CHEMISTRY 12

INSTRUCTOR: Cecilia He
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SCHEDULE: Monday- Friday 12:35 pm – 14:05 pm (12:05 pm – 13:20 pm Wednesday)
ROOM: 109

RATIONALE

Chemistry 12 is a course in physical and inorganic chemistry with a quantitative emphasis; therefore students must be adept at algebraic and numerical problem solving. Students use a variety of analytical skills and experimental techniques to measure rates of reaction, and study equilibrium mixtures, redox systems, and acid-base reactions. This experimental data is used to develop and interpret the appropriate theory. The clear presentation of ideas with full supporting factual data is expected in both written work and in-class activities. An emphasis is placed on making connections between the material studied and the real world.

BIG IDEAS

• Reactants must collide to react, and the **reaction rate** is dependent on the surrounding conditions.

- What factors influence the way reactant molecules, atoms, and ions collide?
- How does collision theory explain reaction rate?

• **Dynamic equilibrium** can be shifted by changes to the surrounding conditions.

- What are the conditions that can affect equilibrium?

• **Saturated solutions** are systems in equilibrium.

- How is the solubility constant useful in studying chemical processes?
- How can ions (e.g., calcium, magnesium) be removed from hard water?

• **Acid or base strength** depends on the degree of ion dissociation.

- How are the concepts of acid/base strength and acid/base concentration different?
- How can acid/base dissociation be measured?
- How are acid and base systems in equilibrium?
- How are aquatic ecosystems affected by changes in pH?

• **Oxidation and reduction** are complementary processes that involve the gain or loss of electrons.

- How can electrochemical and electrolytic cells be used in practical situations?
- What are some applications of redox reactions?

RESOURCES

The text used in this course is: *Chemistry 12 A Workbook for Students* (Hebden, 1998). This text is very useful and will help you gain confidence with the material in this course.

The experiments are from *Heath Chemistry: Laboratory Experiments – Canadian Edition*.

Please keep the data booklet provided as a resource throughout the semester. It is important that you learn how to use the information presented in this booklet.

EVALUATION:

Homework	10%
Quizzes	20%
Labs	20%
Unit Tests	25%
Major Assignment	10%
Final Exam	15%

****Any student caught cheating on homework, assignments, or tests will receive a 0 on the work. A second incident of cheating will result in parents and the principal being contacted****

*****Any student with an unexcused absence on the day of a test or quiz, will receive a mark of zero unless a note is provided from a parent/guardian, excusing the student from the missed class*****

Homework

I will check homework at the beginning of each class. I will give you one of the following marks.
0 --- incomplete, copied, or poor effort
5 --- complete, but poorly done OR about half of the questions are complete
10 --- a good effort was put into the homework, most of the questions are completed

Quizzes

I will have short quizzes about 2 or 3 times each week. The quizzes are for me to check your understanding, and for you to practice what you have learned.

Labs

Experiments are important learning tools for chemistry and necessary for the scientific process. Lab are worth many marks, and any labs you miss will have to be made up as soon as possible. Experiments will be done together in either small groups or individually, however, I need to see

every member working equally. Also, laboratory reports must be written individually (see section on cheating and plagiarism).

Unit Tests and Exams
All tests are closed book. A calculator and the Chemistry 12 data booklet are permitted. Unit tests, midterm and final exams contain multiple choice and short answer questions. Marks are also given for correct significant figures and units.

EXPECTATIONS:

- Adhere to the academic integrity policy
- Contact your teacher when help is needed
- Review feedback from assignments and tests, where applicable
- Work to complete the course in a timely manner
- Communicate respectively

Cell Phones and Technology in the Classroom
Please hand in your cell phone before the class begins. You are allowed to use it when you told to do so.
I expect to have your full attention during class, just like you expect to have my full attention when talking to me.

Cheating and Plagiarism
Plagiarism and cheating will NOT be tolerated. First offence everyone involved gets zero. Second offence everyone involved will be asked to leave the course. I will often ask you to work together, but you cannot copy each other's work. When working together, you must show all your work and have individual responses to questions. In particular, Lab Reports will have the same raw data, however, you do the steps of the calculations, data manipulation, and analysis yourself.

And most importantly: Own your learning. At the end of the day, **YOU** are the one who controls your success in this course. Stay on top of your work, recognize when you need to ask for help, and give it your all.

COURSE SCHEDULE

Unit	Section	Estimated Time
Chemistry 11 Review		Jan 2 – Jan 5
Unit 1 REACTION KINETICS	**reaction rate:** – heterogeneous and homogeneous reactions – factors that affect reaction rate – controlling reaction rate	Jan 8 – Jan 19
	collision theory – collision geometry – relationship between successful collisions and reaction rate – relationship of activated complex, reaction intermediates, and activation energy to PE diagrams	
	energy change: relationship between PE, KE, enthalpy (ΔH), and catalysis	
	reaction mechanism: – relationship of the overall reaction to a series of steps (collisions) – rate-determining step	
	catalysts: applications (e.g., platinum in automobile catalytic converters, catalysis in the body, chlorine from CFCs in ozone depletion)	
Unit 2 EQUILIBRIUM	**dynamic nature of chemical equilibrium:** reversible nature of reactions, relationship to PE diagram	Jan 22 – Feb 7
	Le Châtelier's principle and equilibrium shift: – concentrations of reactants and products – enthalpy and entropy – presence of a catalyst – applications (e.g., Haber process, hemoglobin and oxygen in the blood)	
	equilibrium constant (K_{eq}): – homogeneous and heterogeneous systems – pure solids and liquids	

	– effect of changes in temperature, pressure, concentration, surface area, and a catalyst	
	quantitative relationships: in equilibrium systems (e.g., K_{eq}, initial concentrations, equilibrium concentrations)	
Unit 3 SOLUBILITY EQUILIBRIUM	**solubility product (K_{sp}):** K_{sp} as a specialized K_{eq} expression	Feb 8 - Feb 14
	Predicting the solubility of salts	
	Removing hardness from water by precipitation methods	
	quantitative relationships: in solutions (e.g., K_{sp}, prediction of precipitate formation, calculating the maximum allowable concentration)	
Unit 4 ACIDS, BASES AND SALTS	**relative strength:** – electrical conductivity – table of relative acid strength – equations of strong and weak acids and bases in water	Feb 15 – Mar 8
	weak acids and weak bases: equilibrium systems	
	titration: the method to find an equivalence point: – strong acid–strong base titration – weak acid–strong base titration – strong acid–weak base titration	
	hydrolysis of ions in salt solutions: – acidic, basic, or neutral salt solutions – amphiprotic ions	
	applications of acid-base reactions: – non-metal and metal oxides in water and associated environmental impacts – buffers	
	quantitative relationships: in water as an	

	equilibrium system (e.g., K_w, $[H_3O^+]$ or $[OH^-]$, pH and pOH) – in acid-base systems (e.g., K_a, K_b, $[H_3O^+]$, $[OH^-]$, pH and pOH) – in a titration (e.g., pH of a solution, K_a of an indicator) – pH in hydrolysis of ions in salt solutions	
Unit 5 ELECTROCHEMISTRY	**the oxidation-reduction process:** – oxidation number – balancing redox reactions	Mar 11 - Apr 3
	electrochemical cells: half-reactions, cell voltage (E^0), applications (e.g., lead-acid storage batteries, alkali cells, hydrogen-oxygen fuel cells)	
	electrolytic cells: half-reactions, minimum voltage to operate, applications including metal refining (e.g. zinc, aluminum), preventing metal corrosion (cathodic protection)	
	quantitative relationships: in a redox titration (e.g., grams, moles, molarity) – in an electrochemical cell (e.g., E^0)	
Final Review		Apr 4 – Apr 10