Chapter 10 : Ammonia

No.

Date . .

☆ A reversible reaction is a reaction that can go both forwards and backwards at the same reaction.

☆ In the Haber process, nitrogen combines with hydrogen to form ammonia.

☆ Conditions for Haber process:

- 200 atm
- 450°C
- Finely divided iron catalyst

☆ Hydrogen is obtained from the cracking of petroleum

☆ Nitrogen is obtained from the fractional distillation of liquid air.

☆ The higher the pressure, the better the yield of ammonia.

☆ The lower the temperature, the better the yield of ammonia.

☆ Pure N_2 and pure H_2 are mixed in the ratio of 1:3 by volume, the chemical equation shows this:

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

☆ Ammonia can be used in:

- Making nitrogenous fertilisers like:
  - → Ammonium phosphate
  - → Ammonium nitrate
  - → Ammonium sulfate
- Manufacturing of nitric acid to make explosives
- Manufacturing of dyes, pharmaceuticals and textiles.

Commonly tested qns:

Q: If ↓ temp. = better yield, why don't you reduce temp. of reaction?

A: Although a lower temperature does guarantee a better and higher yield, the reaction would

be very slow and time-consuming, slowing down the Haber Process.

Q: If ↑ pressure = better yield of ammonia, why don't you increase the pressure?

A: Although a higher pressure guarantees a higher and better yield of ammonia, the equipment needed to provide this high pressure is extremely costly and not cost-efficient.

Q: Why is the remaining N_2 and H_2 fed back into the plant after each reaction?

A: This is to recycle and reuse N_2 and H_2 to conserve these natural resources and save costs on these resources.

Q: Why should farmers not add calcium oxide and calcium hydroxide to nitrogenous fertilisers?

A: Ammonia can be displaced from ammonium salts with the help of alkalis, so as calcium oxide and calcium hydroxide are alkalis, when heated, nitrogen can be lost from the soil in the form of ammonia.