13. Water

Exercises

1 A. Question

Magnesium sulphate crystals are commonly called.

A. gypsum salt

B. epsom salt

C. green vitriol

D. alum

Answer

Magnesium sulphate is an inorganic salt with a molecular formula of $MgSO_4.7H_2O$. It is often encountered as the heptahydrate sulfate mineral epsomite commonly called Epsom salt. Gypsum salt chemically known as calcium sulphate ($CaSO_4.2H_2O$) is a sedimentary mineral. It is found in layers that were formed under saltwater millions of years ago. The water evaporated and left the mineral. Ferrous sulphate ($FeSO_4$) is commonly known as green vitriol and alum is aluminium sulphate($KAl(SO_4)_2\ 12H_2O$).

1 B. Question

When you buy washing soda from the market, you will get it in powder form because

A. the crystals of washing soda quickly lose water molecules

B. the shop keeper prefers to powder the crystals.

C. washing soda does not form crystals.

D. washing soda is a drying agent.

Answer

Washing soda (Sodium Carbonate, Na_2CO_3) is an efflorescent substance which means that it loses its water part to the surroundings leaving it in a powder form. As it loses its water part, it is unable to form crystals also and it is not drying agent.

1 C. Question

A sample of hard water is heated in a utensil. A white deposit of calcium carbonate is formed. This is due to the presence of

A. calcium chloride

B. magnesium sulphate

C. calcium bicarbonate

D. calcium hydroxide

Answer

Hard water generally contains magnesium and calcium

bicarbonates. The other options given above are not present in hard water. When hard water is boiled, calcium bicarbonate decomposes into calcium carbonate and carbon dioxide.

$$Ca(HCO_3)_2 \xrightarrow[\text{Heat}]{} CaCO_3 + H_2O + CO_2$$

1 D. Question

The salt that causes hardness in water and also liberates carbon dioxide on heating is,

A. magnesium bicarbonate

B. calcium chloride

C. magnesium sulphate

D. calcium sulphate.

Answer

Hard water generally contains magnesium and calcium

bicarbonates. The other options given above are not present in hard water. When hard water is boiled, calcium bicarbonate decomposes into calcium carbonate and carbon dioxide.

$$Ca(HCO_3)_2 \xrightarrow[\text{Heat}]{} CaCO_3 + H_2O + CO_2$$

1 E. Question

When steam is passed over red hot iron we get the following products.

A. ferric hydroxide and hydrogen

B. magnetic iron oxide and hydrogen

C. ferrous hydroxide and hydrogen

D. ferrous oxide and hydrogen

Answer

When steam is passed over red-hot iron, the magnetic iron oxide is produced and hydrogen gas is released. There is no hydrogen in the product which contains iron, therefore hydroxides would not be an option. Ferrous oxide is FeO and hence it would not be an option.

$3Fe + 4H_2O(steam) \rightarrow Fe_3O_4 + 4H_2$

2. Question

Fill in the Blanks with suitable words

1. Chemical name of Epsom salt is _____.

2. The chemical used to soften hard water is _____

Answer

1. Chemical name of Epsom salt is **Magnesium Sulphate**.

Magnesium sulphate is an inorganic salt with a molecular formula of $MgSO_4.7H_2O$. It is often encountered as the heptahydrate sulfate mineral epsomite commonly called Epsom salt.

2. The chemical used to soften hard water is **Sodium Carbonate (Na_2CO_3)**.

Hard water contains soluble calcium bicarbonates andmagnesium bicarbonates, when washing soda is added to hard water, the soluble bicarbonates are converted to insoluble carbonates and a white residue is left making the water soft.

$Ca(HCO_3)_2 + Na_2CO_3 \rightarrow CaCO_3 + Na_2SO_4$

3. Question

Match the following:

A	B
1. causes scale	a. calcium oxide
2. basic oxide	b. soap
3. test for hardness of water	c. sulphur dioxide
4. acidic oxide	d. calcium bicarbonate
	e. neutral oxide
	f. does not react with water

Answer

1. causes scale - d. calcium bicarbonate

Hard water contains calcium bicarbonates. When it is boiled, the bicarbonates break and an insoluble carbonate are formed which deposits on

the walls of the container.

2. basic oxide - a. calcium oxide

A basic oxide is an oxide that shows basic properties. It reacts with water to form a base to form a salt and water.

3. test for hardness of water - b. soap

Hard water contains calcium and magnesium bicarbonates. When soap is added to hard water, insoluble carbonates are formed.

4. acidic oxide - c. sulphur dioxide

Sulphur dioxide present in the atmosphere reacts with rain water to form sulphurous acid.

e. neutral oxide - f. does not react with water

Neutral oxides neither react with acids nor with bases.

4 A. Question

Answer the following :

Water is tasteless, but we experience different tastes of water in different places. Why?

Answer

The taste of water depends on the source of water. Water comes from different rivers which flow on the different soil surface. The salts and minerals from the soil dissolve in river water and thus affecting its taste. Distilled water is tasteless as it does not contain any minerals dissolved in it.

4 B. Question

Answer the following :

Write balanced equations for the reaction of sodium, potassium, and calcium in the cold water.

Answer

$2K + 2H_2O = 2KOH + H_2$

Potassium when reacts with water gives potassium hydroxide and hydrogen gas.

$Ca + 2H_2O = Ca(OH)_2 + H_2$

Calcium reacts with water gives calcium hydroxide and release hydrogen gas.

$2Na + 2H_2O = 2NaOH + H_2$

Sodium reacts with water gives sodium hydroxide and release hydrogen gas.

4 C. Question

Answer the following :

What happens when steam is passed over red-hot iron? Write the equation.

Answer

When steam is passed over red-hot iron, the reaction occurs which releases magnetic iron oxide and hydrogen gas.

$3Fe + 4H_2O = Fe_3O_4 + 4H_2$

4 D. Question

Answer the following :

Define the terms efflorescence and deliquescence.

Answer

Efflorescence means spontaneous loss of water by a hydrated salt when the aqueous vapour pressure of the hydrate is greater than the partial pressure of the water vapour in the air. For example, washing soda ($Na_2CO_310H_2O$) has a higher water content than the water vapour present in the atmosphere, therefore, it loses its hydrated part and become powdery.

Deliquescence is the process by which a substance absorbs moisture from the atmosphere and dissolves in it to make a solution. Deliquescence occurs when the vapour pressure of the solution that is formed is less than the partial pressure of water vapour in the air. All soluble salts will deliquesce if the air is sufficiently humid. A substance that absorbs moisture from the air but not necessarily to the point of dissolution is called hygroscopic. For example magnesium chloride, anhydrous calcium chloride, calcium nitrate etc.

4 E. Question

Answer the following :

Give two reasons to prove that water is a compound and not an element.

Answer

Two reasons to prove that water is a compound and not an element are:

● Water comprises of 2 parts of hydrogen and one part of oxygen and they combine chemically. Thus water is a compound which is made up of two elements and its properties are completely different from its constituents.

$2H_2 + O_2 = 2H_2O$

● The constituents of the water cannot be separated physically and need chemical methods to separate its constituents.

4 F. Question

Answer the following :

Name three metals which do not react with water, under normal conditions.

Answer

Copper, Aluminium, and tin are the metals which do not react with water under normal conditions. This is the reason why kitchen utensils, vessels are made up of these metals so that when water is stored it does not react with water.

4 G. Question

Answer the following :

Name the products formed when the following oxides are dissolved in water. Write a balanced equation.

a. Sulphur dioxide

b. Potassium oxide

c. Carbon dioxide

d. Calcium oxide

Answer

(a) When sulphur dioxide reacts with water then the product produced is sulphurous acid. Sulphur dioxide is present in the atmosphere and when rain occurs, it reacts with water and become sulphurous acid.

$SO_2 + H_2O \rightarrow H_2SO_3$

(b) When potassium oxide reacts with water then it produces potassium hydroxide.

$K_2O + H_2O \rightarrow 2KOH$

(c) When carbon dioxide reacts with water it produces carbonic acid.

$CO_2 + H_2O \rightarrow H_2CO_3$

(d) When calcium oxide reacts with water it produces calcium hydroxide.

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

4 H. Question

Answer the following :

State the reasons for hardness in water.

Answer

Water is hard due to the minerals dissolved in it. Magnesium and calcium bicarbonates, chlorides and sulphates get dissolved in water which is the main reason for the hardness of water. Hard water does not produce lather when soap is dissolved in it.

5 A. Question

Give reasons for the following :

Sodium metal should be stored in kerosene.

Answer

Sodium is kept in kerosene because it is a highly reactive metal. If it is kept in open container, it will react with oxygen and water vapour present in the atmosphere producing sodium oxides and sodium hydroxides respectively. It should be handled with care because it can react with the moisture of our hands and can cause blisters. kerosene oil does not react with sodium and acts as a barrier which restricts its reaction with oxygen and moisture.

5 B. Question

Give reasons for the following :

Washing soda loses its crystalline structure quickly.

Answer

Washing soda (Na_2CO_3 $10H_2O$) has a higher water content than the water vapour present in the atmosphere, therefore, it loses its hydrated part and become powdery. In other words, washing soda is efflorescent in nature.

5 C. Question

Give reasons for the following :

When calcium nitrate crystals are exposed to air, they form a solution.

Answer

Calcium Nitrate is a deliquescent substance. Calcium nitrate absorbs moisture from the atmosphere and dissolves in it to make a solution. The vapour pressure of the calcium nitrate solution that is formed is less than the partial pressure of water vapour in the air. All soluble salts will deliquesce if the air is sufficiently humid.