

AS91392

Demonstrate understanding of equilibrium principles in aqueous systems

Level 3, Credits 5 (External)

This achievement standard involves demonstrating understanding of equilibrium principles in aqueous systems.

| Achievement | Achievement with Merit | Achievement with Excellence |
|---|--|---|
| Demonstrate understanding of equilibrium principles in aqueous systems. | Demonstrate in-depth understanding of equilibrium principles in aqueous systems. | Demonstrate comprehensive understanding of equilibrium principles in aqueous systems. |

Aqueous systems are limited to those involving

- sparingly soluble ionic solids
 - limited to AB, A₂B and AB₂ types (where neither of the ions A nor B reacts further with water).
- acidic and basic solutions (in which proton transfer occurs).
 - acidic and basic solutions are monoprotic acids, bases, salts, and buffers (those in which the extent of reaction is small so that the equilibrium concentration of a dissolved weak acid or base can be approximated by the initial concentration).

Equilibrium principles in aqueous systems are limited to qualitative descriptions and/or calculations involving:

- relative concentrations of dissolved species
- sparingly soluble ionic solids
 - relating solubility to K_s (AB, A₂B and AB₂ types)
 - predicting precipitation or dissolution
 - solubility of solids in water and in solutions already containing one of the ions A or B (a common ion) or due to the formation of a complex ion, or the reaction of a basic anion with added acid
 - knowledge of specific complex ions from Level 2 AS91162 will be assumed, e.g. [Cu(NH₃)₄]²⁺ and [Zn(OH)₄]²⁻ and [Ag(NH₃)₂]⁺. Less familiar complex ions may be included in resource information.
- acidic and basic solutions (includes buffers)
 - acid/base strength, K_a (pK_a)
 - Values of K_b or pK_b will not be provided, but may be derived and used in calculations.
 - concentration of species present in weak acidic and/or basic solutions (includes buffers)
 - relating concentration of species to pH and conductivity
 - titration curves to represent an acid-base system including selection of indicators (titrations of weak acids with weak bases are excluded).

You are expected to recognise

- common strong acids (HCl, HBr, HNO₃, H₂SO₄);
- common strong bases (KOH, NaOH);
- weak acids (HF, CH₃COOH and NH₄⁺);
- weak bases (NH₃, CH₃NH₂ and CH₃COO⁻).
- NOTE: less familiar weak acids and bases may be included in the context of appropriate resource information.

Symbols / Expressions

M, molar mass, is the mass of one mole of a defined substance and will be used for elements and compounds.

Units: g mol^{-1}

V, volume.

Units: L and mL

n, amount of substance, expressed in moles.

Units: mol

c, amount concentration, is expressed as moles per litre, also denoted by the format [].

Units: mol L^{-1}

Concentrations may also be written as mass concentration, expressed as grams per litre.

Units: g L^{-1}

s (*italic s*), solubility

Units: mol L^{-1}