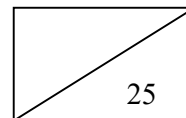


Name: _____ () Class: _____ Date: _____

Ammonia AFL



Multiple-Choice Questions (10 marks)

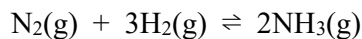
1. When 1 mol of nitrogen is reacted with 3 mol of hydrogen at 250 atm and 450°C in the presence of an iron catalyst, less than 2 mol of ammonia is formed.

Which of the following best explains this observation?

- A The pressure used was too low.
B The temperature used was too low.
C The nitrogen and hydrogen used in the reaction contained impurities.
D The reaction of nitrogen and hydrogen to form ammonia is reversible. ()
2. In the Haber process, gases are combined directly in a hydrogen to nitrogen ratio of _____.
- A 1 : 1 B 2 : 1
C 1 : 3 D 3 : 1 ()
3. The catalyst used in the Haber process is _____.
- A copper B iron
C hydrogen chloride D nickel ()
4. Ammonia gas is produced when ammonium chloride is heated with _____.
- A calcium carbonate B nitric acid
C potassium hydroxide D water ()

Use the following information to answer Questions 5 and 6.

The Haber process is used to manufacture ammonia gas. The reaction is exothermic and the chemical equation for the process is:



5. What is the effect of increasing the pressure inside the reaction vessel on the rate of production and the yield of ammonia gas?

	Rate	Yield
A	decrease	decrease
B	increase	unchanged
C	increase	decrease
D	increase	increase

()

6. What is the effect of increasing the temperature inside the reaction vessel on the rate of production and the yield of ammonia gas?

	Rate	Yield
A	decrease	decrease
B	increase	unchanged
C	increase	decrease
D	increase	increase

()

7. Which of the following statements is **not** true of the Haber process?

- A The raw material, nitrogen gas, is obtained from the cracking of petroleum.
- B Liquid ammonia is the product of the Haber process.
- C Nitrogen and hydrogen gases are compressed at 250 atm during the process.
- D Unreacted nitrogen and hydrogen are recycled and transferred back into the converter.

()

8. Which of the following statements are true of the Haber process?

- 1 An increase in pressure increases the speed of reaction.
- 2 An iron catalyst is used to increase the yield of ammonia.
- 3 A high temperature of 450°C is used to increase the yield of ammonia.
- 4 A relatively low pressure of 250 atm is used because it is costly to maintain a high pressure.

- A 1 and 4
- B 1, 3 and 4
- C 2 and 3
- D 1, 2, 3 and 4

()

9. Which ion will react with ammonium sulfate to give ammonia gas?

- | | | | | |
|----------|-----------------|----------|---------------|-----|
| A | NH_4^+ | B | OH^- | |
| C | H^+ | D | Cl^- | () |

10. Which of the following will **not** react with ammonium salts to give ammonia gas?

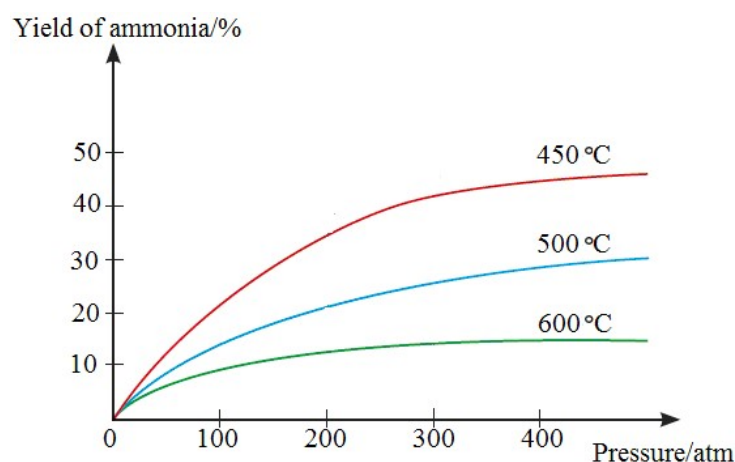
- | | | | | |
|----------|-------------------|----------|---------------------|-----|
| A | Limewater | B | Potassium hydroxide | |
| C | Hydrochloric acid | D | Sodium hydroxide | () |

Structured Questions (15 marks)

11. Complete this statement about a reversible reaction: [3]

A reversible reaction is a reaction that can go in _____. The forward reaction is when _____ become products and the _____ is when products are converted back into reactants.

12. Ammonia is produced commercially by the Haber process. The graph shows the percentage yield of ammonia at different pressures and temperatures.



(a) How does pressure affect the yield of ammonia? [2]

(b) How does temperature affect the yield of ammonia? [2]

(c) What happens to the speed of reaction when the temperature is lowered? [1]

(d) Why is the temperature used in the Haber process usually around 450°C? [2]

(e) Based on the graph, what will be the percentage of ammonia formed at 450°C and 200 atm? [1]

13. Below are the names of some compounds.

Ammonia Ammonium sulfate Ammonium nitrate

Nitric acid Potassium nitrate Potassium hydroxide

(a) Name three compounds that can be used as fertilisers. [1]

(b) Which two compounds react to make a third? [1]

(c) Which two compounds give off ammonia gas when warmed together? [1]

(d) Write a balanced equation with state symbols for the reaction in (c). [1]
