

Making Ammonia

Question Paper

Level	GCSE
Subject	Chemistry
Exam Board	AQA
Unit	C3
Topic	Making Ammonia
Difficulty Level	Bronze Level
Booklet	Question Paper

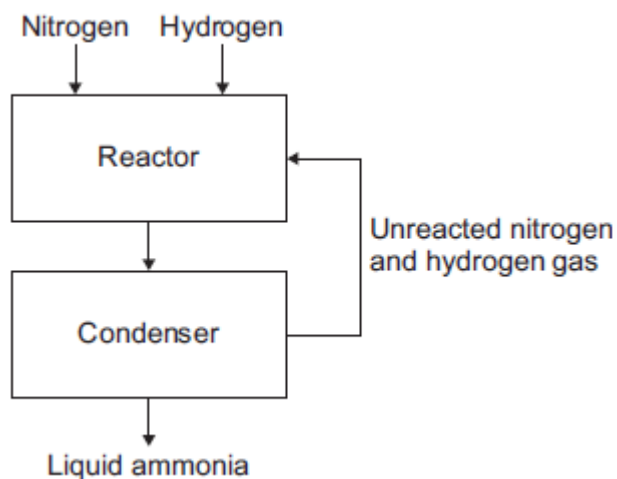
Time Allowed: 61 minutes

Score: /61

Percentage: /100

Q1.A flow diagram of the Haber process is shown below.

The Haber process produces ammonia from nitrogen and hydrogen.



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

air	limestone	natural gas
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Hydrogen is obtained from

(1)

(b) In the reactor, nitrogen and hydrogen at a high pressure are heated and passed over a catalyst.

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

25	100	450
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The temperature in the reactor is °C

(1)

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

copper	iron	nickel
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The catalyst used in the reactor is

(1)

(iii) How does a catalyst speed up a reaction?

Tick (✓) **one** box.

The catalyst lowers the activation energy.

The catalyst gives the reactants extra energy.

The catalyst increases the pressure in the reactor.

(1)

(c) A mixture of gases leaves the reactor.

The mixture contains ammonia, nitrogen and hydrogen.

Describe what happens to this mixture of gases in the condenser.

Use the flow diagram to help you.

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.....

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.....

(3)
(Total 7 marks)

Q2.In 1909 Fritz Haber invented a process to produce ammonia from nitrogen and hydrogen.

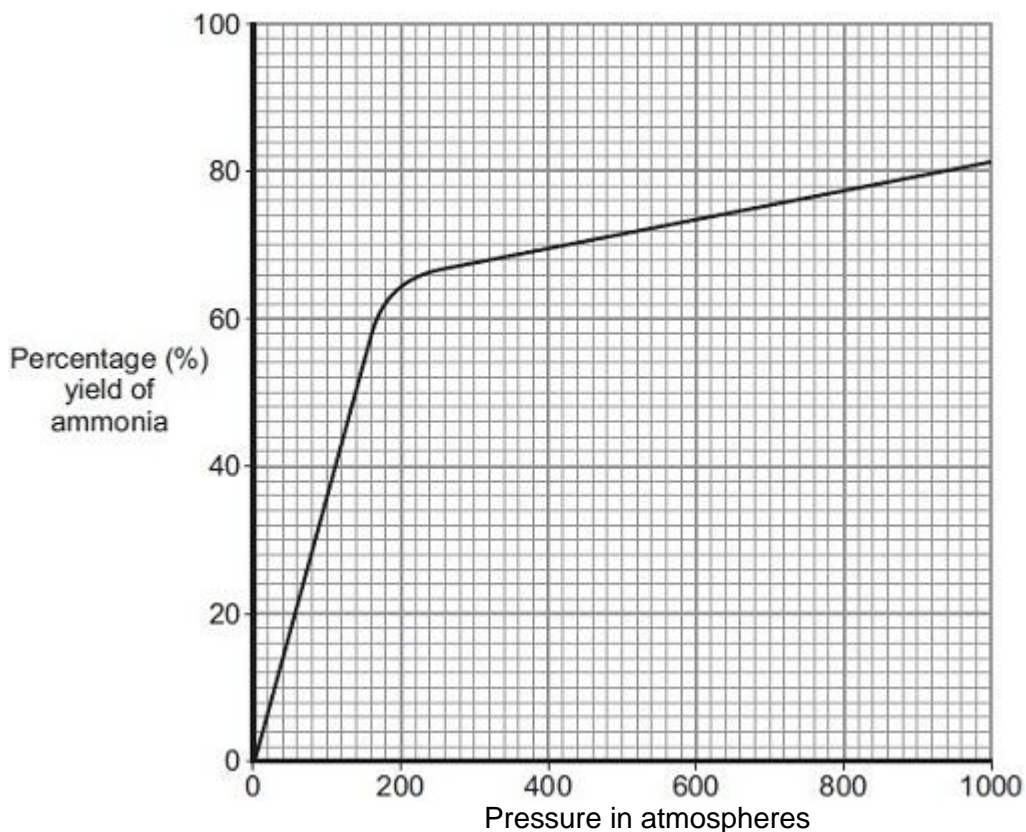
(a) Complete the word equation, showing that the reaction is reversible.

nitrogen + hydrogen

(2)

(b) **Figure 1** shows how the yield of ammonia at 300 °C changes with pressure.

Figure 1



Describe how the yield of ammonia changes as the pressure increases.

.....

.....

.....

.....

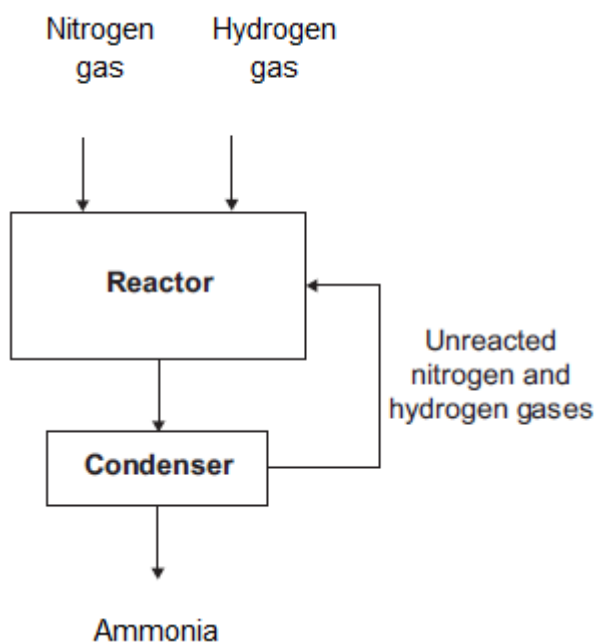
.....

.....

(3)

(c) **Figure 2** represents the Haber process.

Figure 2



How does the Haber process avoid wasting nitrogen and hydrogen?

.....
.....

(1)

- (d) Before the Haber process, nitrates had been mined in South America. Nitrates are used for making fertilisers.

The Haber process allowed nitrates to be produced on a large scale, anywhere in the world.

- (i) Suggest what effect the Haber process had on the miners in South America.

.....
.....

(1)

- (ii) Suggest **one** advantage of producing nitrates on a large scale.

.....

(1)
(Total 8 marks)

Q3. Ammonium salts, such as ammonium sulfate, are used to help farmers grow crops.



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(a) Use the correct word from the box to complete the sentence.

fertilisers	insecticides	pesticides
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Ammonium salts contain nitrogen and are used by farmers asto replace the nitrogen lost from the soil.

(1)

(b) Ammonia is made by reacting nitrogen with hydrogen.

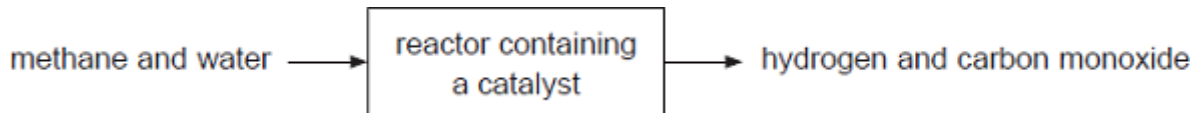
Which raw material provides nitrogen?

Draw a ring around your answer.

air **crude oil** **water**

(1)

- (c) Methane and water react together to form hydrogen.

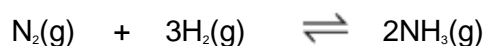


How does the catalyst help this reaction?

.....

(1)

- (d) The reaction between nitrogen and hydrogen to make ammonia can be represented by this equation.



What is the meaning of this symbol \rightleftharpoons ?

Draw a ring around your answer.

endothermic reaction precipitation reaction reversible reaction

(1)

- (e) A solution of ammonia in water is alkaline.

- (i) Which **one** of these values could be the pH of a solution of ammonia?

Draw a ring around your answer.

4

7

10

(1)

- (ii) Ammonium sulfate can be made by reacting ammonia solution with sulfuric acid.

Use the correct answer from the box to complete the sentence.

ammonium sulfate	hydrogen	sulfuric	water
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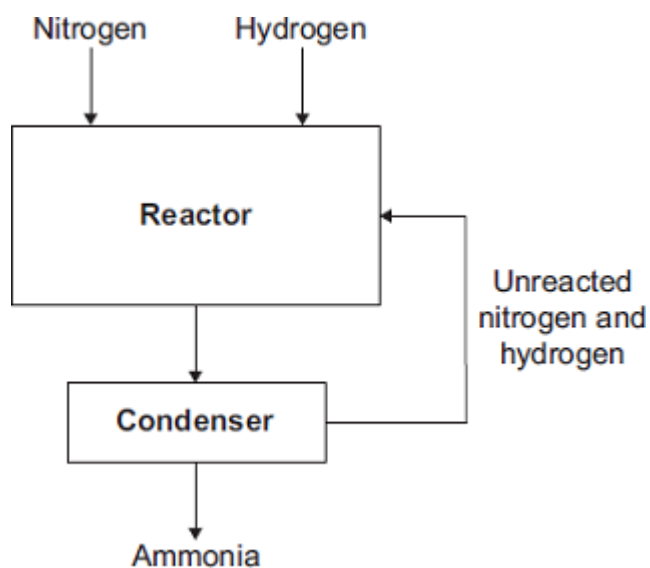
During the reaction the hydrogen ions (H⁺) from the acid react with hydroxide ions

(OH⁻) from the alkali to make

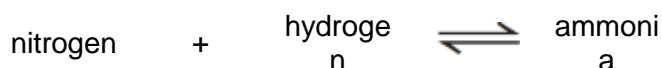
(1)

(Total 6 marks)

Q4. The flow diagram shows the Haber process. In the Haber process ammonia is produced from nitrogen and hydrogen.



(a) The word equation for the production of ammonia is:



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

The symbol \rightleftharpoons in the word equation shows the reaction is

exothermic
reversible.
slow.

(1)

(b) The reactor contains iron.

Complete the sentence.

The iron speeds up the reaction because it is a

(1)

(c) What happens to the unreacted nitrogen and hydrogen?

.....
.....

(1)

(d) The sentences describe how ammonia is produced in the Haber process.

The sentences are in the wrong order.

P Ammonia is separated as a liquid.

Q Nitrogen and hydrogen are mixed together.

R A mixture of gases enters the condenser.

S Nitrogen and hydrogen react to produce ammonia.

Complete the boxes below to show the correct order of the sentences.

The first box has been done for you.



(2)
(Total 5 marks)

- Q5. (a) Ammonia solution is used in cleaning products to remove grease from kitchen surfaces.



Ammonia solution is alkaline.

- (i) Draw a ring around the number most likely to be the pH of ammonia solution.

1 3 7 10

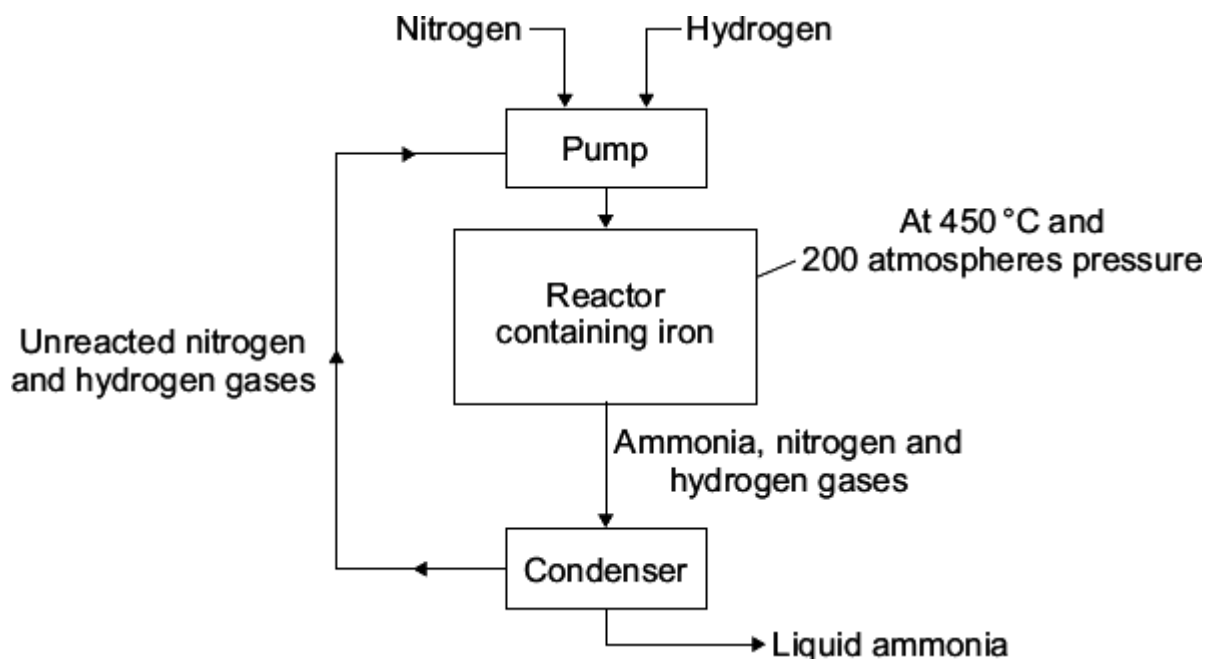
(1)

- (ii) Draw a ring around the ion in ammonia solution which makes it alkaline.

Cl⁻ H⁺ Na⁺ OH⁻

(1)

- (b) Ammonia is made using the Haber process.



(i) Where does the nitrogen used in the Haber process come from?

Draw a ring around your answer.

air **natural gas** **water**

(1)

(ii) A high temperature of 450 °C is used in the reactor.

Tick (✓) **two** reasons in the table which explain why high temperatures make reactions faster.

Reasons	Tick (✓)
Particles move faster	
Particles are closer together	
Particles collide more often	
Particles have less energy	

(2)

(iii) The iron in the reactor speeds up the reaction but is not used up.

What is the name given to substances that speed up the chemical reaction but which are not used up during the reaction?

.....

(1)

(c) Complete the sentence.

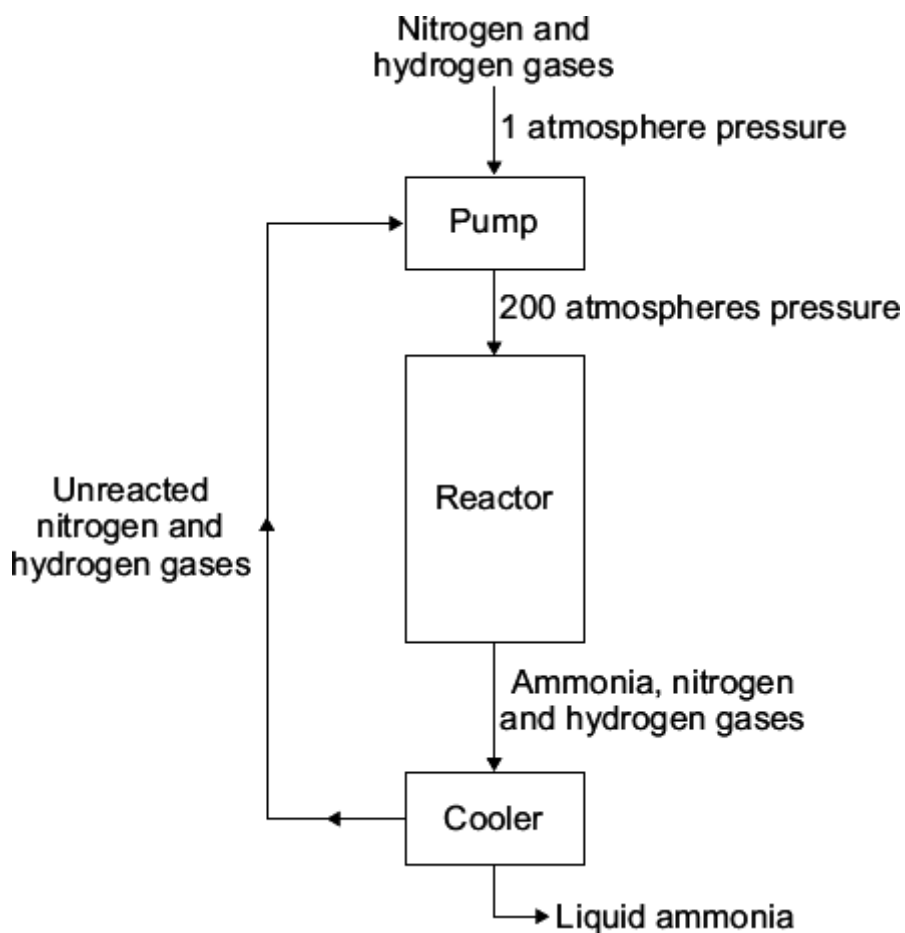
The condenser separates the ammonia from the unreacted nitrogen and hydrogen by

turning the ammonia into a

(1)

(Total 7 marks)

Q6. The flow diagram shows how ammonia is made.



- (a) What effect, if any, does the **pump** have on the pressure of the nitrogen and hydrogen?

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

The pump
 decreases
 has no effect on
 increases
 the pressure.

(1)

- (b) The word equation for making ammonia is:



In the **reactor** only a small amount of the nitrogen and hydrogen is changed into ammonia.

Tick (✓) the reason why.

Reason why	Tick (✓)
Ammonia is formed from two elements.	
Nitrogen and hydrogen are gases.	
The reaction is reversible.	

(1)

(c) In the **cooler** the mixture of gases is cooled.

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

The cooler turns the ammonia into

- a liquid.
- a solid.
- an element.

(1)

(d) What happens to the unreacted nitrogen and hydrogen from the **reactor**?

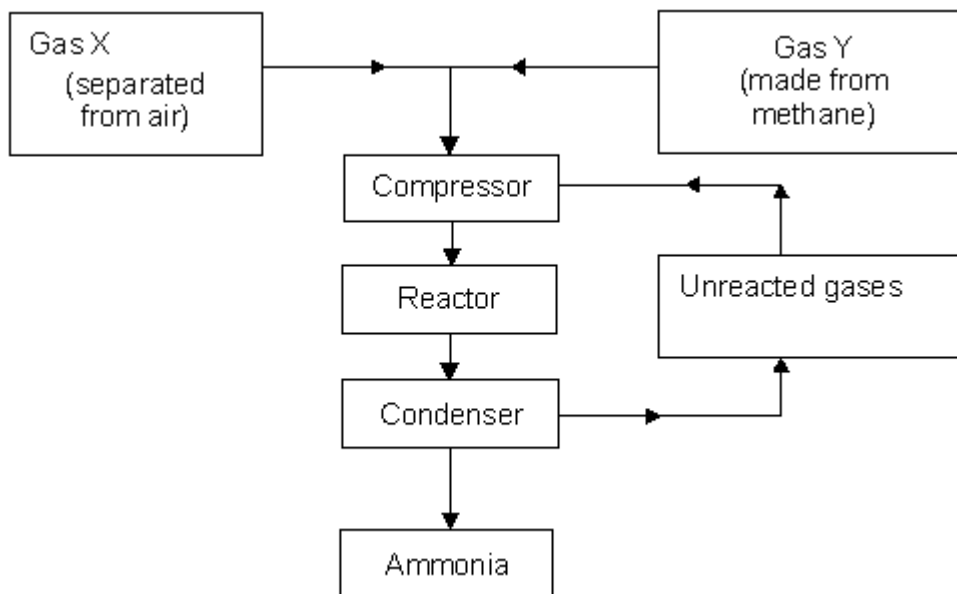
.....
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(1)

(Total 4 marks)

Q7. Ammonia is used in the production of fertilisers. The flow diagram shows the main stages in the manufacture of ammonia.

Study the flow diagram and then answer the questions.



(a) (i) Name gas X and name gas Y.

Gas X is Gas Y is

(2)

(ii) Draw a ring around the correct answer to complete the sequence.

In the condenser the mixture is

cooled
heated
oxidised

 to separate ammonia as a liquid.

(1)

(b) The ammonia is separated as a liquid from the unreacted gases.

Suggest **two** reasons why the unreacted gases are recycled.

.....

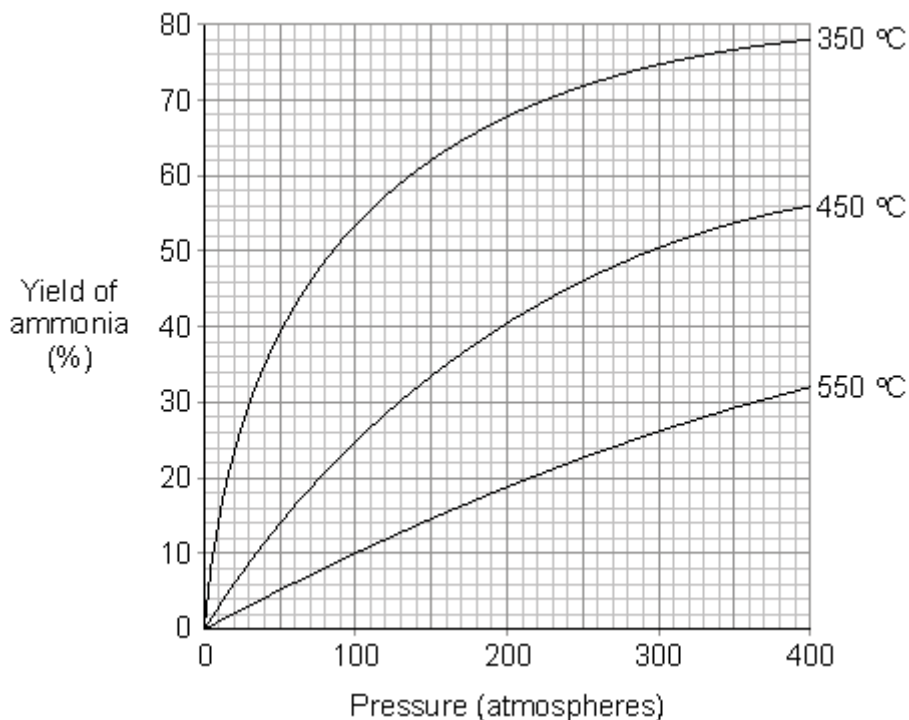
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.....

.....

- (c) The graph shows the percentage of ammonia made at different temperatures and pressures.

Study the graph and then answer the questions.



- (i) Draw a ring around the correct answers to complete the sentence.

To make the greatest percentage yield of ammonia

the temperature should be

low

medium

high

and the pressure

should be

low

medium

high

(2)

- (ii) What is the percentage yield of ammonia at a temperature of 450°C and at a pressure of 200 atmospheres?

..... %

(1)

- (iii) Ammonia is often made at a temperature of 450°C and at a pressure of 200 atmospheres.

Suggest **two** reasons why it is economical to make ammonia using these conditions.

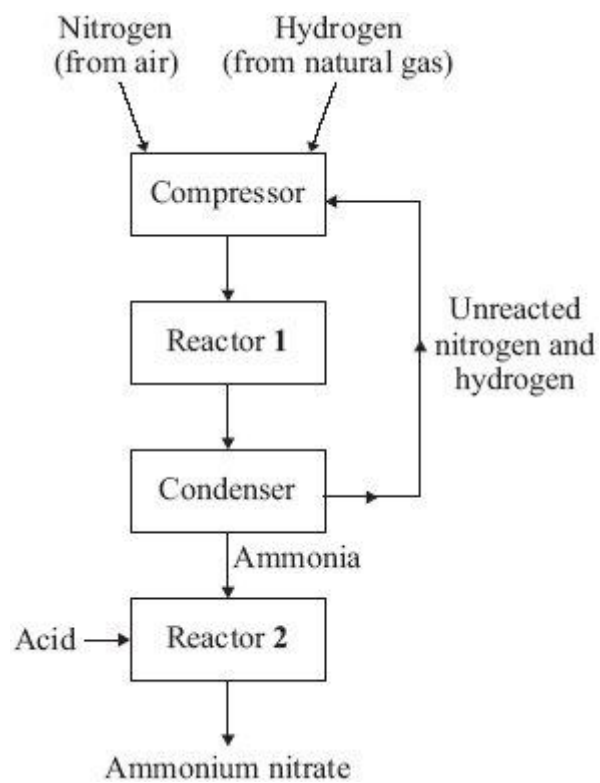
.....
.....
.....
.....

(2)

(Total 10 marks)

- Q8.** 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 questions.



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

(a) The compressor increases the

pressure
temperature
volume

 to 200 atmospheres.

(1)

(b) In reactor 1 ammonia is made by reacting

air
natural gas
nitrogen

 with

air.
hydrogen.
natural gas.

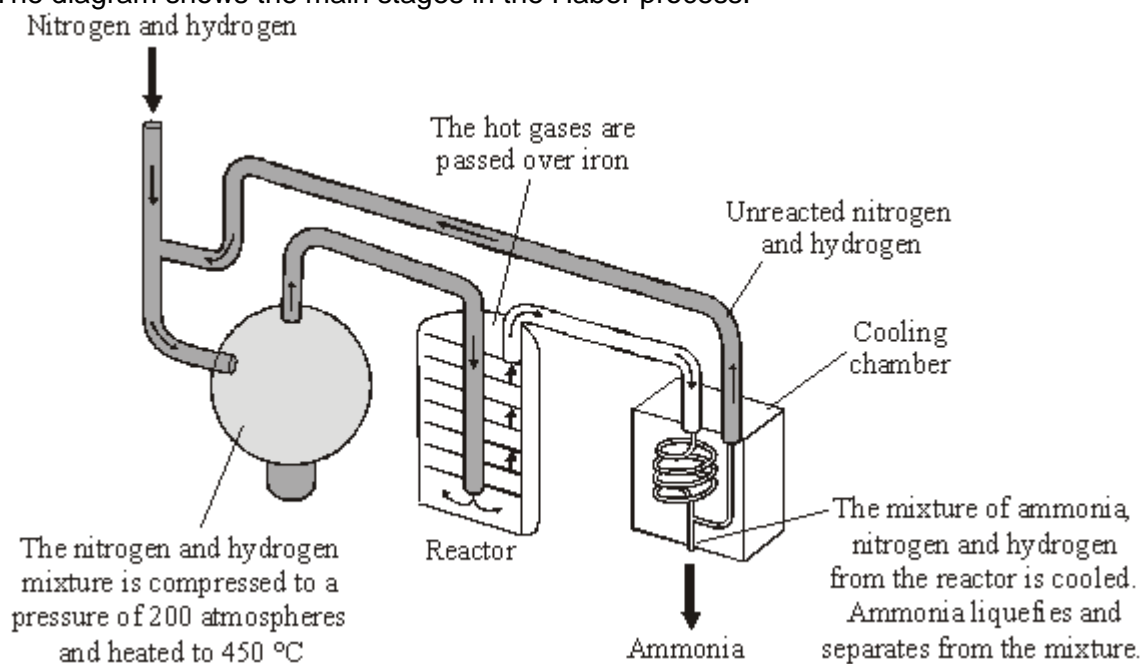
(2)

(c) In the condenser the mixture is heated and the ammonia is cooled and the ammonia is reduced

separated as a liquid.

(1)
(Total 4 marks)

Q9. The Haber process is named after the German chemist, Fritz Haber. The diagram shows the main stages in the Haber process.



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

(i) Complete the word equation for the reaction that takes place in the reactor.



(1)

(ii) What does the symbol \rightleftharpoons mean?

.....

(1)

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

.....

(1)

(iv) Ammonia is separated from unreacted nitrogen and hydrogen.

Draw a ring around the physical property that allows this separation to take place.

boiling point

density

melting point

(1)

(v) What is done with the unreacted nitrogen and hydrogen?

.....

(1)

(b) Some of the products that can be made from ammonia are:

- fertilisers
- dyes
- explosives
- medicines
- plastics

(i) The Haber process was invented a few years before the start of the First World War. It is thought that the First World War would have finished earlier if the Germans had **not** invented the Haber process.

Suggest why.

.....

.....

(1)

(ii) The Haber process has helped to increase food production.

Explain why.

.....
.....

(1)

(c) Factories that make ammonia are very large and operate night and day.

(i) Ammonia factories are often near towns.

Suggest why.

.....

(1)

(ii) Suggest and explain **one** reason why local people might not want an ammonia factory near their town.

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

(2)

(Total 10 marks)