Topic 18: Acids and bases (10 hours)

18.1 Calculations involving acids and bases

4 hours

	Assessment statement	Obj	Teacher's notes
18.1.1	State the expression for the ionic product constant of water (K_w).	1	
18.1.2	Deduce $[H^+(aq)]$ and $[OH^-(aq)]$ for water at different temperatures given K_w values.	3	
18.1.3	Solve problems involving $[H^+(aq)]$, $[OH^-(aq)]$, pH and pOH.	3	
18.1.4	State the equation for the reaction of any weak acid or weak base with water, and hence deduce the expressions for K_a and K_b.	1	Only examples involving the transfer of one proton will be assessed.
18.1.5	Solve problems involving solutions of weak acids and bases using the expressions: $K_a \times K_b = K_w$ $pK_a + pK_b = pK_w$ $pH + pOH = pK_w$.	3	Students should state when approximations are used in equilibrium calculations. The use of quadratic equations will not be assessed.
18.1.6	Identify the relative strengths of acids and bases using values of K_a, K_b, pK_a and pK_b.	2	

18.2 Buffer solutions

2 hours

	Assessment statement	Obj	Teacher's notes
18.2.1	Describe the composition of a buffer solution and explain its action.	3	
18.2.2	Solve problems involving the composition and pH of a specified buffer system.	3	Only examples involving the transfer of one proton will be assessed. Examples should include ammonia solution/ammonium chloride and ethanoic acid/sodium ethanoate. Students should state when approximations are used in equilibrium calculations. The use of quadratic equations will not be assessed.

			Aim 7: Virtual experiments can be used to demonstrate this.

18.3 Salt hydrolysis

1 hour

	Assessment statement	Obj	Teacher's notes
18.3.1	Deduce whether salts form acidic, alkaline or neutral aqueous solutions.	3	Examples should include salts formed from the four possible combinations of strong and weak acids and bases. The effect of the charge density of the cations in groups 1, 2 and 3 and d-block elements should also be considered. For example, $[Fe(H_2O)_6]^{3+}(aq) \longrightarrow [Fe(OH)(H_2O)_5]^{2+}(aq) + H^+(aq)$.

18.4 Acid–base titrations

2 hours

	Assessment statement	Obj	Teacher's notes
18.4.1	Sketch the general shapes of graphs of pH against volume for titrations involving strong and weak acids and bases and explain their important features.	3	Only examples involving the transfer of one proton will be assessed. Important features are: • intercept with pH axis • equivalence point • buffer region • points where pK_a = pH or pK_b = pOH. **Aim 7:** Data logging, databases, spreadsheets and simulations are all possible here.

18.5 Indicators

1 hour

	Assessment statement	Obj	Teacher's notes
18.5.1	Describe qualitatively the action of an acid–base indicator.	2	$HIn(aq) \rightleftharpoons H^+(aq) + In^-(aq)$ Use colour A colour B.
18.5.2	State and explain how the pH range of an acid–base indicator relates to its pK_a value.	3	
18.5.3	Identify an appropriate indicator for a titration, given the equivalence point of the titration and the pH range of the indicator.	2	Examples of indicators are listed in the *Chemistry data booklet*.