

8.3 The pH scale

Nature of science:

Occam's razor—the pH scale is an attempt to scale the relative acidity over a wide range of H^+ concentrations into a very simple number. (2.7)

Understandings:

- $pH = -\log[H^+(aq)]$ and $[H^+] = 10^{-pH}$.
- A change of one pH unit represents a 10-fold change in the hydrogen ion concentration $[H^+]$.
- pH values distinguish between acidic, neutral and alkaline solutions.
- The ionic product constant, $K_w = [H^+][OH^-] = 10^{-14}$ at 298 K.

Applications and skills:

- Solving problems involving pH, $[H^+]$ and $[OH^-]$.
- Students should be familiar with the use of a pH meter and universal indicator.

Guidance:

- Students will not be assessed on pOH values.
- Students should be concerned only with strong acids and bases in this sub-topic.
- Knowing the temperature dependence of K_w is not required.
- Equations involving H_3O^+ instead of H^+ may be applied.

Theory of knowledge:

- Chemistry makes use of the universal language of mathematics as a means of communication. Why is it important to have just one "scientific" language?

Utilization:

Syllabus and cross-curricular links:
Mathematics SL (topic 1.2) and Mathematics HL (topic 1.2)—study of logs

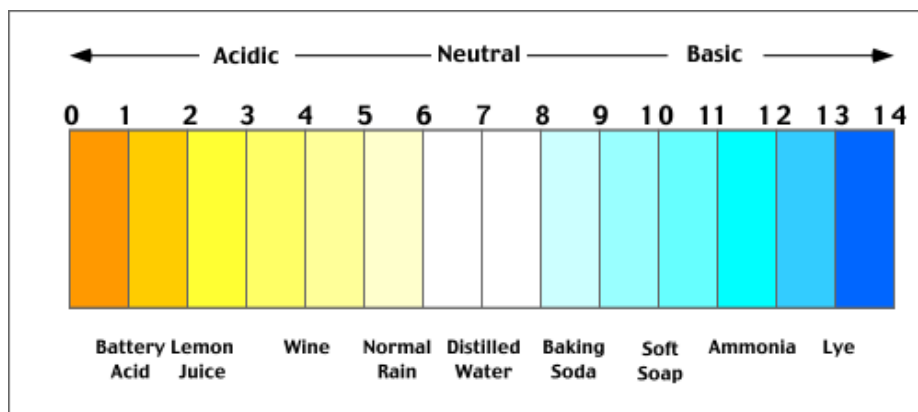
Aims:

- **Aim 3:** Students should be able to use and apply the pH concept in a range of experimental and theoretical contexts.
- **Aim 6:** An acid–base titration could be monitored with an indicator or a pH probe.

UNIT 8.3 – THE PH SCALE

DEFINITION OF PH

pH Scale: Simple and effective way of representing the concentration of hydrogen ions, $[H^+]$



CALCULATING PH

$$pH = -\log[H^+(aq)]$$

$$[H^+] = 10^{-pH}$$

$$[H^+][OH^-] = 1.0 * 10^{-14}$$

K_w = Ionic product constant of water

$$= [H_3O^+][OH^-]$$

$$= 1.0 * 10^{-14} M^2$$

APPLICATION

As we are using log base 10, every change in one unit on the pH scale means a change in hydrogen ion concentration of 10 units.

pH can be measured with an indicator or a probe.