

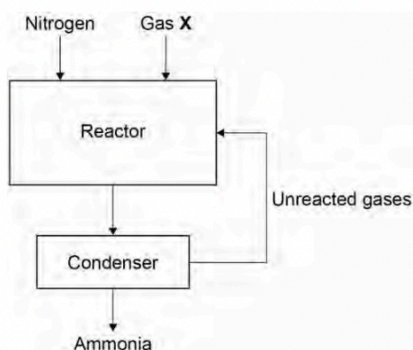
(The Haber process (conditions, yield, equilibrium))

Q1.a)(2018)

This question is about gases.

Figure 10 shows how nitrogen is used in the Haber Process to produce ammonia.

Figure 10



Gas **X** in **Figure 10** is obtained from methane.

Name gas **X**.

[1 mark]

Q1.b)(2018)

Give the approximate temperature and pressure used in the reactor.

[2 marks]

Temperature _____

Pressure _____

Q1.c)(2018)

The mixture of gases from the reactor cools in the condenser.

Suggest why ammonia condenses but the other gases do not.

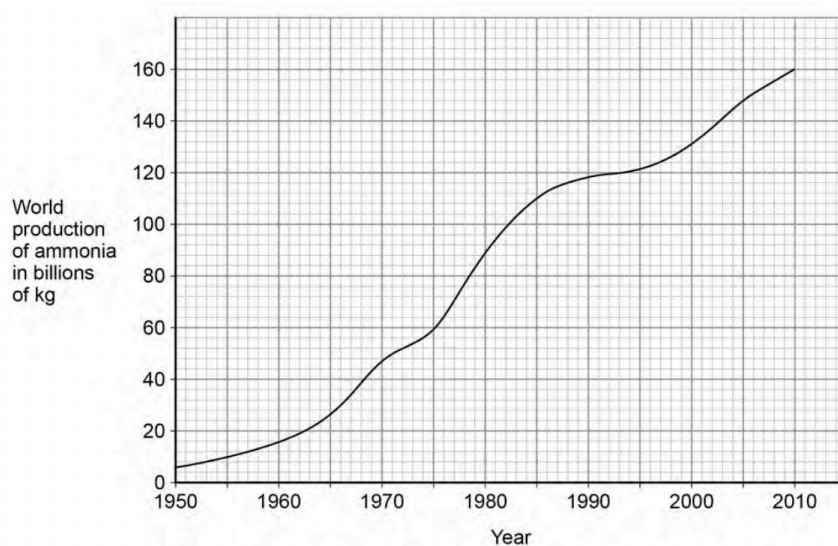
[1 mark]

Q2.(2019)

The Haber process also uses nitrogen to produce ammonia.

Figure 1 shows how the world production of ammonia changed between 1950 and 2010.

Figure 1



Describe how the world production of ammonia changed between 1950 and 2010.

[2 marks]

Q3.(2020)

Which catalyst is used when ammonia is produced from nitrogen and hydrogen?

[1 mark]

Tick (✓) **one** box.

Chlorine

☐

Iron

☐

Oxygen

☐

Q4.a)(2021)

Using Resources

<http://www.pcfgstudy.com>

Ethene and steam react to produce ethanol.

The equation for the reversible reaction is:



The reaction produces a maximum theoretical mass of 400 kg of ethanol from 243 kg of ethene and 157 kg of steam.

A company produces 380 kg of ethanol from 243 kg of ethene and 157 kg of steam.

The percentage yield of ethanol is less than 100%

Calculate the percentage yield of ethanol.

Use the equation:

$$\text{percentage yield of ethanol} = \frac{\text{mass of ethanol actually made}}{\text{maximum theoretical mass of ethanol}} \times 100$$

[2 marks]

Percentage yield = _____ %

Q4.b)(2021)

What are **two** possible reasons why the percentage yield of ethanol is less than 100%?

[2 marks]

Tick (✓) **two** boxes.

Ethanol is the only product of the reaction.

☐

Ethanol is very unreactive.

☐

Some ethanol changes back into ethene and steam.

☐

Some ethanol escapes from the apparatus.

☐

Some ethanol reacts with steam.

☐

Q5.(2022)

Using Resources

<http://www.pcfgstudy.com>

Ammonia is produced in the Haber process.

The raw materials for the Haber process are nitrogen and hydrogen.

Draw **one** line from each raw material to the source of that raw material.

[2 marks]

Raw material	Source of raw material
	Air
	Clay
Nitrogen	Limestone
Hydrogen	Natural gas
	Sand

Q6.(2022)

What are the states of nitrogen and of hydrogen when used in the Haber process?

[1 mark]

Tick (✓) **one** box.

State of nitrogen	State of hydrogen
Gas	Gas ☐
Gas	Liquid ☐
Liquid	Gas ☐
Liquid	Liquid ☐

Q7.(2022)

The word equation for the production of ammonia is:



The atom economy of the reaction is 100%.

How does the word equation show that the atom economy is 100%?

Tick (✓) **one** box.

[1 mark]

The reaction is reversible.

☐

There are two reactants.

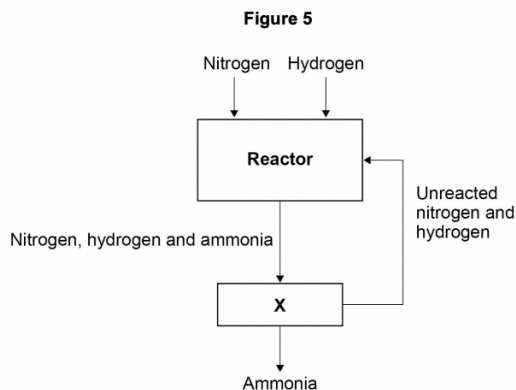
☐

There is one product.

☐

Q8.(2022)

Figure 5 represents the Haber process.



A mixture of nitrogen, hydrogen and ammonia enters X.

Complete the sentences.

Choose answers from the box.

[2 marks]

evaporated	filtered	liquefied	recycled
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In X, the mixture is cooled.

The ammonia can be removed from X because the ammonia is

_____.

The unreacted nitrogen and hydrogen are

_____.

Q9.a)(2022)

Table 8 shows the percentage yield of ammonia at different pressures.

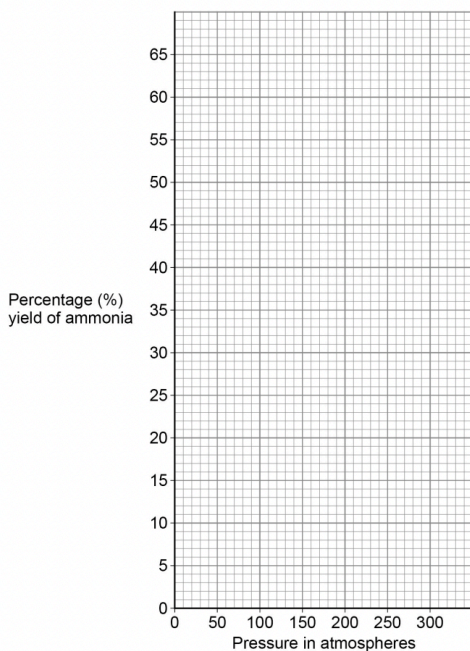
Table 8

Pressure in atmospheres	Percentage (%) yield of ammonia
50	20
100	33
150	44
200	52
250	59
300	64

Plot the data from **Table 8** on **Figure 6**.

Draw a line of best fit.

[3 marks]

Figure 6

Q9.b)(2022)

What is the effect of increasing the pressure on the percentage yield of ammonia?

Use **Table 8**.

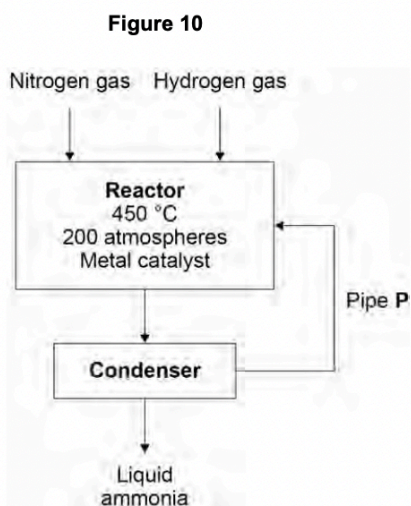
[1 mark]

Q10.a)(2024)

This question is about ammonia and nitric acid.

In the Haber process ammonia is produced from nitrogen and hydrogen.

Figure 10 represents the Haber process.



Pipe **P** links the condenser to the reactor.

Why is the condenser linked to the reactor?

Use **Figure 10**.

[1 mark]

Q10.b)(2024)

Which metal is used as a catalyst in this reaction?

[1 mark]
