

**ICSE Board  
Class IX Chemistry  
Paper-2 Solution**

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**SECTION-I**

**Answer 1**

**(a)**

- (i) **Pure Substance:** A pure substance is a homogeneous material with a definite, invariable chemical composition and definite, invariable physical and chemical properties.
- (ii) **Residue:** An insoluble component left behind after the process of filtration is called residue.
- (iii) **Distillate:** The liquid component recovered after the process of distillation is called distillate.
- (iv) **Distillation:** The process of simultaneous evaporation and condensation is called distillation.
- (v) **Effervescence:** Formation of gas bubbles in a liquid during a reaction is called effervescence.

**(b)**

- (i)  $3\text{Cu} + 8\text{HNO}_3 \rightarrow 3\text{Cu}(\text{NO}_3)_2 + 4\text{H}_2\text{O} + 2\text{NO}$
- (ii)  $2\text{FeSO}_4 \rightarrow \text{Fe}_2\text{O}_3 + \text{SO}_2 + \text{SO}_3$
- (iii)  $\text{Pb}_3\text{O}_4 + 8\text{HCl} \rightarrow 3\text{PbCl}_2 + \text{Cl}_2 + 4\text{H}_2\text{O}$
- (iv)  $2\text{H}_2\text{S} + \text{SO}_2 \rightarrow 2\text{H}_2\text{O} + 3\text{S}$
- (v)  $2\text{Ca}(\text{NO}_3)_2 \rightarrow 2\text{CaO} + 4\text{NO}_2 + \text{O}_2$

**(c)**

- (i) Sodium peroxide
- (ii) Zinc hydroxide
- (iii) Potassium bicarbonate
- (iv) Potassium ferrocyanide
- (v) Sodium hypochlorite

**(d)** Valency of metal 'M' is +2.

- (i)  $\text{MCl}_2$
- (ii)  $\text{M}(\text{OH})_2$
- (iii)  $\text{MCO}_3$
- (i)  $\text{MO}$
- (ii)  $\text{M}(\text{NO}_3)_2$

**(e)**

- (i) Sodium bromide
- (ii) Zinc phosphide
- (iii) Calcium oxalate
- (iv) Ammonium sulphide
- (v) Silver chloride

**(f)**

- (i) Carbon monoxide
- (ii) Hydrogen
- (iii) Carbon
- (iv) Ammonia
- (v) Carbon

**(g)**

- (i) Physical properties depend on atomic mass, and isotopes have different mass number, i.e. they have different number of neutrons. So, isotopes have different physical properties.
- (ii) Steam is more dangerous than boiling water because, particles in steam (water vapour) at 373 K ( $100^\circ\text{C}$ ) have more energy than water at the same temperature. This is because particles in steam have absorbed extra energy in the form of latent heat of vaporization. Thus, steam is more dangerous than water vapour.

**(h)**

- (i) The Charl's law states that, "At constant pressure, the volume of a given mass of a dry gas increases or decreases by  $1/273$  of its original volume at  $0^{\circ}\text{C}$  for each degree centigrade rise or fall in temperature."

$$V \propto T \quad (\text{At constant pressure})$$

At temperature  $T_1$  (K) and Volume  $V_1$  ( $\text{cm}^3$ )

At temperature  $T_2$  (K), Volume is  $V_2$  ( $\text{cm}^3$ )

$$V_1 \propto T_1 \text{ or } \frac{V_1}{T_1} = K = \text{Constant}$$

$$V_2 \propto T_2 \text{ or } \frac{V_2}{T_2} = K = \text{Constant}$$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} = \text{Constant}$$

- (ii) On a hot day, due to increase in temperature the rate of evaporation of water is more.

Also the dryness of the air i.e. decrease in humidity of the air increases the rate of evaporation. Therefore, a desert cooler cools better on a hot dry day.

## SECTION-II

### Answer 2

**(a)**

- (i) Hydrogen shows dual nature because it resembles the alkali metals of Group IA and the halogens of Group VIIA.
- (ii) Gases have maximum intermolecular space. Therefore, when two gases are brought in contact, they readily fill the intermolecular spaces and form a homogeneous mixture.
- (iii) Rivers and lakes have a large amount of water, and water has high specific heat capacity due to which it does not freeze easily.  
Even if water freezes, it freezes into ice on the surface (at the top) of rivers and lakes. Water is present below because of anomalous expansion of water.

**(b)**

- (i) Ammonium hydroxide
- (ii) Ammonium acetate
- (iii) Soluble in hot water
- (iv) Dilute acid
- (v) Alkali or dilute acid.

**(c)** Latent heat of vaporization is the heat energy required to change 1 kg of a liquid to a gas at atmospheric pressure at its boiling point.

### **Answer 3**

**(a)**

- i. A solubility curve is a line graph which shows changes in the solubility of a solute in a given solvent with a change in temperature.

To obtain this curve, values of temperature are plotted on the X-axis and the values of solubility are plotted on the Y-axis

### **Applications:**

The variation in the solubility of any given substance with temperature can be studied with the help of a solubility curve.

To compare the solubility of different substances at a given temperature.

- ii. On heating strongly, an oxidising agent liberates oxygen, which rekindles a glowing splinter.

A reducing agent gives out brown fumes of nitrogen dioxide when warmed with nitric acid.

**(b)**

- i.  $\text{Fe} + \text{CuSO}_4 \rightarrow \text{FeSO}_4 + \text{Cu}$
- ii.  $2\text{HgO} \rightarrow 2\text{Hg} + \text{O}_2$
- iii.  $\text{PbO}_2 + \text{SO}_2 \rightarrow \text{PbSO}_4$
- iv.  $\text{AgNO}_3 + \text{NaCl} \rightarrow \text{AgCl} + \text{NaNO}_3$
- v.  $2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2$

#### **Answer 4**

**(a)** On increasing pressure the solubility of a gas in a liquid increases whereas, on decreasing pressure the solubility of a gas in a liquid decreases. This shows the mass of a given volume of a gas which dissolves in liquid at constant temperature is directly proportional to the pressure on the surface of the liquid and thus in accordance with Henry's law.

**(b)**

- (i) Increases
- (ii) Increases
- (iii) Decreases
- (iv) Increases
- (v) Increases

**(c)** The volume of a given mass of dry enclosed gas depends on the pressure of the gas and the temperature of the gas in Kelvin, so to express the volume of the gases, we compare these to STP.

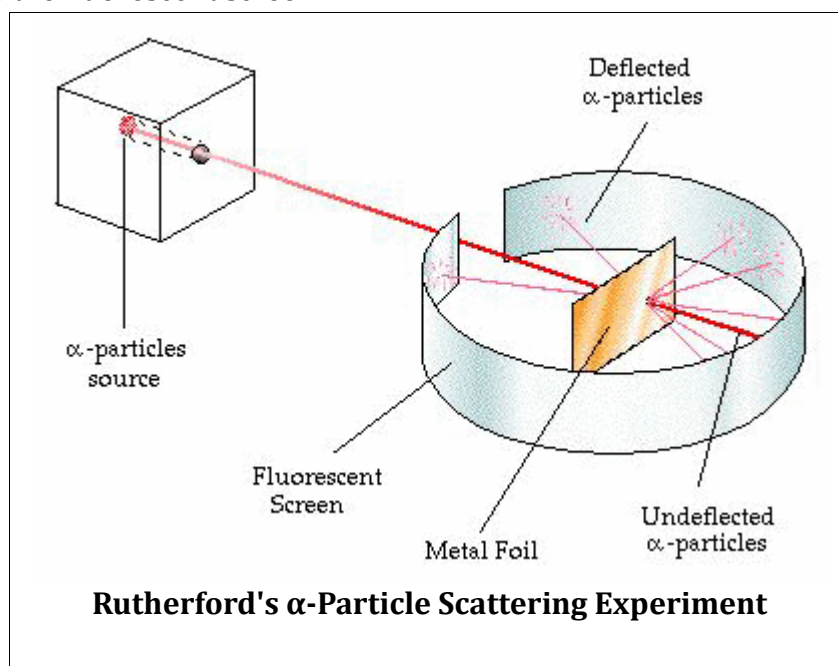
#### **Answer 5**

**(a)**

- (i) The physical and the chemical properties of the elements are the periodic functions of their atomic numbers.
- (ii) Group 17
- (iii) Atomic number
- (iv) Periods
- (v) Alkali

## (b) Rutherford's scattering Experiment

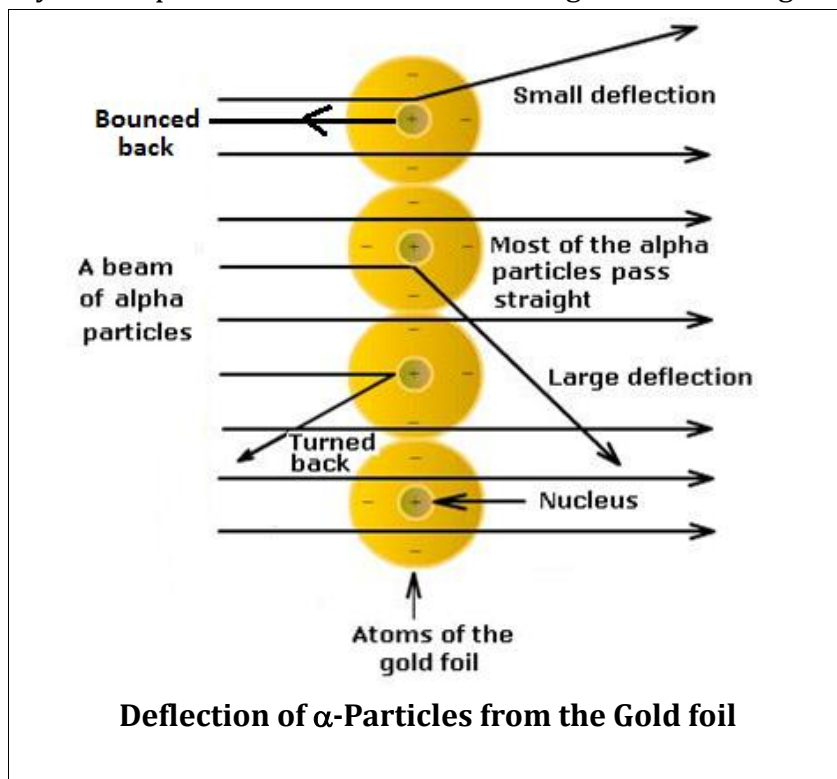
- Rutherford selected a gold foil as he wanted a very thin layer.
- The gold foil used by Rutherford was 0.004 millimeters in thickness. That is, the foil was about 1000 atoms thick.
- In his experiment, fast moving Alpha particles ( $\alpha$ -particles) were made to fall on a thin gold foil.
- Alpha particles are helium ions with +2 charge. Their atomic mass is 4 u, hence a high velocity beam of  $\alpha$ -particles has a lot of energy.
- These particles were studied by means of flashes of light they produced on striking a zinc sulphide screen.
- The  $\alpha$ -particles are much heavier than the sub-atomic particles present in the gold atoms.
- Hence, He expected the  $\alpha$ -particles to pass through the gold foil with little deflections and strike the fluorescent screen.



But the observations he made were quite unexpected.

### Observations made by Rutherford:

1. Rutherford observed that most of the  $\alpha$ -particles passed straight through the gold foil.
2. Some  $\alpha$ -particles were deflected by the foil through small angles while some were deflected through very large angles.
3. One out of every 12000 particles were deflected through  $180^\circ$  showing a full rebound.



Rutherford said that, *"This result was almost as incredible as if you fire a 15-inch shell at a piece of tissue paper and it comes back and hits you"*.

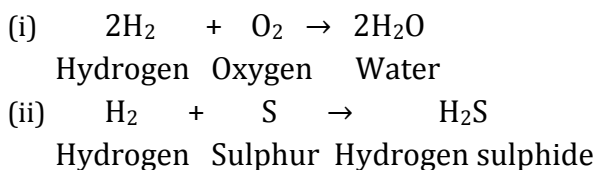
### Explanation of the results of Rutherford's Gold foil experiment

- Rutherford postulated that the atom must contain large empty spaces as most of the  $\alpha$ -particles passed through it without getting deflected.
- The  $\alpha$ -particles, being positively charged, could only be deflected by positive charges present inside the atom.
- As very few  $\alpha$ -particles were deflected, Rutherford concluded that the positively charged particles in an atom must be concentrated in a very small space.
- An even smaller fraction of  $\alpha$ -particles were deflected through an angle of  $180^\circ$ .
- Thus, Rutherford came to the conclusion that all the positive charge of the atom and most of the mass of the atom is concentrated in a very small volume within the atom.

- Rutherford named this small space inside the atom as the "nucleus of the atom" or the "atomic nucleus". When the thickness of the gold foil was doubled, the number of  $\alpha$ -particles reflecting back was also doubled.
- On the basis of these observations, Rutherford calculated that the atomic nucleus is  $10^5$  times smaller than the total area of the atom.
- The radius of the atom is  $10^{-8}$  centimeter while the radius of the nucleus is  $10^{-13}$  centimeter.
- Thus, we can say that the atom is relatively hollow with a heavy nucleus at its centre. The electrons arranged around the nucleus possess negligible mass.
- Based on his observations, he formulated his '**Theory of atom**'.

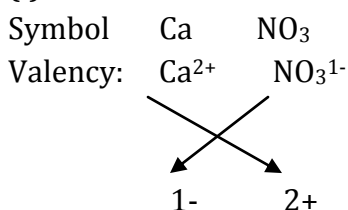
### Answer 6

(a)



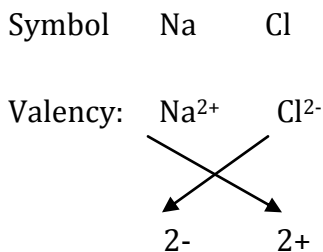
(b)

(i) **Calcium nitrate**



Formula:  **$\text{Ca}(\text{NO}_3)_2$**

(ii) **Sodium chloride**

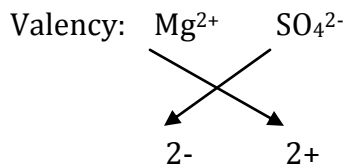


Formula:  $\text{Na}_2\text{Cl}_2 = \text{NaCl}$



**(iii) Magnesium sulphate**

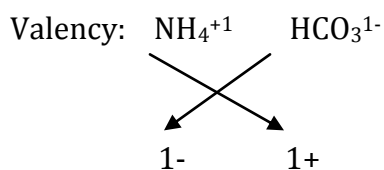
Symbol     Mg     SO<sub>4</sub>



Formula: Mg<sub>2</sub>(SO<sub>4</sub>)<sub>2</sub> = **MgSO<sub>4</sub>**

**(iv) Ammonium bicarbonate**

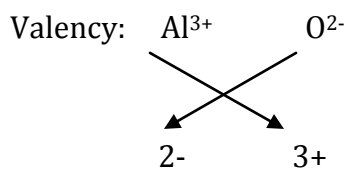
Symbol     NH<sub>4</sub>     HCO<sub>3</sub>



Formula: **NH<sub>4</sub>HCO<sub>3</sub>**

**(v) Aluminium oxide**

Symbol     Al     O



Formula: **Al<sub>2</sub>O<sub>3</sub>**

**(c) Valence electron for-**

(i) K = 1

(ii) Ca = 2

(iii) S = 6

(iv) N = 5

(v) Ar = 8

(vi) O = 6

**Answer 7****(a)**Let,  $V_1 = x$        $V_2 = ?$  $P_1 = 1 \text{ atm.}$     $P_2 = 2 \text{ atm.}$  $T_1$                $T_2 = 3 T_1$ 

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$\frac{1 \times x}{T_1} = \frac{2 \times V_2}{3T_1}$$

$$V_2 = \frac{3T_1 \times}{T_1 \times 2}$$

$$V_2 = 1 \frac{1}{2} \text{ times original volume } V_1$$

**(b)**

Pressure of dry hydrogen

$$P = 750 - 14 = 736 \text{ mm}$$

$$V = 50 \text{ cm}^3$$

$$t = 17^\circ\text{C} = 17 + 273 = 290 \text{ K}$$

$$P_1 = 760 \text{ mm}$$

$$V = ?$$

$$T_1 = 0^\circ\text{C} = 273 \text{ K}$$

Using gas equation,

$$\frac{PV}{t} = \frac{P_1 V_1}{t_1}$$

$$\frac{736 \times 50}{290} = \frac{760 \times V_1}{273}$$

$$\therefore V_1 = \frac{736 \times 50 \times 273}{290 \times 760}$$

$$= 45.58 \text{ cm}^3$$

Let us say (By rounding up),

$$= 45.6 \text{ cm}^3$$

$$\therefore V_1 = 45.6 \text{ cm}^3$$

**(c)**

The three variables for gas laws are:

1. Volume, V
2. Pressure, P
3. Temperature, T

These three are called as the '**Standard variables**'.

S.I. unit of volume is cubic meter ( $\text{m}^3$ ).

S.I. unit of pressure is Pascal (Pa).

S.I. unit of temperature is Kelvin (K) or degree Celsius ( $^{\circ}\text{C}$ ).