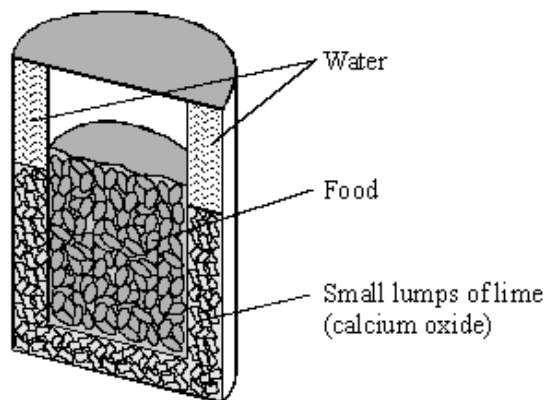


Q1. Mountaineers can warm their food in self-heating, sealed containers.



(a) The water is allowed to react with the lime. The heat from the reaction warms the food. What type of reaction causes a rise in temperature?

.....

(1)

(b) Some students investigated the effect of adding different sized lumps of lime to water. The results of their investigation are shown.

Time in minutes	Temperature in °C		
	Large lumps of lime	Small lumps of lime	Powdered lime
0	18	18	18
1	19	20	28
2	21	23	43
3	24	27	63
4	28	32	88
5	33	38	100

What do these results show? Give an explanation for your answer.

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

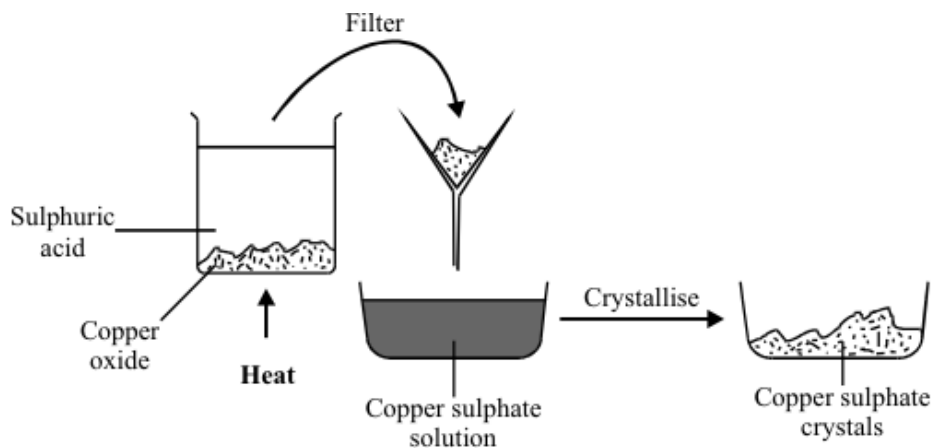
(2)

(c) Suggest and explain **one** disadvantage of using powdered lime to heat food.

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

(2)
(Total 5 marks)

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



(i) Why was the solution filtered?

.....

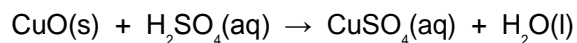
(1)

(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?



.....

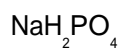
.....

.....

(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.

.....

.....

.....

.....

.....

.....

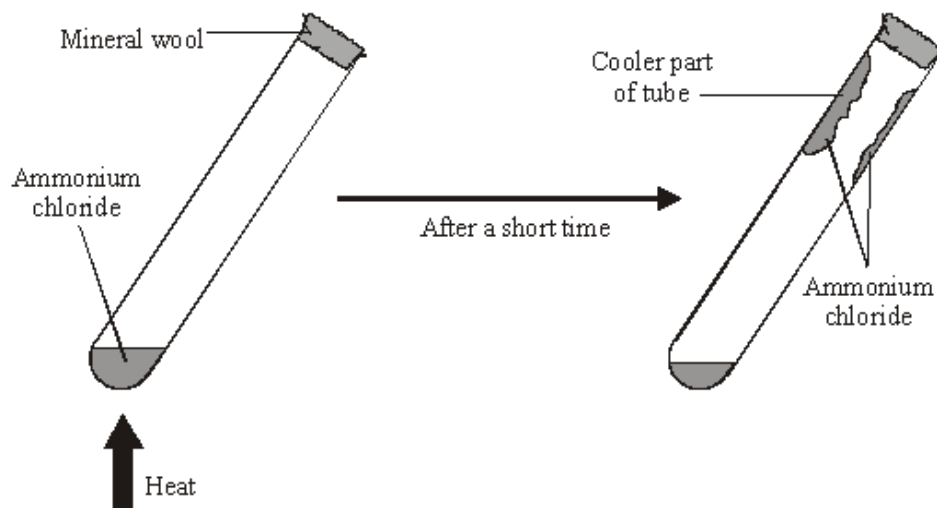
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.....

(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

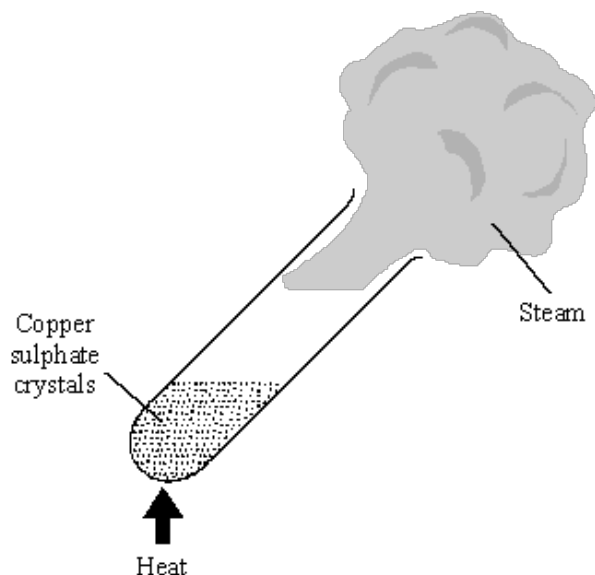
Draw a ring around the word which best describes the process which takes place.

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.

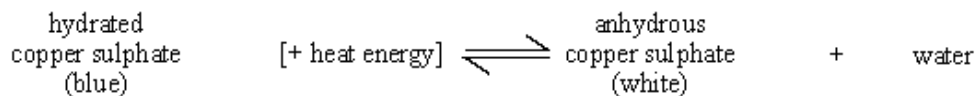
State whether the reaction was exothermic or endothermic.

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)

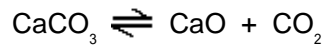
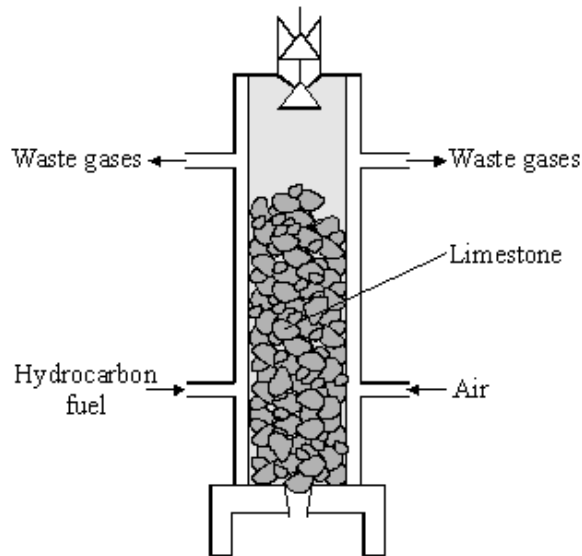
(ii) How could the student turn the white powder back to blue?

.....

(1)

(Total 3 marks)

Q6. Limestone is a useful mineral. Every day, large amounts of limestone are heated in limekilns to produce lime. Lime is used in the manufacture of iron, cement and glass and for neutralising acidic soils.



(i) The decomposition of limestone is a *reversible* reaction. Explain what this means.

.....

.....

.....

.....

(2)

(ii) Calculate the mass of lime, CaO, that would be produced from 250 tonnes of limestone, CaCO₃.

Relative atomic masses: C 12; O 16; Ca 40.

.....

.....

.....

.....

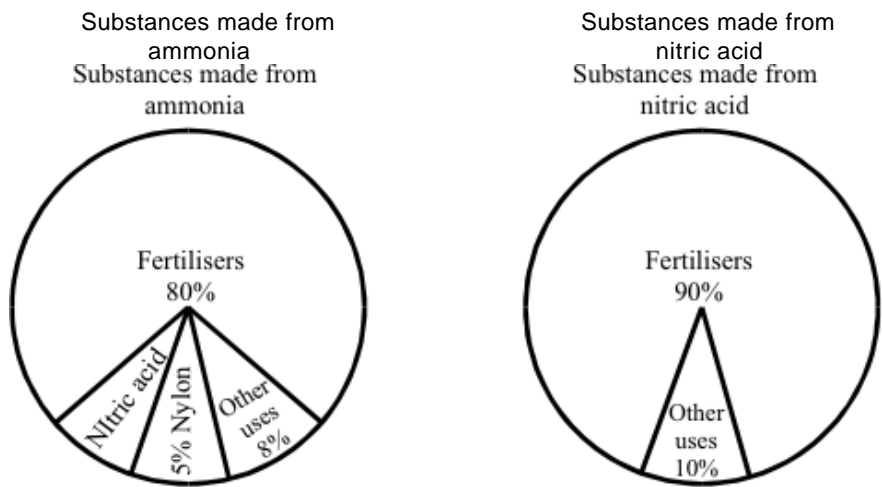
.....

Mass of lime = tonnes

(3)
(Total 5 marks)

Q7. Ammonia and nitric acid are both important chemicals. Nitric acid is made from ammonia.

The charts below show substances made from ammonia and nitric acid.



(a) Use the charts to help you answer these questions.

(i) What is the main use of both ammonia and nitric acid?

.....

(1)

(ii) Work out the percentage of ammonia used to make nitric acid.

Percentage = %

(1)

(iii) 100 million tonnes of ammonia are made in the world each year.

How much of this ammonia is used to make nylon?

..... million tonnes

(1)

(b) The word equations below show how nitric acid is made.

1. nitrogen + hydrogen → ammonia
2. ammonia + oxygen → nitrogen monoxide + water
3. nitrogen monoxide + oxygen → nitrogen dioxide
4. nitrogen dioxide + water → nitric acid

Use the word equations to help you answer these questions.

(i) From which **two** elements is ammonia made?
..... and (1)

(ii) Name **two** of the raw materials needed to make nitric acid.
..... and (2)

(c) A large amount of nitric acid is reacted with ammonia to make a fertiliser.

nitric acid + ammonia → fertiliser

(i) The reaction is a neutralisation reaction.
What type of chemical must ammonia be?
..... (1)

(ii) Complete the chemical name for the fertiliser made from ammonia and nitric acid.
ammonium (1)

(iii) The reaction of nitric acid with ammonia is exothermic.
Name the piece of equipment you could put into the solution to prove that the reaction is exothermic.
..... (1)

(Total 9 marks)

Q8. The word equation below shows a reaction used in an industrial process.

chromium oxide + aluminium → chromium + aluminium oxide

The reaction is highly exothermic.

(a) What is an exothermic reaction?
.....
..... (2)

(b) Name the products of this reaction.
..... (1)

(c) In the reaction one substance is reduced.

(i) Name the substance which is reduced.

.....

(1)

(ii) What happens to the substance when it is reduced?

.....

.....

(1)

(Total 5 marks)

Q9. (i) Which acid from the list should the student add to sodium hydroxide solution to make sodium sulphate?

ethanoic acid

hydrochloric acid

nitric acid

sulphuric acid

.....

(1)

(ii) When the acid was added to the alkali the beaker became warm.
Name the type of reaction that releases heat.

.....

(1)

(iii) Use the Data Sheet to help you to write the formula of sodium sulphate.

Formula:

(1)

(Total 3 marks)

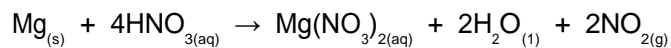
Q10. This item appeared in the *Wolverhampton Express and Star* on October 31st, 1997.
Read the passage and answer the questions that follow.

Fumes scare at factory

Workers were forced to flee a factory after a chemical alert. The building was evacuated when a toxic gas filled the factory.

It happened when nitric acid spilled on to the floor and mixed with magnesium metal powder.

(a) The equation which represents the reaction between magnesium and nitric acid is:



Give the formula of the toxic gas that was produced.

.....

(1)

(b) Explain, in terms of particles, how the toxic gas was able to fill the factory quickly.

.....

.....

.....

(2)

(c) The reaction of nitric acid with magnesium metal powder is more dangerous than if the acid had fallen on to the same mass of magnesium bars. Explain why.

.....

.....

.....

(1)

(d) (i) Water was sprayed on to the magnesium and nitric acid to slow down the reaction. Explain, in terms of particles, why the reaction would slow down.

.....

.....

.....

(2)

(ii) Explain why it is better to add alkali, rather than just add water to the spillage.

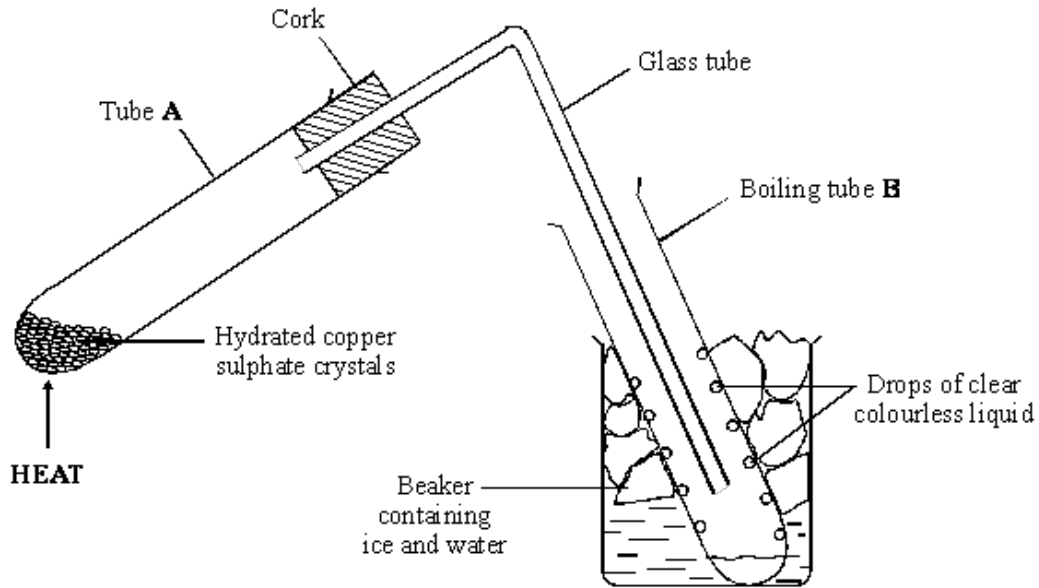
.....

.....

(1)

(Total 7 marks)

Q11. 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)

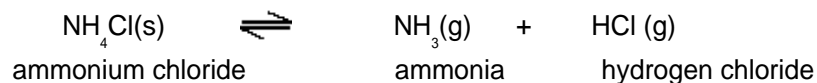
Q12. Ammonium nitrate and ammonium sulphate are used as fertilisers.



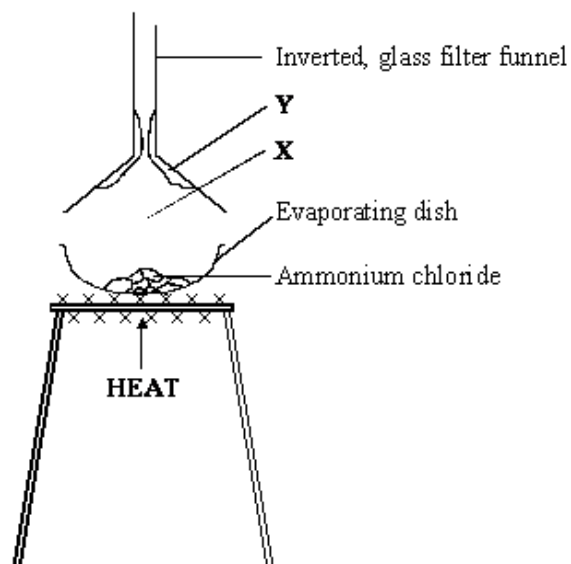
- (i) Which acid reacts with ammonia to form ammonium nitrate?
 (1)
- (ii) Which acid reacts with ammonia to form ammonium sulphate?
 (1)
- (iii) The reactions in (i) and (ii) are both exothermic. How can you tell that a reaction is exothermic?

 (1)
- (iv) The reactions in (i) and (ii) are both examples of acid + base reactions. What is the name of the chemical change which takes place in every acid + base reaction?
 (1)
- (Total 4 marks)**

Q13. (a) The equation for the reaction that takes place when ammonium chloride is heated is:



The diagram shows how a teacher demonstrated this reaction. The demonstration was carried out in a fume cupboard.



(i) Apart from the gases normally in the atmosphere, which two gases would be at **X**?
 and (1)

(ii) Name the white solid that has formed at **Y**.
 (1)

(iii) Why was the demonstration carried out in a fume cupboard?

 (1)

(iv) Complete the **four** spaces in the passage.
 The chemical formula of ammonia is NH_3 . This shows that there is one atom of and three atoms of in each of ammonia. These atoms are joined by bonds that are formed by sharing pairs of electrons. This type of bond is called a bond. (4)

(b) Electrons, neutrons and protons are sub-atomic particles.

(i) Complete the **three** spaces in the table.

Name of sub-atomic particle	Relative mass	Relative charge
.....	1	+1
.....	1	0
.....	$\frac{1}{1840}$	-1

(2)

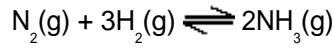
(ii) Which **two** sub-atomic particles are in the nucleus of an atom?
 and (1)
(Total 10 marks)

Q14. (a) Iron powder is used in the manufacture of ammonia. Why is it used?

.....
.....

(1)

(b) Ammonia is manufactured from nitrogen and hydrogen. The equation for the reaction between them is:



(i) Which **two** raw materials are used to make the hydrogen?

..... and

(1)

(ii) Why does increasing the pressure increase the chance of molecules of nitrogen reacting with molecules of hydrogen?

.....
.....

(1)

(iii) Calculate the mass, in tonnes, of ammonia which could be produced from 560 tonnes of nitrogen.

The relative atomic masses are: H 1; N 14.

Show clearly how you get to your answer.

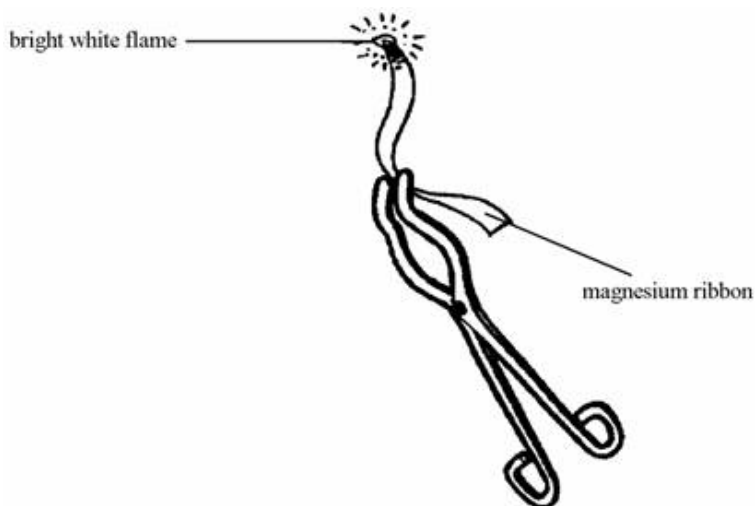
.....
.....
.....

Mass of ammonia = tonnes

(3)

(Total 6 marks)

Q15. The diagram shows some magnesium ribbon burning.



(a) Choose words from the list to complete the sentences below.

- electrical heat light kinetic**
an endothermic an exothermic a neutralisation a reduction

When magnesium burns, it transfers

and energy to the surroundings.

We say that it is reaction.

(3)

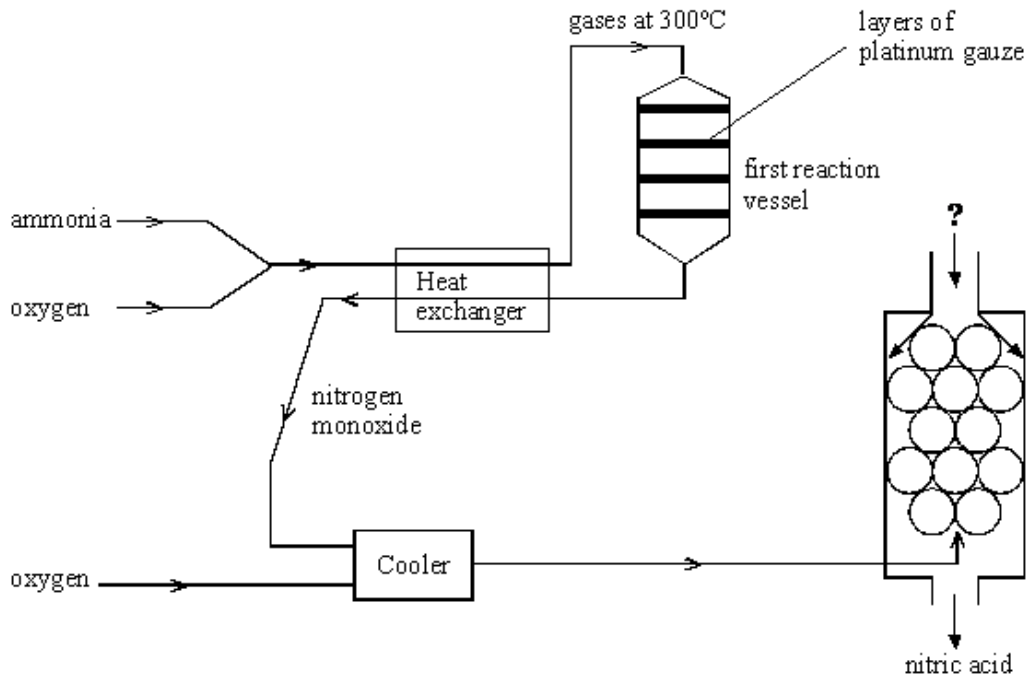
(b) Complete the word equation for the reaction.

magnesium + _____ → magnesium oxide

(1)

(Total 4 marks)

Q16. The chart shows the processes involved in the manufacture of nitric acid from ammonia.



(a) Complete the word equation for the reaction that takes place in the first reaction vessel.



(1)

(b) (i) What is the use of the platinum gauze in the reaction vessel?

.....

(1)

(ii) At first, the platinum gauze is electrically heated. However, as the reaction continues, no further heating is necessary. Explain why.

.....

(1)

(c) Explain why the heat exchanger is used.

.....

(2)

(d) To convert nitrogen monoxide into nitric acid, **two** further reactants are needed. What are they?

..... and

(1)

- (e) In an old method, nitrogen monoxide was produced from nitrogen instead of ammonia.



The reaction was carried out at a high temperature (3000°C).
Suggest **two** reasons for this.

1

2

(2)

- (f) Complete the word equation below, to show how to make the fertiliser, ammonium nitrate.

..... + \longrightarrow ammonium nitrate + water

(2)

(Total 10 marks)

- Q17.** 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.

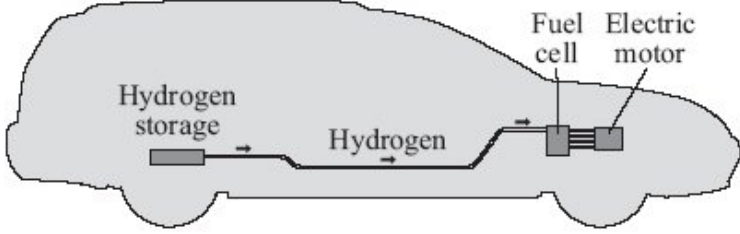
.....
.....
.....
.....

(2)

(Total 4 marks)

Q18. Read the article and then answer the questions that follow.

Hydrogen fuel for cars?



Hydrogen is an excellent fuel. It can be made by the electrolysis of potassium hydroxide solution.

Hydrogen gas can be stored under pressure in a cylinder but a leak of the gas could cause an explosion.

It has been found that lithium nitride can absorb and then release large volumes of hydrogen. A chemical reaction takes place between the hydrogen and the lithium nitride. The hydrogen is held in the resulting compounds by chemical bonds.

The problem is that the rate at which hydrogen is absorbed and then released from normal sized particles of lithium nitride is slow.

Recently scientists have made 'nanosized' particles of lithium nitride. These particles absorb hydrogen in the same way as normal sized lithium nitride particles. The 'nanosized' particles have the advantage that they absorb and release the hydrogen much faster when needed in the fuel cell.

It is hoped that 'nanosized' particles of lithium nitride may provide a safe method of storing hydrogen in the future.

(a) Hydrogen is produced at the negative electrode during the electrolysis of potassium hydroxide solution.

(i) Why are hydrogen ions attracted to the negative electrode?

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

(1)

(ii) Potassium ions are also attracted to the negative electrode.

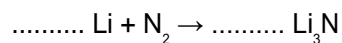
Explain why hydrogen gas is formed but not potassium.

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

(1)

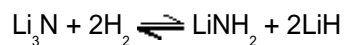
(b) Lithium nitride is made by reacting lithium with nitrogen.

Balance the equation for this reaction.



(1)

(c) (i) The equation for the reaction of lithium nitride with hydrogen is:



What feature of this reaction allows the hydrogen to be released?

.....
.....

(1)

(ii) Hydrogen stored in a fuel tank filled with lithium nitride would be safer in an accident than a cylinder full of hydrogen.

Suggest and explain why.

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

(2)

(d) Lithium nitride is an ionic compound which contains lithium ions (Li^+) and nitride ions (N^{3-}).

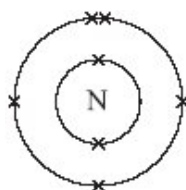
(i) The formation of a lithium ion from a lithium atom is an oxidation reaction.

Explain why.

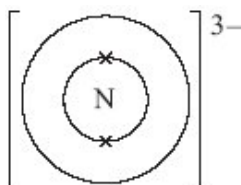
.....
.....

(1)

(ii) The diagram shows the electronic structure of a nitrogen atom.



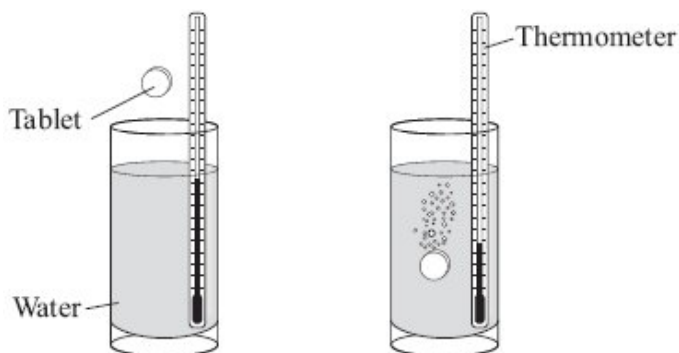
Complete the diagram below to show the electronic structure of a nitride ion (N^{3-}).



(1)
(Total 8 marks)

Q19. 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.	

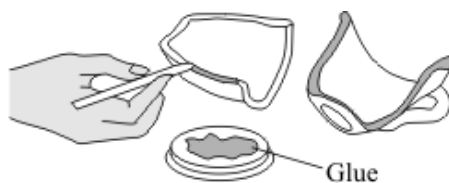
(1)
(Total 3 marks)

Q20. The following steps show how to use a type of glue.

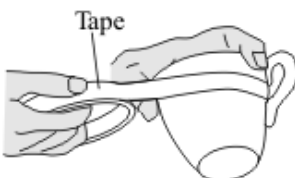
Step 1 Measure out equal amounts of the liquids from tubes **A** and **B**.



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

.....

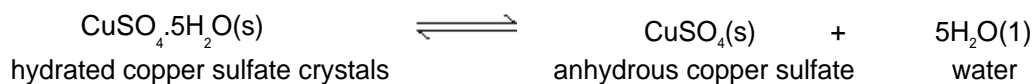
(2)

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

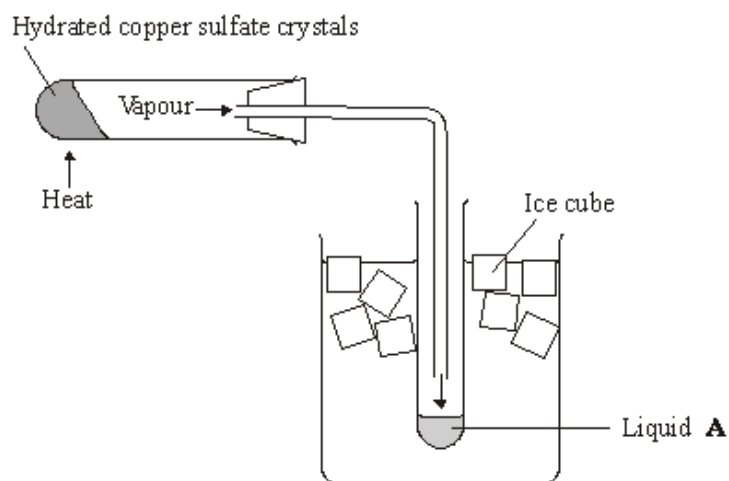
Reason	(✓)
It gives the particles more energy.	
It increases the concentration of the particles.	
It increases the surface area of the particles.	
It makes the particles move faster.	

(2)
(Total 6 marks)

- Q21.** 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
------	-------	-----	-------

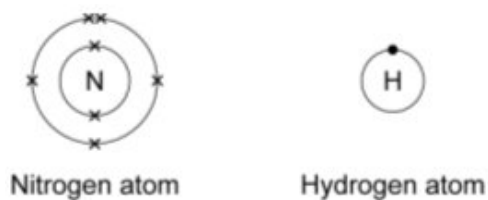
Water changes the colour of anhydrous copper sulfate from

to

(2)
(Total 8 marks)

Q22. Ammonia has the formula NH_3

The diagrams show how electrons are arranged in nitrogen and hydrogen atoms.



(a) Draw a diagram to show how the electrons are arranged in an ammonia molecule.

You need only show the electrons in the highest energy level.

(2)

(b) Ammonia is a gas at room temperature.

Explain why ammonia has a low boiling point.

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

(2)

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

(i) Name the ion in the ammonia solution that causes the pH of 10.

..... ion

(1)

(ii) Ammonium nitrate is made by reacting ammonia with an acid.

Name the acid.

..... acid

(1)

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



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

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

Explain why the bag gets cold.

.....

.....

.....

.....

(2)
(Total 8 marks)

Q23. (a) Ammonia has the formula NH_3 . It is made from nitrogen and hydrogen.

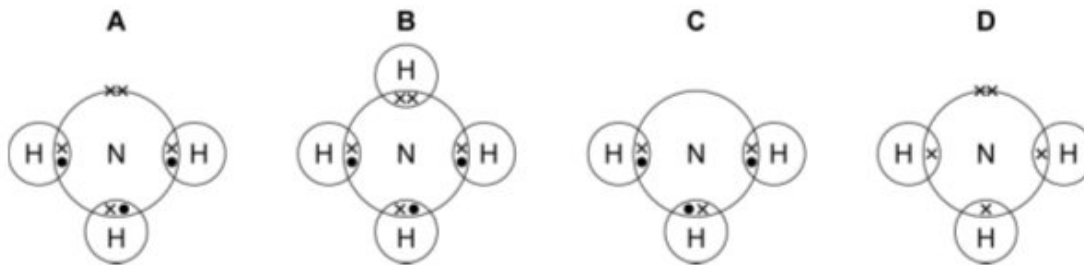
How many atoms are in an ammonia molecule?

(1)

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



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)

Q24. 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*.

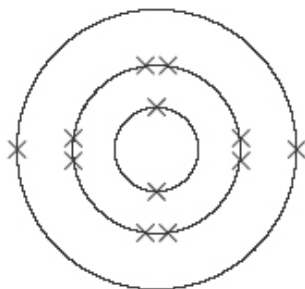
Complete the following sentence using the correct words from the box.

gives out heat stores heat takes in heat

An *exothermic* reaction is one which

(1)

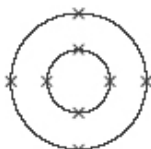
(b) The diagram shows the electronic structure of a magnesium atom.
The atomic (proton) number of magnesium is 12.



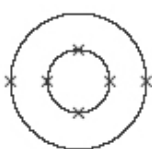
Magnesium atom

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

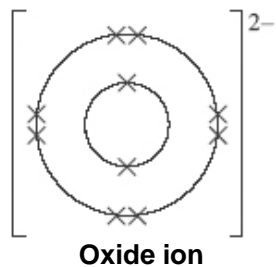


D

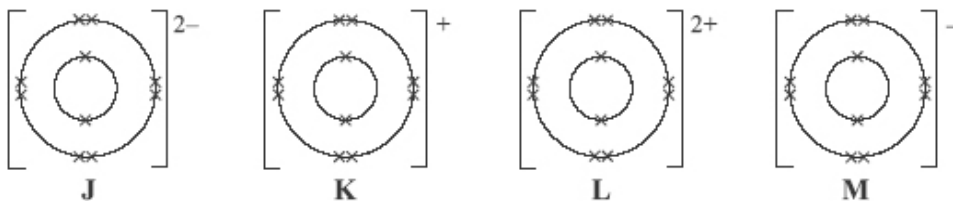
Diagram

(1)

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



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



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)

- M1.** (a) exothermic (reaction) 1
- (b) smaller lumps react faster
or larger lumps react slower 1
*accept smaller lumps cause a more rapid rise in temperature **or** vice versa*
*do **not** accept higher temperature*
***or** more heat unless linked to time*
- smaller lumps have a larger surface (area) or larger lumps have a smaller surface (area) 1
more water can react at the same time
***or** so less water can react at the same time*
- (c) heats up (too) rapidly 1
accept temperature (too) high
- burning the food **or** the hands 1
*accept danger of container exploding **or** splitting **or** food overheating*
do not accept reference to handling of powder
*do **not** accept a lot of powder needed **or** powder getting into food **or** too hot to eat **or** food would not cook properly **or** heat through properly*

[5]

- M2.** (a) (i) to remove or separate copper oxide 1
accept to remove or separate unreacted or excess base
accept to remove or separate insoluble solids
- (ii) heat (the solution) 1
accept heat the water
accept evaporate the water
***rapid** cooling/cool to lower temperature*
accept boil the water or solution
***not** increase surface area, put in draught*
***not** increase the temperature*

(iii) aqueous
accept in water
accept solution
not soluble in water

1

(b) add water/liquid/solution

1

colour changes to blue

1

[5]

M3. (a) sodium
hydrogen
phosphorus
oxygen

2 marks for all 4
1 mark for 2 or 3
0 marks for 0 or 1
not symbols / formulae

2

(b) (i) gives out
gets hot(ter) / temperature rises (1)

1

heat / energy
independent mark

1

(ii) **Quality of written communication**
for clearly expressed ideas

1

take temperature of water at start
owtte

1

take temperature after adding soup powder

1

plus any **one** from:

- using a thermometer
- mix / stir / shake etc
- in beaker / conical flask / test tube / plastic cup
- temperature will rise (indicates an exothermic reaction)

1

[8]

- M4.** (a) (i) high **and** low
both needed for mark 1
- (ii) reversible 1
- (iii) to prevent ammonium chloride / solid / particles escaping
idea of a filter
*do **not** accept 'to prevent gases escaping'* 1
- (b) endothermic 1
- [4]**

- M5.** (a) endothermic **and** because it takes in heat / energy
both for one mark 1
- (b) (i) reversible reaction (or explanation) 1
- (ii) add water
*do **not** accept cooling **or** reverse the reaction* 1
- [3]**

- M6.** (i) a reaction in which the products can
be changed back to reactants
*accept a reaction that can go forwards **or** backwards* 1
- under certain conditions 1
- (ii) $M_r \text{CaCO}_3 = 100$ 1
- $M_r \text{CaO} = 56$ 1
- mass of CaO = 140 (tonnes) 1
- mark consequentially*
- [5]**

M7.	(a) (i) fertilisers <i>for 1 mark</i>	1
	(ii) 7 <i>for 1 mark</i>	1
	(iii) 5 <i>for 1 mark (ignore other units)</i>	1
	(b) (i) both nitrogen and hydrogen <i>for 1 mark</i>	1
	(ii) two of: nitrogen; hydrogen/methane/natural gas; oxygen/air; water; any fuel (allow symbols, do not allow nitrogen oxides) <i>any two for 1 mark each</i>	2
	(c) (i) alkali/alkaline/base/basic <i>for 1 mark</i>	1
	(ii) must be nitrate <i>for 1 mark</i>	1
	(iii) thermometer or any other temperature measuring device <i>for 1 mark</i>	1

[9]

M8.	(a) gives out heat <i>each for 1 mark</i>	2
	(b) chromium and aluminium oxide	1

(c)	(i)	chromium oxide	1	
	(ii)	oxygen removed/gains electrons	1	
				[5]
M9.	(i)	sulphuric acid / H_2SO_4 <i>accept sulfuric 1 for one mark</i>	1	
	(ii)	exothermic <i>for one mark</i>	1	
	(iii)	Na_2SO_4 / $(Na)_2SO_4$ / $Na_2(SO_4)$ / $(Na^+)_2SO_4^{2-}$ <i>for one mark</i> <i>lower case O(Na_2SO_4) not accepted / tops of subscripted letters</i> <i>should be in line or lower than lower case letters of symbols</i>	1	[3]
M10.	(a)	NO_2 / $2NO_{2(g)}$ / Nitrogen dioxide <i>for one mark</i>	1	
	(b)	particles of gas move / they move <i>reject spread out</i> particles move randomly / mix / go between air molecules / diffusion <i>any two for 1 mark each</i>	2	
	(c)	faster reaction / more surface area (<i>not</i> smaller pieces) <i>for one mark</i>	1	
	(d)	(i) either lower temperature / particles move slower fewer collisions (owtte) / less energetic collisions / owtte or acid diluted (owtte) fewer collisions (owtte) <i>for 1 mark each</i>	2	

- (ii) alkali neutralises the acid / stops the reaction
or water will only slow the reaction not stop it
either for 1 mark

1

[7]

M11. (a) Bunsen (burner)

accept spirit burner do not credit candle

1

(b) blue

1

white

credit (1) if both colours correct but answers are reversed

1

to cool the tube (B)

*accept answers which anticipate part (d) e.g. 'to condense the water vapour' or gases **or** vapours*

1

(d) (i) water

do not credit 'condensation'

1

(ii) (Water) vapour from the crystals (from tube A)

*accept steam **or** steam from tube A*

1

condenses **or** cools

accept turns to (liquid) water

1

(e) add water

gets hot **or** hotter **or** warm **or** warmer turns into solution
dissolves

*or the temperature rises or there is an exothermic reaction
accept steams **or** hisses ignore any reference to colour(s)*

2

(f) sulphuric acid

*accept H_2SO_4 only if correct in every
detail*

1

[10]

M12. NOTE

In this question and throughout the Paper, if the name of a chemical is asked for, then the formula is acceptable only if it is correct in every detail. If the name is correct and the candidate has tried to be 'helpful' by giving, in addition, an incorrect version of the formula, then this is acceptable provided it does not lead to ambiguity.

- (i) nitric (acid)
accept HNO_3
1
- (ii) sulphuric (acid)
accept H_2SO_4
1
- (iii) heat given out
or temperature rise
or energy given out
or steam
do not credit just 'use a thermometer'
do not credit just 'change in temperature'
1
- (iv) neutralisation
accept neutralise
accept neutral
accept formation of salt or water
do not credit exothermic
1

[4]

- M13.** (a) (i) ammonia and hydrogen chloride
both required either order
accept formulae if correct in every detail
1
- (ii) ammonium chloride / NH_4Cl
do not credit ammonia chloride
1
- (iii) the fumes / gases / are poisonous / toxic
or ammonia and hydrogen chloride are
poisonous / toxic / lethal
accept just ammonia is poisonous / toxic
accept just hydrogen chloride is
poisonous / toxic
accept vapour is poisonous / toxic
do not credit just fumes are dangerous
or harmful
1

- (iv) nitrogen
do not credit N/N_2 1
- hydrogen
do not credit H/H_2 1
- molecule
do not credit compound **or** mole 1
- covalent
accept single / molecular 1

- (b) (i) proton
neutron
electron
either all three correct
or one or two correct
however do not credit a response
which is repeated 2
- (ii) protons and neutrons
both required in either order 1

[10]

- M14.** (a) any **one** from
(as a) catalyst
or to mix with promoters
to speed up the reaction (process)
or process is quicker do not credit just it is quicker
to save energy
to reduce costs
or process is cheaper
do not credit just it is cheaper
larger surface area
(than lumps of iron)
or larger surface area for the
(catalysed) reaction (to take place) 1

- (b) (i) water **or** steam
and methane
or natural gas
or North Sea gas
both required either order 1
- (ii) **EITHER**
more (chance) of them colliding / coming into contact
do not credit just faster
- OR** volume of the product / ammonia less than / only half the
volume of the reactants / the nitrogen and hydrogen 1
- (iii) **EITHER**
680 (tonnes)
- OR** 28 (of nitrogen) → 34 (of ammonia)
accept any correct 14 : 17 ratio 1
- 560 (of nitrogen) → 34 × 20 (of ammonia) 3
- [6]

- M15.** (a) heat
light
an exothermic
in any order for 1 mark each 3
- (b) oxygen / O₂
for 1 mark 1
- [4]

- M16.** (a) oxygen / O₂
(do not allow air) for 1 mark 1
- (b) (i) *idea that*
it is a catalyst / it increases the rate of reaction / lowers
activation energy
for 1 mark 1
- (ii) the reaction is exothermic **or** releases energy / heat
for 1 mark 1

- (c) *idea that*
- hot gases from the first reaction vessel need to be cooled
 - incoming gases / ammonia / oxygen need to be heated
 - there is an energy saving / cost saving
any two for 1 mark each
- 2
- (d) water and oxygen (need both)
(accept H_2O and O_2)
for 1 mark
- 1
- (e) *idea that*
- breaking bonds / breaking up molecules requires a lot of energy / reaction has a high activation energy
 - gives a better / faster rate of reaction
 - the reaction is endothermic / more energy needed to break existing bonds than to form new ones
allow a higher temperature gives a greater yield / pushes the equilibrium position to the right
any two for 1 mark each
- 2
- (f) ammonia (solution) / ammonium hydroxide
(credit NH_3 NH_4OH)
nitric acid / HNO_3
in any order for 1 mark each
- 2

[10]

- M17.** (a) the bag gets cold because heat energy is taken in from the surroundings
- 1
- (b) endothermic
- 1

(c) any **two** from:

- mix / spread (the ammonium nitrate and water)
- dissolve faster(*)
- get cold faster **or** so the whole bag gets cold(*)
*(*allow increase rate **or** quicker reaction*
- particles collide more **or** more collisions

2

[4]

M18. (a) (i) any **one** from:

- they are positive / cations
- they are H⁺
- opposite charges attract
ignore atom

1

(ii) potassium is more reactive (or reverse)

assume 'it' refers to hydrogen

allow potassium reacts with water

*allow potassium is very reactive **or** most reactive metal / element*

allow hydrogen gains electrons more easily / is reduced more easily

accept potassium is higher up the reactivity series

1

(b) **6 and 2**

accept correct multiples and fractions

1

(c) (i) the reaction / it is reversible **or** a description of a reversible reaction

allow 'it is an equilibrium'

allow reversible symbol drawn correctly

allow 'the reverse / back reaction'

1

(ii) **lithium nitride**

assume that 'it' or if they do not specify means lithium nitride

assume lithium / lithium nitrate refers to lithium nitride

- hydrogen is bonded / held / absorbed / has formed a compound / reacted with lithium nitride

1

plus **one** of:

- does not explode / cause a fire
 - is not free / less hydrogen
 - is not under pressure
 - does not leak
 - is only released slowly
-
- compound of hydrogen with lithium nitride / product is (more) stable / less reactive / less chance of a reaction
accept converse for hydrogen as below
assume that gas / hydrogen means gas in the cylinder
 - *hydrogen (in cylinder) / gas is not bonded / held absorbed / in a compound / reacted with lithium nitride*

1

1

plus one of:

- *can explode / cause a fire*
- *is free*
- *is under pressure*
- *can leak*
- *releases quickly*

1

- (d) (i) loss of an electron **or** loses electrons
do not accept any ref. to oxygen

1

- (ii) full outer shell of 8 electrons on circle
need not be paired
can be x, dot or e
*do **not** accept if extra electrons added to inner shell*

1

[10]

- M19.** (a) carbon dioxide
must be name
*do **not** accept carbon oxide*

1

- (b) (i) the temperature of the solution will decrease
(list principle) 1
- (ii) energy is taken in from the surroundings
(list principle) 1
- [3]

- M20.** (a) (i) increase 1
- (ii) high melting point 1
- (b) (i) decreases 1
- increases 1
- (ii) it gives the particles more energy 1
- it makes the particles move faster 1
- [6]

- M21.** (a) water
accept H_2O or $5H_2O$
- 2 must be below halfway 1
- (b) the cold water / ice / cubes (owtte)
accept 'cooled down' or references to cold 1
- (c) reversible reaction 1
- (d) (i) 0.87g 1
- (ii) the student made errors in weighing during
the experiments 1
- the student did not heat the copper sulfate for long enough in one of the experiments 1

- (e) white 1
- blue 1
- allow 1 mark for blue to white*

[8]

- M22.** (a) one nitrogen atom joined to three hydrogen atoms 1
- correct pairs of electrons 1
- (b) because ammonia is made of small molecules / simple molecules / simple molecular structures 1
- and so there are weak forces between the molecules
or and so the intermolecular forces are weak 1
- incomplete answers that link only size of molecule or strength of intermolecular forces with boiling point only gain 1 mark*

- (c) (i) hydroxide 1
- (ii) nitric 1
- (d) because this is an endothermic reaction 1
- that takes in energy from the surroundings as the ammonium nitrate dissolves 1

[8]

- M23.** (a) 4 1
- (b) A 1
- (c) it is alkaline
accept alkali / basic / base 1

- (d) (i) salt 1
- (ii) nitric 1
- (ii) fertiliser 1
- (e) because energy 1
- is taken in (from the surroundings)
second mark must be linked to energy 1

[8]

- M24.** (a) gives out (heat) 1
- (b) D 1
- (c) L 1
- (d) magnesium chloride 1

[4]

