Q.1 **A) Solve the following questions.**

1)

	Group A		Group B
i)	Acceleration due to gravity	a)	m/s^2
ii)	Gravitational constant	c)	Nm^2/kg^2

2) Alkaline earth metals.

3) The relative humidity at the dew point is 100%.

4) Pure iron undergoes rusting easily, but when it is mixed with 18% chromium and 8% carbon, it forms an alloy called stainless steel which does not get stains with air or moisture and also does not rust.

5) North pole of the magnetic needle will move towards wire XY.

B) Choose the correct alternative and rewrite the statement.

1) A) $CuSO_4$ solution and silver

2) A) 50^0

3) Rusting of iron requires both oxygen and water

4) According to Cartesian sign conventions for lenses all distance in direction of incident ray are taken positive.

5) d) Radium

Q.2 **Answer the following questions.(Any Five)**

1)

Sr. No.	Position of the object	Positions of the images	Size of the images	Nature of the images
i)	**At infinity**	On the first focus F_1	**Point image**	Virtual and erect
ii)	Anywhere between optical centre (O) and infinity	**Between optical centre and focus F_1**	Small	**Virtual and erect**

2) (i) Zinc (ii) Iron (iii) Tin (iv) Lead

3)

Given: Height (h) = 19.6 m,
         Initial velocity (u) = 0 m/s,
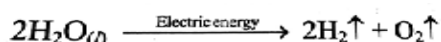To find: Final velocity (v)
Formula: $v^2 = u^2 + 2as$
Calculation: For downward motion,
         a = g, s = h, u = 0
         From formula,
         $v^2 = 2 \times 9.8 \times 19.6$
∴ $v^2 = 384.16$
∴   v = **19.6 m/s**

Ans: Final velocity of the stone just before touching the ground is **19.6 m/s**.

4) The complete reaction is :

$$2H_2O_{(l)} \xrightarrow{\text{Electric energy}} 2H_2\uparrow + O_2\uparrow$$

i) This reaction is decomposition reaction

ii) The chemical reaction in which two or more products are formed from a single reactant is called a decomposition reaction.

5) i) Liquids expand on heating and contract on cooling.

ii) But water exhibits an exceptional behavior in temperature range of $0\ ^0C$.

iii) When water is heated from $0\ ^0C$ upto $4\ ^0C$, instead of expanding it contracts. Its volume decreases continuously from

iv) At 4 ^{0}C, its volume is minimum.

v) Upon heating further, however, it expands and its volume increases.

vi) This behavior of water between temperature interval of 0 ^{0}C to 4 ^{0}C is called anomalous behavior of water.

6)		Saturated Hydrocarbons	Unsaturated Hydrocarbons
	i)	Hydrocarbons with the carbon atoms linked to each other by single bonds are called saturated hydrocarbons	Hydrocarbons with one or more carbon – carbon double or triple bonds are called unsaturated Hydrocarbons
	ii)	When saturated hydrocarbons are burned, they give a clean blue flame.	When unsaturated hydrocarbons are burned, they give a yellow flame with lots of black smoke.
	iii)	Saturated hydrocarbons do not decolorize bromine or tincture of iodine solutions.	Unsaturated hydrocarbons decolorize bromine or tincture of iodine solutions.
	iv)	Saturated hydrocarbons are less reactive	Unsaturated hydrocarbons are usually highly reactive.

7) i) If the satellite is revolving in an orbit parallel to the equator, the time of revolution for the earth around itself and that for the satellite to revolve around the earth is the same which makes the satellite appear to be stationary with respect to the earth.

ii) Therefore, the satellites revolving in high earth orbits are called as geosynchronous satellites.

Q.3 Answer the following questions.(Any Five)

1) i) a) Rusting of iron occurs in the presence of air and moisture.

  b) In the test tube 1, the oil layer over the boiled water prevents the contact of the nail with air. Thus,

   the nail is in contact with moisture (water) but not in the contact with air.

   Hence, the nail in the test tube 1 is not rusted.

ii) a) The nail in test tube 4 is not rusted.

  b) The test tube 4 contains dry air but it does not contain moisture. Further, calcium chloride in the test tube 4 will absorb any small amount of moisture if present. Thus, the nail is in contact with air

   but not in the contact with moisture. Hence, the nail in the test tube4 is not rusted.

iii) a) The nail in test tube 2 is in contact with air and salt solution whereas the nail in test tube 3 is in contact with air only.

  b) The process of rusting is rapid in salt solution as compared to iron nail exposed to air only due to presence of ions.

   Hence the rusting of the nail in test tube 2 is faster than the nail is test tube 3.

2) i) The rainbow appears in the sky after a rainfall.

ii) Water droplets present in the atmosphere act as small prism.

iii) When sunlight enters these water droplets, it gets refracted and dispersed.

iv) This dispersed light gets totally reflected inside the droplet and again is refracted while coming out of the droplet

v) As a combined effect all these phenomena, the seven coloured rainbow is observed.

Formation of rainbow
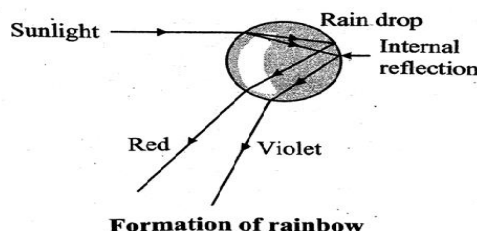
3) i) Hydrocarbons which have one or more carbon-carbon double or triple bonds are called unsaturated hydrocarbons.

ii) The unsaturated hydrocarbons which contain a carbon-carbon double bond are called alkenes.

iii) The unsaturated hydrocarbons which contain a carbon-carbon triple bond are called alkynes.

iv) The unsaturated hydrocarbons are generally more reactive than saturated hydrocarbons.

E.g.

Alkene	Alkyne
Ethene ($CH_2 = CH_2$)	Ethyne ($CH \equiv CH$)
Propene ($CH_3CH_2 = CH_2$)	Propyne ($CH_3C \equiv CH$)
Butene ($CH_3CH_2CH = CH_2$)	Butyne ($CH_3CH_2C \equiv CH$)

4) i) The given temperature vs time graph demonstrates the behavior of water when heated continuously and uniformly.

ii) a. Line . segment AB indicates temperature of ice remaining constant at 0 °C for certain period of time (about 4 minutes).

b. This means, amount of heat supplied to ice is entirely used for changing its state from solid to liquid.

c. Thus, line segment AB denotes conversion of ice at 0 °C into water at 0 °C.

iii) Line segment BC indicates continuous rise in temperature of water from 0 ℃ to 100 ℃.

iv) a. At point C, boiling point of water is reached and heat energy supplied further is used to convert water into steam.

b. During this transformation, temperature remains unchanged as represented by line segment CD.

c. Thus, line segment CD denotes conversion of water at 100℃ into steam at 100℃.

5) **Demerits of Mendeleev's periodic table:**

i) The whole number atomic mass of the elements cobalt (Co) and nickel (Ni) is the same, that is. 59. Therefore, there was an ambiguity regarding the sequence of these elements in the Mendeleev's periodic table.

ii. Isotopes have same chemical properties but different atomic masses. Therefore, isotopes could not be given a proper place in Mendeleev's periodic table.

iii. In Mendeleev's periodic table, elements arc arranged in an increasing order of atomic masses. However, the rise in atomic mass is not uniform. Hence, it was not possible to predict the number of elements that could be discovered between two heavy elements

iv. No fixed position was given to hydrogen in Mendeleev's periodic table because it resembled alkali metals (group I) as well as halogens (group VII).

6) *Given:* Image formed is real, inverted and of same size as that of object.

∴ $- h_2 = h_1$

Image distance (v) = 60 cm

To find: i. Focal length (f)

ii. Power (P)

iii. Object distance (u)

Formulae: i. $M = \dfrac{h_2}{h_1} = \dfrac{v}{u}$ ii. $\dfrac{1}{v} - \dfrac{1}{u} = \dfrac{1}{f}$

iii. $P = \dfrac{1}{f(m)}$

Calculation: From formula (i),

$M = \dfrac{-h_1}{h_1} = -1$

∴ $-1 = \dfrac{v}{u} = \dfrac{60}{u}$

∴ u = **–60 cm** (–ve sign indicates object is placed at left of lens)

From formula (ii),

$$\frac{1}{f} = \frac{1}{60} - \frac{1}{-60} = \frac{1}{60} + \frac{1}{60} = \frac{2}{60} = \frac{1}{30}$$

∴   f = **30 cm**

Focal length of a lens = 30 cm = 0.3 m

From formula (iii),

$$P = \frac{1}{0.3} = 3.3 \text{ D}$$

Ans: Focal length, power of a lens and object distance are **30 cm, 3.3 D** and **60 cm** respectively.

7) i) During the electrolysis of alumina, oxygen gas is liberated at the anode.

ii) Oxygen reacts the graphite anode to form carbon dioxide.

iii) Thus, the mass of graphite rods decrease over the time.

Hence, anodes need to be replaced from time to time during the electrolysis of alumina

Q.4 Answer the following questions.(Any One)

1) i) Medium X has lower refractive index as light rays travelling from medium y when enters medium X bend away from normal

ii) When a ray of light enters a rarer medium from a denser medium, it gets partially reflected i.e, part of the light gets reflected and comes back into the denser medium obeying the laws of reflection. This is called partial reflection.

iii) According to Snell's law, the refractive index of the material is constant. Hence, on increasing the angle of incidence the angle of refraction increases. Hence, if $\angle i < \angle i'$ then $\angle r < \angle r'$

iv) The particular value of angle incidence for which value of angle of refraction becomes 90^0 is called as a critical angle.

v) For angle of incidence greater than critical angle, angle of refraction will be larger than 90^0. This means all the incident light will get reflected back resulting into total internal reflection.

2) i) **Diagram:**

Electrolytic reduction of alumina
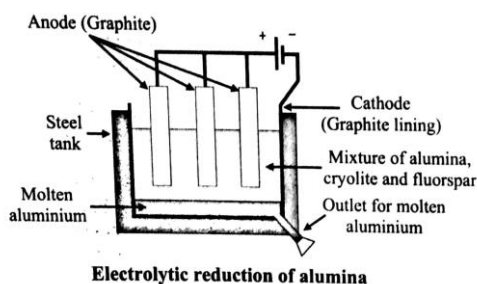
ii) **Explanation :**

a) Alumina has a very high melting point (> 2000 ℃). Addition of cryolite and fluorspar reduces the melting point to about 1000 ^{0}C. Therefore during electrolytic reduction, alumina is dissolved in molten cryolite (Na_3AlF_6) and fluorspar (CaF_2).

b) In electrolytic cell, a lining of carbon (graphite) on the inner side acts as cathode and a set of carbon (graphite) rods dipped in the molten electrolyte acts as anode.

c) When electric current is passed, electrolysis of alumina takes place.

d) Aluminium is formed at the cathode and oxygengas is liberated at the anode. The oxygen gas liberated at the anode reacts with the carbon anode and forms carbon dioxide gas.
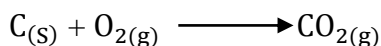
e) The electrode reactions are as follows:

Cathode:

$Al^{3+} + 3e^- \longrightarrow Al_{(l)}$ (Reduction)

Anode:

$2O^{2-} \longrightarrow O_2 + 4e^-$ (Oxidation)
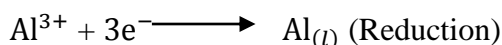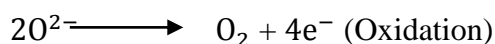
f) The oxygen gas liberated at the anode reacts with the carbon anode and forms carbon dioxide gas.

$C_{(S)} + O_{2(g)} \longrightarrow CO_{2(g)}$

g) The molten aluminium sinks to the bottom of the tank from where it is collected periodically.