Chemistry 3202
June 2015 Public Exam Outcome Report

This examination follows the specifications, conventions and standards set out in the:
Chemistry 3202 Provincial Exam Standards

Units 1 – From Kinetics to Equilibrium
2 – Acids and Bases
3 – Thermochemistry
4 – Electrochemistry

PART I: Selected Response—Total Value: 50%

Item	Curriculum Guide Page	Outcome	Cognitive Level	Outcome Description
1	(Unit 1) 28	ACC-1	L2	Given a diagram, identify $E_{a(forward)}$, $E_{a(reverse)}$, and ΔH.
2	28	ACC-1	L1	Given a diagram, identify $E_{a(forward)}$, $E_{a(reverse)}$, and ΔH.
3	28	ACC-1	L2	Identify a method of measuring the reaction rate for a given reaction.
4	32	ACC-3	L1	Given a reaction mechanism, identify the rate-determining step.
5	34	ACC-3	L1	Describe how a catalyst changes the reaction rate.
6	38	323-3	L1	Identify the criteria that apply if a system is at equilibrium.
7	40	323-4 323-5	L2	Use Le Chatelier's principle to determine how the concentration of a reactant and/or product changes after a change is imposed on an equilibrium.
8	44	323-3	L1	Identify what would cause an equilibrium constant (K_{eq}) to change.
9	40	323-4 323-5	L3	Use Le Chatelier's principle to predict shifts in equilibrium caused by a change in temperature, pressure, volume or concentration.
10	44	323-3	L2	Identify the equilibrium constant expression for a given reaction.
11	44	323-3	L2	Predict whether reactants or products are favoured and the physical characteristics of the equilibrium on the basis of the magnitude of the equilibrium constant.
12	46	ACC-4	L2	Calculate K_{eq} for an equilibrium.

13	(Unit 2) 52,58	214-1 214-17	L2	Distinguish between weak and strong acids (or bases) using operational definitions.
14	54	320-1	L1	Define Arrhenius, modern Arrhenius and Bronsted-Lowry acids and bases.
15	54	320-1	L2	Identify Arrhenius, modern Arrhenius and Bronsted-Lowry acids and bases.
16	56	214-17	L2	Identify an amphoteric substance.
17	56	214-17	L2	Identify the Brønsted-Lowry conjugate acid-base pairs given an equilibrium equation.
18	62,66	320-4 320-6	L2	Calculate $[H_3O^+]$, $[OH^-]$, pH or pOH of a strong acid or a strong base.
19	58	214-17	L1	Identify the strongest acid/base from a list of substances.
20	66	320-4	L2	Calculate one of $[H_3O^+]$, $[OH^-]$, pH and pOH when one value is provided.
21	62	320-4	L1	Identify the equilibrium equation for the auto-ionization of water.
22	64	320-4	L2	Describe the relationship between pH and $[H_3O^+]$.
23	68,52	320-4 214-1	L3	Identify the slowest reaction rate when given the K_a and concentration of an acid.
24	78	213-3	L1	Identify the function of lab equipment used for a titration.
25	80	320-7	L3	Use a titration curve to determine the colour of a specific acid-base indicator.
26	76	320-6	L1	Distinguish between equivalence point and endpoint.
27	80	320-7	L2	Determine the pH of a solution based on given indicator colours.
28	82	214-5	L1	Identify mono-, di-, and triprotic acids.
29	(Unit 3) 92	324-3	L1	Define specific heat capacity.
30	94	324-3	L2	Use $q = mc\Delta T$ to calculate one of q, m, c or ΔT.
31	104	324-1	L2	Calculate the heat gained or lost during a reaction using the formula $q = n\Delta H$ when ΔH is the molar heat of a chemical reaction.
32	102	324-5	L2	Match a given enthalpy diagram with the correct thermochemical equation.

33	106,96	324-1,3	L1	Identify the correct apparatus needed for a given calorimetry experiment.
34	110	117-9	L1	Compare the energy change produced in physical, chemical and nuclear reactions.
35	104	324-1	L3	Identify an unknown element using q = nΔH to calculate one of q, n or ΔH given a thermochemical equation.
36	104	324-1	L2	Calculate the heat gained or lost from a system using the formula q = nΔH when ΔH is the molar heat of a phase change.
37	114	214-3	L1	Relate ΔH^{o}_{f} to the stability of a compound.
38	114	324-4	L2	Determine the molar enthalpy of a reaction using given standard molar enthalpies of formation (ΔH^{o}_{f}).
39	108	214-3	L2	Identify changes in PE and KE when given a heating or cooling curve.
40	118	324-4	L1	Recognize the limitations of using bond energies to estimate ΔH of a reaction.
41	(Unit 4) 124	322-1	L1	Define oxidation and reduction.
42	130	322-2	L2	Identify a correctly balanced half-reaction.
43	126	322-3	L2	Determine the oxidation number of an atom within an ion/molecule.
44	132	322-4	L1	Describe the function of a salt bridge.
45	128	322-3	L1	Identify an oxidation or reduction half reaction.
46	134	322-4	L2	Identify the parts of a cell given cell notation.
47	126,136	322-5 322-6	L3	Identify which species is reduced in a given spontaneous reaction.
48	136	322-5 322-6	L1	Compare the strength of oxidizing agents and reducing agents.
49	138	322-5 322-6	L2	Predict the cell voltage (E^{o}) of a given electrochemical cell.
50	136,150	322-5 322-6 322-7	L2	Identify an electrochemical cell as a cell which produces electrical energy in spontaneous oxidation-reduction reactions.

PART II: Constructed Response—Total Value: 50%

Item	Curriculum Guide Page	Outcome	Cognitive Level	Value	Outcome Description
51a	(Unit 1) 30	ACC-2	L2	2	Explain using collision theory one method of increasing the rate of a given chemical reaction.
51b(i)	34	ACC-3	L2	1	Write the overall reaction when given the elementary steps for a reaction mechanism.
51b(ii)	34	ACC-3	L2	2	Determine the catalyst(s) and the reaction intermediate(s) for a given reaction mechanism.
51c	46	ACC-4	L2	4	Calculate K_{eq} for a reaction when given the percent reaction and one initial concentration.
51d	28,40	ACC-1 323-4 323-5	L3	2	Use Le Chatelier's Principle and a potential energy diagram to predict shifts in equilibrium caused by a change in temperature, pressure, volume or concentration.
51e	38	323-3	L3	2	Write the equation for an equilibrium reaction when given a graphical representation of a system reaching equilibrium.
52a	(Unit 2) 60	320-2	L2	2	Write the Brønsted-Lowry neutralization reaction that occurs when two solutions are combined.
52b	70	320-3	L2	4	Calculate the pH of a solution given the initial weak acid (or weak base) concentration and the K_a (or K_b).
52c	76	320-6	L2	4	Calculate the concentration of an unknown solution using data from a titration experiment. (science communication mark)
52d	68	320-4	L3	2	Demonstrate an understanding of the difference between acid concentration and acid strength.
52e(i)	80,84	320-7 214-5	L3	1	Sketch a titration curve given a specific indicator and the number of protons transferred.
52e(ii)	58,84	214-17 214-5	L3	1	Give an example of an acid and a base that would produce a specific titration curve.

53a	(Unit 3) 112	ACC-8	L2	2	Calculate fuel value for a substance from calorimetry data.
53b	114	324-4	L2	4	Use Hess's Law to determine the enthalpy of a reaction.
53c	118	324-4	L2	3	Calculate the enthalpy of a reaction given average bond energies.
53d	108	214-3	L3	4	Calculate ΔH for a phase change when given data for a substance being heated and undergoing a phase change.
54a	(Unit 4) 130	322-2	L2	3	Balance a redox reaction under acidic or basic conditions.
54b	144	322-8	L2	4	Use Faraday's Law to perform stoichiometric calculations. (science communication mark)
54c	138	322-5 322-6	L3	3	Identify an unknown metal based on its reactivity with other metal ions.