**14.4 Acidic, Basic and Neutral Solutions**

* The acidity of a solution is a measure of the concentration of hydrogen ions.
* The higher the concentration of hydrogen ions the more acidic the solution.
* Water has the ability to act as both an acid and a base and undergo self-ionisation to a very small extent (One water molecule out of 10 million will ionise at 25oC)
* This reaction is:
* In pure water at 25oC the H3O+(aq) and OH-(aq) concentrations are each 10-7 M.

Therefore:

* Acidic solutions contain a greater concentration of H3O+ than OH-
* Neutral solutions contain equal concentrations of H3O+ and OH-
* Basic solutions contain a lower concentration of H3O+ than OH-

**Measuring Acidity.**

* All aqueous solutions contain both H3O+ and OH- ions and the product of their molar concentrations is always 10-14.
* This relationship is called the ionic product and is represented by:

Pure water is neutral so [H3O+] = [OH-]

If either [H3O+] or [OH-] in an aqueous solution is increased, then the concentration of the other must decrease proportionally at 25oC.

Note: Square brackets [ ] are used to represent concentration in mol L-1.

Therefore at 25oC, a solution is:

**Worked Examples.**

1. **0.1 mol of HCl was bubbled through water to produce 1 L of solution. Calculate the solution concentration of H3O+ ions and OH- ions.**
2. **In a 5.6 x 10-6 M HNO3 solution at 25oC, calculate the concentration of H3O+ ions and OH- ions.**

**The pH scale**

* Mathematically, pH is defined as
* Since the scale is based on the negative logarithm of hydrogen ion concentration, the pH of a solution decreases as the concentration of H+ ions increases.
* Since the pH scale is a logarithmic scale, increasing the concentration by a factor of ten results in a decrease of one pH unit.

Example

Acidic, neutral and basic can now be defined in terms of their pH at 25oC:

**Calculating the pH of Aqueous solutions.**

* **First calculate the concentration of H+ ions.**
* **Second apply the formula pH = -log10[H30+]**
* **If the OH- ion concentration is given then use [H3O+] x [OH-] = 10-14 M**
1. **What is the pH of a solution in which [H+] = 0.0135 M?**
2. **What is the pH of a 0.0050 M solution of Ba(OH)2?**
3. **30.0 mL of 0.100 M HNO3 is added to 50.0 mL water. What is the pH of the diluted solution?**

**Calculating the Concentration of H+ in a solution of a given pH.**

* If the pH of a solution is known, it can be used to determine the concentration of hydronium ions.
* The pH relationship can be used in the form:
1. **What is the [H+] in a solution of pH 3.47?**

**Calculating the Concentration of OH- in a Solution of a given pH.**

* First calculate [H+] and then use [H3O+] x [OH-] = 10-14 M.
1. **What is the concentration of OH- ions in a solution of pH 10.4?**

**Text Questions: 9 – 14 Chapter Review: 15, 18-23, 26-28**