

# Reversible Reacts + Dynamic Equilibrium

## Question Paper

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Chemistry
Exam Board	AQA
Topic	5.6 Rate + Extent Chemical Change
Sub-Topic	Reversible Reacts + Dynamic Equilibrium
Difficulty Level	Bronze Level
Booklet	Question Paper

Time Allowed: 55 minutes

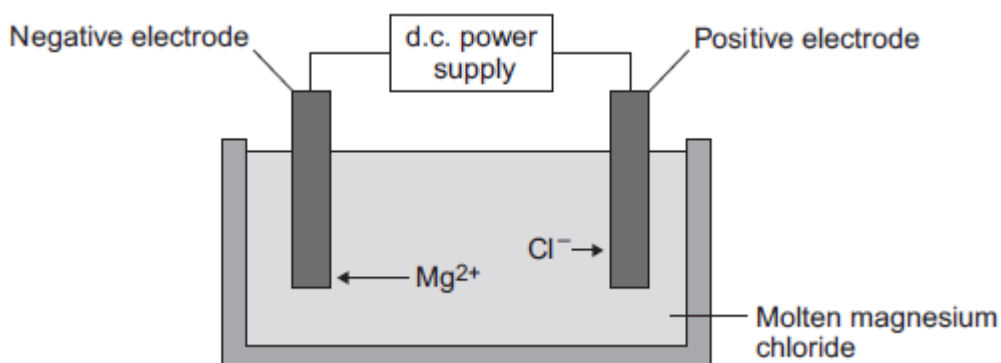
Score: /55

Percentage: /100

Grade Boundaries:

**Q1.** Some students investigated reactions to produce magnesium.

- (a) The students used electrolysis to produce magnesium from magnesium chloride, as shown in the figure below.



- (i) Magnesium chloride contains magnesium ions and chloride ions.

Why does solid magnesium chloride **not** conduct electricity?

.....  
.....

(1)

- (ii) One of the products of the electrolysis of molten magnesium chloride is magnesium.

Name the other product.

.....

(1)

- (iii) Why do magnesium ions ( $\text{Mg}^{2+}$ ) move to the negative electrode?

.....  
.....

(1)

- (iv) At the negative electrode, the magnesium ions ( $\text{Mg}^{2+}$ ) gain electrons to become magnesium atoms.

How many electrons does each magnesium ion gain?

.....

(1)

- (b) The students did the experiment four times and weighed the magnesium produced.

The table below shows their results.

Experiment	Mass of magnesium produced in grams
1	1.13
2	0.63
3	1.11
4	1.09

- (i) There is an anomalous result.

Suggest **one** possible reason for the anomalous result.

.....  
 .....

(1)

- (ii) Calculate the mean mass of magnesium produced, taking account of the anomalous result.

.....  
 .....  
 .....

Mean mass = ..... g

(2)

- (c) The formula of magnesium chloride is  $\text{MgCl}_2$

The relative formula mass of magnesium chloride is 95.

The relative atomic mass of magnesium is 24.

- (i) Use the equation to calculate the percentage mass of magnesium in

magnesium chloride.

$$\text{Percentage mass of magnesium} = \frac{\text{mass of magnesium}}{\text{mass of magnesium chloride}} \times 100\%$$

.....  
.....  
.....

Percentage mass of magnesium in magnesium chloride = ..... %

(2)

- (ii) Draw a ring around the relative mass of chlorine in  $\text{MgCl}_2$

71

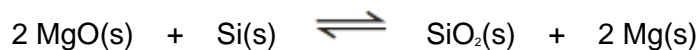
95

119

(1)

- (d) Magnesium is also produced from the reaction of magnesium oxide with silicon.

- (i) The equation for the reaction is:



What is the meaning of this symbol  $\rightleftharpoons$  ?

Draw a ring around the correct answer.

neutralisation  
reaction

precipitation reaction

reversible reaction

(1)

- (ii) The forward reaction is endothermic.

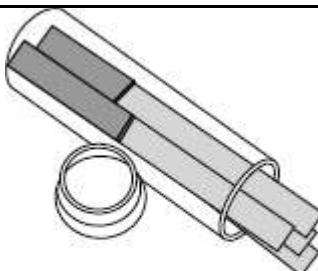
Draw a ring around the correct answer to complete the sentence.

In an endothermic reaction the temperature of the surroundings

decreases.
increases.
stays the same.

(1)  
(Total 12 marks)

**Q2.** Read the information and then answer the questions.



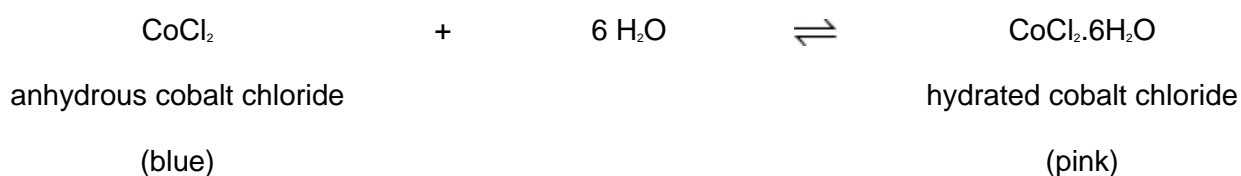
COBALT CHLORIDE  
PAPER

Cobalt chloride paper can be used to test for water.

The paper contains anhydrous cobalt chloride.

The jar containing the papers must be kept closed when not being used.

The equation shows the reaction between anhydrous cobalt chloride and water.



(a) Choose **one** word from the box to complete the sentence.

endothermic	exothermic	reversible
-------------	------------	------------

The symbol  $\rightleftharpoons$  means that the reaction is .....

(1)

(b) Describe the colour change when water is added to the cobalt chloride paper.

.....

.....

(1)

- (c) Suggest why the jar containing the unused cobalt chloride papers must be kept closed.

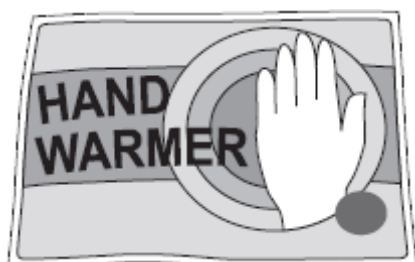
.....

.....

(1)

(Total 3 marks)

**Q3.** Hand warmers use chemical reactions.



- (a) The table shows temperature changes for chemical reactions **A**, **B** and **C**.

Reaction	Starting temperature in °C	Final temperature in °C	Change in temperature in °C
<b>A</b>	18	25	+ 7
<b>B</b>	17	.....	+ 5
<b>C</b>	18	27	+ 9

What is the final temperature for reaction **B**? Write your answer in the table.

(1)

- (b) (i) What name is given to reactions that heat the surroundings? .....

(1)

- (ii) Which reaction, **A**, **B** or **C**, would be best to use in a hand warmer?

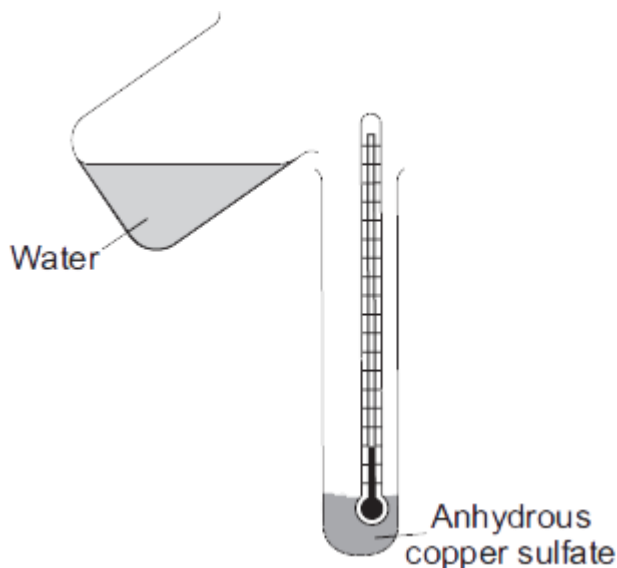
Reaction

Give a reason why you chose this reaction.

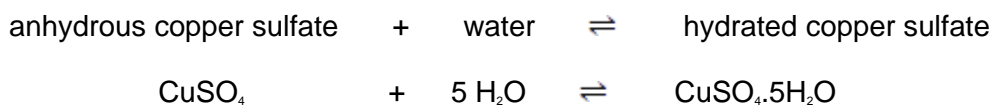
.....  
.....

(2)

- (c) A student added water to some anhydrous copper sulfate.



The equation for the reaction is shown.



The student measured the temperature before and after the reaction.

- (i) The measurements showed that this reaction can be used for a hand warmer.

Draw a ring around the correct answer to complete the sentence.

When water is added to anhydrous copper sulfate the temperature

of the mixture

increases.  
decreases.  
stays the same.

(1)

(ii) Anhydrous copper sulfate is white.

What colour is seen after water is added to the anhydrous copper sulfate?

.....

(1)

(iii) What does the symbol  $\rightleftharpoons$  mean?

.....

(1)

(iv) The student heated a tube containing hydrated copper sulfate.

Name the solid substance produced.

.....

(1)

(Total 8 marks)

**Q4.** Stage smoke is used for special effects at pop concerts.



By Sam Cockman [CC BY 2.0], via Flickr

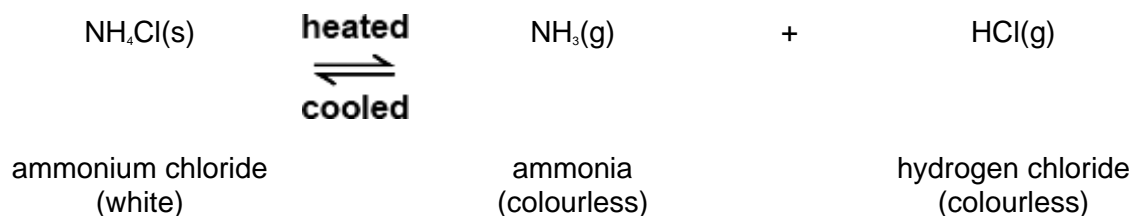
Ammonium chloride can be used to make stage smoke.



Ammonium chloride is a white solid.

When heated, ammonium chloride produces white smoke which can be blown onto the stage.

The equation shows what happens when ammonium chloride is heated and cooled.



- (a) The sentences explain how the smoke is made.

Draw a ring around the correct answer in each box to complete each sentence.

Use the information and the equation to help you.

When heated, ammonium chloride makes two colourless

solids.

liquids.

gases.

These are blown into the air where they cool and make a

colourless

black

white

solid.

liquid.

gas.

which is

ammonia.

ammonium chloride.

hydrogen chloride.

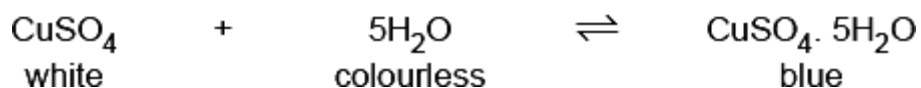
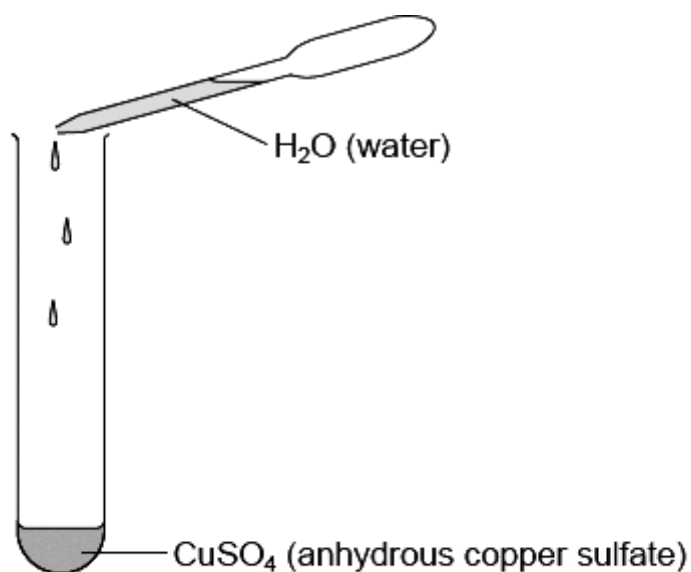
(4)

- (b) Complete the sentence.

The symbol  $\rightleftharpoons$  means that the reaction is .....

(1)  
(Total 5 marks)

**Q5.** The diagram shows how anhydrous copper sulfate can be used to test for water.



(a) What colour change will you see when water is added to the  $\text{CuSO}_4$ ?

Colour changes from ..... to .....

(1)

(b) Draw a ring around the meaning of the symbol  $\rightleftharpoons$

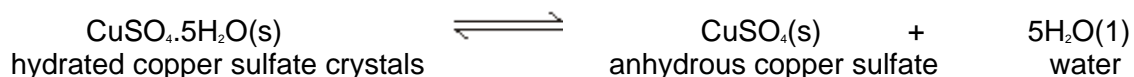
**endothermic**

**exothermic**

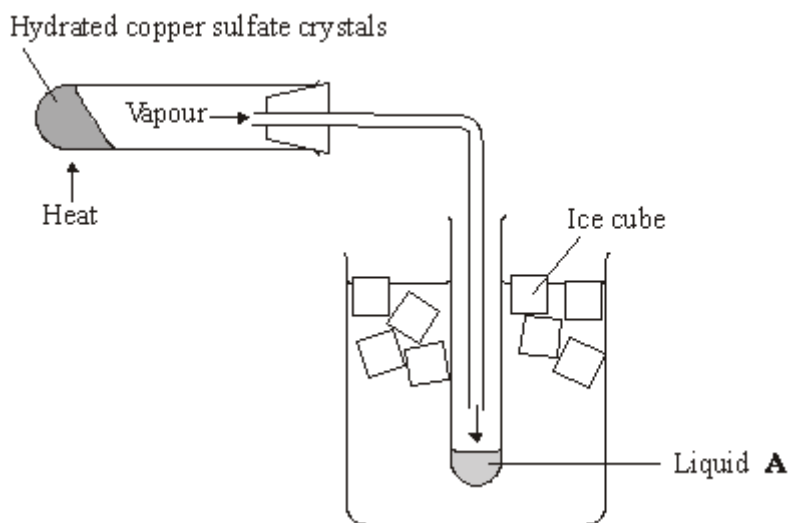
**reversible**

(1)  
(Total 2 marks)

- Q6.** A student heated some hydrated copper sulfate crystals.  
The equation for this reaction is shown below.



The diagram shows the apparatus used.



- (a) Name liquid **A** .....

(1)

- (b) What helped the vapour to condense into liquid **A**?

.....  
.....

(1)

- (c) Put a tick (✓) next to the correct meaning of the symbol  $\rightleftharpoons$

Meaning	(✓)
---------	-----

equal amounts of reactants and products	
exothermic reaction	
reversible reaction	

(1)

- (d) The student weighed the copper sulfate before and after it was heated. The experiment was repeated and the two sets of results are shown in the table.

Mass of copper sulfate before heating in grams	Mass of copper sulfate after heating in grams	Mass lost in grams
2.50	1.65	0.85
2.50	1.61	0.89

- (i) Draw a ring around the **average** mass lost for these two sets of results.

**0.85 g      0.87 g      0.89 g**

(1)

- (ii) The student used the same mass of copper sulfate each time but the mass lost was different.

Put a tick (✓) next to the **two** reasons which could explain why the mass lost is different.

Reason	(✓)
The student used different test tubes for the two experiments.	
The student made errors in weighing during the experiments.	
The student used more ice in one of the experiments.	
The student did not heat the copper sulfate for long enough in one of the experiments.	

(2)

- (e) Anhydrous copper sulfate is used to test for water.

Use words from the box to complete the sentence.

blue	green	red	white
------	-------	-----	-------

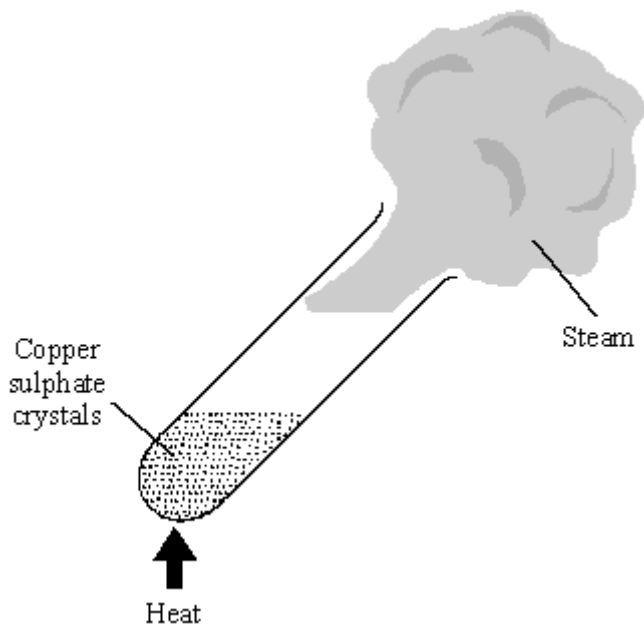
Water changes the colour of anhydrous copper sulfate from

.....

to .....

(2)  
(Total 8 marks)

- Q7.** A student heated some blue copper sulphate crystals. The crystals turned into white copper sulphate.

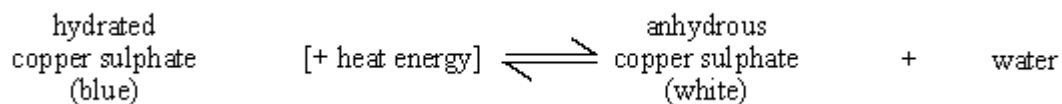


- (a) The blue copper sulphate had to be heated to change it into white copper sulphate.  
State whether the reaction was exothermic or endothermic. ....  
Explain your answer.

.....  
.....  
.....  
.....

(1)

(b) The word equation for this reaction is shown below.



(i) What does the symbol  $\rightleftharpoons$  tell you about this reaction?

.....

(1)

(ii) How could the student turn the white powder back to blue?

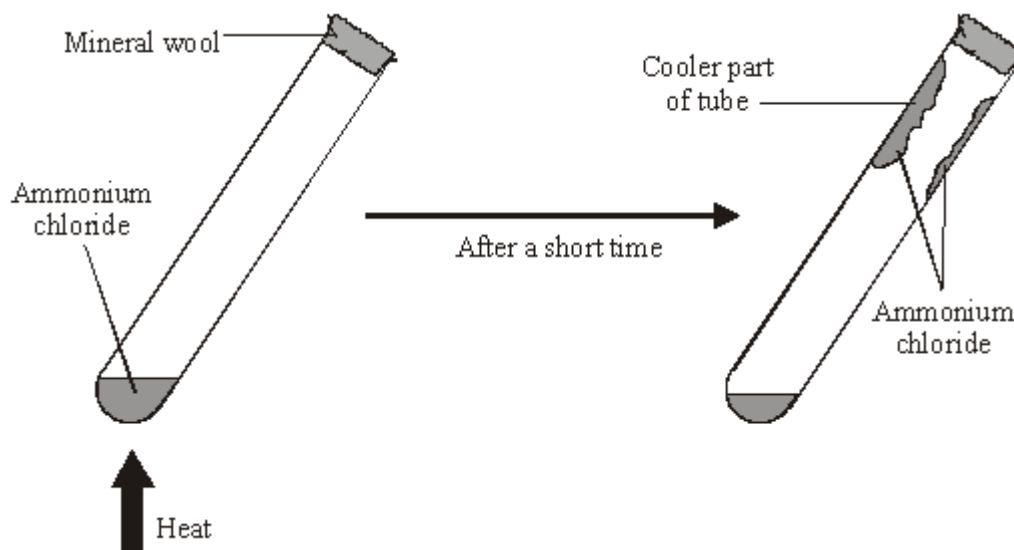
.....

(1)

(Total 3 marks)

**Q8.** A student did two experiments using ammonium chloride.

(a) In the first experiment the student heated a small amount of ammonium chloride in a test tube.



Two reactions take place in the test tube.

Reaction 1	$\text{ammonium chloride} \rightarrow \text{ammonia} + \text{hydrogen chloride}$ (colourless gases)
Reaction 2	$\text{ammonia} + \text{hydrogen chloride} \rightarrow \text{ammonium chloride}$

- (i) Complete the sentences by crossing out the **incorrect** word in each box.

Reaction 1 takes place at a 

high  
low

 temperature.

Reaction 2 takes place at a 

high  
low

 temperature.

(1)

- (ii) Draw a ring around the word which best describes reactions 1 and 2.

**combustion    displacement    oxidation    reduction    reversible**

(1)

- (iii) Suggest a reason for the mineral wool at the top of the test tube.

.....

(1)

- (b) In the second experiment the student mixed a small amount of ammonium chloride with some water in a beaker.

The temperature of the water was measured before and after adding the ammonium chloride.

Temperature before adding the ammonium chloride	20°C
Temperature after adding the ammonium chloride	16°C

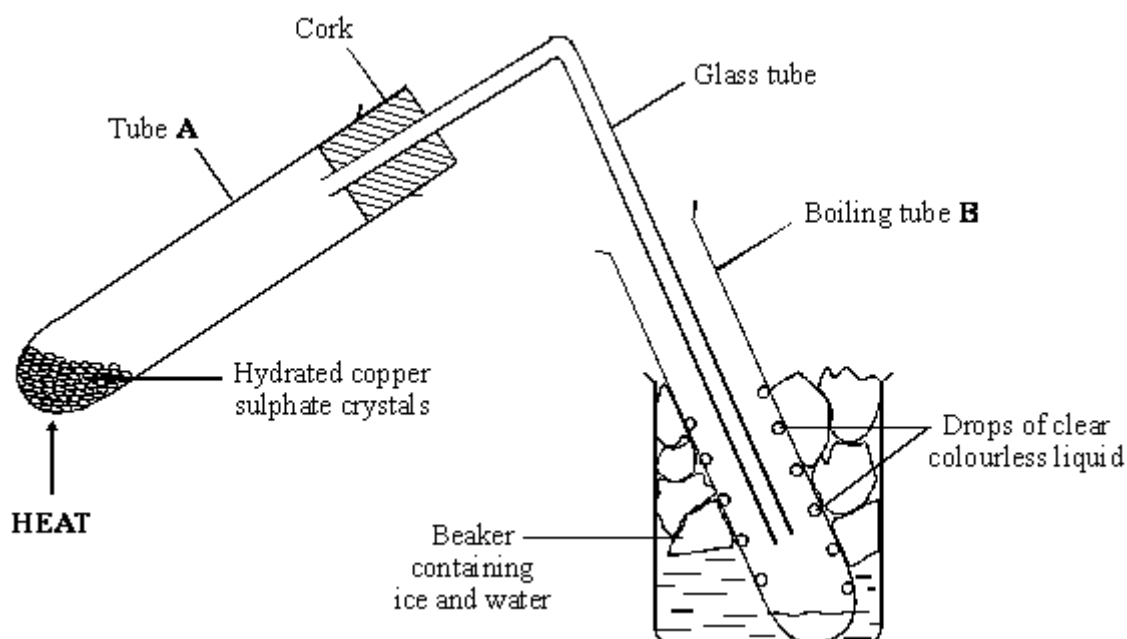
Draw a ring around the word which best describes the process which takes place.

**combustion      displacement      endothermic      exothermic      freezing**

(1)

(Total 4 marks)

- Q9.** The diagram shows the apparatus for an experiment. Hydrated copper sulphate crystals were heated. They became anhydrous copper sulphate.





- (a) Name a suitable piece of equipment to heat tube **A**.

.....

(1)

- (b) Use words from the box to complete the **two** spaces in the table. You may use each word once or not at all.

black	blue	orange	red	purple	white
-------	------	--------	-----	--------	-------

Name	Colour
Hydrated copper sulphate crystals	.....
Anhydrous copper sulphate	.....

(2)

- (c) What is the purpose of the ice and water in the beaker?

.....

.....

(1)

- (d) Drops of a clear, colourless liquid formed on the inside of tube **B**.

- (i) Name the liquid.

.....

(1)

- (ii) Explain how the liquid came to be inside tube **B**.

.....

.....

.....

(2)

- (e) Anhydrous copper sulphate can be turned into hydrated copper sulphate. What would you need to add? Apart from the change in colour, what could you observe?

.....

.....

.....

(2)

- (f) Copper sulphate can be made from black copper oxide by reacting it with an acid. Name the acid.

.....

(1)

(Total 10 marks)