

O-level

Three ways in which the atmosphere may react with substance:

I. Hygroscopic

A **hygroscopic substance** is one, which absorbs water from the atmosphere e.g. copper oxide, anhydrous copper sulphate, calcium oxide. Liquids like concentrated sulphuric acid that have high affinity for water can also be described as being hygroscopic. Hygroscopic substances are used as drying agents.

II Deliquescence: is the absorbing of water from the atmosphere by a solid to form a solution e.g. calcium chloride, sodium hydroxide, zinc chloride and Iron III chloride

III Efflorescence: is the giving up of water of crystallization by a crystal to the atmosphere e.g. hydrated sodium carbonate, hydrated sodium sulphate

Exercise

- Which one of the following chlorides is deliquescent?
 - Zinc chloride
 - Calcium chloride
 - Potassium chloride
 - Magnesium chloride
- Which of the following crystalline substances will turn white powder when exposed to air
 - Copper (II) sulphate
 - Magnesium sulphate
 - Sodium carbonate
 - Calcium chloride
- Which of the following substances is/are efflorescent?
 - $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$
 - $\text{NaB}_3\text{O}_7 \cdot 10\text{H}_2\text{O}$
 - $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$
 - $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$
- Which of the following crystals will show decrease in mass when exposed in atmosphere
 - Calcium chloride-6-water
 - Copper (II) sulphate -5-water
 - Iron (II) sulphate-7-water
 - Sodium carbonate -10-water
- Sodium carbonate contains water of crystallization and its efflorescent. Explain the terms water of crystallization and efflorescent.
 - Aqueous sodium carbonate was added to
 - A solution of zinc and
 - Ethanoic acidState what was observed and write ionic equations for the reaction in each case
 - When 3.22g of a hydrated sodium sulphate, $\text{Na}_2\text{SO}_4 \cdot n\text{H}_2\text{O}$, was heated until there was no further change, 1.42g of the residue remained
 - Write an equation for the reaction
 - Determine the value of n .



Answer

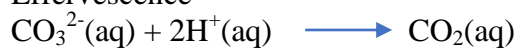
1. B 2.B 3. B (1 and 3) 4D (4 only)

5. (a) Water of crystallization is the definite amount of water with which combine with salts to form crystals from solution while efflorescence is the giving up of water of crystallization by a substance to the atmosphere.

(b) (i) White precipitate of zinc carbonate formed



(ii) Effervescence



(c) (i) $\text{NaSO}_4 \cdot n\text{H}_2\text{O}(\text{s}) \longrightarrow \text{NaSO}_4 + n\text{H}_2\text{O}$

(ii) Mass of water = $3.22 - 1.42 = 1.8$

Substance	NaSO ₄	H ₂ O
mass	1.42	1.8
RFM	142	18
mole	0.01	0.1
Mole ration	1	10
n = 10		

