Fertilizers

↳ water soluble

N	P	K
$(NH_4)_3PO_4$		KNO_3

Haber's process → Manufacture of Ammonia gas

↓

$$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$$

Forward reaction: exothermic

Pressure : 200 atm
temp : 450°C
catalyst : Powdered Iron → Fe metal

High pressure is used since it would favor the forward reaction, since it would shift the equilibrium towards the side of less moles.

We can't have higher temperature as doing so will shift the equilibrium backwards, since increasing temperature favours endothermic reaction.
We can't use very low temperature since that would mean less kinetic energy.
450°C is a compromised temperature

Uses of ammonia

using its basic properties → $NH_{3(g)} + H_2O \rightarrow NH_4OH_{(aq)} \rightleftharpoons NH_{4(aq)}^+ + OH_{(aq)}^-$
↳ ammonia is basic in nature

using it as a base → $NH_4OH_{(aq)} + HCl_{(aq)} \longrightarrow NH_4Cl_{(aq)} + H_2O_{(l)}$

$NH_{3(g)} + HCl_{(g)} \longrightarrow NH_4Cl_{(s)}$

$3NH_{3(g)} + H_3PO_{4(aq)} \longrightarrow (NH_4)_3PO_4$

When we add synthetic fertilisers eg. NH_4Cl, NH_4 comes from base NH_4OH, which is a weaker than the HCl which gives the Cl. Which is why when water is added, the HCl being more stronger than NH_4OH, the soil becomes added.

IF P is in excess, it would mix in with the water and promotes growth of Algae. This would decrease amount of Dissolved Oxygen.

Both CaO and $CaCO_3$ are used to neutralise acidic soil.

But $CaCO_3$ is more preffered as after reaction with the soil, the remaining $CaCO_3$ (white powder) gets washed away when it rains, since it is insoluble.

When we use CaO, after reaction with soil, the remaining CaO reacts with rain water to form $Ca(OH)_2$. The OH^- ions make soil basic which then needs to be neutralised using acid. This process would continuously need to be repeated, which is why it is not preferred.