UNIT 8 THE CHEMISTRY AND REACTIONS OF ACIDS AND BASES

1. state Arrhenius definition of acids
2. state Bronsted concept of acids and bases
3. write reactions for acids in water, hydroxide bases in water, and non-hydroxide bases in water
4. recognize conjugate acids and bases and conjugate pairs
5. list strong acids and bases
6. calculate pH, pOH, $[OH^-]$, or $[H_3O^+]$ for strong and weak acids and bases
7. determine the pH of salt solutions and write hydrolysis reactions
8. state Lewis theory of acids and bases
9. solve common ion problems
10. write reactions between acids and bases and calculate the pH
11. determine the pH of titrations before titrant added, before equivalence point, at equivalence point and after equivalence point for strong acid and bases, weak acid strong base, strong acid and weak base
12. write reactions for buffers and solve pH problems involving buffers
13. Interpret titration curves
14. determine pH of polyprotic acids

Vocabulary:

hydronium ion	monoprotic	equivalence point
hydroxide ion	polyprotic	end point
conjugate acids and bases	coordinate covalent bond	titration
amphoteric	indicators	hydrolysis

AP Course Guide correlation:

III. Reactions

A. Reaction types

1. Acid-base reactions; concepts of Arrhenius, Brønsted-Lowry, and Lewis; amphoterism

C. Equilibrium

2. Quantitative treatment

b. Equilibrium constants for reactions in solution

(1) Constants for acids and bases; pK; pH

(3) Common ion effect; buffers; hydrolysis

IB Course Outline correlations:

8.1.1 Define *acids* and *bases* according to the Brønsted–Lowry and Lewis theories.

8.1.2 Deduce whether or not a species could act as a Brønsted–Lowry and/or a Lewis acid or base.

8.1.3 Deduce the formula of the conjugate acid (or base) of any Brønsted–Lowry base (or acid).

8.3.1 Distinguish between *strong* and *weak* acids and bases in terms of the extent of dissociation, reaction with water and electrical conductivity.

8.3.2 State whether a given acid or base is strong or weak.

8.3.3 Distinguish between *strong* and *weak* acids and bases, and determine the relative strengths of acids and bases, using experimental data.

8.4.1 Distinguish between aqueous solutions that are *acidic*, *neutral* or *alkaline* using the pH scale.

8.4.2 Identify which of two or more aqueous solutions is more acidic or alkaline using pH values.

8.4.3 State that each change of one pH unit represents a 10-fold change in the hydrogen ion concentration [H+(aq)].

8.4.4 Deduce changes in [H+(aq)] when the pH of a solution changes by more than one pH unit.

18.1.2 Deduce [H+(aq)] and [OH–(aq)] for water at different temperatures given *K*w values.

18.1.3 Solve problems involving [H+(aq)], [OH–(aq)], pH and pOH.

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.
18.1.5 Solve problems involving solutions of weak acids and bases using the expressions:
$K_a \times K_b = K_w$
$pK_a + pK_b = pK_w$
$pH + pOH = pK_w$.
18.1.6 Identify the relative strengths of acids and bases using values of K_a, K_b, pK_a and pK_b.
18.2.1 Describe the composition of a buffer solution and explain its action.
18.2.2 Solve problems involving the composition and pH of a specified buffer system.
18.3.1 Deduce whether salts form acidic, alkaline or neutral aqueous solutions.
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.
18.5.1 Describe qualitatively the action of an acid–base indicator.
18.5.2 State and explain how the pH range of an acid–base indicator relates to its pK_a value.
18.5.3 Identify an appropriate indicator for a titration, given the equivalence point of the titration and the pH range of the indicator.