

GCSE Combined Science: Trilogy

Worksheet: Reversible reactions

TIME 30 min	TOTAL 27 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Reversible reactions

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
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0	1	.	1
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 Which of these is a reversible reaction?

Tick (✓) **one** box.

Burning magnesium in oxygen

☐

Heating pink hydrated cobalt chloride to turn it blue

☐

Neutralising an acid with an alkali

☐

Rusting of iron

☐

[1 mark]

0	1	.	2
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 What does the symbol $\rightleftharpoons$ mean when it is used in an equation?

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.....

.....

.....

[1 mark]

0 2

When ammonium chloride is heated in a test tube, it decomposes into ammonia and hydrogen chloride. A white solid forms near the cool top of the test tube.



0 2 . 1

What does the symbol $\rightleftharpoons$ show about this reaction?

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.....

[1 mark]

0 2 . 2

Name the white solid that forms near the top of the test tube.

.....

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.....

.....

[1 mark]

0 2 . 3

Explain why the white solid forms near the top of the test tube.

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.....

[2 marks]

0 2 . 4

How can the direction of a reversible reaction be changed?

.....

.....

[1 mark]

0 3

Blue cobalt chloride paper turns pink when water is added. When the pink paper is heated, it turns blue again.

0 3 . 1

Explain how these observations show that the reaction is reversible.

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.....

.....

[2 marks]

0 3 . 2

Complete the word equation for the reversible reaction.

anhydrous cobalt chloride (blue) + water $\rightleftharpoons$ _____

.....

.....

[1 mark]

0 3 . 3

Blue cobalt chloride paper is used to test for water.

Suggest why the paper must be stored in a sealed container.

.....

.....

[1 mark]

0 3 . 4

Which of these is also a reversible reaction?

Tick (✓) **one** box.

Burning methane

☐

Heating hydrated copper sulfate

☐

Reacting magnesium with hydrochloric acid

☐

Frying an egg

☐

[1 mark]

0 4

Water boils to form steam, and steam condenses back to water. Ammonium chloride decomposes reversibly when heated:



0 4 . 1

Explain why boiling and condensing water is **not** an example of a reversible chemical reaction, even though it can be reversed.

.....

.....

.....

.....

[2 marks]

0 4 . 2

Explain how the decomposition of ammonium chloride shows that it **is** a reversible chemical reaction.

.....

.....

.....

.....

[2 marks]

0 5

A student investigated a reversible reaction using blue hydrated copper sulfate crystals. Table 1 shows the mass of a sample at each stage.

Table 1

Stage	Description	Mass in g
1	Blue hydrated copper sulfate crystals	2.50
2	After strong heating until the mass stopped changing (white solid)	1.60
3	After adding enough water to fully rehydrate the white solid (blue solid re-forms)	2.50
4	After heating the resulting blue solid again until the mass stopped changing	1.60

0 5 . 1

Explain why the mass decreased between stage 1 and stage 2.

.....

.....

.....

.....

[2 marks]

0 5 . 2

Explain why the mass increased between stage 2 and stage 3, back to its original value.

.....

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.....

.....

[2 marks]

0 5 . 3

Explain why the mass at stage 4 is the same as at stage 2.

.....

.....

[1 mark]

0 6

A student heated solid ammonium chloride, NH_4Cl , in a test tube. The solid disappeared from the bottom of the tube and a white solid formed near the top of the tube.

0 6 . 1

Write a balanced symbol equation, with state symbols, for the reversible reaction.

.....

.....

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.....

[2 marks]

0 6 . 2

A student says:

'The ammonium chloride has just turned into a gas and then back into a solid, so this is a physical change.'

Explain why the student is wrong.

.....

.....

.....

.....

[2 marks]

0 6 . 3

The student held a piece of damp red litmus paper at the mouth of the tube. The litmus paper turned blue.

Name the gas that turned the litmus paper blue.

.....

.....

.....

.....
[1 mark]

0 6 . 4

Suggest why the ammonium chloride must be heated for the forward reaction to happen.

[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: Reversible reactions · 27 marks

Question 1 (2 marks)

01.1 [1 mark]

Correct: Heating pink hydrated cobalt chloride to turn it blue

01.2 [1 mark]

Answer: The reaction can go in both directions (it is reversible).

- the reaction is reversible / can go in both directions (1)
-

Question 2 (5 marks)

02.1 [1 mark]

Answer: The reaction is reversible.

- the reaction is reversible (1)
-

02.2 [1 mark]

Answer: Ammonium chloride

- ammonium chloride (1)
-

02.3 [2 marks]

Answer: The top of the tube is cooler, so ammonia and hydrogen chloride react to re-form ammonium chloride.

- the top of the tube is cooler (1)
 - so the reverse reaction happens / ammonia and hydrogen chloride react to form ammonium chloride (1)
-

02.4 [1 mark]

Answer: By changing the conditions, such as the temperature.

- by changing the conditions (e.g. the temperature) (1)
-

Question 3 (5 marks)

03.1 [2 marks]

Answer: The pink product can change back into the blue starting substance when the conditions are changed.

- the product (pink) can react to re-form the original substance (blue) (1)
- the direction of the reaction changes when the conditions are changed (adding water or heating) (1)

03.2 [1 mark]

Answer: hydrated cobalt chloride (pink)

- hydrated cobalt chloride (1)

03.3 [1 mark]

Answer: Water vapour in the air would turn it pink.

- water vapour in the air would turn the paper pink (so it could not be used for the test) (1)

03.4 [1 mark]

Correct: Heating hydrated copper sulfate

Question 4 (4 marks)

04.1 [2 marks]

Answer: Boiling and condensing are physical changes of state; no new substance is formed (it is still water, H_2O , throughout), so no chemical reaction has taken place.

- boiling and condensing are physical changes (changes of state), not chemical reactions (1)
- no new substance is formed — it is water (H_2O) before and after — so there is no chemical reaction to reverse (1)

04.2 [2 marks]

Answer: New substances (ammonia and hydrogen chloride, different from ammonium chloride) are formed on heating, and these can react together again to re-form the original ammonium chloride.

- new substances (ammonia and hydrogen chloride) are formed, which are chemically different from ammonium chloride, so a chemical reaction has occurred (1)
 - these new substances can react together again to re-form the original ammonium chloride (1)
-

Question 5 (5 marks)

05.1 [2 marks]

Answer: Water was driven off as steam and escaped, so the remaining solid has a lower mass.

- water (of crystallisation) is driven off as steam and escapes from the container (1)
- so the mass of the remaining solid decreases (1)

05.2 [2 marks]

Answer: The water added reacts with (combines with) the white anhydrous solid, re-forming the blue hydrated compound; the mass of water added is incorporated into the solid, so the total mass increases back to the original 2.50 g.

- the water added reacts with (combines with) the white anhydrous solid, re-forming the blue hydrated compound (1)
- the mass of the water added becomes part of the solid, so the total mass increases back to the original value (1)

05.3 [1 mark]

Answer: The same amount of anhydrous copper sulfate is left each time, once all the water has been driven off again.

- the same (anhydrous) solid is left once all the water has been driven off again, so the mass returns to the stage 2 value (1)
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Question 6 (6 marks)

06.1 [2 marks]

Answer: $\text{NH}_4\text{Cl(s)} \rightleftharpoons \text{NH}_3\text{(g)} + \text{HCl(g)}$

- $\text{NH}_4\text{Cl} \rightleftharpoons \text{NH}_3 + \text{HCl}$ (1)
- state symbols: (s) on the left and (g), (g) on the right (1)

Notes: Allow $\rightarrow$ for the first mark.

06.2 [2 marks]

Answer: New substances (ammonia and hydrogen chloride) are formed, so it is a chemical change.

- new substances (ammonia and hydrogen chloride) are formed (1)
- so it is a chemical change / the solid decomposes rather than just changing state (1)

06.3 [1 mark]

Answer: Ammonia

- ammonia (1)

06.4 [1 mark]

Answer: The forward reaction is endothermic, so it needs energy.

- the forward reaction is endothermic / needs energy to break bonds (1)
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