Topic 8: Acids and bases (6 hours)

8.1 Theories of acids and bases
2 hours

	Assessment statement	Obj	Teacher's notes
8.1.1	Define *acids* and *bases* according to the Brønsted–Lowry and Lewis theories.	1	**TOK:** Discuss the value of using different theories to explain the same phenomenon. What is the relationship between depth and simplicity?
8.1.2	Deduce whether or not a species could act as a Brønsted–Lowry and/or a Lewis acid or base.	3	
8.1.3	Deduce the formula of the conjugate acid (or base) of any Brønsted–Lowry base (or acid).	3	Students should make clear the location of the proton transferred, for example, CH_3COOH/CH_3COO^- rather than $C_2H_4O_2/C_2H_3O_2^-$.

8.2 Properties of acids and bases
1 hour

	Assessment statement	Obj	Teacher's notes
8.2.1	Outline the characteristic properties of acids and bases in aqueous solution.	2	Bases that are not hydroxides, such as ammonia, soluble carbonates and hydrogen carbonates, should be included. Alkalis are bases that dissolve in water. Students should consider the effects on indicators and the reactions of acids with bases, metals and carbonates.

8.3 Strong and weak acids and bases
2 hours

	Assessment statement	Obj	Teacher's notes
8.3.1	Distinguish between *strong* and *weak* acids and bases in terms of the extent of dissociation, reaction with water and electrical conductivity.	2	**Aim 8:** Although weakly acidic solutions are relatively safe, they still cause damage over long periods of time. Students could consider the effects of acid deposition on limestone buildings and living things.
8.3.2	State whether a given acid or base is strong or weak.	1	Students should consider hydrochloric acid, nitric acid and sulfuric acid as examples of strong acids, and carboxylic acids and carbonic acid (aqueous carbon dioxide) as weak acids. Students should consider all group 1

			hydroxides and barium hydroxide as strong bases, and ammonia and amines as weak bases.
8.3.3	Distinguish between *strong* and *weak* acids and bases, and determine the relative strengths of acids and bases, using experimental data.	2	

8.4 The pH scale

1 hour

	Assessment statement	Obj	Teacher's notes
8.4.1	Distinguish between aqueous solutions that are *acidic*, *neutral* or *alkaline* using the pH scale.	2	
8.4.2	Identify which of two or more aqueous solutions is more acidic or alkaline using pH values.	2	Students should be familiar with the use of a pH meter and universal indicator.
8.4.3	State that each change of one pH unit represents a 10-fold change in the hydrogen ion concentration $[H^+(aq)]$.	1	Relate integral values of pH to $[H^+(aq)]$ expressed as powers of 10. Calculation of pH from $[H^+(aq)]$ is not required. **TOK:** The distinction between artificial and natural scales could be discussed.
8.4.4	Deduce changes in $[H^+(aq)]$ when the pH of a solution changes by more than one pH unit.	3	**Aim 8:** A study of the effects of small pH changes in natural environments could be included.