Worksheet 8.1

Chapter 8: Acids and bases – glossary

**Acid–base indicator**  Weak acids or weak bases in which the dissociated and undissociated forms have different colours. They therefore change colour when the pH is changed. Indicators are used to signal change in pH and are commonly used to detect the equivalence point in titrations.

**Acid dissociation constant, \( K_a \)**  The modified equilibrium constant for the reaction of ionization of an acid. It is defined as:

\[
K_a = \frac{[H^+][A^-]}{[HA]}
\]

and is a useful measure of the strength of a weak acid.

**Acid rain**  Rain water that has a pH of less than about 5. It is an environmental problem, causing damage to living and non-living structures. It arises from acidic gases being released into the atmosphere from industrial sources.

**Alkali**  A base which is soluble in water and produces hydroxide ions.

**Alkalosis**  An increase in the pH of the blood. This can occur in pulmonary oedema, a potentially fatal condition that can occur at high altitude due to the decrease of carbon dioxide in the blood.

**Amphiprotic**  A compound which can act as an acid or a base, specifically by the donation or acceptance of a proton. Amphiprotic compounds are all amphoteric.

**Amphoteric**  A compound that can act as an acid or a base, by reacting with either an acid or a base.

**Anion hydrolysis**  The reaction when the anion of a salt hydrolyses water to produce the parent acid and hydroxide ions. The reaction occurs when the anion is the conjugate base of a weak acid, and the reaction causes the pH of the salt solution to be greater than 7.

**Base dissociation constant, \( K_b \)**  The modified equilibrium constant for the reaction of ionization of a base. It is defined as:

\[
K_b = \frac{[BH^+][OH^-]}{[B]}
\]

and is a useful measure of the strength of a weak base.

**Brønsted–Lowry acid**  A proton donor.

**Brønsted–Lowry base**  A proton acceptor.

**Buffering capacity**  A measure of the amount of acid or base that can be added to a buffer solution with no significant change in pH.

**Buffer region**  The region on a titration curve where the pH changes only slightly on the addition of acid or alkali. It ends when equivalence is reached.
**Buffer solution**  A solution that is resistant to changes in pH on the addition of a small amount of acid or alkali.

**Cation hydrolysis**  The reaction when the cation of a salt hydrolysies water to produce the parent base and hydrogen ions. The reaction occurs when the cation is the conjugate acid of a weak base, or when the cation has a high density of positive charge, such as Fe$^{3+}$ or Al$^{3+}$. The reaction causes the pH of the salt solution to be less than 7.

**Complex ion**  A compound in which molecules or ions – known as ligands – form dative bonds to a metal atom or ion, typically a transition metal. In the complex, the central ion acts as a Lewis acid and the ligands as Lewis bases.

**Conjugate acid**  The species formed when a base gains a proton.

**Conjugate acid–base pair**  An acid-base pair in which the acid has one more proton than the base, e.g. H$_2$O / OH$^-$.

**Conjugate base**  The species formed when an acid loses a proton.

**Dative bond**  A covalent bond in which both the shared electrons originate from one atom. In Lewis theory the Lewis acid is the species that accepts the bonded pair; the Lewis base donates the electron pair.

**Effervescence**  When bubbles of a gas form within a solution, such as occurs when an acid reacts with a metal carbonate.

**End point**  Also known as the change point. The pH at which an indicator changes colour suddenly. Different indicators have different end points due to their different $K_a$ values, and so are useful to detect the equivalence points in different titrations. The end point of an indicator occurs when the pH is equal to its pKa.

**Equivalence point**  The pH at which stoichiometrically equivalent amounts of acid and base have reacted together. At this point the mixture consists of salt and water only.

**Half-equivalence point**  The point where one half of a volume of acid has been neutralized by a base in a titration. At this point the mixture consists of equal concentrations of acid and salt, and is a buffer. The pH at the half-equivalence point is equal to the $pK_a$ of the acid.

**Hydrogen ion** H$^+$  A proton. Also known in solution as H$_3$O$^+$, a hydroxonium ion, an oxonium ion or a hydronium ion.

**Ionic product constant of water, $K_w$**  It is defined as the product [H$^+$][OH$^-$] and has a constant value at a specified temperature. At 25°C the value of $K_w$ is 1.00 $\times$ 10$^{-14}$.

**Lewis acid**  An electron pair acceptor.

**Lewis base**  An electron pair donor.

**Neutralization**  The reaction between an acid and a base to produce a salt and water.

**Parent acid and base**  The acid and base that reacted together to produce a particular salt in a neutralization reaction. The parent acid supplies the anion and the parent base the cation.
**pH meter**  A device used to measure the pH of a solution. It can be analogue, digital or a data logging device, and can also be calibrated to read conductivity.

**pH scale**  A convenient means of expressing and comparing the hydrogen ion concentration of solutions. It is defined as $-\log [H^+]$.

**$pK_a$**  A convenient means of describing and comparing the strengths of weak acids. It is defined as $-\log K_a$. The smaller the value of $K_a$, the stronger the acid.

**$pK_b$**  A convenient means of describing and comparing the strengths of weak bases. It is defined as $-\log K_b$. The smaller the value of $K_b$, the stronger the base.

**$pK_w$**  $-\log K_w$. It has a constant value at a specified temperature. At 25°C the value is 14.00.

**pOH scale**  A convenient means of expressing and comparing the hydroxide ion concentration of solutions. It is defined as $-\log [OH^-]$.

**Point of inflection**  The point in a graph where the gradient changes abruptly. In a titration curve it is used to determine the equivalence point.

**Spectator ion**  An ion that does not change during a reaction and so appears on both sides of an equation. Spectator ions are not shown in ionic equations.

**Standardization**  A technique for determining the exact concentration of a solution. It typically uses titration where the exact concentration of one solution is known.

**Strong acid/base**  An acid/base which ionizes almost completely in solution.

**Titration**  A technique for adding a controlled volume of a solution from a burette to a carefully measured volume of another reactant solution, typically in a conical flask. It is commonly used in acid–base reactions of neutralization.

**Titration curve**  A graph showing the change in pH in the reaction mixture, against the volume of acid or alkali added from the burette.

**Universal indicator**  A mixture of indicators which therefore gives a range of colours as pH changes.

**Weak acid/base**  An acid/base which ionizes only partially in solution.