Q1. (a) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The salt called potassium chloride is made when potassium hydroxide solution reacts with hydrochloric acid.

potassium hydroxide solution + hydrochloric acid → potassium chloride solution + water

Describe a method for making **crystals** of potassium chloride from potassium hydroxide solution and hydrochloric acid.

In this method you should:

- describe how you will add the correct amount of the hydrochloric acid to neutralise the potassium hydroxide solution
- describe how you will get crystals of potassium chloride.

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(6)

(b) Ammonium nitrate is another salt.
Ammonium nitrate is made when ammonia solution is neutralised with an acid.

Name the acid to complete the word equation.

ammonia + ... acid → ammonium nitrate

(1)

(c) Read the information.

Ammonium nitrate – good or bad?

Some farmers put a lot of ammonium nitrate on their farmland.

Many people are worried about this use of ammonium nitrate.

Rain water can wash the ammonium nitrate off the farmland and into rivers and lakes. The ammonium nitrate may get into drinking water supplies and could be harmful to health.

(i) Why do some farmers put ammonium nitrate on their farmland?

.....

.....

(1)

(ii) Which **one** of the questions in the table cannot be answered by science alone?

Tick (✓) **one** question.

Question	**Tick (✓)**
How much ammonium nitrate is in drinking water?	

Should farmers stop using ammonium nitrate on their farmland?	
Is ammonium nitrate soluble in rain water?	

Give **two** reasons why this question **cannot** be answered by science alone.

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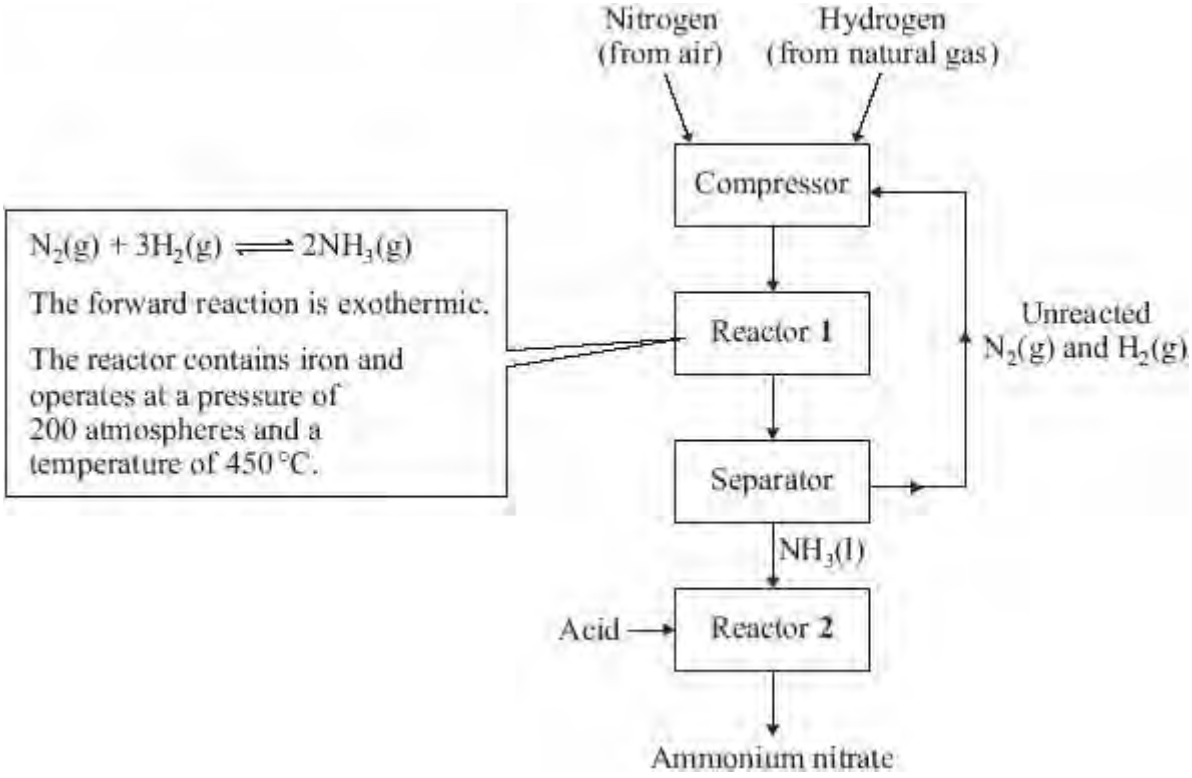
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(3)
(Total 11 marks)

Q2. Ammonium nitrate is an important chemical. The diagram shows the main stages in the manufacture of ammonium nitrate.

Study the diagram and then answer the question.



(a) What is the purpose of the iron in reactor **1**?

.....

.....

(1)

(b) Explain why the best yield of ammonia at equilibrium is obtained:

(i) at low temperature

.....

.....

(1)

(ii) at high pressure.

.....

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(1)

(c) The temperature used in reactor **1** is 450 °C.

Explain why a much lower temperature is **not** used.

.....

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(1)

(d) A mixture of ammonia, nitrogen and hydrogen leaves reactor **1**.

In the separator, what is done to the mixture to separate the ammonia from the other gases?

.....

.....

(1)
(Total 5 marks)

Q3. Neutralisation reactions can be used to make salts.

(a) Write an ionic equation for a neutralisation reaction, including state symbols.

.....

(2)

(b) Ammonium nitrate is a salt used as a fertiliser.



(i) Ammonium nitrate is made by mixing two solutions. Name these solutions.

..... and .....

(1)

(ii) Hazard information about ammonium nitrate states:

- it is not itself a fire hazard (does not burn);
- it must not be allowed to come into contact with combustible materials such as fuels because it can cause these to catch fire.

Suggest why ammonium nitrate helps other substances to burn.

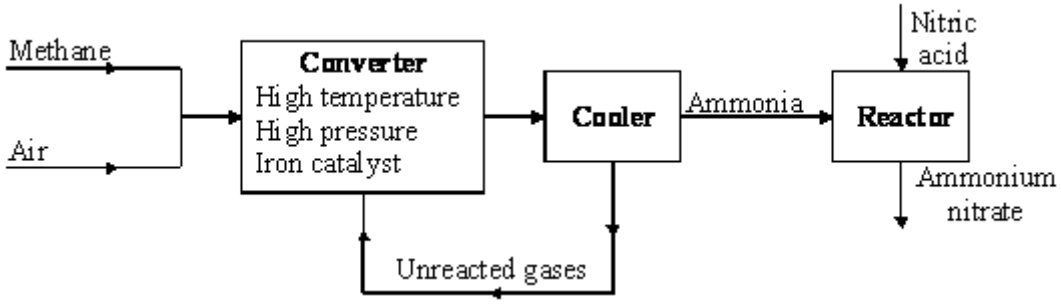
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(1)

(Total 4 marks)

Q4. The flow diagram shows some stages in the manufacture of ammonium nitrate, NH_4NO_3.



(a) Which elements are obtained from the raw materials to make ammonia in the converter?

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(2)

(b) Suggest the purpose of the iron catalyst.

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(1)

(c) Farmers add ammonium nitrate to the soil. Explain why.

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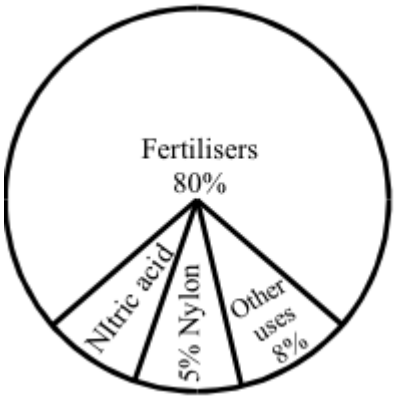
(2)

(Total 5 marks)

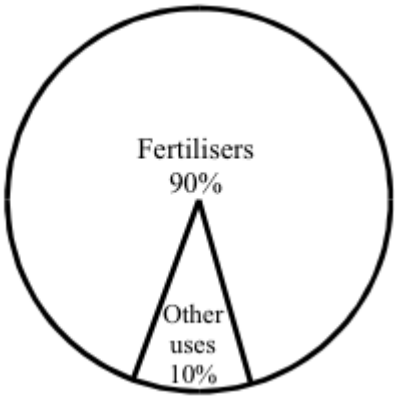
Q5. Ammonia and nitric acid are both important chemicals. Nitric acid is made from ammonia.

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

Substances made from ammonia



Substances made from 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.

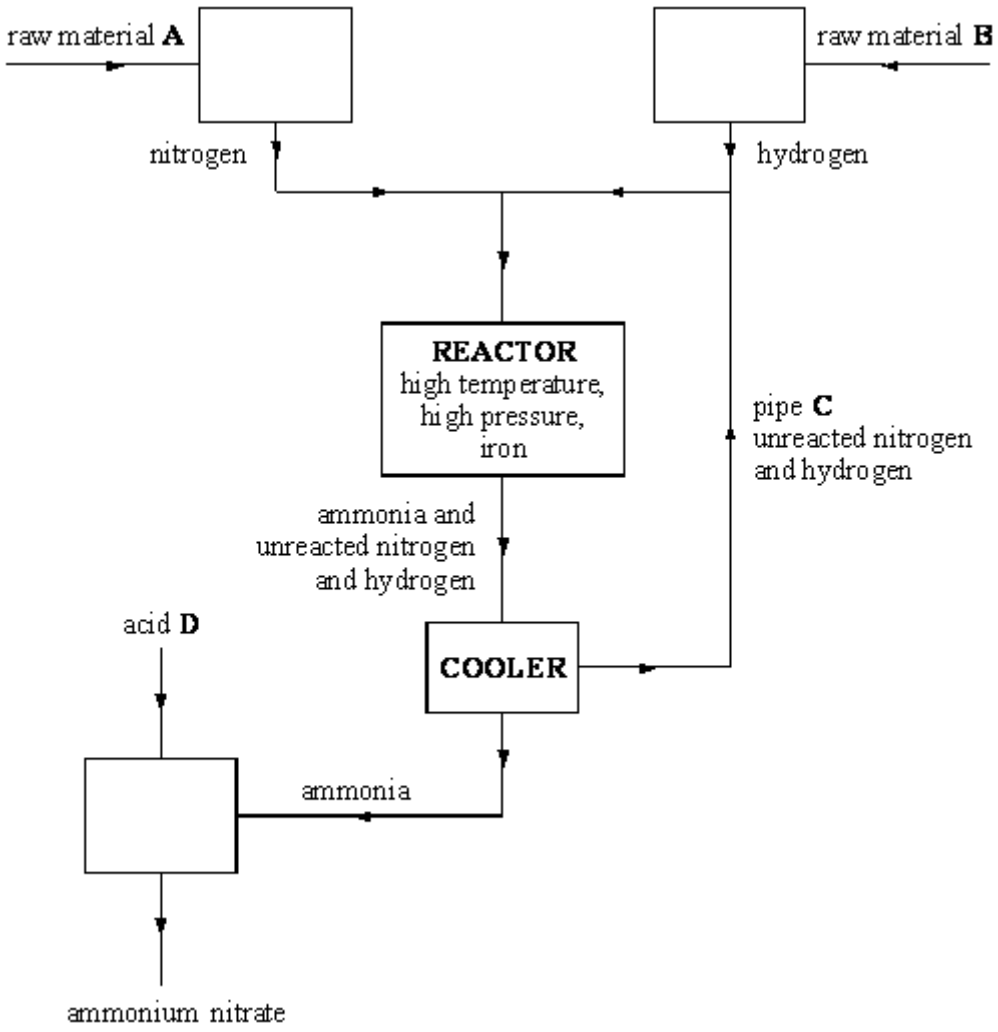
Name the piece of equipment you could put into the solution to prove that the reaction is exothermic.

.....

(1)

(Total 9 marks)

Q6. The flow chart below shows the main stages in the production of ammonium nitrate.



(i) Name the **two** raw materials shown in the flow chart as **A** and **B** by choosing words from the list.

air **coke** **limestone** **natural gas**

Raw material **A** .....

Raw material **B** .....

(2)

(ii) Complete the word equation for the reaction which makes ammonia.

..... + ... → ammonia

(1)

(iii) What is the purpose of the iron in the reactor?

.....

.....

(1)

(iv) What is the purpose of pipe **C**?

.....

.....

(1)
(Total 5 marks)

Q7. Nitrates, such as ammonium nitrate, are added to soil to help plant growth.



(a) When rain falls nitrates dissolve and can end up in drinking water.
Nitrates in drinking water can stop respiration in babies. This only happens if there is a lot of nitrate in the drinking water.

Plants use nitrates for growth. Humans need plants. Should large amounts of nitrates be added to soil?
Give **two** reasons for your answer.

Answer .....

Reason 1 .....

.....

Reason 2 .....

.....

(2)

(b) The amount of nitrogen in a nitrate compound is important.

(i) How many nitrogen atoms are there in the formula of ammonium nitrate, NH_4NO_3

.....

(1)

(ii) Calculate the percentage of nitrogen in ammonium nitrate, NH_4NO_3.

(Relative atomic masses: H = 1; N = 14; O = 16)

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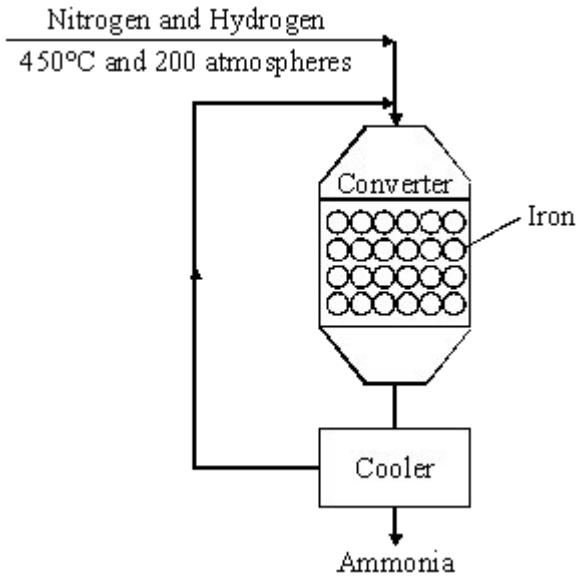
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Percentage of nitrogen in ammonium nitrate = ... %

(3)

(Total 6 marks)

Q8. The diagram shows the final stages in the manufacture of ammonia.



(a) Why is iron used in the converter?

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(1)

(b) Write the word equation for the reaction in the converter.

..... + ... ⇌ .....

(1)

(c) The yield of ammonia is only about 15%.

(i) Why can the yield **not** be 100%?

.....

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(1)

(ii) Describe what happens to the mixture of gases after it leaves the converter.

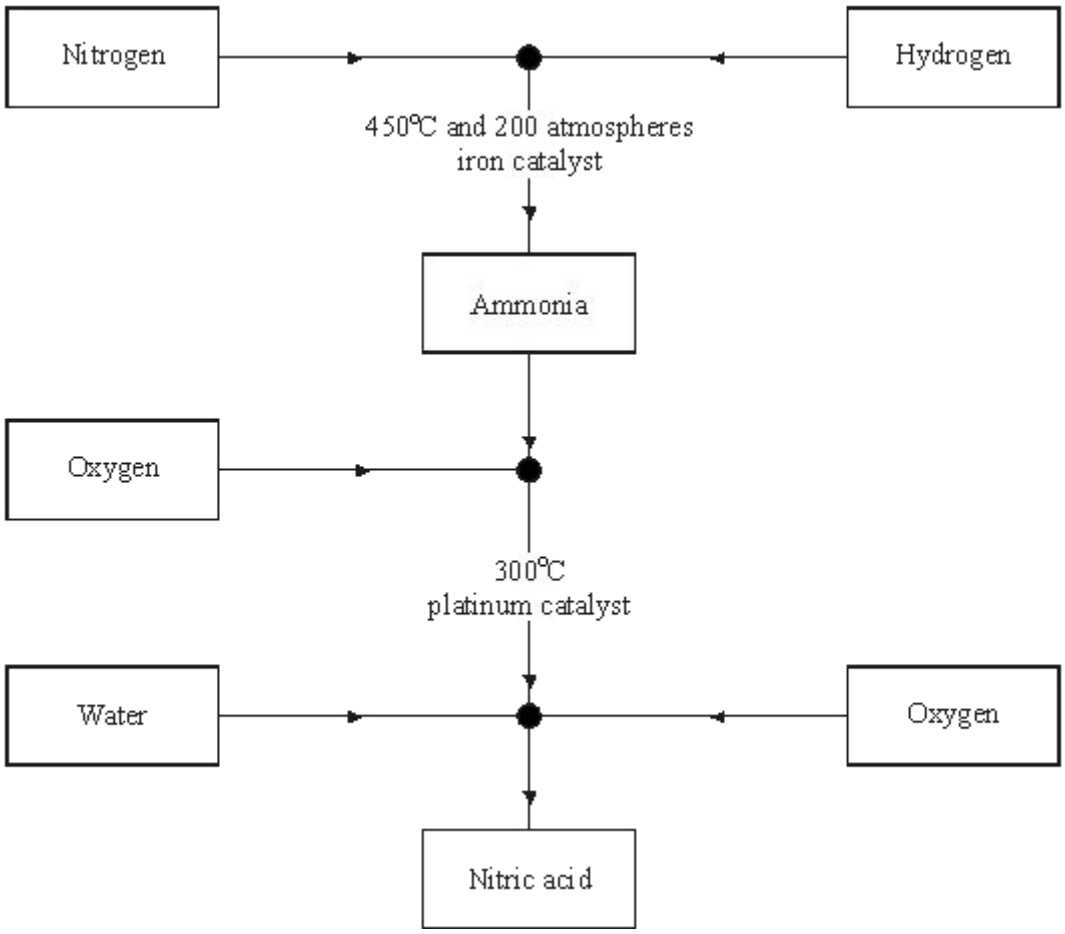
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(2)
(Total 5 marks)

Q9. The flow diagram shows how to make ammonia and nitric acid from the nitrogen in the air.



(a) A fertiliser is made by neutralising ammonia with nitric acid. What is the name of this fertiliser?

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(1)

(b) In the flow diagram, why are two different catalysts used?

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(1)

(c) What happens to catalysts at the end of a reaction?

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(1)

(d) Explain why catalysts are used in many industrial chemical reactions.

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(2)

(e) Explain, in terms of collisions between molecules, why a high pressure is used in the reaction between nitrogen and hydrogen.

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(2)
(Total 7 marks)