Chemistry 3202
June 2016 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	28	ACC-1	L1	Identify ΔH from a PE diagram.
2	28	ACC-1	L1	Identify evidence that supports the Kinetic Molecular Theory.
3	28	ACC-1	L2	Identify a method of measuring the rate of a given reaction in a closed system.
4	30	ACC-2	L1	Identify the reactant with the fastest reaction rate.
5	34	ACC-3	L1	Identify rate-determining step and its E_a from a PE diagram.
6	34	ACC-3	L1	Describe how a catalyst affects the rate of a chemical reaction.
7	38	323-3	L1	Identify a characteristic of a chemical equilibrium.
8	38	323-3	L2	Given changes in a system's properties, identify when a system reaches equilibrium.
9	40,74	323-4, 323-5, ACC-7	L3	Given equilibrium systems, identify how a change will affect the concentration of a chemical species and the effect on the blood pH.
10	40-42	323-4, 323-5	L2	Describe how a given equilibrium system is affected by a change in temperature.
11	44	323-3	L1	Identify the equilibrium constant expression for a chemical system.
12	44	323-3	L2	Calculate K_{eq} from given equilibrium concentrations.

13	(Unit 2) 54	320-1	L1	Identify an acid or a base using a specific acid/base theory.
14	56	214-17	L1	Identify an amphoteric substance.
15	52,58	214-1, 214-17	L2	Identify which acid or base corresponds to given operational characteristics.
16	58,60	320-2, 214-17	L2	Given an acid-base equilibrium, identify the strongest acid and equilibrium position favoured.
17	66,80	320-4, 320-7	L3	Given the colours of several indicator tests, identify $\left[\mathrm{H_3O^+}\right]$ of the unknown solution.
18	64	320-4	L2	Identify the change in $\left[\mathrm{OH^-}\right]$ required to produce a given pH change.
19	68	320-3	L2	Given a *K* expression with an unknown quantity, determine whether the expression represents K_a or K_b and identify the unknown quantity.
20	66	320-4	L2	Calculate $\left[\mathrm{H_3O^+}\right]$ for a given pOH.
21	62	320-4	L1	Identify the auto-ionization of water.
22	78	212-8	L1	Identify an instrument that is used in a titration lab.
23	56, 74	214-7, ACC-5, ACC-6	L2	Identify a species which can be used to neutralize both an acid and a base.
24	56	214-17	L2	Identify the conjugate base for a given equilibrium.
25	80	320-7	L1	Given the pH and indicator, identify the colour that is observed for a solution.
26	80,84	320-7, 214-5	L2	Select an appropriate indicator for a given acid-base titration.
27	76,80	320-6, 320-7	L3	Determine pH and colour, when a given indicator is added to a solution produced from combining an acid and a base, one of which is in excess.
28	82	214-5	L1	Distinguish between mono-, di-, and triprotic acids.
29	(Unit 3) 92	324-3	L1	Define *specific heat capacity.*

30	94	324-3	L2	Perform a calculation using $q = mc\Delta T$.
31	94	324-3	L1	Distinguish between open, closed, and isolated systems.
32	104	324-1	L2	Perform a calculation using $q = n\Delta H$ after interpreting a chemical reaction.
33	100	324-3	L1	Relate the sign of ΔH to endothermic and exothermic reactions.
34	100	324-3	L1	Identify a process that is endothermic.
35	104	324-1	L3	Determine the identity of a reactant in a chemical reaction given the enthalpy of reaction, amount of energy absorbed/released, and mass of reactant.
36	104	324-1	L2	Calculate the mass of a substance that will release a certain amount of energy during a phase change.
37	110	117-9	L1	Compare the magnitude of energy that is involved when physical, chemical and nuclear changes occur.
38	106	324-1	L2	Identify the changes in heat and temperature within a simple calorimeter for either an endothermic or exothermic process.
39	108	214-3	L2	Identify changes in PE and KE in a given heating or cooling curve.
40	114	324-4	L2	Use standard molar enthalpies of formation to determine the enthalpy change of a given reaction.
41	(Unit 4) 124	322-1	L1	Define the terms oxidation and reduction.
42	124	322-1	L1	Identify a half-reaction as oxidation or reduction.
43	126	322-3	L2	Determine the oxidation number of an atom in an ion or molecule.
44	138	322-5, 322-6	L3	Identify an unknown substance in a redox reaction given the resulting cell voltage.
45	126	322-1	L2	Identify the oxidizing agent in a redox reaction.
46	130	322-2	L2	Balance charge in a half-reaction.
47	134	322-4	L1	Identify the species that is reduced given electrochemical cell notation.
48	132,142	322-4	L1	Distinguish between electrolytic and electrochemical cells.

49	132,138	322-4, 322-5, 322-6	L2	Given a diagram of an electrochemical cell, determine the cell voltage.
50	144,146	322-8	L2	Perform stoichiometry calculations related to electroplating using $Q = It$ and $Q = nF$.

PART II: Constructed Response—Total Value: 50%

Item	Curriculum Guide Page	Outcome	Cognitive Level	Value	Outcome Description
51a(i)	34	ACC-3	L2	1	Write the overall reaction when given the elementary steps for a reaction mechanism.
51a(ii)	34	ACC-3	L2	1	Determine the catalyst(s) and reaction intermediate(s) for a given reaction mechanism.
51a(iii)	34	ACC-3	L2	1	Explain how increasing the concentration of a given compound would affect the reaction rate of the mechanism.
51b(i)	40	323-4, 323-5	L2	2	Use Le Chatelier's Principle to predict and explain the changes to an equilibrium caused by a change in temperature, pressure, volume or concentration.
51b(ii)	40	323-4, 323-5	L3	2	Use Le Chatelier's Principle to predict and explain the changes that occur to a given equilibrium when a particular solution is added to the system.
51c	46	ACC-4	L2	4	Calculate K_{eq} for a reaction when given the number of moles of reactants, volume of the reaction vessel, and the percent reaction of one reactant.
51d(i)	44	323-3	L3	1	Given concentrations of all chemical species, determine if a system is at equilibrium.
51d(ii)	44	323-3	L3	1	Describe how a system must shift in order to establish 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)
52d(i)	66, 82	320-4 214-5	L3	1	Determine the initial concentration of a substance from a titration curve.

52d(ii)	82	214-5	L3	1	Given a titration curve, determine the volume of acid or base required to reach equivalence point.
52e	66, 80	320-4, 320-7	L3	2	Given the concentration of an unknown solution and the results of several indicator tests, determine $\left[OH^- \right]$ for the solution.
53a	(Unit 3) 96, 106	324-3, 324-1	L2	3	Calculate the specific heat capacity of a metal using calorimetry data.
53b	108	214-3	L2	3	Calculate the total energy released by a substance as it cools, undergoing both phase change(s) and temperature change(s).
53c	114	324-4	L3	4	Using Hess's law, determine the heat of reaction for one of the intermediate reactions. (Science Communication)
53d	118	324-4	L2	3	Use bond energies to calculate the enthalpy change for a reaction.
54a	(Unit 4) 130	322-2	L2	4	Balance a redox reaction under basic conditions.
54b	138	322-5, 322-6	L3	3	Identify an unknown metal based on its reactivity with other metal ions.
54c	144	322-8	L2	3	Use Faraday's Law to perform stoichiometric calculations.