Chemistry 3202
June 2012 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	L1	Identify $E_{a(forward)}$, $E_{a(reverse)}$, and ΔH from a PE diagram.
2	28	ACC-1	L2	Identify $E_{a(forward)}$, $E_{a(reverse)}$, and ΔH from a PE diagram.
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	Describe how a catalyst affects the rate of a reaction.
5	32	ACC-3	L1	Identify the rate-determining step from a given reaction mechanism.
6	38	323-3	L1	State the criteria that apply to a system at equilibrium.
7	40	323-4 323-5	L2	Use LCP to determine how the concentration of a reactant or product changes when a stress is imposed on a system at equilibrium.
8	44	323-3	L2	Write the equilibrium constant expression, K_{eq}, for chemical systems.
9	40	323-4 323-5	L3	Use LCP and the solubility table to predict the direction of equilibrium shift when a stress is imposed on an equilibrium system.
10	44	323-3	L1	Recognize the condition that causes a change in an equilibrium constant, K_{eq}.
11	44,40	323-3 323-4 323-5	L2	Relate the magnitude of K_{eq} to the concentration of species present at equilibrium, and to the stresses that cause a shift in equilibria.
12	46	ACC-4	L2	Calculate K_{eq} from given equilibrium concentrations.

13	(Unit 2) 54	320-1	L1	Define an acid or a base using the appropriate theory.
14	54	320-1	L2	Identify an acid or a base using the appropriate theory.
15	52,58	214-1 214-17	L2	Use operational definitions to distinguish between weak and strong acids (or bases).
16	56	214-17	L2	Identify an amphoteric substance.
17	56	214-17	L2	Identify a Brønsted-Lowry conjugate acid-base pair .
18	62	320-4	L1	Identify the equilibrium equation for the auto-ionization of water.
19	58	214-17	L1	Use the table of acid strength to identify strong acids or bases.
20	66	320-4	L2	Convert between any two of $[H_3O^+]$, $[OH^-]$, pH, and pOH.
21	62,66	320-4	L2	Calculate $[H_3O^+]$, $[OH^-]$, pH, or pOH given the concentration of a strong monoprotic acid or a strong base.
22	64	320-4	L2	Describe how a change of one pH unit is related to the $[H_3O^+]$.
23	68,30	320-4 ACC-2	L3	Use acid strength and concentration to analyze reaction rate between an acid and a metal.
24	76	320-6	L1	Differentiate between endpoint and equivalence point.
25	80	320-7	L3	Determine the colour of a given indicator at different points on a titration curve.
26	78	213-3	L1	Select appropriate equipment for a titration.
27	80	320-7	L2	Determine the pH of a solution based on given indicator colours.
28	82	214-5	L1	Distinguish between mono-, di-, and triprotic acids.
29	(Unit 3) 92	324-3	L1	Define the term specific heat capacity.
30	94	324-3	L2	Perform a calculation using $q = mc\Delta T$.
31	98	324-3	L2	Select the thermochemical equation that matches a given enthalpy diagram.
32	98	324-3	L2	Perform a calculation using $q = n\Delta H$.
33	106,96	324-1,3	L1	Identify equipment needed for a given calorimetry experiment.

34	110	117-9	L1	Compare physical, chemical, and nuclear changes.
35	104, 98	324-1 324-3	L3	Use information provided in a thermochemical equation to perform a calculation using $q = n\Delta H$.
36	104	324-1	L2	Calculate the energy change associated with a phase change.
37	114	324-4	L2	Use standard molar enthalpies of formation, ΔH^o_f, to determine the molar enthalpy of a given reaction.
38	114	214-3	L1	Use ΔH^o_f to identify the most stable compound.
39	108	214-3	L2	Explain changes in PE and KE in 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	136	322-5 322-6	L1	Use the Standard Reduction Potentials table to compare the strength of oxidizing agents and reducing agents.
43	126	322-3	L2	Determine the oxidation number of an atom in an ion or molecule.
44	130	322-2	L2	Identify a correctly balanced half-reaction.
45	128	322-3	L1	Write the half-reaction equation for an oxidation or for a reduction half-reaction.
46	132	322-4	L1	Describe electron and ion movement in an electrochemical cell.
47	134	322-4	L2	Use electrochemical cell notation to represent an electrochemical cell.
48	126,136	322-5 322-6	L3	Write a balanced redox reaction using half-reactions from the Standard Reduction Potentials table.
49	138	322-5 322-6	L2	Use the Standard Reduction Potentials table to predict cell voltage, E^o.
50	136,150	322-5 322-6 322-7	L2	Use the Standard Reduction Potentials table to predict whether a redox reaction is spontaneous.

PART II: Constructed Response—Total Value: 50%

Item	Curriculum Guide Page	Outcome	Cognitive Level	Value	Outcome Description
51a(i)	(Unit 1) 32,34	ACC-3	L2	1	Given the elementary steps for a reaction mechanism, write the net equation for the overall reaction.
51a(ii)	32,34	ACC-3	L2	2	Identify the reaction intermediate(s) and the catalyst(s) from a given reaction mechanism.
51b	30	ACC-2	L2	2	Describe, using Kinetic Molecular Theory and Collision Theory, one method to increase the rate of a given chemical reaction.
51c	38	323-3	L3	2	Given a graphical representation of a system that has reached equilibrium, write the equation for the equilibrium reaction.
51d	46	ACC-4	L2	4	Solve K_{eq} questions given at least one initial concentration and the percent reaction.
51e	28,40	ACC-1 323-4 323-5	L3	2	Use LCP and the information in a PE diagram to predict an equilibrium shift.
52a	(Unit 2) 60	320-2	L2	2	Predict the Brønsted-Lowry reaction that occurs when two solutions are combined.
52b	68	320-4	L3	2	Evaluate whether the information provided about an acid is sufficient to ascertain whether the acid is strong or weak.
52c	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).
52d	76	320-6	L2	4	Use titration data to determine an unknown solution concentration. (science communication mark)
52e(i)	80,84	320-7 214-5	L3	1	Given the number of protons transferred, and the indicator for the titration, sketch the titration curve.
52e(ii)	80,84	320-7 214-5	L3	1	Identify one possible acid and one possible base from a titration curve.

53a	(Unit 3) 114	324-4	L2	4	Use Hess's Law to calculate the enthalpy of a reaction.
53b	108	214-3	L3	4	Given data from a substance being heated and undergoing a phase change, calculate ΔH for the phase change.
53c	112	ACC-8	L2	2	Calculate fuel value for a substance based on calorimeter data.
53d	118	324-4	L2	3	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	138	322-5 322-6	L3	3	Use the Standard Reduction Potentials table to identify an unknown metal based on its reactivity with other metal ions.
54c	144	322-8	L2	4	Perform stoichiometric calculations using Faraday's Law (science communication mark)