Chemistry 3202
June 2018 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	L2	Identify $E_{a(\text{reverse})}$ from a PE diagram.
2	28	ACC-1	L1	Identify ΔH from a PE diagram.
3	30, 34	ACC-2 ACC-3	L1	Describe how a catalyst affects the rate of a chemical reaction.
4	28	ACC-1	L2	Identify which E_a and ΔH values would give the slower/faster rate and absorb/release a given amount of energy.
5	32	ACC-3	L2	Identify the catalyst in a given reaction mechanism.
6	38	323-3	L1	Identify a characteristic of a chemical equilibrium.
7	40	323-4 323-5	L2	Use LCP to identify the stress which causes a given shift in equilibrium.
8	38, 40	323-3 323-4 323-5	L3	Determine which concentration vs time graph represents the given the equilibrium system and initial conditions.
9	44	323-3	L1	Relate the magnitude of K_{eq} to the position of the equilibrium.
10	44	323-3	L1	Identify the species that would be omitted from an equilibrium constant expression.
11	44	323-3	L2	Given the percentage yield for a system at equilibrium, describe the relative sizes of the equilibrium constant and the volume of the system.
12	44	323-3	L2	Calculate K_{eq} given the equilibrium equation and equilibrium concentrations.

Item	Curriculum Guide Page	Outcome	Cognitive Level	Outcome Description
13	(Unit 2) 52	214-1	L2	Identify which acid or base corresponds to a given operational characteristic.
14	54	320-1	L1	Define Arrhenius, modern Arrhenius and Brønsted -Lowry acids and bases.
15	56	214-17	L2	Identify an amphoteric substance.
16	58	214-17	L3	Determine the unknown given its behavior in the presence of two other substances.
17	62, 64	320-4	L1	Calculate pH of a strong acid.
18	62	320-4	L1	Identify the equilibrium constant expression for the auto-ionization of water.
19	68	320-3	L2	Identify which species would complete a given equilibrium expression.
20	66	320-4	L2	Calculate $[H_3O^+]$ given the pOH of a solution.
21	74	ACC-6	L2	Identify a buffer solution.
22	64	320-4	L2	Describe the relationship between pH and $[H_3O^+]$.
23	80	320-7	L2	Given the indicator, identify the correct acid-base titration.
24	78	213-3	L1	Select the appropriate instrument used in a titration process given the function of the instrument.
25	66, 80	320-4 320-7	L3	Calculate $[H_3O^+]$ based on given indicator colours.
26	76	320-6	L1	Differentiate between endpoint and equivalence point.
27	84	214-5	L2	Interpret from a titration curve the strength of the acid and base.
28	82	214-5	L1	Distinguish between mono-, di-, and triprotic species.
29	(Unit 3) 92	308-2	L1	Recognize the relationship between average kinetic energy and temperature.
30	94	324-3	L2	Perform a calculation using $q = mc\Delta T$.
31	94	324-3	L1	Distinguish between a system and its surroundings.
32	104	324-1	L3	Identify an unknown given the mass of the unknown, the heat and the enthalpy

				change.

Item	Curriculum Guide Page	Outcome	Cognitive Level	Outcome Description
33	98, 100, 102	324-3 324-5	L2	Identify the enthalpy diagram for a given reaction.
34	110	117-9	L1	Compare the magnitude of energy that is involved when physical, chemical and nuclear changes occur.
35	106	324-1	L2	Perform calculations involving heat capacity.
36	104	324-1	L2	Calculate the energy associated with a substance undergoing a phase change.
37	114	214-3	L1	Use ΔH^0_f to identify the most stable compound.
38	114	324-4	L2	Use standard molar enthalpies of formation to determine the enthalpy change of a given reaction.
39	108	214-3	L2	Identify changes in PE and KE on a given heating or cooling curve.
40	118	324-4	L1	Recognize that the calculation of molar enthalpy for a reaction using bond energy results in an estimate of the ΔH.
41	(Unit 4) 124	322-1	L1	Define the terms 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 in an ion or molecule.
44	138/140	322-5 322-6 213-8 214-16	L3	Given a list of solutions, use standard reduction potentials to predict cell voltage.
45	142	322-8	L1	Describe an electrolytic cell in terms of energy and spontaneity.
46	134, 138, 144	322-4 322-5 322-6 322-8	L2	Identify the cell type and voltage based on electrochemical cell notation.
47	150	322-7	L1	Identify a cell type.
48	126, 138	322-1 322-5	L1	Use Standard Reduction potentials table to identify strongest oxidizing/reducing

		322-6		agent.

Item	Curriculum Guide Page	Outcome	Cognitive Level	Outcome Description
49	138	322-5 322-6	L2	Given a labelled diagram of an electrochemical cell, determine the cell voltage.
50	136,150	322-5 322-6 322-7	L2	Given a half-reaction, identify a second half-reaction that would produce a spontaneous reaction.

PART II: Constructed Response—Total Value: 50%

Item	Curriculum Guide Page	Outcome	Cognitive Level	Value	Outcome Description
51a(i)	32	ACC-3	L2	1	Write the overall reaction when given the elementary steps for a reaction mechanism.
51a(ii)	34	ACC-3	L2	3	Draw and label a potential energy diagram for a given mechanism.
51b	30	ACC-2	L2	2	Explain how increasing the temperature of a given reaction would affect the reaction rate.
51c	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.
51d	44	323-3	L3	2	Describe how a system must shift to re-establish equilibrium, given concentrations of all chemical species and K_{eq}.
51e	46	ACC-4	L2	3	Given the initial concentrations and equilibrium concentration of a species which is allowed to reach equilibrium, calculate the value of K_{eq}.
52a	(Unit 2) 60	320-2	L2	2	Predict the Brønsted-Lowry 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 concentration and the K_a.
52c	68	320-4	L3	2	Demonstrate an understanding of the difference between acid concentration and acid strength.
52d	76, 78	213-3 320-6	L2	3	Calculate the concentration of an unknown solution using data from a titration experiment.
52dX1				0.5	Science Communication – Significant Figures
52dX2				0.5	Science Communication – Units
52e(i)	82	214-5	L3	1	Determine the initial concentration of a substance from a titration curve.
52e(ii)	82	214-5	L3	1	Given a titration curve, determine the volume of acid or base required to reach equivalence point.

Item	Curriculum Guide Page	Outcome	Cognitive Level	Value	Outcome Description
53a	(Unit 3) 108, 114	214-3	L2	3	Calculate the total energy absorbed by a substance as it is heated, undergoing both phase change(s) and temperature change(s).
53b	114, 116	324-4 214-6	L2	4	Use Hess's Law to calculate the enthalpy of a reaction.
53c	96, 106	324-1 324-3	L3	3	Calculate the initial temperature of a metal, given the mass of the metal, the specific heat capacity of the metal, the final temperature, and the volume of water in a simple calorimeter.
53cX1				0.5	Science Communication – Significant Figures
53cX2				0.5	Science Communication – Units
53d	118	324-4	L2	2	Use average bond energies to calculate the enthalpy of a given reaction.
54a	(Unit 4) 130	322-2	L2	3	Balance a redox reaction under acidic conditions.
54b(i)	132	322-4	L2	2	Identify and label parts of an electrochemical cell.
54b(ii)	138	322-6	L2	1	Determine the overall cell potential.
54b(ii)X1				0.5	Science Communication – Significant Figures
54b(ii)X2				0.5	Science Communication – Units
54c	144	322-8	L3	3	Use Faraday's law to perform stoichiometric calculations and determine the unknown metal.