Write your name, centre number and candidate number in the boxes below.

Surname	Other names

Centre number | | | | | |

Candidate number | | | | |

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Making salts

Time allowed: 1 hour 30 minutes

Subject code **0620**

Chemistry

Questions from Paper 4 and Paper 6

You must have: a ruler marked in centimetres and millimetres, a protractor, compasses, a pen, an HB pencil and an eraser.

Total marks

/ 67

Instructions

- Answer every question in the space provided on this paper.
- Write in black or dark blue ink. Pencil may be used for diagrams and graphs.
- Fill in your name, centre number and candidate number above.
- Show your working: a correct method can earn marks even if the answer is wrong.

Information

- This paper has 9 questions worth 67 marks in total.
- The marks for each question or part are shown in brackets, for example [3].

Advice

- Read every question through once before you write anything.
- Use the marks in brackets to judge how long to spend on each part.
- If you finish early, go back and check your working.

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Print at 100% (Actual size) so diagrams keep their real measurements.

1 The following instructions were used to prepare magnesium sulfate crystals, $MgSO_4.7H_2O$.

Step 1 Measure 50 cm^3 of dilute sulfuric acid into a beaker and warm the solution.

Step 2 Using a spatula, add some magnesium oxide and stir the mixture. Continue adding the magnesium oxide until excess is present.

Step 3 Separate the excess magnesium oxide from the solution of magnesium sulfate.

Step 4 Heat the solution until crystals form. Obtain the crystals and dry them.

(a) Why is the sulfuric acid warmed?

..... [1]

(b) How would you know when excess magnesium oxide is present in **Step 2**?

..... [1]

(c) What method is used in **Step 3**?

..... [1]

(d) Why must care be taken when drying the crystals in **Step 4**?

..... [1]

(e) Explain how the method would differ if magnesium carbonate was used instead of magnesium oxide.

.....

..... [2]

[Total: 6]

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2 The notes below show the steps taken by a student to prepare crystals of hydrated nickel nitrate, $Ni(NO_3)_2.6H_2O$.

Step 1 Place 25 cm^3 of dilute nitric acid in a beaker.

Step 2 Add nickel carbonate powder to the beaker until it is in excess.

Step 3 Separate the solution of nickel nitrate from the mixture.

Step 4 Heat the solution to obtain crystals of hydrated nickel nitrate.

(a) (i) Name the piece of apparatus used to measure the nitric acid in **Step 1**.

..... [1]

(ii) Why is it **not** necessary to heat the dilute nitric acid before adding the nickel carbonate?

..... [1]

(b) How would the student know when excess nickel carbonate was present in **Step 2**?

..... [1]

(c) Draw a diagram to show the separation method used in **Step 3**.

[2]

(d) How could the student make sure a good sample of crystals was obtained when carrying out **Step 4**? Explain your answer.

.....

.....

..... [2]

[Total: 7]

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3 Potassium sulfate is the salt produced when sulfuric acid is neutralised by potassium hydroxide solution.
The correct amount of potassium hydroxide solution must be added to neutralise all of the sulfuric acid.
Plan an experiment to obtain pure crystals of potassium sulfate from sulfuric acid and potassium hydroxide solution.
You are provided with common laboratory apparatus.

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..... [6]

[Total: 6]

Preparation of salts Click for more variations

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4 Solid cobalt(II) oxide is a base which is insoluble in water. It reacts very slowly with cold dilute sulfuric acid to form a solution of cobalt(II) sulfate.

Describe how to make pure, dry crystals of hydrated cobalt(II) sulfate.

You are provided with cobalt(II) oxide, dilute sulfuric acid and common laboratory apparatus.

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.... [6]

Preparation of salts Click for more variations

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5 Lead(II) chloride, $PbCl_2$, is an insoluble salt. Solid lead(II) chloride can be made by reacting aqueous sodium chloride with aqueous lead(II) nitrate.

$$2NaCl(aq) + Pb(NO_3)_2(aq) \rightarrow 2NaNO_3(aq) + PbCl_2(s)$$

Describe how to make a pure, dry sample of solid lead(II) chloride.

You are provided with solid sodium chloride, solid lead(II) nitrate, distilled water and common laboratory apparatus.

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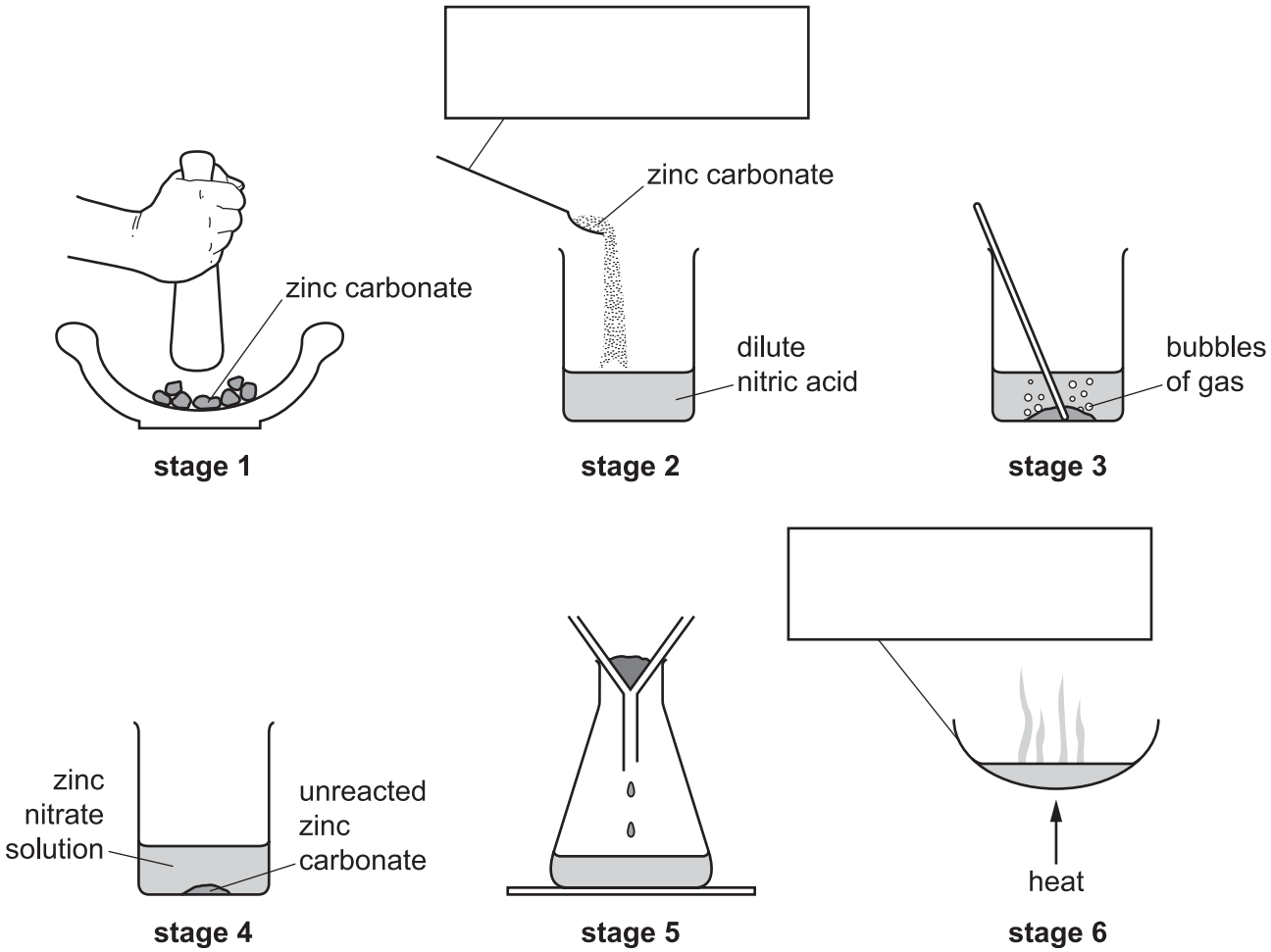
....

.... [6]

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6 The diagrams show the stages in the preparation of zinc nitrate crystals from lumps of zinc carbonate.



(a) Complete the boxes to show the apparatus used. [2]

(b) Use the diagrams to write a list of instructions for the stages of this preparation.

(i) stages 1, 2, 3 and 4

.....

.....

..... [3]

(ii) stage 5

..... [1]

(iii) stage 6

.....

..... [2]

[Total: 8]

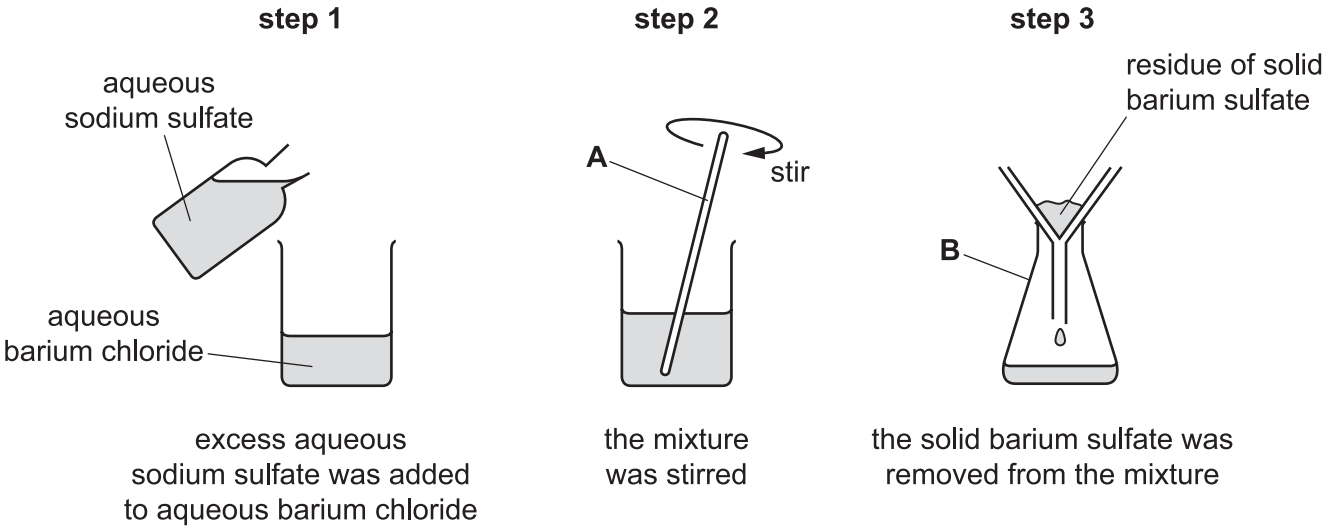
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7 Barium sulfate is an insoluble salt. Barium sulfate can be made by reacting excess aqueous sodium sulfate with aqueous barium chloride.

$$\text{sodium sulfate} + \text{barium chloride} \rightarrow \text{sodium chloride} + \text{barium sulfate}$$

A student made a sample of barium sulfate using the following steps.



(a) Name the items of apparatus labelled **A** and **B**.

A .....

B .....
[2]

(b) Name the process shown in **step 3**.

..... [1]

(c) The general name for the solid in **step 3** is residue.

State the general name for the solution obtained from the process in **step 3**.

..... [1]

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(d) Two more steps, **step 4** and **step 5**, are needed to obtain a pure sample of barium sulfate. In each of these steps something is removed from the residue.

State what is done in each of **step 4** and **step 5** and identify the substance removed from the barium sulfate.

step 4 .....

.....

substance removed .....

step 5 .....

.....

substance removed .....

[4]

[Total: 8]

Preparation of salts Click for more variations

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8 Three common methods of preparing salts are shown below.

method **A** adding an excess of an insoluble base or carbonate or metal to a dilute acid and removing excess by filtration

method **B** using a burette and indicator

method **C** mixing two solutions to obtain the salt by precipitation

For each of the following salt preparations, choose a method, **A**, **B** or **C**. Name any additional reagent which is needed and complete the equation.

(a) the soluble salt, nickel chloride, from the insoluble compound nickel carbonate

method .....

reagent .....

word equation .....

[3]

(b) the insoluble salt, lead(II) bromide, from aqueous lead(II) nitrate

method .....

reagent .....

ionic equation ..... + ... $\rightarrow$ $PbBr_2$

[3]

(c) the soluble salt, lithium sulfate, from the soluble base lithium hydroxide

method .....

reagent .....

equation .....

[4]

[Total: 10]

Preparation of salts Click for more variations

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9 Three ways of making salts are

- titration using a soluble base or carbonate
- neutralisation using an insoluble base or carbonate
- precipitation.

(a) Complete the following table of salt preparations.

method	reagent 1	reagent 2	salt
titration	....	....	sodium nitrate
neutralisation	nitric acid	....	copper(II) nitrate
precipitation	....	....	silver(I) chloride
neutralisation	sulfuric acid	zinc(II) carbonate	....

[6]

(b) (i) Write an ionic equation with state symbols for the preparation of silver(I) chloride.

..... [2]

(ii) Complete the following equation.

$ZnCO_3 + H_2SO_4 \rightarrow$ ..... + ... + ...

[2]

[Total: 10]

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