

GCSE Combined Science: Trilogy

Worksheet: Soluble salts

TIME 35 min	TOTAL 31 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Soluble salts

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

A student made copper sulfate crystals from copper oxide and dilute sulfuric acid.
The steps of the method are shown in the wrong order:

- **A** filter the mixture
- **B** add copper oxide to warm acid until no more dissolves
- **C** leave the solution to cool so that crystals form
- **D** heat the filtrate to evaporate some of the water

0 1 . 1

Give the correct order of the steps.

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.....

.....

.....

[2 marks]

0 1 . 2

Explain why the student added copper oxide until no more dissolved.

.....

.....

[1 mark]

0 1 . 3

Name the apparatus used to remove the excess copper oxide.

.....

.....

[1 mark]

0 2

A student makes copper(II) sulfate solution by adding copper(II) oxide to warm dilute sulfuric acid until some of the black solid is left undissolved. The student filters the mixture, then heats the filtrate to evaporate some of the water.

The student then investigates how the place where the hot solution is left to cool affects the size of the crystals that form. The student pours 20 cm³ of the hot solution into each of three identical evaporating dishes. One dish is left in a refrigerator, one on the laboratory bench and one in a warm cupboard. After two days, the student measures the length of the largest crystal in each dish.

0 2 . 1

What is the independent variable in this investigation?

Tick (✓) **one** box.

The mass of copper(II) oxide added

☐

The place where the solution was left to cool

☐

The length of the largest crystal

☐

The volume of solution in each dish

☐

[1 mark]

0 2 . 2

What is the dependent variable in this investigation?

.....

.....

[1 mark]

0 2 . 3

Give **two** control variables in this investigation.

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.....

.....

.....

[2 marks]

0 2 . 4

Why did the student add copper(II) oxide until some was left undissolved?

.....

.....

[1 mark]

0 2 . 5

Name the method used to remove the excess copper(II) oxide from the mixture.

.....

.....

.....

.....

[1 mark]

0 3

A student made crystals of magnesium sulfate by reacting magnesium carbonate with dilute sulfuric acid.

0 3 . 1

Write a word equation for the reaction.

.....

.....

[1 mark]

0 3 . 2

The student warmed the acid before adding the magnesium carbonate.
Give a reason why.

.....

.....

[1 mark]

0 3 . 3

How would the student know when enough magnesium carbonate had been added?

[2 marks]

0 3 . 4

The student evaporated the solution using a water bath instead of heating it strongly with a Bunsen burner.
Suggest why.

[1 mark]

0 3 . 5

Suggest how the student could dry the crystals.

[1 mark]

0 4

A student made copper(II) sulfate crystals three times, each time from the same volume of the same solution. The student pressed the crystals between filter papers and then weighed them. The masses were 4.62 g, 4.60 g and 4.61 g.

The crystals were not completely dry: water on the surface of the crystals added about 0.25 g to each mass.

0 4 . 1

What type of error is caused by weighing the crystals before they were completely dry?

Tick (✓) **one** box.

A random error

☐

A systematic error

☐

A zero error

☐

An anomalous result

☐

[1 mark]

0 4 . 2

Were the three masses precise, accurate, both or neither?
Explain your answer.

.....

.....

.....

.....

[2 marks]

0 4 . 3

Explain why repeating the experiment more times and calculating a mean would **not** remove this error.

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.....

[2 marks]

0 4 . 4

Describe how the student could make sure that the crystals are dry before recording their mass.

.....

.....

.....

.....

[2 marks]

0 5

After crystals of a soluble salt have formed, they need to be dried.

0 5 . 1

Describe a suitable method for drying the crystals without damaging them.

.....

.....

[1 mark]

0 5 . 2

Explain why the crystals should not be dried quickly in a very hot oven.

.....

.....

.....

.....

[2 marks]

0 6

A student wrote this method for making zinc sulfate crystals:

1. Put 50 cm³ of dilute sulfuric acid into a beaker.
2. Add one spatula of zinc oxide and stir.
3. Filter the mixture.
4. Heat the filtrate strongly in an evaporating basin until all the water has gone.

0 6 . 1

Identify **two** problems with the method. For each problem, describe how the method should be improved.

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[4 marks]

0 6 . 2

Suggest why the student should warm the acid before adding the zinc oxide.

.....

.....

[1 mark]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Soluble salts · 31 marks

Question 1 (4 marks)

01.1 [2 marks]

Answer: B, A, D, C

- B first and C last (1)
 - A before D: B, A, D, C (1)
-

01.2 [1 mark]

- to make sure all of the acid had reacted / was used up (1)
-

01.3 [1 mark]

- filter funnel and filter paper (1)

Notes: Allow filter paper / funnel on its own. Do not accept sieve.

Question 2 (6 marks)

02.1 [1 mark]

Correct: The place where the solution was left to cool

02.2 [1 mark]

Answer: The length of the largest crystal.

- the length / size of the (largest) crystal(s) (1)
-

02.3 [2 marks]

Answer: The volume of solution in each dish; the size of the evaporating dishes.

- the volume of solution in each dish (20 cm^3) (1)
- the concentration of the solution / all the solution taken from the same batch (1)
- the type / size of the evaporating dishes (1)
- the time the dishes are left before the crystals are measured (1)

Any 2 of the points above.

02.4 [1 mark]

Answer: To make sure that all of the sulfuric acid had reacted.

- to make sure all of the (sulfuric) acid has reacted / been used up (the copper(II) oxide is in excess) (1)

Notes: Ignore 'to neutralise the acid' unless 'all' or 'completely' is stated.

02.5 [1 mark]

Answer: Filtration.

- filtration / filtering (1)
-

Question 3 (6 marks)

03.1 [1 mark]

Answer: magnesium carbonate + sulfuric acid → magnesium sulfate + water + carbon dioxide

- magnesium carbonate + sulfuric acid → magnesium sulfate + water + carbon dioxide (1)
-

03.2 [1 mark]

- to increase the rate of reaction / so the solid reacts faster (1)
-

03.3 [2 marks]

- no more fizzing / bubbles (1)
 - some solid is left (undissolved) in the beaker (1)
-

03.4 [1 mark]

- gentle heating stops the solution spitting / stops the salt decomposing / allows crystals to form (instead of a powder) (1)
-

03.5 [1 mark]

- pat dry between pieces of filter paper / leave in a warm place / leave on a windowsill (1)
-

Question 4 (7 marks)

04.1 [1 mark]

Correct: A systematic error

04.2 [2 marks]

Answer: Precise (very close together) but not accurate (each is about 0.25 g more than the true mass of the dry crystals).

- precise, because the three masses are very close together (a range of only 0.02 g) (1)
- not accurate, because every mass is about 0.25 g more than the true mass of the dry crystals (1)

Notes: Each mark needs the judgement and its reason. A bare 'precise but not accurate' scores 0.

04.3 [2 marks]

Answer: Every mass is too high by about the same amount, so the mean is also too high; repeats only reduce random errors.

- every mass is too high (by about the same amount) / the error is always in the same direction (1)
 - so the mean would also be too high; repeating only reduces the effect of random errors (1)
-

04.4 [2 marks]

Answer: Dry them further and reweigh, repeating until the mass stops changing.

- dry the crystals further (e.g. in a desiccator or a warm place) and weigh them again (1)
- repeat until the mass no longer changes (constant mass) (1)

Notes: Do not accept heating the crystals strongly, e.g. with a Bunsen burner.

Question 5 (3 marks)

05.1 [1 mark]

- allow: pat/blot dry between sheets of filter paper, then leave in a warm place (or a desiccator) to dry slowly in air (1)
-

05.2 [2 marks]

- a very hot oven could melt the crystals or decompose the salt (1)
 - if the salt is hydrated, strong heating could drive off its water of crystallisation, changing/damaging the crystals (1)
-

Question 6 (5 marks)

06.1 [4 marks]

- one spatula of zinc oxide may not react with all of the acid (1)
- add zinc oxide until it is in excess / until no more dissolves (1)
- heating strongly to dryness may decompose the salt / make it spit / gives a powder instead of crystals (1)
- heat gently (e.g. water bath) until crystals start to form, then leave to cool and crystallise (1)

06.2 [1 mark]

- so the zinc oxide reacts / dissolves faster (1)
-