Chemistry 12

Unit IV Acids, Bases and Salts

Prescribed Learning Outcomes

The following grid contains all the prescribed learning outcomes (2007 / 2008) for the Acid / Base unit of Chemistry 12. Use this in conjunction with the Acid / Base Study Guide to determine your level of competence and understanding of each learning outcome. Once you are confident that you completely understand each learning outcome, place a check mark in the square provided.

Please Note: The Chemistry 12 Study Guides are based on the OLD PLO's. Use the "Study Guide Equivalent" column to match up the old PLO's to the new ones.

Prescribed Learning Outcomes	Achievement Indicators	Study Guide Equivalent	Status
D1 identify acids and bases through experimentation	List general properties of acids and bases	J2	❑
	Write the names and formulae of some common household acids and bases	J5	❑
	Write balanced equations representing the neutralization of acids by bases in solution	J3	❑
	Outline some of the uses and commercial names of common household acids and bases	J5	❑
D2 identify various models for representing acids and bases	Define Arrhenius acids and bases	J4	❑
	Define Bronsted-Lowry acids and bases	J6	❑
D3 analyse balancing equations representing the reaction of acids or bases with water	Identify Bronsted-Lowry acids and bases in an equilibrium	J7	❑
	Define conjugate acid-base pair	J10	❑
	Identify the conjugate of a given acid or base	J11	❑
	Show that in any Bonsted-Lowry acid-base equation there are two conjugate pairs present	J12	❑
	Identify an H_3O^+ ions as a protonated H_2O molecule that can be represented in shortened form as H^+	J9	❑
D4 classify an acid or base in solution as either weak or strong, with reference to its electrical conductivity	Relate electrical conductivity in a solution to the total concentration of ions in the solution	K1	❑
	Define and give several examples for the following terms: - Strong acid - Strong Base - Weak Acid - Weak Base	K3, K4	❑
	Write equations to show what happens when strong and weak acids and bases are dissolved in water.	K5	❑
D5 analyse the equilibria that exists in weak acid or weak base systems	Compare the relative strengths of acids or bases by using a table of relative acid strengths	K6	❑
	Predict whether products or reactants are favoured in an acid-base equilibrium by comparing the strength of the two acids (or two bases)	K8	❑
	Compare the relative concentration of H_3O^+ (OH^-) between two acids (or between two bases) using their relative positions on an acid strength table	K9	❑

Prescribed Learning Outcomes	Achievement Indicators	Study Guide Equivalent	Status
D6 identify chemical species that are amphiprotic	Define amphiprotic	K10, K11	❑
	Describe situations in which H_2O would act as an acid or base	K12	❑
E1 analyse the equilibrium that exists in water	Write equations representing the ionization of water using either H_3O^+ and OH^- or H^+ and OH^-	L1	❑
	Predict the effect of the addition of an acid or base to the equilibrium system: $2H_2O \rightleftharpoons H_3O^+ + OH^-$	L3	❑
	State the relative concentrations of H_3O^+ and OH^- in acid, base and neutral solutions	L4	❑
	Write the equilibrium expression for the ion product constant of water (water ionization constant: K_w)	L2	❑
	State the value of K_w at 25^oC	L5	❑
	Describe and explain the variation in the value of K_w with temperature	L6	❑
	Calculate the concentration of H_3O^+ (OH^-) given the other, using K_w	L7	❑
E2 perform calculations relating pH, pOH, $[H_3O^+]$, and $[OH^-]$	Define pH and pOH	L9	❑
	Define pK_w, give its value at 25^oC, and its relation to pH and pOH	L10	❑
	Calculate $[H_3O^+]$ or $[OH^-]$ from pH and pOH	L11, L12	❑
	Describe the pH scale with reference to everyday solutions	L8	❑
E3 explain the significance of the K_a and K_b equilibrium expressions	Write K_a and K_b equilibrium expressions for weak acids or weak bases	M1	❑
	Relate the magnitude of K_a (the acid ionization constant) or K_b (the base ionization constant) to the strength of the acid or base	M2	❑
E4 perform calculations involving K_a and K_b	Given the K_a, K_b, and initial concentrations, calculate any of the following: - $[H_3O^+]$ - $[OH^-]$ - pH - pOH	M3	❑
	Calculate the value of K_b for a base given the value of K_a for its conjugate acid (or vice versa)	M4	❑
	Calculate the value of K_a or K_b given the pH and initial concentration	M5	❑
	Calculate the initial concentration of an acid or base, given the appropriate K_a, K_b, pH or pOH values.	N/A	❑
F1 demonstrate an ability to design, perform, and analyse a titration experiment involving the following: - Primary standards - Standardized solutions - Titration curves - Appropriate indicators	Write formulae, complete ionic equation and net ionic equations for: - A strong acid reacting with a strong base (neutralization) - A weak acid reacting with a strong base - A strong acid reacting with a weak base	P4	❑
	Demonstrate proper titration technique when performing a titration experiment	N/A	❑
	Explain the difference between the equivalence point (stoichiometric point) of a strong acid-strong base titration and the equivalence point of a titration involving a weak acid-strong base or strong acid-weak base	P6	❑

Prescribed Learning Outcomes	Achievement Indicators	Study Guide Equivalent	Status
F1 demonstrate an ability to design, perform, and analyse a titration experiment involving the following: - Primary standards - Standardized solutions - Titration curves - Appropriate indicators ***(Continued…)***	Interpret titration curves plotted from experimental data	N/A	❑
	Select indicators whose transition point coincides with the equivalence point of the titration reaction	N/A	❑
	Calculate the concentration of an acid or base using titration data or similar data (e.g., grams or moles)	P2	❑
	Calculate the volume of an acid or base of known molarity needed to completely react with a given amount of base or acid	P3	❑
	Calculate the pH of a solution formed when a strong acid is mixed with a strong base	P5	❑
F2 describe an indicator as an equilibrium system	Describe an indicator as a mixture of a weak acid and its conjugate base, each with distinguishing colours	O1	❑
	Describe the term transition point of an indicator, including the conditions that exist in the equilibrium system	O2	❑
	Describe the shift in equilibrium and resulting colour changes as an acid or a base is added to an indicator	O3	❑
F3 perform and interpret calculations involving the pH in a solution and K_a for an indicator	Predict the approximate pH at the transition point using the K_a value of the indicator	O4	❑
	Predict the approximate Ka value of an indicator given the approximate pH range of the colour change	O5	❑
	Match an indicator's colour in a solution with an approximate pH, using a table of indicators	N/A	❑
F4 describe the hydrolysis of ions in salt solution	Write a dissociation equation for a salt in water	N1	❑
	Write the net ionic equations representing the hydrolysis of ions in solution	N2	❑
F5 analyse the extent of hydrolysis in salt solutions	Predict whether a salt solution would be acidic, basic, or neutral (compare K_a and K_b values, where necessary)	N3	❑
	Determine whether an amphiprotic ion will act as a base or an acid in solution (compare K_a and K_b values, where necessary)	N4	❑
	Calculate the pH of a salt solution from relevant data, assuming that the predominant hydrolysis reaction is the only reaction determining the pH	N/A	❑
F6 describe buffers as equilibrium systems	Describe the tendency of buffer solutions to resist changes in pH (i.e., able to buffer the addition of small amounts of strong acid or the addition of small amount s of strong base)	Q1	❑
	Describe the composition of an acidic buffer and a basic buffer	Q2	❑
	Describe qualitatively how the buffer equilibrium shifts as small quantities of acid or base are added to the buffer; the stress being the change in the concentration of the stronger acid (H_3O^+) or base (OH^-)	Q5	❑
	Describe in detail a common buffer system (e.g., the blood buffer system)	Q6	❑
F7 describe the preparation of buffer systems	Outline a procedure to prepare a buffer solution	Q3	❑
	Identify the limitations in buffering action	Q4	❑

Prescribed Learning Outcomes	Achievement Indicators	Study Guide Equivalent	Status
F8 predict what will happen when oxides dissolve in rain water	Write the equations representing the formation of acidic solutions or basic solutions from non-metal and metal oxides	R1	❑
	Describe the pH conditions required for rain to be called acid rain (pH 5.0 and lower)	R2	❑
	Relate the pH of normal rain water to the presence of dissolved CO_2 (approximately pH 5.6)	R3	❑
	Describe sources of NO_x (automobile engines) and SO_x (fuels containing sulphur and smelters of sulphide ores)	R4	❑
	Discuss general environmental problems associated with acid rain	R5	❑