O Level Combined Chemistry Structured

Salts Test 2.0

Q1

(a) A student was asked to prepare a pure sample of copper(II) carbonate.

Use the following information below, describe how the student can prepare a pure sample of copper(II) carbonate from copper metal.

- Copper does not react with dilute acids.
- Copper reacts with concentrated nitric acid to form copper(II) nitrate.
- All nitrates are soluble in water.
- Copper(II) carbonate is insoluble in water.

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..... [5]

Q2

A clean and dry sample of copper(II) chloride, $CuCl_2$, is to be prepared.

(i) State the two reagents needed to prepare copper(II) chloride.

..... and .....[1]

(ii) Describe the steps taken to prepare a clean and dry sample of copper(II) chloride, starting with the two reagents stated in **(c)(i)**.

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.....[2]

Q3

A soluble salt, sodium phosphate, Na_3PO_4, is used in washing powder as a water softener. It is made by reacting dilute phosphoric acid, H_3PO_4, with an alkali.

(a) (i) Give the formula of the ions present in sodium phosphate. [1]

(ii) Name the alkali used to react with phosphoric acid to obtain sodium phosphate. [1]

(iii) Write a balanced chemical equation for the reaction. [2]

(b) Describe the steps involved in preparing a pure and dry sample of sodium phosphate salt by reacting dilute phosphoric acid and the alkali. [6]

Q4

(a) Magnesium chloride can be produced by reacting magnesium with a suitable acid. Name the acid and describe the experimental procedure that could be used to produce a pure and dry sample of magnesium chloride.

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.....[5]

Q5

The table below shows a study of the reaction between aqueous sodium sulfate and aqueous barium nitrate. Different volumes of aqueous sodium sulfate are added separately to 5.0 cm^3 of aqueous barium nitrate in a reaction tube. The height of the precipitate is measured and recorded.

volume of sodium sulfate added/ cm^3	1.0	1.5	2.0	2.5	3.0	3.5
height of precipitate / cm	2.5	3.0	3.5	4.0	4.0	

(a) Write a balanced chemical equation, including state symbols, for the reaction between aqueous sodium sulfate and aqueous barium nitrate.

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(b) Describe how a dry, pure sample of precipitate can be prepared in the science laboratory from the given reactants.

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(c) Predict, in cm, the height of the precipitate in reaction tube 6. Explain your answer.

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(d) Describe a test to identify nitrate ions in barium nitrate.

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..... [2]

Answers

Salts Test 2.0

Q1

(a) 1. Add excess copper power to fixed volume of concentrated nitric acid in a beaker [1] and filter to collect aqueous copper(II) nitrate as the filtrate. [1] [5]

2. Add an equal volume of an aqueous sodium carbonate to aqueous copper(II) nitrate. [1]

   Reject if did not mention aqueous / solution

3. Filter the resulting mixture to obtain copper(II) carbonate as the residue. [1]

4. Wash the copper(II) carbonate with distilled water and dry by pressing between pieces of dry filter paper. [1]

Q2

copper(II) carbonate/ copper(II) oxide and hydrochloric acid

Steps:

1. Add **excess** copper (II) carbonate/ copper (II) oxide to dilute hydrochloric acid. Stir.
2. Filter to remove excess solid.
3. Heat filtrate to get saturated solution.
4. Cool to form crystals.
5. Filter, rinse crystals with distilled water, dry crystals with filter paper.

Q3

(a) (i) Na^+ and PO_4^{3-} [1]

(ii) sodium hydroxide [1]

(iii) $3NaOH + H_3PO_4 \rightarrow Na_3PO_4 + 3H_2O$ [formula:1, balancing:1]

(b) Steps :

1. Pour phosphoric acid into the burette and note its volume.
2. Pipette 25 cm^3 of sodium hydroxide into a conical flask.
3. Add a few drops of methyl orange to the alkali in the flask.
4. Titrate the alkali in the flask with the acid until the indicator changes colour to orange.
5. Take note of the volume of acid- x cm^3.
6. Repeat the experiment without adding the indicator.
7. Add x cm^3 of acid from the burette to 25 cm^3 of alkali in the conical flask without the indicator.
8. Swirl the flask and pour the sodium phosphate solution into and evaporating dish.
9. Heat the solution until saturated.
10. Cool the solution to obtain sodium phosphate crystals.
11. Filter to obtain the crystals.
12. Dry the crystals by pressing between filter papers. [½ mark for each step]

Q4

a	**Acid: Hydrochloric acid** 1. **Add excess** magnesium to dilute hydrochloric acid and **stir** until no more magnesium can dissolve in the acid / no more effervescence is observed. 2. **Filter** the mixture. 3. **Heat** the magnesium chloride solution till a **saturated solution** is obtained. 4. Allow the saturated solution to **cool** so that magnesium chloride **crystals** can be formed. 5. Filter the mixture and **wash** the crystals using **little cool distilled water.** 6. **Dry** the magnesium sulfate crystals **between filter paper**.

Q5

(a)	$Ba(NO_3)_2$ (aq) + Na_2SO4 (aq) → $BaSO_4$ (s) + 2$NaNO_3$ (aq) 1m eqn, 1m ss
(b)	Mix barium nitrate to sodium sulfate. (1) Filter the mixture to collect the precipitate (barium sulfate) (1). Wash the precipitate with a little distilled water to remove impurities. (1). Dry the precipitate with filter paper. (1)
(c)	4.0 cm (1) Barium nitrate is the limiting reagent and is used up and hence no more precipitation occurs. (1)
(d)	Add sodium hydroxide and aluminium foil and warm gently. (1) Ammonia gas which turns damp red litmus paper blue will be produced. (1)