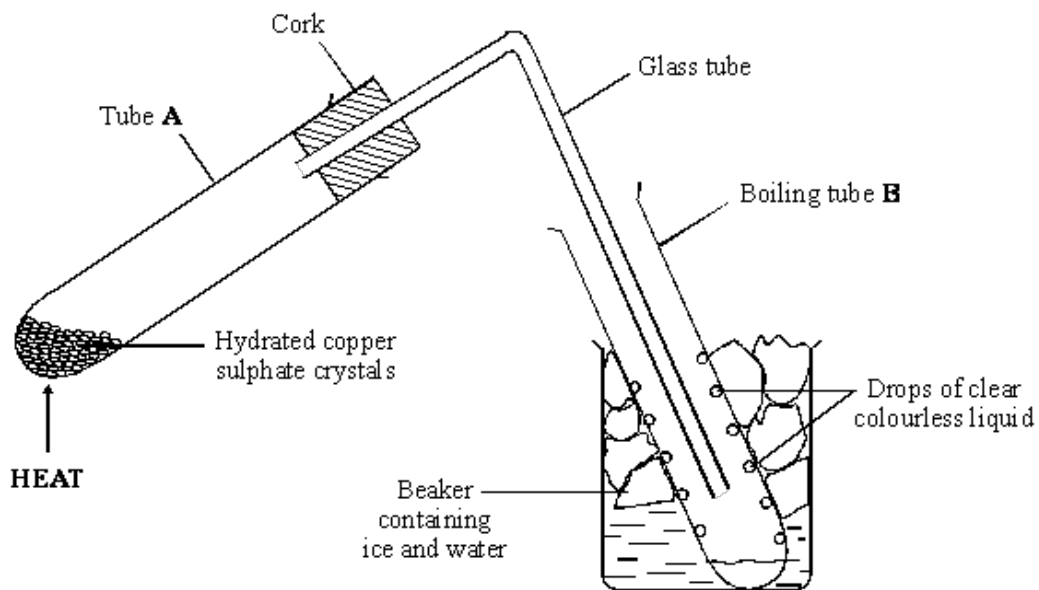


Q1. The diagram shows the apparatus for an experiment. Hydrated copper sulphate crystals were heated. They became anhydrous copper sulphate.



(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)

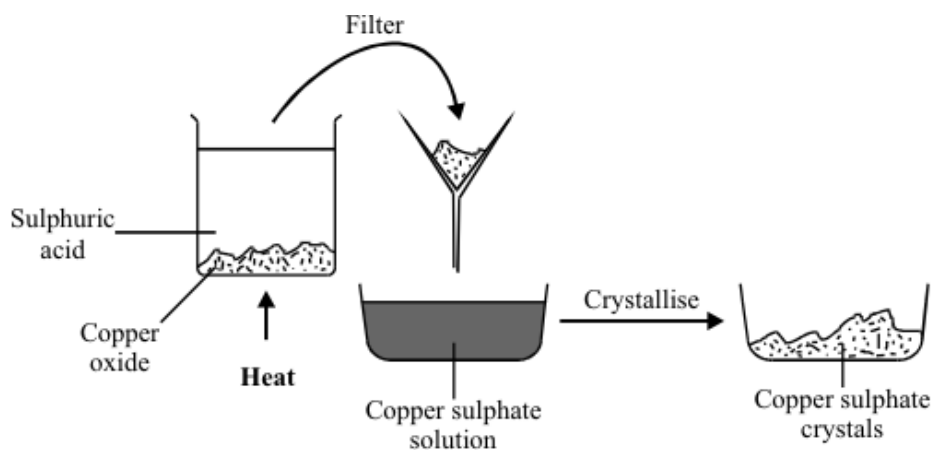
(f) Copper sulphate can be made from black copper oxide by reacting it with an acid. Name the acid.

.....

(1)

(Total 10 marks)

Q2. (a) The diagram shows one way of making crystals of copper sulphate.



(i) Why was the solution filtered?

.....

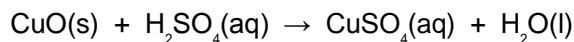
(1)

(ii) How could you make the crystals form faster from the copper sulphate solution?

.....

(1)

(iii) The chemical equation is shown for this reaction.



In the chemical equation what does (aq) mean?

.....

(1)

(b) Blue copper sulphate crystals go white when warmed. How could you use the white copper sulphate as a test for water?



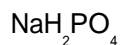
.....
.....
.....

(2)

(Total 5 marks)

Q3. A student investigated some instant soup.

(a) Instant soup contains a food additive which has the formula:



Give the names of all the elements in this compound.

The periodic table on the Data Sheet may help you to answer this question.

.....
.....

(2)

(b) The student investigated the reaction which takes place when soup powder is added to cold water.

The student thought that the reaction might be *exothermic*.

(i) What is meant by the term *exothermic* reaction?

.....
.....

(2)

- (ii) Describe an experiment that the student could do to prove that this reaction is exothermic.

To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

.....

.....

.....

.....

.....

.....

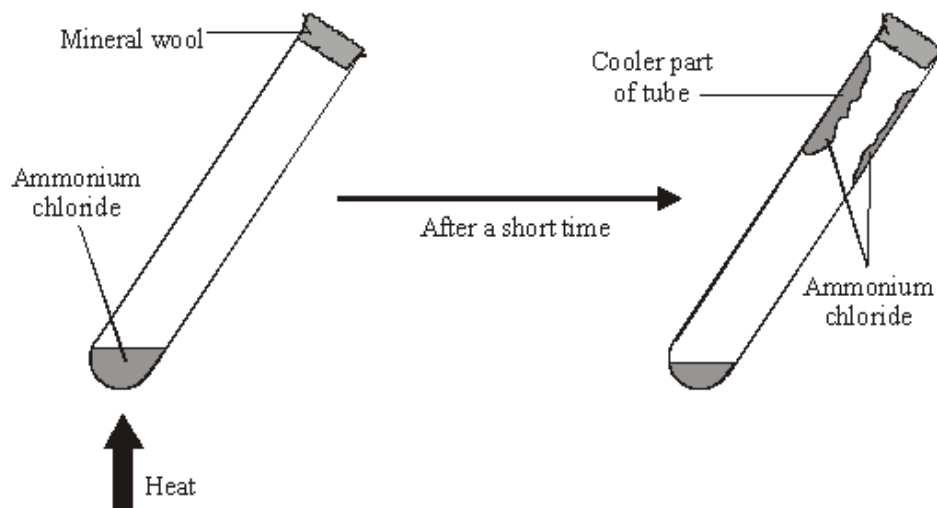
.....

.....

(4)
(Total 8 marks)

Q4. 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

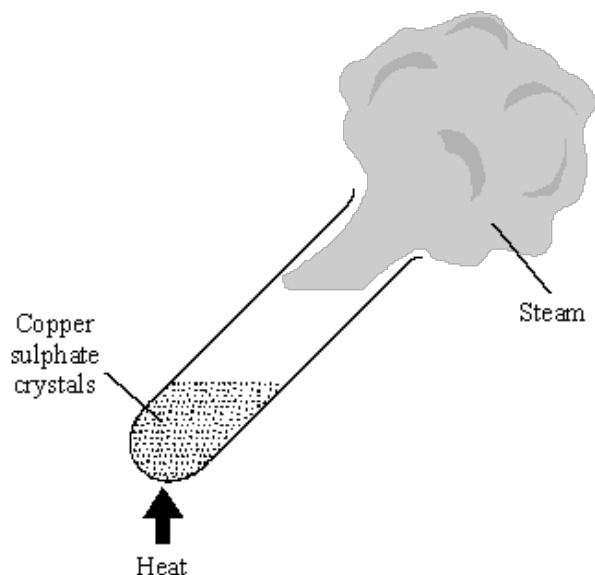
Draw a ring around the word which best describes the process which takes place.

combustion displacement endothermic exothermic freezing

(1)

(Total 4 marks)

Q5. 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.

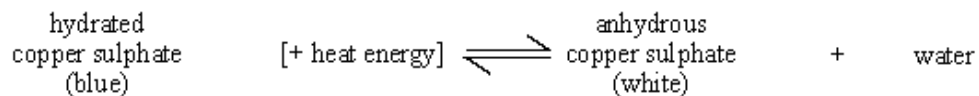
State whether the reaction was exothermic or endothermic.

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)

Q6. Instant cold packs are used to treat sports injuries.



One type of cold pack has a plastic bag containing water. Inside this bag is a smaller bag containing ammonium nitrate.

The outer bag is squeezed so that the inner bag bursts. The pack is shaken and quickly gets very cold as the ammonium nitrate dissolves in the water.

(a) **One** of the statements in the table is correct.

Put a tick (✓) next to the correct statement.

Statement	(✓)
The bag gets cold because heat energy is given out to the surroundings.	
The bag gets cold because heat energy is taken in from the surroundings.	
The bag gets cold because plastic is a good insulator.	

(1)

(b) Draw a ring around the word that best describes the change when ammonium nitrate dissolves in water.

electrolysis endothermic exothermic

(1)

(c) Suggest and explain why the pack is shaken after the inner bag has burst.

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

(2)
(Total 4 marks)

Q7. Distress flares are used to attract attention in an emergency.



Flares often contain magnesium. Magnesium burns to form magnesium oxide.

(a) The distress flare burns with a bright flame because the reaction is very *exothermic*.

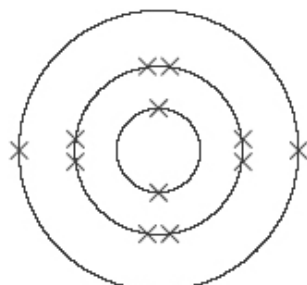
Complete the following sentence using the correct words from the box.

gives out heat	stores heat	takes in heat
-----------------------	--------------------	----------------------

An *exothermic* reaction is one which

(1)

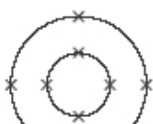
- (b) The diagram shows the electronic structure of a magnesium atom. The atomic (proton) number of magnesium is 12.



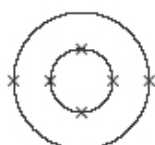
Magnesium atom

The atomic (proton) number of oxygen is 8.

Which diagram, **A**, **B**, **C** or **D**, shows the electronic structure of an oxygen atom?



A



B



C

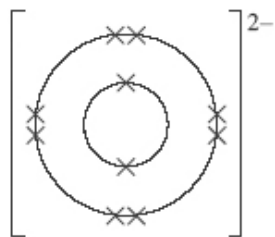


D

Diagram

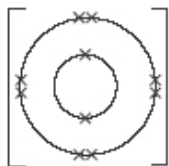
(1)

- (c) Magnesium ions and oxide ions are formed when magnesium reacts with oxygen. The diagram shows the electronic structure of an oxide ion.

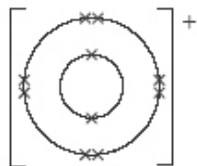


Oxide ion

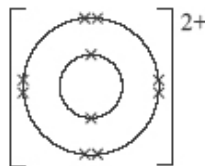
Which diagram, **J**, **K**, **L** or **M**, shows the electronic structure of a magnesium ion?



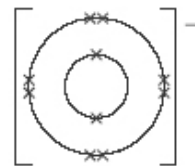
J



K



L



M

Diagram

(1)

- (d) Indigestion tablets can be made from magnesium oxide. The magnesium oxide neutralises some of the hydrochloric acid in the stomach.

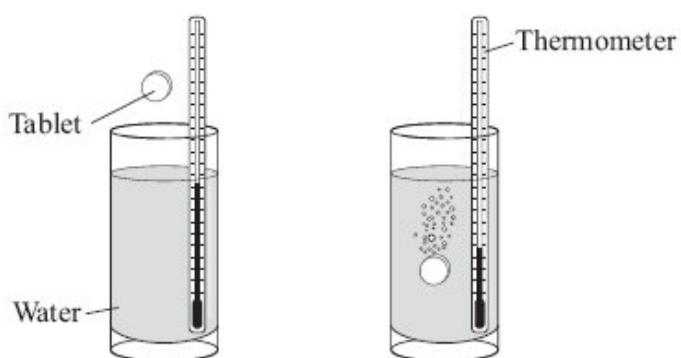
Draw a ring around the name of the salt formed when magnesium oxide reacts with hydrochloric acid.

magnesium chloride magnesium hydroxide magnesium sulfate

(1)
(Total 4 marks)

- Q8.** An indigestion tablet contains sodium hydrogencarbonate and citric acid.

When the tablet is added to cold water a chemical reaction takes place and there is a lot of fizzing.



- (a) The formula of the gas that causes the fizzing is CO_2

Name this gas

(1)

- (b) This chemical reaction is endothermic.

- (i) Tick (✓) the statement which describes what happens to the temperature of the solution.

Statement	Tick (✓)
The temperature of the solution will increase.	
The temperature of the solution will decrease.	
The temperature of the solution will stay the same.	

(1)

- (ii) Tick (✓) the statement which describes what happens to the energy during the reaction.

Statement	Tick (✓)
Energy is given out to the surroundings.	
Energy is taken in from the surroundings.	
No energy is given out to or taken from the surroundings.	

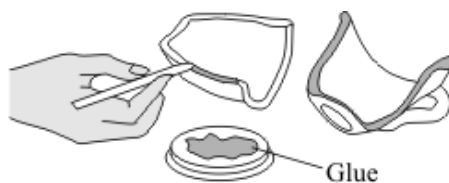
(1)
(Total 3 marks)

- Q9.** The following steps show how to use a type of glue.

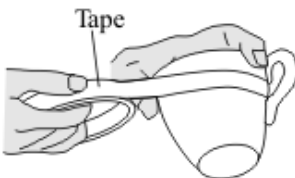
Step 1 Measure out equal amounts of the liquids from tubes **A** and **B**.



Step 2 Mix the liquids to make the glue.
Put a thin layer of the glue onto each of the surfaces to be joined.



Step 3 Assemble the pieces to be joined and then hold them together with tape.



Step 4 Leave the glue to set.

(a) When liquids **A** and **B** are mixed a chemical reaction takes place.

(i) This reaction is exothermic.

Complete the sentence below using a word or phrase from the box.

decrease increase stay the same
--

During the reaction the temperature of the mixture will

(1)

(ii) When the glue sets it forms a giant covalent structure.

Draw a ring around **one** property that you would expect the set glue to have.

good conductor of electricity **low melting point** **high melting point**

(1)

(b) The time taken for the glue to set at different temperatures is given in the table below.

Temperature in °C	Time taken for the glue to set
20	3 days
60	6 hours
90	1 hour

(i) Complete the sentences below using words or phrases from the box.

decrease increase stay the same
--

When the temperature is increased the time taken for the glue to set

.....

When the temperature is increased the rate of the setting reaction

.....

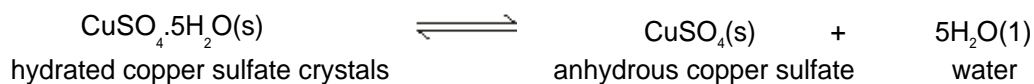
(2)

- (ii) Put a tick (✓) next to the **two** reasons why an increase in temperature affects the rate of reaction.

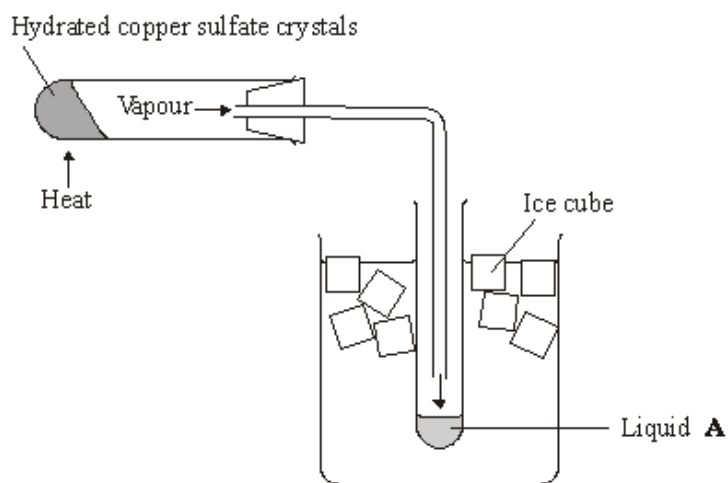
Reason	(✓)
It gives the particles more energy.	
It increases the concentration of the particles.	
It increases the surface area of the particles.	
It makes the particles move faster.	

(2)
(Total 6 marks)

- Q10.** 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

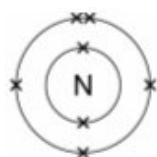
(2)
(Total 8 marks)

Q11. (a) Ammonia has the formula NH_3 . It is made from nitrogen and hydrogen.

How many atoms are in an ammonia molecule?

(1)

(b) The diagrams show the electron arrangement in nitrogen and hydrogen.

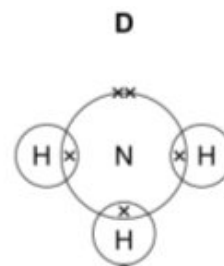
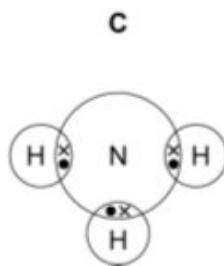
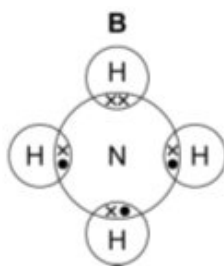
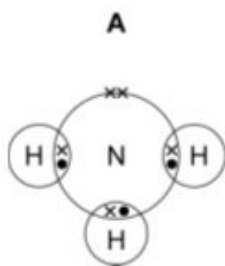


Nitrogen



Hydrogen

Which diagram below, **A**, **B**, **C** or **D**, represents an ammonia molecule?



Write your answer in the box.

Diagram

(1)

(c) Ammonia dissolves in water to form a solution with a pH of 10.

What does this pH value tell you about ammonia solution?

.....

(1)

(d) In industry a large amount of ammonia is neutralised by an acid to make ammonium nitrate.

(i) What type of substance is ammonium nitrate?

Tick (✓) **one** box.

acid

alkali

base

salt

(1)

(ii) Which acid is added to ammonia to make ammonium nitrate?

Tick (✓) **one** box.

hydrochloric

citric

nitric

sulfuric

(1)

(iii) Draw a ring around the main use of ammonium nitrate.

fertiliser

lubricating oil

medicine

plastic

(1)

- (e) Instant cold packs are used to treat sports injuries.



One type of cold pack has a plastic bag containing water. Inside the bag is a smaller bag containing ammonium nitrate.

The outer bag is squeezed so that the inner bag bursts. The ammonium nitrate dissolves in the water. This process is endothermic.

Explain why the bag becomes cold.

.....

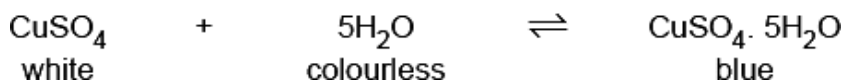
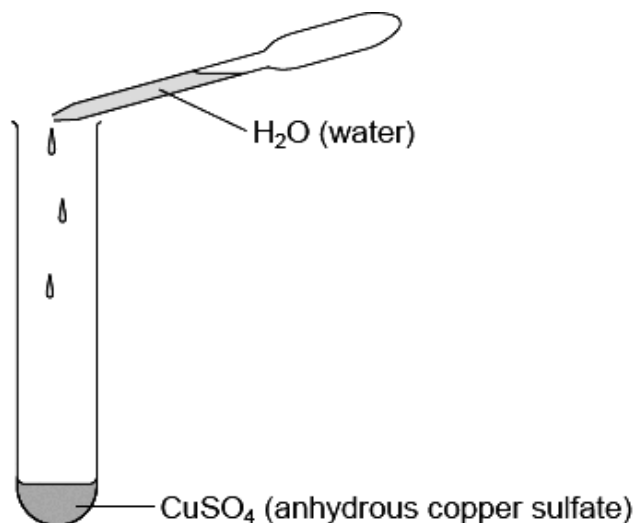
.....

.....

.....

(2)
(Total 8 marks)

Q12. 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 CuSO_4 ?

Colour changes from to (1)

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

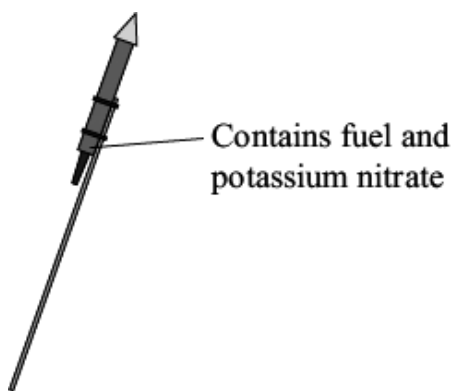
endothermic

exothermic

reversible

(1)
(Total 2 marks)

Q13. Firework rockets contain fuel and potassium nitrate.



The potassium nitrate provides oxygen for the fuel to react.

(a) The table shows how a student worked out the relative formula mass (M_r) of potassium nitrate.

Some of the numbers are missing.

Relative atomic masses (A_r): N = 14; O = 16; K = 39.

Name of atom (symbol)	Number of atoms	A_r	Mass
potassium (K)	1	39	39
nitrogen (N)	1	14	14
oxygen (O)		16	
The M_r of potassium nitrate =			101

(i) The mass of oxygen is not shown in the table.

Draw a ring around the correct mass of oxygen.

16

32

48

(1)

(ii) Draw a ring around the number of oxygen atoms in the formula of potassium nitrate.

1

2

3

(1)

(b) When the fuel reacts with the oxygen an *exothermic* reaction takes place.

What does *exothermic* mean?

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

(2)

(c) The fuel contains carbon. Carbon reacts with oxygen to make carbon dioxide.

Which **two** statements in the table explain why carbon dioxide is a gas at room temperature?

Tick (✓) the **two** statements.

Statement	Tick (✓)
It has a giant structure	
It has a low boiling point.	
It is made of small molecules.	
It is made of ions.	

(2)
(Total 6 marks)

Q14. Read the information in the box.

Flash powder is used to produce special effects at pop concerts.



Flash powder contains aluminium. The powder burns with a bright white flame and gives out lots of heat and light. It also produces white smoke.

The flash powder is placed on stage in a special container. At the bottom of the container there is a thin piece of wire. When the flash is needed, electricity is passed through the wire. The wire gets hot and starts the aluminium burning.

By russellsmith [CC BY 2.0], via Flickr

(a) When aluminium burns the reaction is exothermic.

Give **one** piece of information from the box which shows that the reaction is exothermic.

.....

(1)

(b) The hot wire provides energy to start the aluminium burning.

Draw a ring around the name given to the energy needed to start a chemical reaction.

activation energy

potential energy

solar energy

(1)

(c) When aluminium burns it reacts with oxygen to make aluminium oxide.

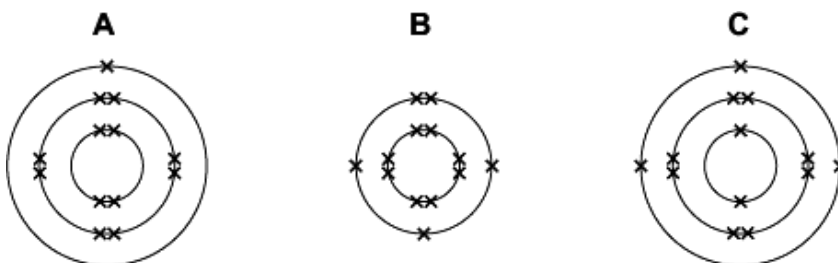
Complete the word equation for this reaction.

aluminium + →

(1)

(d) An aluminium atom has 13 electrons.

Which diagram, **A**, **B** or **C**, represents the electronic structure of an aluminium atom?



The electronic structure of an aluminium atom is diagram

(1)

(e) The white smoke produced is aluminium oxide.

Aluminium oxide contains aluminium ions (Al^{3+}) and oxide ions (O^{2-}).

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

(i) Electrons have

a negative
no
a positive

charge.

(1)

(ii) When an aluminium atom (Al) turns into an aluminium ion (Al^{3+})

it

gains
loses
shares

three electrons.

(1)

(iii) When an oxygen atom (O) turns into an oxide ion (O^{2-})

it

gains
loses
shares

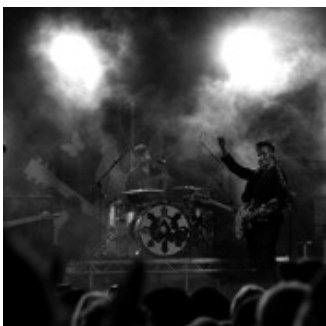
one
two
three

electrons.

(2)

(Total 8 marks)

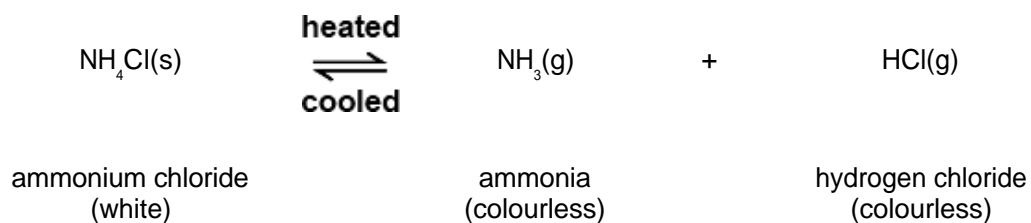
Q15. Stage smoke is used for special effects at pop concerts.



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

solid.

black

liquid.

white

gas.

which is

ammonia.

ammonium chloride.

hydrogen chloride.

(4)

(b) Complete the sentence.

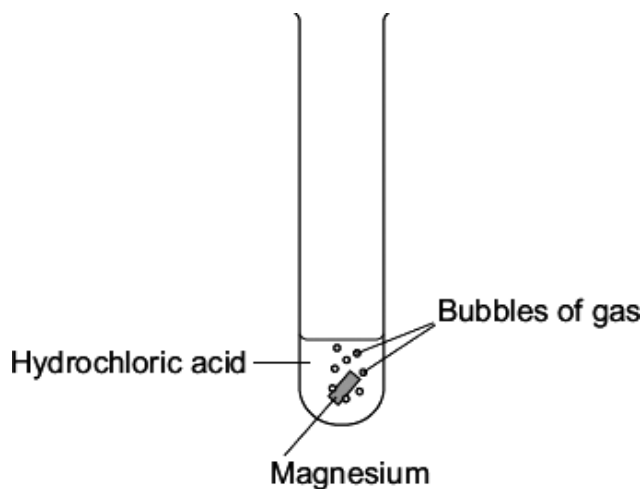
The symbol \rightleftharpoons means that the reaction is

(1)

(Total 5 marks)

Q16. A student investigated the reaction of magnesium with hydrochloric acid.

(a) A piece of magnesium was dropped into the hydrochloric acid.



Bubbles of gas were produced and the magnesium disappeared.

The reaction is exothermic.

(i) What measurements would the student make to show that the reaction is exothermic?

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

(2)

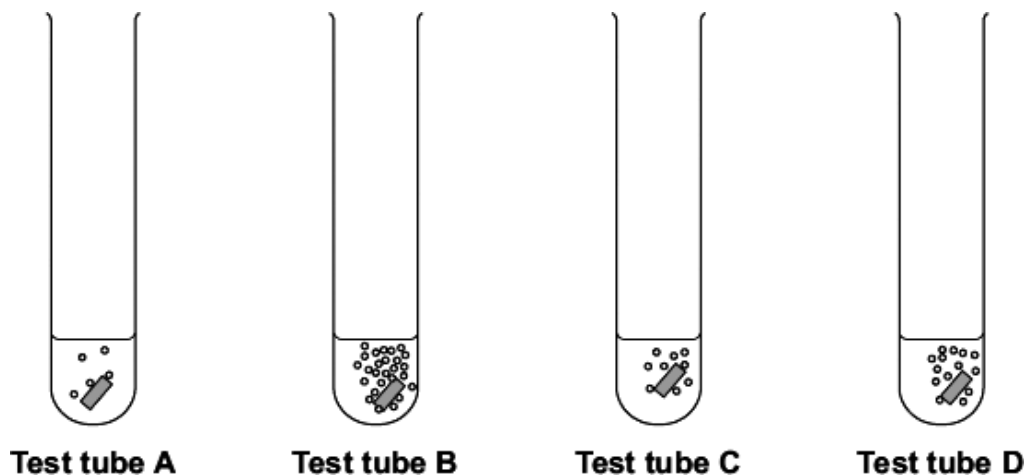
(ii) How would these measurements show that the reaction is exothermic?

.....

(1)

The student investigated how changing the concentration of the hydrochloric acid affects this reaction.

Each test tube contained a different concentration of hydrochloric acid. The diagrams show the results of this experiment.



(b) Suggest **one** control variable in this investigation.

.....
.....

(1)

(c) (i) Which test tube, **A**, **B**, **C** or **D**, contained the greatest concentration of hydrochloric acid?

Test tube

(1)

(ii) Why did you choose this test tube?

.....
.....

(1)

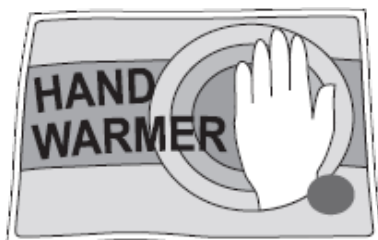
- (d) The student predicted that if the temperature of the acid was increased the reaction would take place faster.

Tick (✓) **two** statements in the table which explain why.

Statement	Tick (✓)
The particles move faster	
The particles collide with less energy	
The particles collide more often	
The particles are bigger	

(2)
(Total 8 marks)

- Q17.** 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
A	18	25	+ 7
B	17	+ 5
C	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?

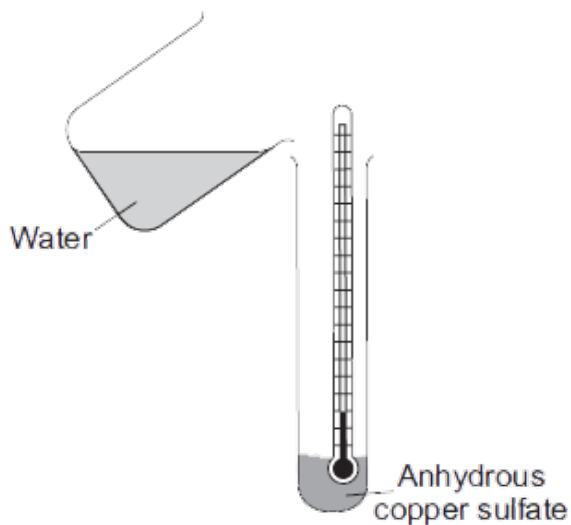
Reaction

Give a reason why you chose this reaction.

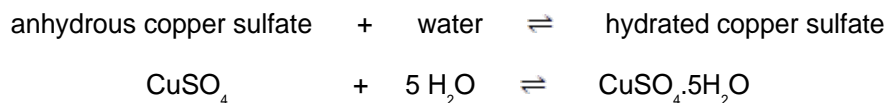
.....
.....

(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.

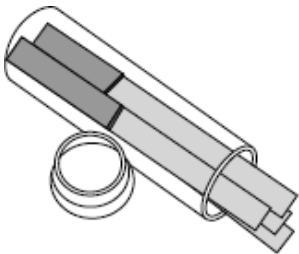
Name the solid substance produced.

.....

(1)

(Total 8 marks)

Q18. Read the information and then answer the questions.



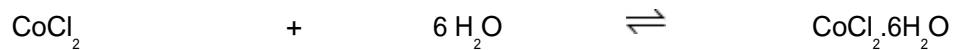
COBALT CHLORIDE PAPER

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.



anhydrous cobalt chloride

hydrated cobalt chloride

(blue)

(pink)

(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.

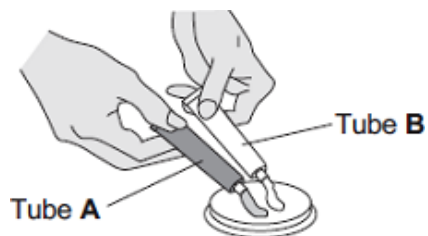
.....
.....

(1)

(Total 3 marks)

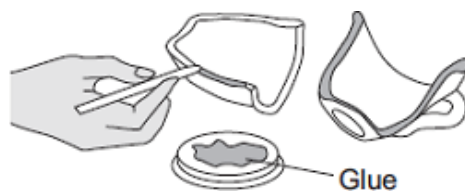
Q19. The following steps show how to use a type of glue.

Step 1 Measure out equal amounts of the liquids from tubes **A** and **B**.

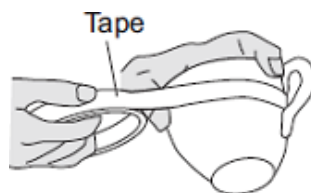


Step 2 Mix the liquids to make the glue.

Put a thin layer of the glue onto each of the surfaces to be joined.



Step 3 Put the pieces together and hold them with tape.



Step 4 Leave the glue to set.

(a) When liquids **A** and **B** are mixed a chemical reaction takes place.

This reaction is *exothermic*.

What does *exothermic* mean?

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

(2)

(b) The time taken for the glue to set at different temperatures is given in the table below.

Temperature in°C	Time taken for the glue to set
20	3 days
60	6 hours
90	1 hour

(i) Use the correct answer from the box to complete each sentence.

decreases	increases	stays the same
------------------	------------------	-----------------------

When the temperature is increased the time taken for the glue to set

.....

When the temperature is increased the rate of the setting reaction

.....

(2)

(ii) Tick (✓) **two** reasons why an increase in temperature affects the rate of reaction.

Reason	Tick (✓)
It gives the particles more energy	
It increases the concentration of the particles	
It increases the surface area of the particles	
It makes the particles move faster	

(2)

(Total 6 marks)

Q20. Kelp is a seaweed.

Kelp can be burned to give out energy.



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(a) Draw a ring around the correct answer to complete each sentence.

Reactions which give out energy are

- | |
|--------------|
| endothermic. |
| exothermic. |
| reversible. |

(1)

(b) Which **two** of the following questions **cannot** be answered by scientific experiments alone?

Tick (✓) **two** boxes.

Question	Tick (✓)
How much carbon dioxide is produced when 100 g of kelp is burned?	
Does kelp give out more heat energy than coal when burned?	
Should people use kelp instead of oil as an energy source?	
Will kelp be more popular than coal in the next 10 years?	

(2)

(c) Potassium iodide can be produced from kelp.

(i) Potassium can be reacted with iodine to produce potassium iodide.



The diagram shows how this happens.

Only the outer electrons are shown.

The dots (●) and crosses (×) are used to represent electrons



Use the diagram to help you answer this question.

Describe, as fully as you can, what happens when potassium reacts with iodine to produce potassium iodide.

To get full marks you should use the words atom, electron and ion in your answer.

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

(4)

(ii) Potassium iodide reacts with lead nitrate.



Why is this reaction a precipitation?

.....
.....

(1)

(iii) How can the precipitate be removed from the reaction mixture?

.....
.....

(1)
(Total 9 marks)

