

L.S COLLEGE MUZAFFARPUR

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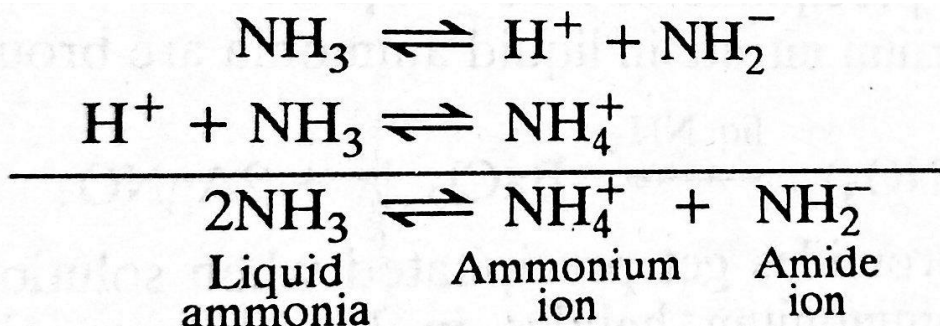
Department of Chemistry

**TOPIC :-NONAQUEOUS
SOLVENT ,LIQUID AMMONIA**

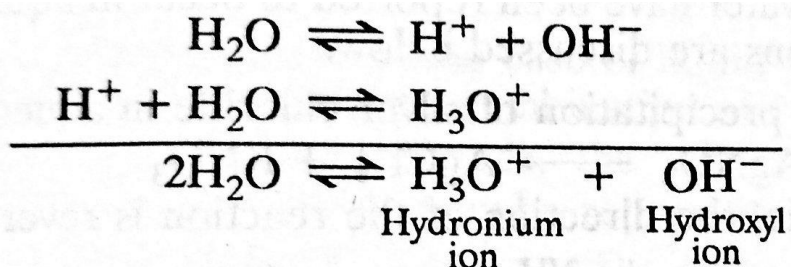
**Self Ionisation,
Comparison of Water and
Liquid ammonia**

Self ionization

As stated before, liquid ammonia undergoes self-ionization according to the following equation,



This can be compared to that of water which is represented as,



$$K_w = [\text{H}_3\text{O}^+][\text{OH}^-] = 1.0 \times 10^{-14} \text{ at } 25^\circ\text{C}$$

The extent of auto ionization of liq.NH₃ is less than that of water because oxygen is more electronegative than nitrogen.

Besides, the specific conductance of ammonia is low compared to water. The ionization constant of water and that of ammonia are expressed below,

$$K_w = [\text{H}_3\text{O}^+][\text{OH}^-] = 1.0 \times 10^{-14} \text{ at } 25^\circ\text{C}$$

$$K_b = [\text{NH}_4^+][\text{NH}_2^-] = 1.9 \times 10^{-33} \text{ at } -50^\circ\text{C}.$$

Solvent advantages of liquid ammonia over water

In spite of its low dielectric constant and specific conductivity, liquid ammonia has some advantages as a solvent over water. Some of these advantages are listed below,

Liquid ammonia is a poor conductor of electricity indicating that it can be used to study poorly ionize compounds that are not soluble (or too soluble) in water.

Specific heat of liquid ammonia is more than that of water. This property gives a wider temperature tolerance range than water

Unlike water, liquid ammonia has critical temperature and pressure

Liquid ammonia is a solvent than is less associated than water and could be a better solvent for some organic compounds.

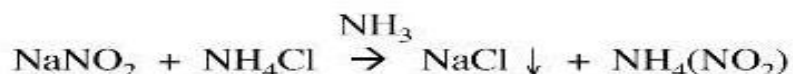
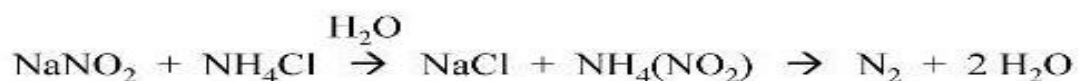
However, some of the disadvantages of liquid ammonia as a solvent are,

It is not suitable for a high temperature and pressure study because its liquid range is -77 to -33 °C.

It requires seal tubes for reactions to be carried out because it is hygroscopic.

It has a very offensive odour

Liquid ammonia is a good solvent for some organic compounds including ester, amines and alcohol. SCN^- , I^- , NO^- , NO^- and ClO^- are also soluble in liquid ammonia but fluoride ion, chloride, bromide, carbonate, sulphate, hydroxyl and sulphide ions are not soluble in liquid ammonia. The differences in solvent properties of water and ammonia can give some advantages in chemical analysis as the under listed example suggests,



In the above equations, it is clearly evidence that synthesis of ammonium nitrate using ammonium chloride can best be carried out using liquid ammonia as a solvent instead of water because the product is soluble in water (and not soluble in liquid ammonia) indicating that after formation, it will dissolve in water and generate nitrogen gas whereas in liquid ammonia, it can easily be precipitated out.