.
a) pupil b) retina c) lens d) iris

14. The eye lens forms an ---------- image of the object on the retina.
a) inverted, real b) erect, real c) inverted, virtual d) erect, virtual

15. The least distance of distinct vision is ----------
a) 25 m **b) 25 cm** c) 15 cm d) 20 cm

16. The near point of normal eye is ----------
a) 25 m **b) 25 cm** c) 15 cm d) 20 cm

17. The far point of normal eye is ----------
a) 25 m b) 25 cm **c) infinity** d) 20 cm

18. ---------- mirrors are used in Hubble telescope
a) concave b) convex **c) hyperbolic** d) plane

2 MARK

Fill up the blanks using the given pair of answers

1. a) ---------- is known for the study of electromagnetism (Oersted / Ampere)
Ans: Oersted

b) ---------- suggested that the magnet must also exert an equal and opposite force on the current carrying conductor. (Ampere / Fleming)
Ans: Ampere

2. a) ---------- discovered that an electro motive force is produced in a circuit whenever the magnetic flux linked with a coil changes. (Faraday / Fleming)
Ans: Faraday

b) ---------- made an important breakthrough by discovering how a magnet can be used to generate electric currents. (Ampere / Faraday)
Ans: Faraday

3. The phenomenon of ---------- is employed to produce large currents for use in homes and industry. (electromagnetic induction / Joules law of heating)
Ans: electromagnetic induction

4. To get a direct current (DC), a ---------- ring type commutator must be used. (slip / split)
Ans: split

5. Refraction of light is due to change in the ---------- of light as it enters from one transparent medium to another. (wavelength / speed)
Ans: speed

6. In electric motor ---------- acts as a commutator. ((split ring / slip ring)
Ans: split ring

7. The phenomenon of electromagnetic induction is employed in ----------
(Electric motor / Electric generator)
Ans: Electric generator

8. Magnetic field is a ---------- quantity (scalar / vector)
Ans: vector

9. a) ---------- mirrors are used as rear-view mirrors in vehicles.(Convex / Concave)
Ans: Convex

b) Speed of light ---------- in glass. (increases / reduces)
Ans: reduces

10. The twinkling of stars is an effect of ---------- (reflection / atmospheric refraction)
Ans: atmospheric refraction

11. Wavering or flickering of objects when seen through a turbulent stream of hot air rising above a fire is an effect of ---------- (reflection / atmospheric refraction)
Ans: atmospheric refraction

12. ---------- mirror always forms virtual and diminished image (Convex / Concave)
Ans: Convex

13. ---------- lens always forms virtual and diminished image (Convex / Concave)
Ans: Concave

14. Rainbow is caused due to ---------- (reflection / dispersion)
Ans: dispersion

Spot the error in the following statements

1. The direction of magnetic field produced by the electric current does not depend upon the direction of flow of current.
Ans:
The direction of magnetic field produced by the electric current **depends** upon the direction of flow of current.

2. The magnitude of the magnetic field produced at a given point increases as the current through the wire, decreases.
Ans:
The magnitude of the magnetic field produced at a given point increases as the current through the wire, **increases**.

3. The magnetic field produced by the given current in the conductor increases as the distance from it increases.
Ans:
The magnetic field produced by the given current in the conductor **decreases** as the distance from it increases.

4. The magnetic field lines are straight lines. Two field lines are found to cross each other
Ans: The magnetic field lines are **closed curves**. **No** two field lines are found to cross each other

5. An electric motor is a rotating device that converts mechanical energy in to electrical energy
Ans:
An electric motor is a rotating device that converts **electrical energy in to mechanical energy**

6. The direction of force on the current carrying conductor when it is placed on a magnetic field can be found by Fleming's right hand rule
Ans: The direction of force on the current carrying conductor when it is placed on a magnetic field can be found by Fleming's **left** hand rule

7. The direction of the induced current can be found using Fleming's left hand rule.
Ans:
The direction of the induced current can be found using Fleming's **right** hand rule.

8. In an electric generator, electricity is used to rotate a conductor in a magnetic field to produce mechanical energy.
Ans:
In an electric generator, **mechanical energy** is used to rotate a conductor in a magnetic field to produce **electricity.**

9. We can see a full length image of a tree (or object) in a small concave mirror.
Ans: We can see a full length image of a tree (or object) in a small **convex** mirror.

10. The power of a convex lens is negative and that of a concave lens is positive.
Ans:
The power of a convex lens is **positive** and that of a concave lens is **negative.**

11. When white light is passed through a prism, the green light bends the least while the red the most.
Ans:
When white light is passed through a prism, the **red** light bends the least while the **violet** the most.

Odd one out

1. a) Myopia, hypermetropia, scurvy, presbyopia
Ans: scurvy

2. Convex mirror, concave mirror, plane mirror, convex lens
Ans: convex lens

3. Torch, search light, vehicles head light, rear-view mirrors in vehicles.
Ans: rear-view mirrors in vehicles

Assertion and Reason

1. **Assertion (A):** If there is a circular coil having *n* turns, the magnetic field produced is *n* times as large as produced by a single turn.
   Reason (R): This is because the current in each circular turn has the same direction, and the field due to each turn then just adds up.
   a) **A** is right **R** is wrong
   b) **A** is wrong **R** is right
   c) **A** is right and **R** explains **A**
   d) Both **A** and **R** are wrong

   Ans: c) **A** is right and **R** explains **A**

2. **Assertion (A):** A lemon kept in water in a glass tumbler appears to be bigger than its actual size, when viewed from the sides.
   Reason (R): This due to refraction of light
   a) **A** is right **R** is wrong
   b) **A** is wrong **R** is right
   c) **A** is right and **R** explains **A**
   d) Both **A** and **R** are wrong

   Ans: c) **A** is right and **R** explains **A**

Answer the following

1. Define magnetic field

The region surrounding the magnet, in which the force of the magnet can be detected, is called magnetic field.

2. State Fleming left hand rule

Stretch the thumb, fore finger and middle finger of your left hand such that they are mutually perpendicular. If the forefinger points in the direction of magnetic field and the middle finger points in the direction of current, then the thumb will point in the direction of motion or the force acting on the conductor.

3. What is an electrical motor?

An electric motor is a rotating device that converts electrical energy in to mechanical energy

4. What changes are to be done to increase the power of commercial motor?

The commercial motors use

1. an electro magnet in place of permanent magnet;
2. large number of turns of the conducting wire in the current-carrying coil, and
3. a soft iron core on which the coil is wound . The soft iron core, on which the coil is wound, plus the coils, is called an armature. This enhances the power of the motor.

5. What is electromagnetic induction?

Electromotive force (emf) is generated in a conductor whenever there is a relative motion between the conductor and a magnetic field. The emf produced in this way is called an induced emf and the phenomenon is known as electromagnetic induction.

6. What is meant by induced current?

Electromotive force (emf) is generated in a conductor whenever there is a relative motion between the conductor and a magnetic field. The emf produced in this way is called an induced emf. The induced emf will cause a current to flow through the conductor. Such a current is known as induced current.

7. State Fleming's right hand rule

The direction of the induced current can be found using Fleming's right hand rule.

Stretch the thumb, forefinger and middle finger of right hand so that they are perpendicular to each other. If the forefinger indicates the direction of the magnetic field and the thumb shows the direction of motion of conductor, then the middle finger will show the direction of induced current.

8. What is meant by alternating current?

Current which changes direction after equal intervals of time, is called an alternating current (AC).

9. How can you convert an AC generator into DC generator?

AC generator can be converted into DC generator by replacing slip ring in AC generator with a split ring type commutator.

10. What is the advantage of AC over DC?

An important advantage of AC over DC is that electric power can be transmitted over long distances without much loss of energy.

11. What is a commutator?

A device that reverses the direction of flow of current through a circuit is called a commutator.

12. Why is split ring used in D.C generator?

When slip rings are used alternating current is produced. In order to produce direct current split ring is used in D.C generator.

13. Write the differences between A.C generator and D.C generator

No.	A.C generator	D.C generator
1	A.C generator produces an alternating current (change in the direction of current)	D.C generator produces unidirectional current
2	Two slip rings are used	Split ring typecommutator is used

14. Distinguish between Motor and Generator

No.	Motor	Generator
1	Motor converts electrical energy into mechanical energy	Generator converts mechanical energy into electrical energy
2	It is based on Fleming's left hand rule	It is based on Fleming's right hand rule

15. Write the differences between AC and DC

No.	Alternating current	Direct current
1	AC changes direction after equal intervals of time	DC is unidirectional current
2	AC can be transmitted over long distances without much loss of energy.	Transmission of DC over long distances involves heavy loss of energy

16. Write the mirror formula

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

Where, v = image distance, u = object distance, f = focal length

17. State the laws of reflection of light.

1. The angle of incidence is equal to the angle of reflection.
2. The incident ray, the normal to the mirror at the point of incidence and the reflected ray, all lie in the same plane.

18. What is concave mirror?

A spherical mirror whose reflecting surface is curved inwards is called a concave mirror.

19. What is convex mirror?

A spherical mirror whose reflecting surface is curved outwards is called a convex mirror.

20. Define pole of spherical mirror

The centre of the reflecting surface of a spherical mirror is a point, called the pole.

21. Define centre of curvature of spherical mirror

The reflecting surface of a spherical mirror forms a part of a sphere. This sphere has a centre. This point is called the centre of curvature of the spherical mirror. .

22. Define radius of curvature of spherical mirror

The radius of the sphere of which the reflecting surface of a spherical mirror forms a part, is called the radius of curvature of the mirror.

23. Define principle axis of spherical mirror

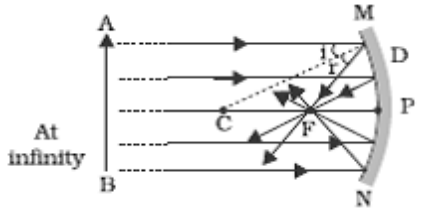
The straight line passing through the pole and the centre of curvature of a spherical mirror is called the principle axis.

24. When sunlight is directed by a concave mirror onto a paper, the paper catches fire. Why?

The light from the sun is converged at a point, as a sharp, bright spot by the concave mirror. This point is the focus of the concave mirror. The heat produced due to the concentration of the sunlight ignites the paper.

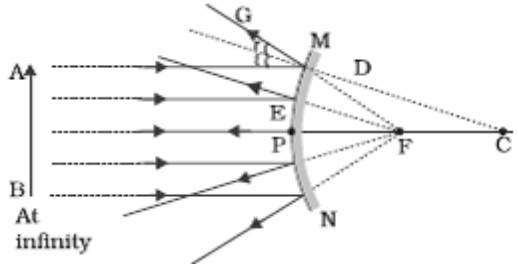
25. What is meant by principal focus of the concave mirror?

The rays parallel to the principal axis of the concave mirror are reflected and they are all meeting at a point on the principal axis of the mirror. This point is called the principal focus of the concave mirror.



26. What is meant by principal focus of the convex mirror?

The rays parallel to the principal axis of the convex mirror are reflected and the reflected rays appear to come from a point on the principal axis. This point is called the principal focus of the convex mirror.



27. Write the uses of concave mirror

1. Concave mirrors are commonly used in torches, search-lights and vehicles head lights to get powerful parallel beams of light.
2. They are used as shaving mirrors to see a lager image of the face.
3. The dentists use concave mirrors to see large images of the teeth of patients.
4. Large concave mirrors are used to concentrate sun light to produce heat in solar furnaces.

28. Write the uses of convex mirrors

Convex mirrors are commonly used as rear-view mirrors in vehicles. These mirrors are fitted on the sides of the vehicle, enabling the driver to see traffic behind him/her to facilitate safe driving. Convex mirrors are preferred because they always give an erect image. Also they have a wider field of view as they are curved outwards.

29. What is meant by the focal length of spherical mirror?

The distance between the pole and the principal focus of a spherical mirror is called the focal length.

30. What is meant by aperture of spherical mirror?

The diameter of the reflecting surface of spherical mirror is called its aperture.

31. A pencil partially immersed in water in a glass tumbler appears to be displaced at the interface of air and water. Give reason

The light reaching you from the portion of the pencil inside water seems to come from a different direction, compared to the part above water. This makes the pencil appear to be displaced at the interface.

32. What is meant by refraction of light?

Light does not travel in the same direction in all media. It appears that when traveling obliquely from one medium to another, the direction of propagation of light in the second medium changes. This phenomenon is known as refraction of light.

33. Write the laws of refraction

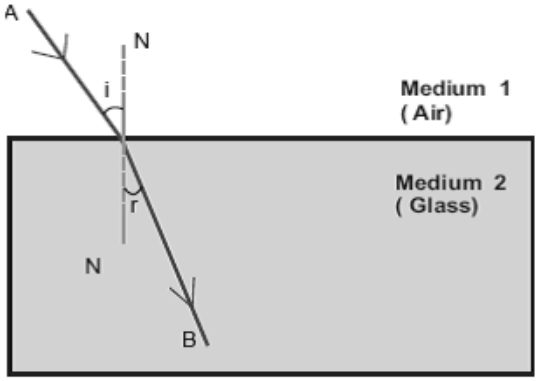
1. The incident ray, the refracted ray and the normal to the interface of two transparent media at the point of incidence, all lie in the same plane.
2. The ratio of sine of angle of incidence to the sine of angle of refraction is a constant, for the light of a given colour and for the given pair of media. This law is also known as **Snell's law** of refraction.

   If i is the angle of incidence and r is the angle of refraction, then,

$$\frac{\text{Sin } i}{\text{Sin } r} = \text{constant}$$

This constant value is called the refractive index of the second medium with respect to the first.

34. From the diagram given below, relate the refractive index with relative speed of propagation of light in different media.



The refractive index of the second medium with respect to the first $\mu = \dfrac{\text{Sin } i}{\text{Sin } r}$

$$\mu = \frac{\text{Speed of light in air}}{\text{Speed of light in medium 2}}$$

35. Define lens

A transparent material bound by two surfaces, of which one or both surfaces are spherical, forms a lens. This means that a lens is bound by at least one spherical surface.

36. What is a convex lens?

A lens which has two spherical surfaces, bulging outward is called a double convex lens. It is simply called a convex lens.

It is thicker at the middle as compared to the edges.

Convex lens converges light rays. Hence it is called converging lens.

37. What is a concave lens?

A lens which has two spherical surfaces, curved inwards is called double concave lens. It is simply called a concave lens.

It is thicker at the edges than at the middle.

Concave lenses diverge light rays and are called diverging lenses.

38. Define centre of curvature of lens

A lens has two spherical surfaces. Each of these surfaces forms a part of a sphere. The centers of these spheres is called centre of curvature of the lens.

39. Define principal axis of lens

An imaginary straight line passing through the two centre of the curvature of a lens is called its principal axis.

40. Define optic centre of lens

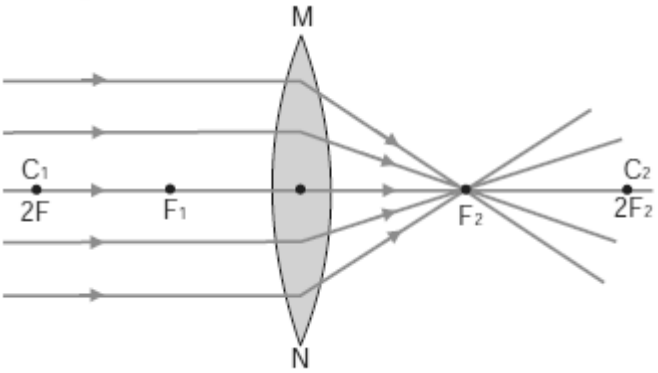
The central point of a lens is called its optical centre. A ray of light through the optical centre of a **lens passes without suffering any deviation**.

41. Define aperture of lens

The effective diameter of the circular outline of a spherical lens is called its aperture. Lenses whose aperture is much less than its radius of curvature are called thin lenses.

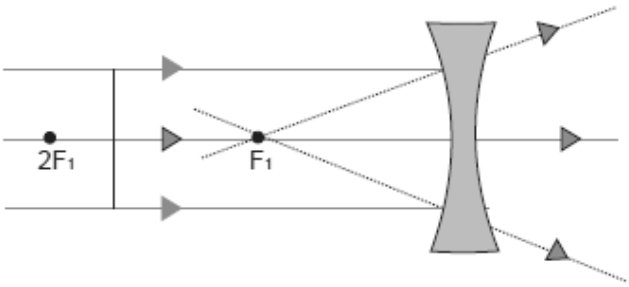
42. Define the principal focus of the convex lens

Several rays of light parallel to the principal axis are falling on a convex lens. These rays after refraction from the lens are converging to a point on the principal axis. This point is called the principal focus of the convex lens.



43. Define the principal focus of the concave lens

Several rays of light parallel to the principal axis are falling on a concave lens. These rays after refraction from the lens are appearing to diverge from a point on the principal axis. This point is called the principal focus of the concave lens.



44. Define focal length of lens

The distance of the principal focus from the optical centre of a lens is called its focal length.

45. What happens when sunlight is focused on a sheet of paper using convex lens?

The light from the sun constitutes parallel rays. These rays are converged by the convexlens as a sharp bright spot. This is the real image of the sun. The concentration of the sun light at this spot generates heat. This causes the paper to burn.

46. Define 'Magnification produced by a lens'

The magnification produced by a lens is defined as the ratio of the height of the image to the height of the object.

$$m = \frac{\text{Height of the image}}{\text{Height of the object}} = \frac{v}{u}$$

47. Define the power of lens

The power of a lens is defined as the reciprocal of its focal length.
The power P of a lens of focal length f is given by

$$P = \frac{1}{f}$$

The SI unit of power of a lens is 'dioptre'. It is denoted by the letter D.

If f is expressed in meter, then, power is expressed in dioptres.

48. What is dispersion?

The splitting of light into its component colours is called dispersion.

49. What is spectrum?

The band of the coloured component of a light beam is called its spectrum.

50. White light is dispersed into its seven-colour components by a prism. Why do we get these colours?

Different colours of light bend through different angles with respect to the incident ray as they pass through the prism. The red light bends the least while the violet the most. Thus the rays of each colour emerge along different paths and thus become distinct. It is the band of distinct colours that we see in a spectrum.

51. Give the reason for the apparent random wavering or flickering of objects when seen through a turbulent stream of hot air rising above a fire.

The air just above the fire becomes hotter than the air further up. The hotter air is lighter (less dense) than the cooler air above it, and has a refractive index slightly less than that of the cooler air. Since the physical conditions of the refracting medium (air) are not stationary, the apparent position of the object, as seen through the hot air fluctuates. This wavering is thus an effect of atmospheric refraction (refraction of light by the earth's atmosphere) on a small scale in our local environment.

52. How do we perceive objects as they are?

The light sensitive cells get activated upon illumination and generate electrical signals. These signals are sent to the brain via the optic nerves. The brain interprets these signals, and finally, processes the information so that we perceive objects as they are.

Match the following

1.

1	Motor	Fleming's right hand rule
2	Generator	Fleming's left hand rule
3	Commutator	Oersted
4	Electromagnetism	Reverses the direction of current flow

Ans:

1	Motor	Fleming's left hand rule
2	Generator	Fleming's right hand rule
3	Commutator	Reverses the direction of current flow
4	Electromagnetism	Oersted

2.

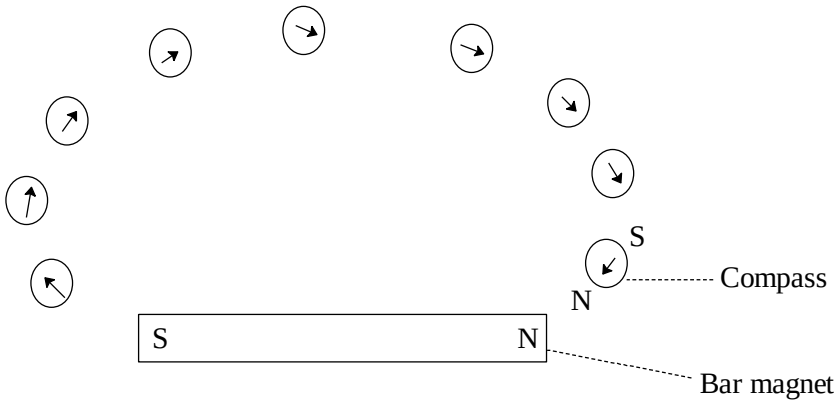
1	Myopia	Convex lens
2	Hypermetropia	Concave lens
3	Presbyopia	Hyperbolic mirrors
4	Hubble' telescope	By-focal lenses

Ans:

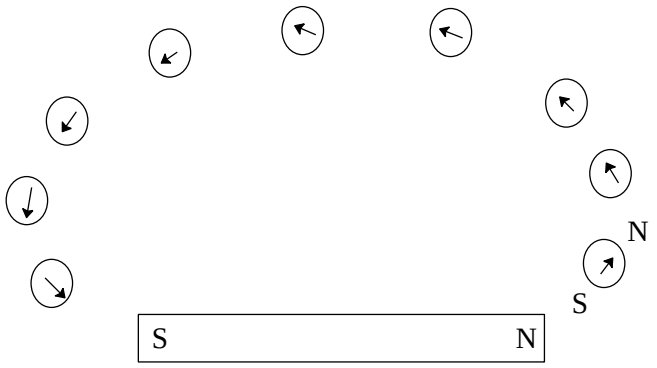
1	Myopia	Concave lens
2	Hypermetropia	Convex lens
3	Presbyopia	By-focal lenses
4	Hubble' telescope	Hyperbolic mirrors

Diagram based questions

1. a) Correct the mistakes in the following diagram

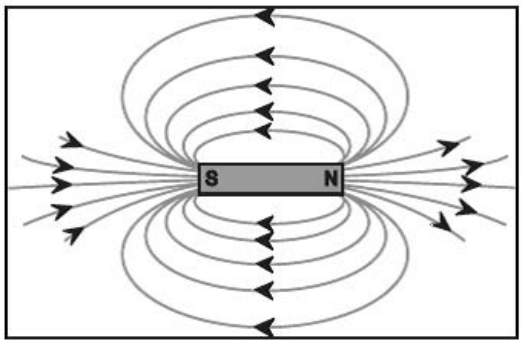


The south pole of the compass needle points towards the north pole of the magnet. The north pole of the compass is directed away from the north pole of the magnet.
The magnetic field lines emerge from the north pole and merge at the south pole.



b) The deflection of the compass needle ---------- as the needle is moved towards the pole.
Increases

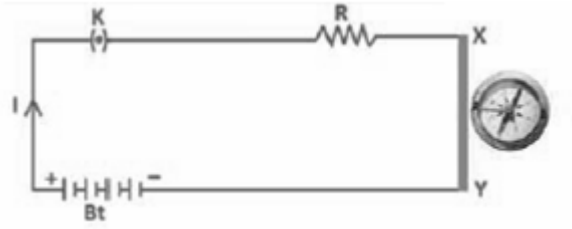
2. a) Draw the diagram showing magnetic field lines around the bar magnet



b) Write the characteristics of magnetic field lines

1. The field lines emerge from the north pole and merge at the south pole.
2. Inside the magnet, the direction of field lines is from its south pole to its north pole.
3. The magnetic field lines are closed curves.
4. No two field-lines are found to cross each other.

3.

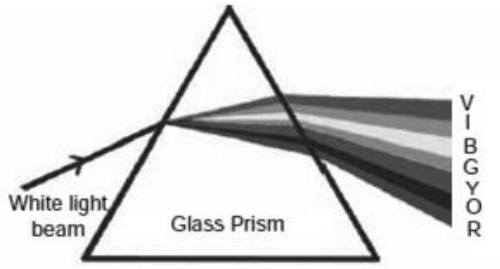


In the above diagram, XY is a current carrying conductor (thick copper wire). It is kept perpendicular to the plane of the paper.
What do you observe when a compass is placed horizontally near the copper wire?

Ans:

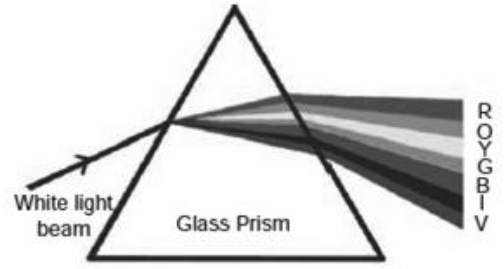
1. Electric current through a metallic conductor produces a magnetic field around it.
2. If the current flows from X to Y, the north pole of the compass needle would move towards the east.
3. If the current flows in opposite direction (from Y to X), the compass needle moves in opposite direction, that is towards the west.
4. It means that the direction of magnetic field produced by the electric current depends upon the direction of flow of current.

4. Correct the mistake in the diagram given below

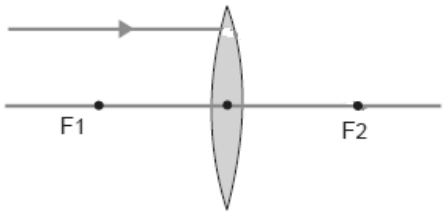


Ans:

When white light is passed through a prism, the red light bends the least while the violet the most.

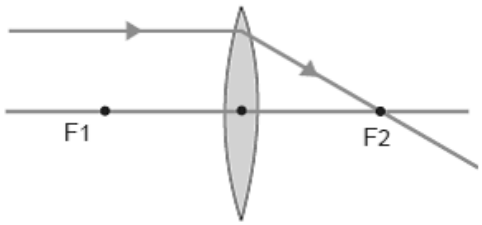


5. Complete the ray diagram

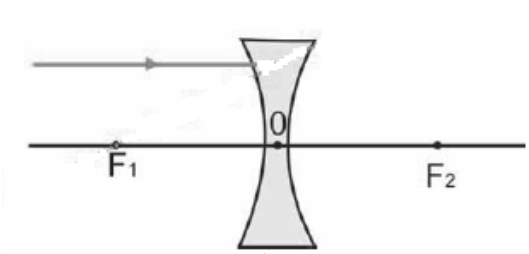


Ans:

A ray of light from the object, parallel to the principal axis, after refraction from a convex lens, passes through the principal focus on the other side of the lens.

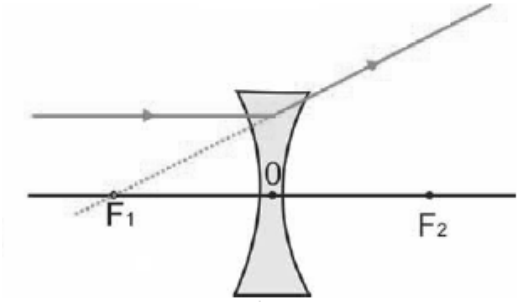


6. Complete the ray diagram

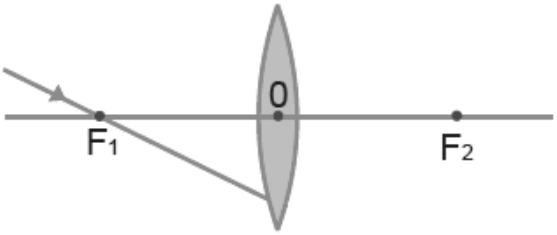


Ans:

A ray of light from the object, parallel to the principal axis, after refraction from a concave lens, appears to diverge from the principal focus located on the same side of the lens

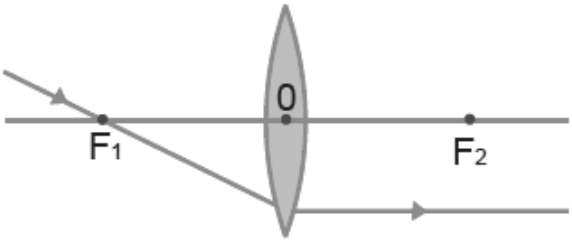


7. Complete the ray diagram

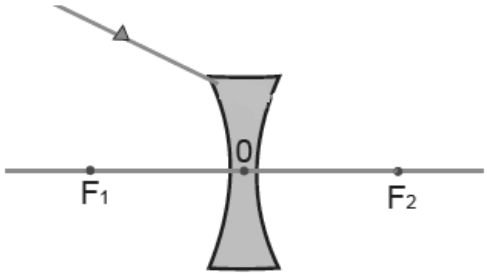


Ans:

A ray of light passing through a principal focus after refraction from a convex lens will emerge parallel to the principal axis.

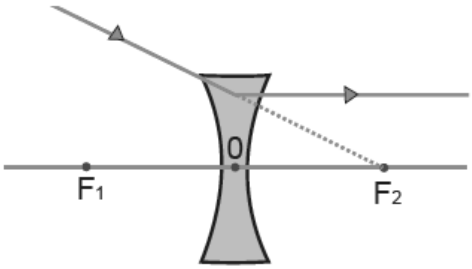


8. Complete the ray diagram

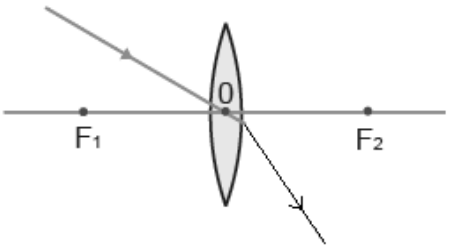


Ans:

A ray of light appearing to meet at the principal focus of a concave lens, after refraction, will emerge parallel to the principal axis.

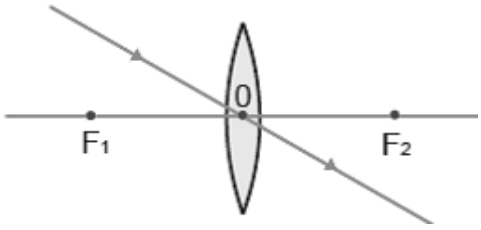


9. Correct the mistake and complete the ray diagram

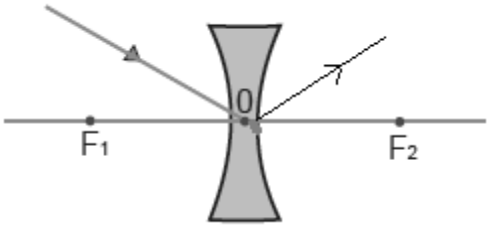


Ans:

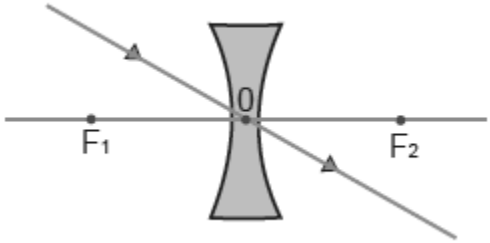
A ray of light passing through the optical centre of a lens will emerge without any deviation.



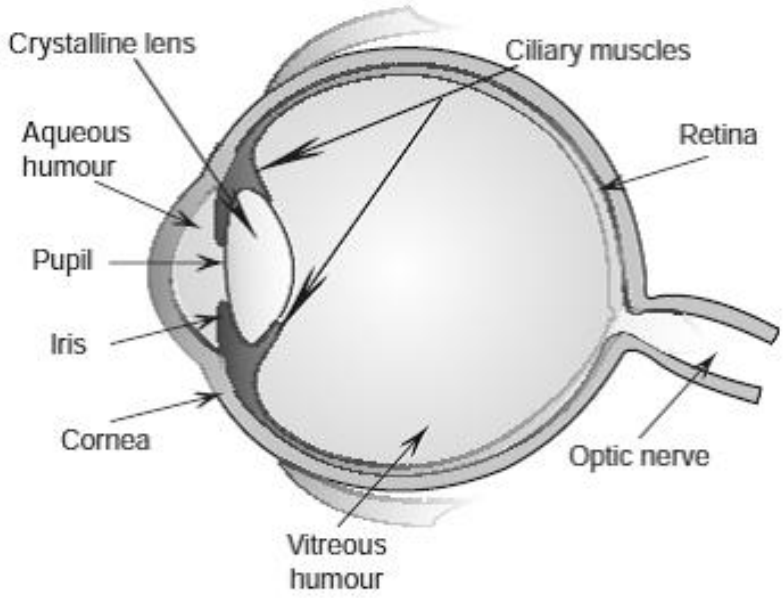
10. Correct the mistake and complete the ray diagram



Ans:
A ray of light passing through the optical centre of a lens will emerge without any deviation.



11. Draw the diagram of human eye and label the parts



Problems

1. A convex mirror used for rear-view on an automobile has a radius of curvature of 3 m. If a bus is located at 5 m from this mirror, find the position and nature of the image.

Solution:

Radius of curvature, R = +3.00 m

Object distance u = – 5.00 m

Image distance v = ?

Focal length ,

$f = \frac{R}{2} = \frac{+3}{2} = 1.5$ m

We know,

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

Where, v = image distance, u = object distance, f = focal length

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

$$\frac{1}{v}=\frac{1}{1.5}-\frac{1}{-5}$$

$$=\frac{1}{1.5}+\frac{1}{5}$$

$$=\frac{6.5}{7.5}$$

$$\therefore v=\frac{7.5}{6.5}=1.15 \text{ m}$$

The image is 1.15 m at the back of the mirror. The image is virtual.

2. A concave lens has focal length of 15 cm. At what distance should the object from the lens be placed so that it forms an image 10 cm from the lens?

v = –10 cm, f = – 15 cm, u = ?

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

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

$$\frac{1}{u}=\frac{1}{-10}-\frac{1}{-15}$$

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

u = –30 cm

Thus, the object distance is 30 cm.

3. An object is placed at a distance of 30 cm from a concave lens of focal length 15 cm. An erect and virtual image is formed at a distance of 10 cm from the lens. Calculate the magnification.

Solution:
Object distance, u = –30 cm
Image distance, v = –10 cm

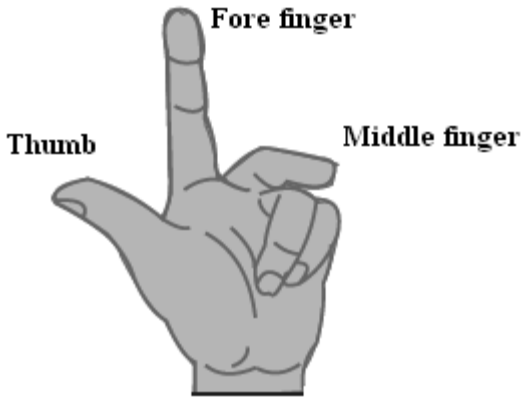
Magnification, $m = \frac{v}{u} = \frac{-10}{-30} = \frac{1}{3} = +0.33$

4. The focal length of a concave lens is 2m. Calculate the power of the lens.
Solution:
Focal length of concave lens, f = – 2 m

Power of the lens $= \frac{1}{f} = \frac{1}{-2} = -0.5$ dioptre

5 MARK

1. The figure below is the left hand of a person. The three stretched fingers are mutually perpendicular to each other.



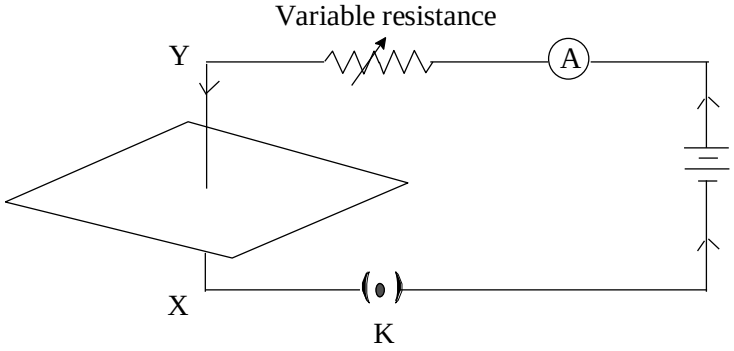
a) What does the fore finger represent?
The fore finger represents the direction of the magnetic field

b) What does the middle finger represent?
The middle finger represents the direction of current.

c) What does the thumb represent?
The thumb represents the direction of motion or the force acting on the conductor.

d) Name the rule represented by this figure
Fleming's left hand rule

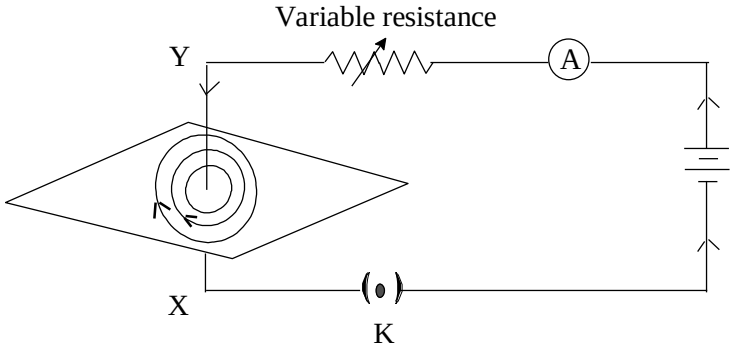
2. The diagram below illustrates the magnetic field due to current carrying straight conductor.



a) What happens when some iron fillings are sprinkled uniformly on the cardboard?
The iron fillings align themselves showing a pattern of concentric circles around the copper wire. These concentric circles represent the magnetic field lines.

b) How can the direction of the magnetic field be found?
The direction of the magnetic field can be found by placing a compass at a point over a circle. The direction of the north pole of the compass needle would give the direction of the magnetic field lines produced by the electric current through the straight wire.

c) Show the direction by an arrow

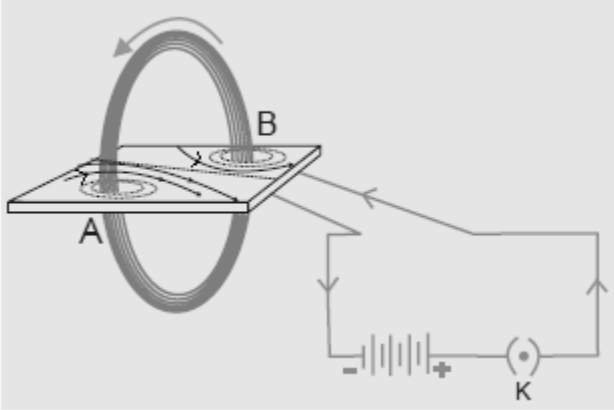


d) Does the direction of magnetic field lines get reversed if the direction of current through the straight copper wire (XY) is reversed?
Yes

e) What happens to the deflection of the compass needle when current in the copper wire (XY) is increased?
If the current is increased, the deflection in the compass needle also increases. It indicates that the magnitude of the magnetic field produced at a given point increases as the current through the wire increases.

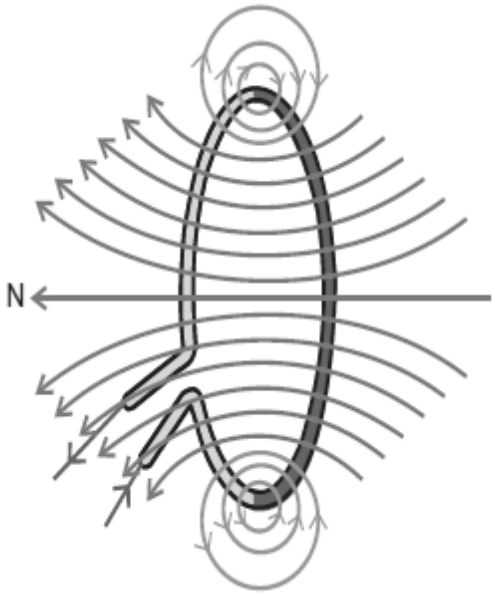
f) What happens to the deflection of the compass needle if the compass is moved from the copper wire?
If the compass is moved from the copper wire, the deflection in the needle decreases. Thus the magnetic field produced by the given current in the conductor decreases as the distance from it increases.

3. The diagram below illustrates the magnetic field due to current carrying circular loop



a) What happens when some iron fillings are sprinkled uniformly on the cardboard?

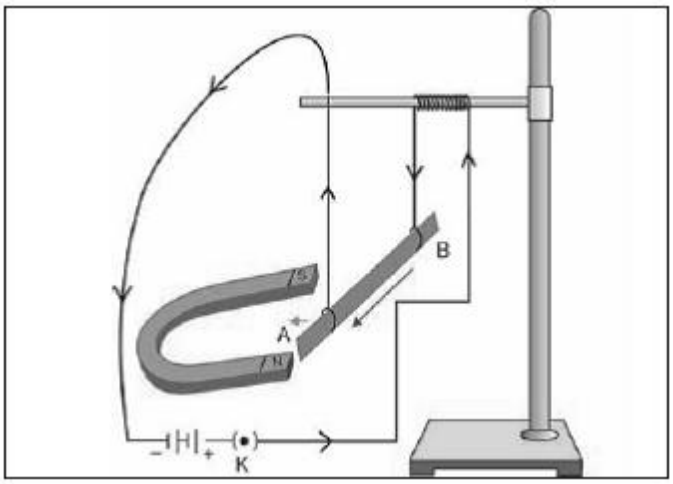
The iron fillings align themselves showing a pattern of concentric circles. At every point of a current carrying circular loop, the concentric circles representing the magnetic field around it become larger and larger as we move away from the wire. By the time we reach the centre of the circular loop, the arcs of these big circles would appear as straight lines. Every point on the wire carrying current would give rise to the magnetic field appearing as straight lines at the centre of the loop.



b) If there is a circular coil having *n* turns, the magnetic field produced is *n* times as large as produced by a single turn. Why?

This is because the current in each circular turn has the same direction, and the field due to each turn then just adds up.

4. The diagram below illustrates the force on a current carrying conductor in magnetic field. Aluminium rod AB is placed between the two poles of horse-shoe magnet.



a) What do you observe when current is passed from B to A?
When current is passed from B to A the rod is displaced towards the left. The displacement of the rod suggests that a force is exerted on the current-carrying aluminium rod when it is placed on a magnetic field.

b) What happens when the direction of current through the conductor is reversed (A to B)?
When the direction of current through the conductor is reversed, the direction of force is also reversed.

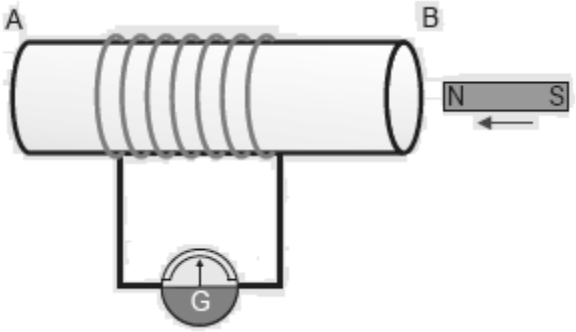
c) What happens when the direction of magnetic field is changed by interchanging the two poles of the magnet?
When the direction of magnetic field is changed by interchanging the two poles of the magnet it is observed that the direction of force acting on the current-carrying rod gets reversed.

d) The direction of force on the current carrying conductor in magnetic field depends on
i) ---------- & ii) ----------
i) The direction of current & ii) the direction of magnetic field.

e) The displacement of the rod is largest when the direction of current is at ---------- to the direction of magnetic field
The displacement of the rod is largest when the direction of current is at right angles to the direction of magnetic field.

f) ---------- rule is used to identify the direction of motion or the force acting on the conductor.
Fleming's left hand rule

5. The diagram given below illustrates Faraday's experiment.



a) What happens when the north pole of a strong bar magnet is moved towards the end B of the coil?
There is a momentary deflection in the needle of the galvanometer, say to the right. This indicates the presence of a current in the coil AB.

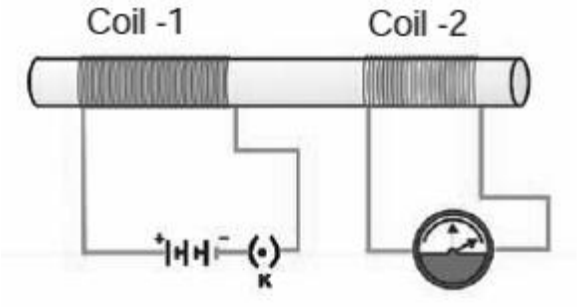
b) What happens when the north pole of the magnet is withdrawn away from the coil?
Now the galvanometer is deflected toward the left, showing that the current is now setup in the direction opposite to the first.

c) What happens when the magnet is placed stationary at the point near to the coil?
When the coil is kept stationary with respect to the magnet, the deflection of the galvanometer drops to zero.

d) What do you conclude from this experiment?
Motion of a magnet with respect to the coil produces an induced electromotive force, which sets up an **induced electric current** in the circuit.

e) ---------- rule is used to find the direction of the induced current
Fleming's right hand rule.

6. In the diagram given below, two different coils of copper wire having large number of turns (Coil-1 : 100 turns & coil-2 : 50 turns) are inserted over a non conducting cylindrical roll.



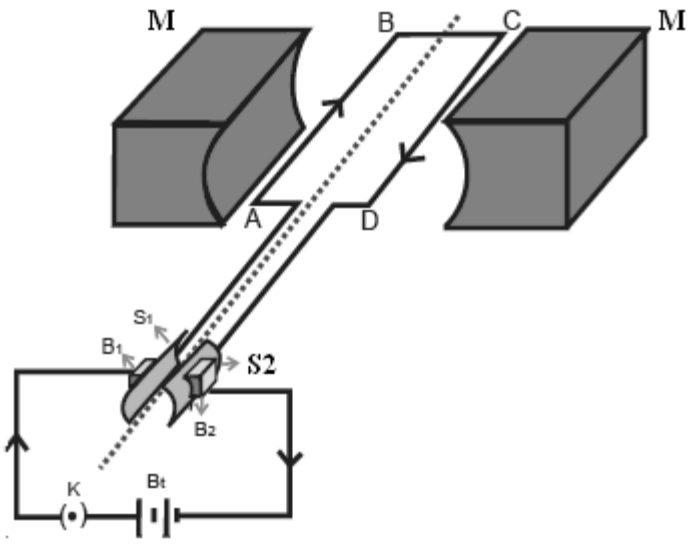
a) What happens when current is passed through the coil-1?
When current is passed through the coil-1, the needle of the galvanometer instantly jumps to one side and quickly returns to zero, indicating a momentary current in coil -2

b) What happens when current is stopped in the coil-1?
The needle momentarily moves, to the opposite side and quickly returns to zero. It means that, the current flows in the opposite direction in coil -2.

c) What do you conclude from this experiment?
From this experiment we observe that as soon as the current in coil-1 reaches either a steady value or zero, the galvanometer in coil-2 shows no deflection. From these observations we conclude that a potential difference is induced in coil-2 whenever the current through the coil-1 is changing. Coil-1 is called the primary coil and coil-2 is called the secondary coil. As the current in the first coil changes, the magnetic field associated with it also changes. Thus the magnetic field lines around the secondary coil also change. Hence the change in magnetic field lines associated with the secondary coil is the cause of **induced electric current** in it.

d) ---------- rule is used to find the direction of the induced current
Fleming's right hand rule.

7. Given below is the diagram of an electric motor



a) What is an electric motor?
An electric motor is a rotating device that converts electrical energy into mechanical energy.

b) Label the parts
ABCD : Insulated rectangular copper wire
MM: Permanent magnet
S_1 & S_2 : Split ring
B_1 and B_2 : Conducting brushes

c) What is the principle of electric motor?
An electric motor works on the principle of mechanical effect of current.

d) Explain the construction of an electric motor

An electric motor consists of a rectangular coil ABCD of insulated copper wire. The coil is placed between two poles of a magnetic field such that the arm AB and CD are perpendicular to the direction of magnetic field. The ends of the coil are connected to the two halves S_1 and S_2 of a split ring. The inner side of these halves insulated and attached to an axle. The external conducting edges of S_1 and S_2 touch two conducting stationary brushes B_1 and B_2, respectively.

e) Explain the working of electric motor

Current in the coil ABCD enters from the source battery through conducting brush B_1 and flows back to the battery through brush B_2. Notice that the current in arm AB of the coil flows from A to B. In arm CD it flows from C to D, that is, opposite to the direction of current through arm AB.

On applying Fleming's left hand rule we can find the direction of force on a current-carrying conductor in a magnetic field.

We find that the force acting on arm AB pushes it downwards while the force acting on arm CD pushes it upwards. Thus the coil and the axle, mounted free to turn about an axis, rotate anti-clockwise. At half rotation S_2 makes contact with the brush B_1 and S_2 with brush B_2. Therefore the current in the coil gets reversed and flows along the path DCBA.

A device that reverses the direction of flow of current through a circuit is called a commutator. In electric motors, the split ring acts as a commutator. The reversal of current also reverses the direction of force acting on the two arms AB and CD. Thus the arm AB of the coil that was earlier pushed down is now pushed up and the arm CD previously pushed up is now pushed down. Therefore the coil and the axle rotate half a turn more in the same direction. The reversing of the current is repeated at each half rotation, giving rise to a continuous rotation of the coil and to the axle.

f) What is a commutator?

A device that reverses the direction of flow of current through a circuit is called a commutator.

g) In electric motors, ---------- acts as a commutator.

split ring

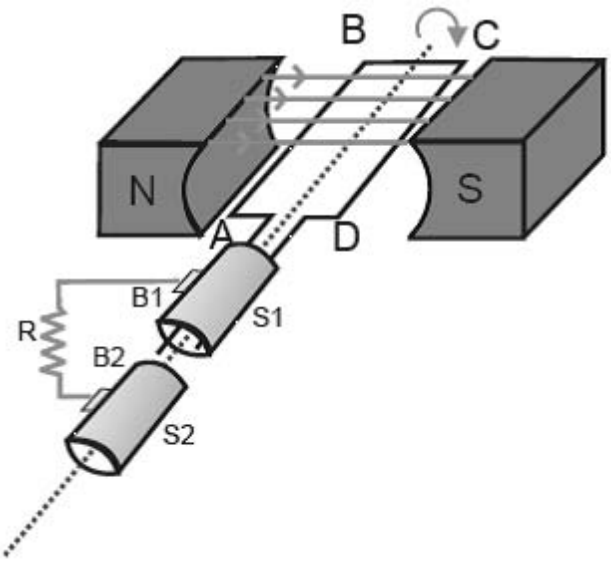
h) The direction of force on a current-carrying conductor in a magnetic field can be found by ---------- rule

Fleming's left hand rule

i) What changes can be done in a commercial motor to increase the power?

1. An electro magnet in place of permanent magnet
2. Large number of turns of the conducting wire in the current-carrying coil, and
3. A soft iron core on which the coil is wound. The soft iron core, on which the coil is wound, plus the coils, is called an armature. This enhances the power of the motor.

8. Given below is the diagram of AC generator



a) What is a generator?

Generator is a device that converts mechanical energy into electrical energy

b) Label the parts

ABCD : rotating rectangular coil
NS: Poles of permanent magnet
S_1 & S_2 : Slip rings
B_1 and B_2 : Conducting brushes

c) What is the principle of generator?

Electromagnetic induction

d) Explain the construction of AC generator

An electric generator consists of rotating rectangular coil ABCD placed between the two poles of a permanent magnet. The two ends of this coil are connected to the two rings S_1 and S_2. The inner sides of these rings are made insulated. The two conducting stationary brushes B_1 and B_2 are kept pressed separately on the rings S_1 and S_2 respectively. The two rings S_1 and S_2 are internally attached to an axle. The axle may be mechanically rotated from outside to rotate the coil inside the magnetic field. Outer ends of the two brushes are connected to the external circuit.

e) Explain the working of AC generator

In an electric generator, mechanical energy is used to rotate a conductor in a magnetic field to produce electricity.

When the axle attached to the two rings is rotated such that the arm AB moves up, the arm CD moves down in the magnetic field produced by the permanent magnet. Let us say the coil ABCD is rotated clockwise. The induced currents are setup in these arms along the directions AB and CD according to Fleming's right hand rule. Thus an induced current flows in the direction ABCD. If there are large numbers of turns in the coil, the current generated in each turn adds up to give a large current through the coil. This means that the current in the external circuit flows from B_1 to B_2.

After half a rotation, arm CD starts moving up and AB moving down. As a result, the directions of the induced currents in both the arms change, giving rise to the net induced current in the direction DCBA. The current in the external circuit now flows from B_2 to B_1. Thus after every half rotation the polarity of the current in the respective arms changes. Such a current which changes direction after equal intervals of time, is called an alternating current (AC).

f) ----------rule is used to find the direction of the induced current

Fleming's right hand rule

g) What can be done to get large current?

We can increase the number of turns in the coil. If there are large numbers of turns in the coil, the current generated in each turn adds up to give a large current through the coil.

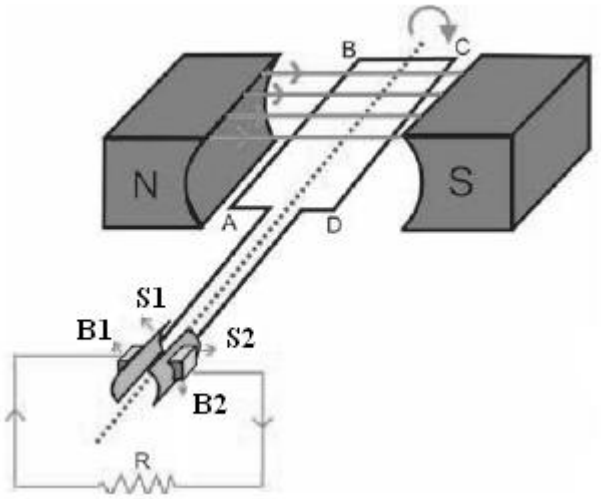
h) To get direct current (DC), slip rig is replaced by ----------

Split ring type commutator

i) What is the advantage of AC over DC?

The advantage of AC over DC is that electric power can be transmitted over long distances without much loss of energy.

9. Given below is the diagram of DC generator



a) What is a generator?

Generator is a device that converts mechanical energy into electrical energy

b) Label the parts

ABCD : rotating rectangular coil

NS: Poles of permanent magnet

S_1 & S_2 : Split ring

B_1 and B_2 : Conducting brushes

c) What is the principle of generator?

Electromagnetic induction

d) Explain the working of DC generator

To get a direct current (DC), a split ring type commutator is used. One brush is at all times in contact with the arm moving up in the field, while the other is in contact with the arm moving down. Thus a unidirectional current is produced.

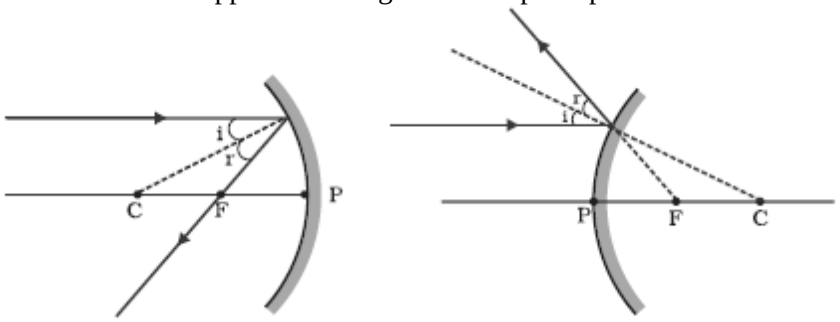
e) ----------rule is used to find the direction of the induced current
Fleming's right hand rule

f) What can be done to get large current?
We can increase the number of turns in the coil. If there are large numbers of turns in the coil, the current generated in each turn adds up to give a large current through the coil.

g) To get direct current (DC), slip rig is replaced by ----------
Split ring type commutator

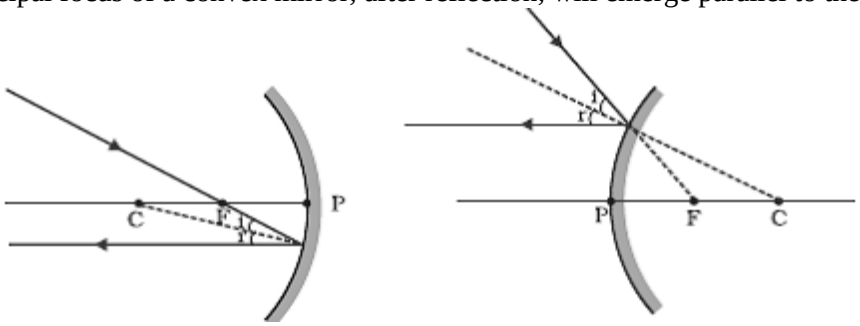
10. The reflection of light by a spherical mirror takes place according to certain definite rules. Explain the rues

1. A ray parallel to the principal axis, after reflection, will pass through principal focus in case of a concave mirror or appear to diverge from the principal focus in case of a convex mirror.



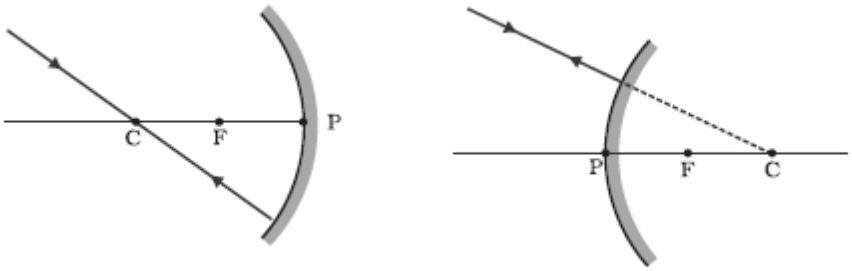
Concave mirror *Convex mirror*

2. A ray passing through the principal focus of a concave mirror or a ray directed towards the principal focus of a convex mirror, after reflection, will emerge parallel to the principal axis.



Concave mirror *Convex mirror*

3. A ray passing through the centre of curvature of a concave mirror or directed in the direction of the centre of curvature of a convex mirror, after reflection, is reflected back along the same path.



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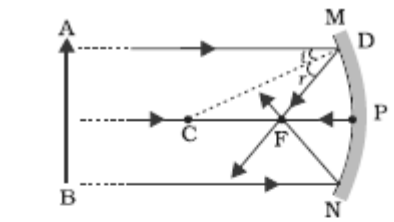
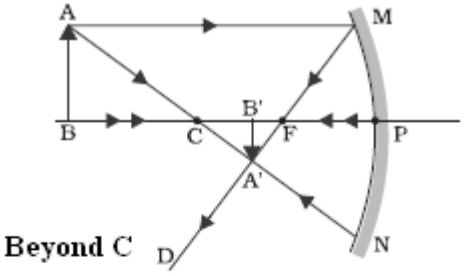
Concave mirror *Convex mirror*

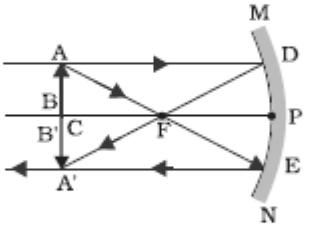
11. Write note on image formation by concave mirror (Ray diagram)



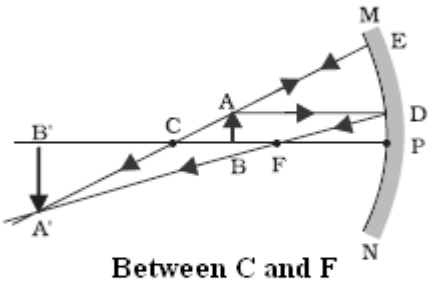
At infinity



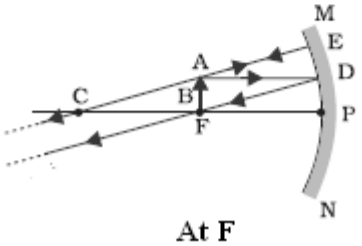
Beyond C



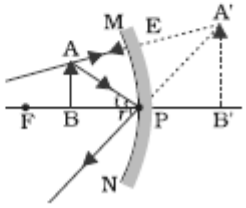
At C



Between C and F



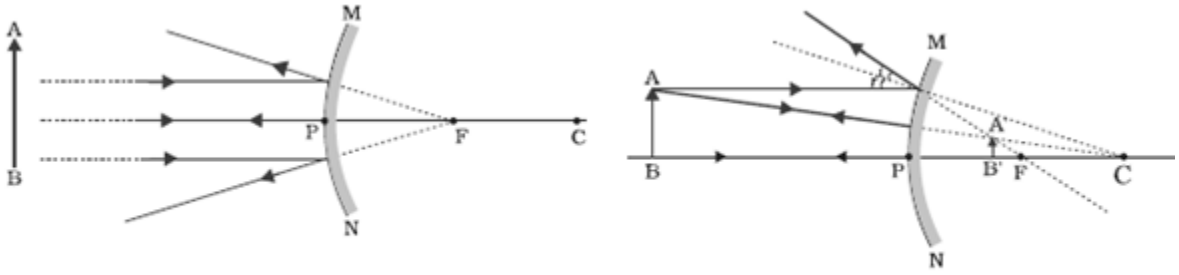
At F



Between P and F

Position of the Object	Position of the image	Relative size of the image	Nature of the image
At infinity	At 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 focus F	At infinity	Infinitely large or highly enlarged	Real and inverted
Between P and F	Behind the mirror	Enlarged	Virtual and erect

12. Write note on image formation by convex mirror (Ray diagram)



At infinity

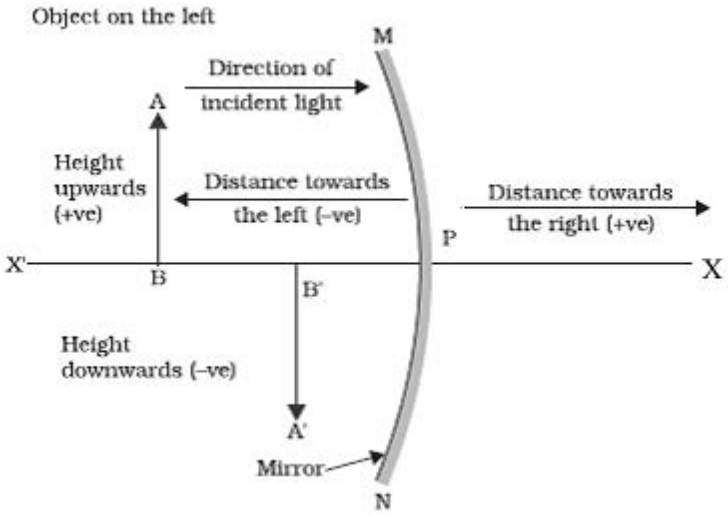
Between infinity and ploe

Position of the Object	Position of the image	Relative size of the image	Nature of the image
At infinity	At focus F (Behind the mirror)	Highly diminished, point-sized	Virtual and erect
Between infinity and pole	Between P and F (Behind the mirror)	Diminished	Virtual and erect

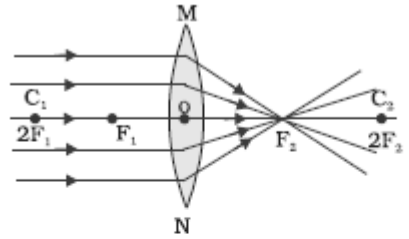
13. Explain the sign convention for reflection by spherical mirrors

While dealing with the reflection of light by spherical mirrors, we shall follow a set of sign conventions called the **New Cartesian Sign Convention**. In this convention, the pole (P) of the mirror is taken as the origin. The principal axis of the mirror is taken as the X axis (X′X) of the coordinate system. The conventions are as follows.

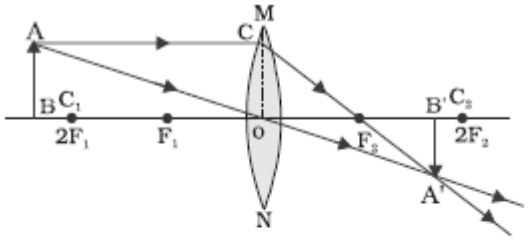
1. The object is always placed to the left of the mirror.
2. All distances parallel to the principal axis are measured from the pole of the mirror.
3. All the distances measured to the right of the origin (along +X-axis) are taken as positive while those measured to the left of the origin (along –X-axis) are taken as negative
4. Distances measured perpendicular to and above the principal axis (along +Y-axis) are taken as positive.
5. Distances measured perpendicular to and below the principal axis (along –Y-axis) are taken as negative.



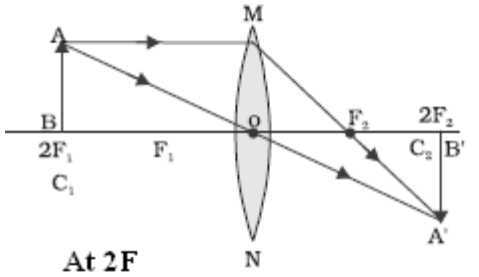
14. Draw the ray diagrams for the image formation in a convex lens



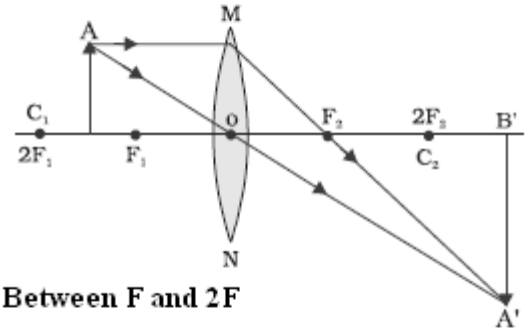
At infinity



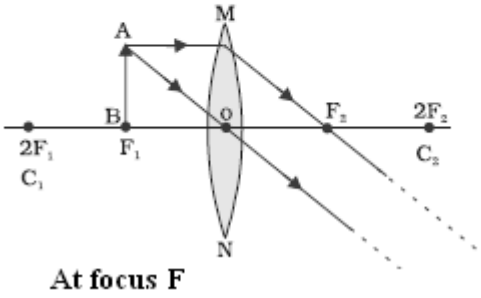
Beyond 2F



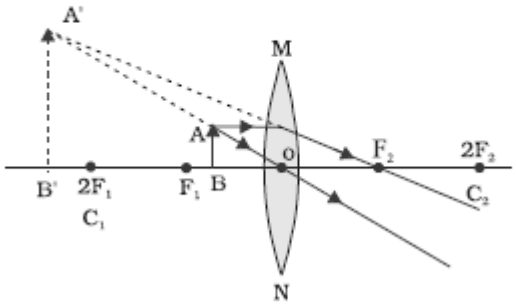
At 2F



Between F and 2F



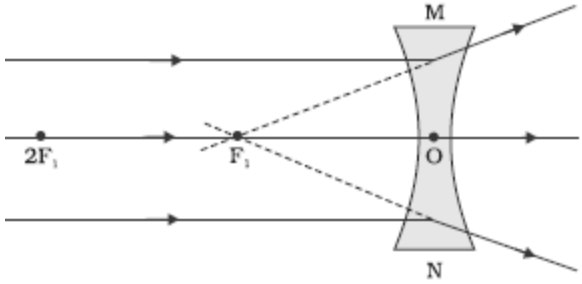
At focus F



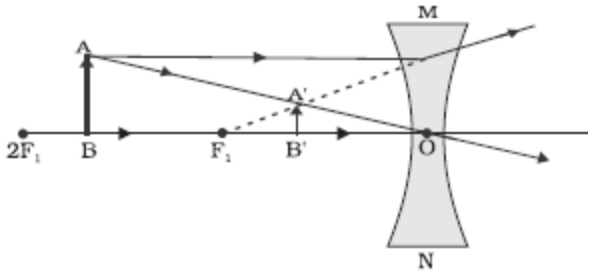
Between focus F and optic centre O

Position of the Object	Position of the image	Relative size of the image	Nature of the image
At infinity	At focus F	Highly diminished, point-sized	Real and inverted
Beyond 2F	Between F and 2F	Diminished	Real and inverted
At 2F	At 2F	Same size	Real and inverted
Between F & 2F	Beyond 2F	Enlarged	Real and inverted
At focus F	At infinity	Infinitely large or highly enlarged	Real and inverted
Between focus F and optical centre O	On same side of the lens as the object	Enlarged	Virtual and erect

15. Draw the ray diagrams for the image formation in a concave lens



At infinity



Between infinity and optic centre O of the lens

Position of the Object	Position of the image	Relative size of the image	Nature of the image
At infinity	At focus F	Highly diminished, point-sized	Virtual and erect
Between infinity and optical centre O of the lens	Between focus F and optical centre O	Diminished	Virtual and erect

16. Explain the defects of vision and rectification

There are mainly three common refractive defects of vision. These are

1. Myopia or near - sightedness.
2. Hypermetropia or far-sightedness, and
3. Presbyopia.

1. Myopia

Myopia is also known as nearsightedness. A person with myopia can see nearby objects clearly but cannot see the distant objects distinctly.

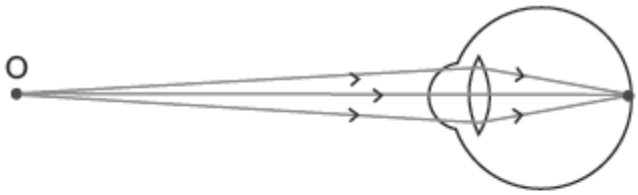
A person with this defect has the far point nearer than infinity. Such a person may see clearly up to a distance of a few meters.

In a myopic eye, the image of a distant object is formed in front of the retina and not at the retina itself.

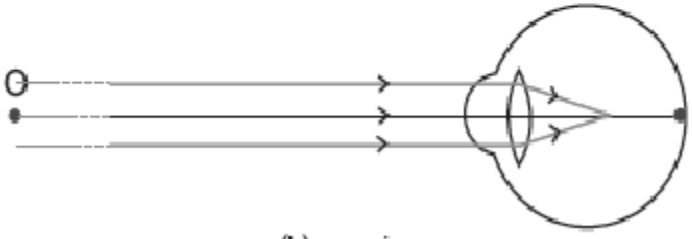
This defect may arise due to

1. excessive curvature of the eye lens, or
2. elongation of the eyeball.

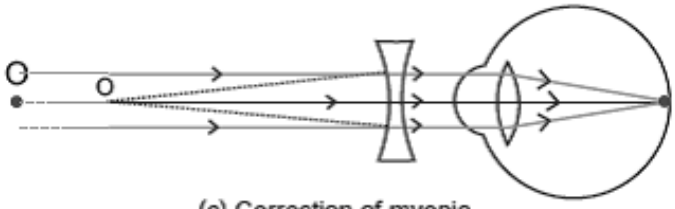
This defect can be corrected by using a concave lens of suitable power. A concave lens of suitable power will bring the image back on to the retina and thus the defect is corrected.



(a) Far point of myopia eye



(b) myopia eye



(c) Correction of myopia

2. Hypermetropia

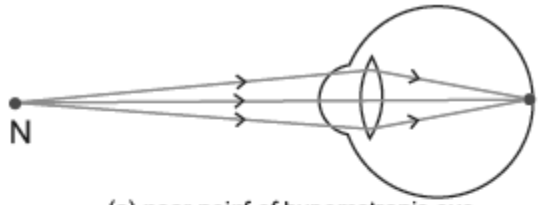
Hypermetropia is also known as far-sightedness. A person with hypermetropia can see distant objects clearly but cannot see nearby objects distinctly. The near point, for the person, is further away from the normal near point (25 cm). Such a person has to keep a reading material beyond 25cm from the eye for comfortable reading.

In this defect, the image of a close by object is formed behind the retina.

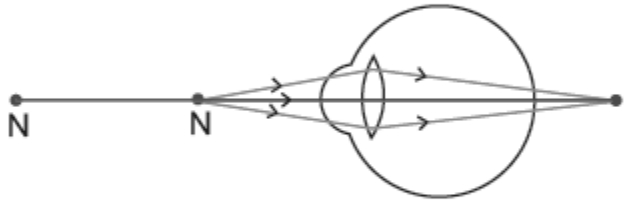
This defect may arise due to

1. the focal length of the eye lens is too long or
2. the eyeball has become too small.

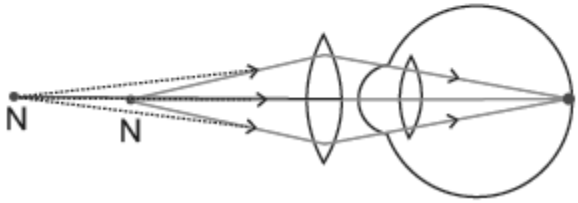
This defect can be corrected by using a convex lens of appropriate power. Eye-glasses with converging lenses provide the additional focusing power required for forming the image on the retina.



(a) near poinf of hypemetropic eye



(b) Hypemetropia eye



(c) correction of hypemetropia eye

3. Presbyopia

The power of accommodation of the eye usually decreases with ageing. For most people, the near point gradually recedes away. They find it difficult to see nearby objects comfortably and distinctly without corrective eye-glasses. This defect is called Presbyopia.

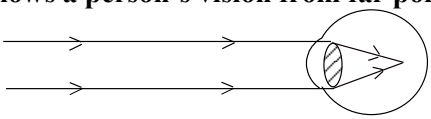
It arises due to the gradual weakening of the ciliary muscles and diminishing flexibility of the eye lens. Sometimes, a person may suffer from both myopia and hypermetropia. Such people often require by-focal lenses. A common type of by-focal lenses consists of both concave and convex lenses. The upper portion consists of a concave lens. It facilitates near vision.

17. Write a note on Hubble telescope

- Hubble telescope is a space telescope that was carried into orbit by a space shuttle in April 1990.
- It is named after the American astronomer Edwin Hubble.
- It becomes a most popular research tool for astronomy.
- The H.S.T is collaboration between NASA and the European Space Agency, and is one of NASA's great observatories.
- Hubble is the only telescope ever designed to be serviced in space by astronauts.
- The H.S.T design with two hyperbolic mirrors is known for good imaging performance over a wide field of view.
- The telescope is now expected to function until at least 2014.
- Hubble's orbit outside the distortion of earth's atmosphere allows it to take extremely sharp images with almost no background light.
- Hubble's Ultra Deep Field image is the most detailed visible light image ever made of the universe's most distant object.
- Hubble Deep field and Hubble ultra Deep field images reveals that galaxies are billions of light years away.

- Many Hubble observations accurately measure the rate at which the universe is expanding.
- It constrains the value of Hubble's constant and estimates the age of the Universe.
- Hubble's images of planets were crucial in studying the dynamics of the collision of a comet with Jupiter, an event believed to occur once every few centuries.
- Hubble's observations found that black holes are common to the centers of all galaxies.
- The astronomers used the telescope to observe distant supernovae.

18. The following diagram shows a person's vision from far point.



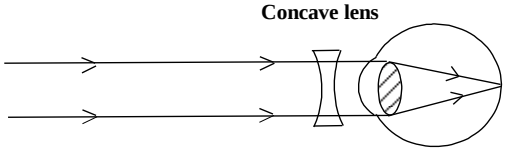
a) What defect is the person suffers from?
Myopia (Near sightedness)

b) What is the position of the image in this defect?
The image is formed in front of the retina.

c) State the causes for the occurrence of this defect.
This defect may arise due to
1. excessive curvature of the eye lens, or
2. elongation of the eyeball.

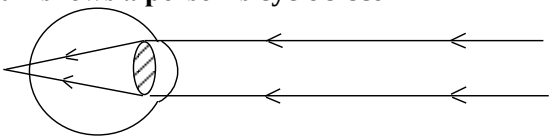
d) Copy the diagram and complete to show how this defect is rectified

Concave lens



Corrected vision

19. The following diagram shows a person's eye defect



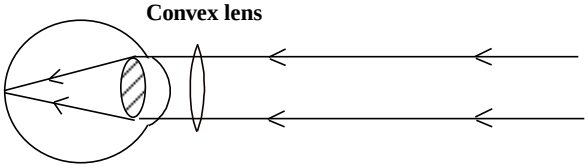
a) What defect is the person suffers from?
Hypermetropia (far-sightedness)

b) What is the position of the image in this defect?
The image is formed behind the retina.

c) State the causes for the occurrence of this defect.
This defect may arise due to
1. the focal length of the eye lens is too long or
2. the eyeball has become too small.

d) Copy the diagram and complete to show how this defect is rectified

Convex lens



Corrected vision

This defect can be corrected by using a convex lens of appropriate power.

X - Std. SCIENCE (Theory) - BLUE PRINT

Unit	No. of 1 Mark questions	No. of 2 Mark questions	No. of 5 Mark questions	Total Marks
1. Heredity and Evolution	1	1	1	8
2. Immune System	1	1	1	8
3. Structure and Function of the Human body	-	3	-	6
4. Reproduction in plants	1	1	1	8
5. A representative study of mammals	-	3	-	6
6. Life processes	1	1	-	3
7. Conservation of Environment	1	1	1	8
8. Waste water management	-	3	-	6
9. Solutions	1	2	-	5
10. Atoms and Molecules	-	1	1	7
11. Chemical reaction	1	2	-	5
12. Periodic classification of elements	2	2	-	6
13. Carbon and its compounds	1	1	1	8
14. Measurements	-	-	-	-
15. Laws of motion and Gravitation	1	2	1	10
16. Electricity and Energy	2	3	-	8
17. Magnetic effect of electric current and Light	2	3	1	13

Section – I Objective Type $\left(\frac{15}{15}\right)$ 15 × 1 = 15 Marks

Section – II Short Answer $\left(\frac{20}{30}\right)$ 20 × 2 = 40 Marks

Section – III Long Answer

(Contains 4 parts. Each part consists of 2 questions. Answer any four questions by choosing one question from each part) 4 × 5 = 20 Marks

Total = 75 Marks (Time : 2 ½ Hours)

2 Mark (Section-II) – Split up

1. Match = 3 questions
2. Spot the error in the statement = 3 ″
3. Reason and Assertion = 3 ″
4. To raise questions = 3 ″
5. To label the parts in the given diagram = 3 ″
6. To copy a diagram & to mark the parts = 3 ″
7. Problem = 3 ″
8. Fill up the blanks (from the given pair of answers) = 3 ″
9. To interpret what happens in the given situations = 3 ″
10. To find the odd one out = 3 ″

10th SCIENCE (EM) :

A COMPLETE GUIDE

for

10th STD - SCIENCE

&

+2 CHEMISTRY (EM):

Unitwise Govt. Exam Q & A (2006 – 2013)
& Compulsory Problem (Solved)

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