Langley Secondary School
Course Outline

Course Title/Teacher

Advanced Placement Chemistry / G. Disney

Course overview or summary

Chemistry AP is a first year university level equivalent course which introduces students to modern theories of matter and its behaviour as well as giving students considerable opportunity to acquire sophisticated analytical laboratory skills.

Prescribed Learning Outcomes

It is expected that students will meet the following prescribed learning outcomes. However many of these outcomes are met elsewhere in Chemistry 11 and 12 and are therefore not included in the list of course topics and skills specifically covered in Advanced Placement Chemistry at Langley Secondary School.

A. Structure of Matter

- State and explain the historical evidence for the atomic theory
- Describe the structure of specific atoms, isotopes, and ions given their mass number, atomic number, and electrical charge
- Derive the quantum mechanical model of an atom from atomic spectra and energy levels
- Define and explain quantum numbers and atomic orbitals
- Write "spdf" electron configurations for atoms
- State and explain periodic relationships including atomic radii, ionization energies, electron affinities, and oxidation numbers in terms of the quantum mechanical model of the atom
- Describe and explain chemical bonding including ionic, covalent, metallic, hydrogen, dipole-dipole, and Van der Waals
- Explain polarity of bonds in relation to electronegativity
- Draw Lewis structures for ionic and molecular compounds
- Explain the formation of bonds in terms of hybridization of atomic orbitals
- Determine the geometry of molecules using VSEPR Theory
- Describe the formation of molecular orbitals from overlapping atomic orbitals
- Define and calculate the half life of radioactive isotopes and write nuclear equations for the decay of radioactive isotopes

B. States of matter

- Derive the Ideal Gas Law and use it to perform calculations dealing with pressure, temperature, and volume of gases
- Interpret the behaviour of ideal gases in relation to the kinetic molecular theory
- Describe and apply Avogadro's Hypothesis and the mole concept to the properties of gases
- Interpret the behaviour of liquids and solids in terms of the kinetic molecular theory
- Describe and interpret phase diagrams
- Describe the structure and bonding of aggregates including metals, network solids, molecular substances, and ionic compounds
- Describe types of solutions and factors affecting solubility
- Describe various methods of expressing concentration of solutions
- describe and explain colligative properties of solutions

C. Reactions

- Describe acid-base reactions using the concepts of Arrhenius, Brönsted-Lowry, and Lewis
- Write balanced ionic equations for precipitation, neutralization, oxidation-reduction, and synthesis reactions
- Define and explain the concepts of oxidation and reduction
- Describe electrolytic and galvanic cell and half cell potentials
- Use the Nernst equation to predict the direction of oxidation-reduction reactions
- Perform stoichiometry calculations applied to balanced equations
- Explain dynamic equilibrium and apply Le Chatelier's Principle to predict the direction of equilibrium shift
- Calculate equilibrium concentrations using the equilibrium constant
- Describe the solubility product constant and its application to precipitation
- Apply equilibrium concepts to explain buffers, pH, and hydrolysis
- Define and describe the Collision Theory of reaction rates
- Use integrated rate laws to determine the rate constant and reaction order
- Define activation energy and use it to explain the effects of temperature and catalysts on reaction rate
- Define and state the relationship between rate determining step and reaction mechanism
- Determine the Heat of Reaction using Hess' Law
- Perform calorimetry calculations
- State the Second Law of Thermodynamics and calculate entropy and Gibb's free energy changes
- State, explain, and perform calculations of free energy using the Gibb's-Helmholtz equation
- Describe and calculate relationships between free energy, equilibrium constants, and electrode potentials

A complete and more detailed set of prescribed learning outcomes for AP Chemistry can be accessed on the Advanced Placement Canada web site at: http://www.ap.ca/index.shtml

Outline of course content and skills

Topics:		Time allotment
UNIT I:	ATOMIC STRUCTURE	8 weeks
	A. Historical evidence (isotopes, mass spectrograph)	
	B. Quantum Mechanics (orbitals, electron configurations)	
	D. Periodic Trends (ionization energy, electron affinity)	
UNIT II:	CHEMICAL BONDING	8 weeks
	A. Bonding Theory (infrared spectroscopy)	
	B. Covalent Bonding (Lewis diagrams, bond energy)	
	C. Molecular Geometry (VSEPR, polarity, hybridization)	
UNIT III:	COORDINATION COMPOUNDS	5 weeks
	A. Complex Ions (ligands, nomenclature)	
	B. Isomerism (geometric and stereo isomerism, optical activity)	
	C. Crystal Field Theory (colour, spectrochemical series))	
UNIT IV:	AGGREGATES	6 weeks
	A. Classification of Binding Forces (metals, network solids, molecular solids, ionic compounds)	
	B. Properties of Aggregates (solubility, conductivity)	
	C. Crystal Structure (packing systems, X-ray diffraction)	
UNIT V:	THERMODYNAMICS	8 weeks
	A. Law of Conservation of Energy (Hess' Law, calorimetry))	
	B. Entropy and Free Energy (Gibbs-Helmholtz Equation)	
	C. Thermodynamic Relationships (Keq, E°, Nernst Equation)	
UNIT VI:	REACTION KINETICS (continued from Chem 12)	3 weeks
	A. Rate Laws (reaction order, integrated rate laws)	
	B. Arrhenius Equation (activation energy)	
	C. Reaction Mechanisms	
UNIT VII:	FLUID STATES OF MATTER	self study
	A. Kinetic Molecular Theory of Gases (Graham's Law)	
	B. Gas Laws (Charles' Law, Boyle's Law, Ideal Gas Law)	
	C. Phase Diagrams (vapour pressure, critical phenomena)	
	D. Colligative Properties (Raoult's Law, freezing pt. depression)	

Procedures for Assessment and Evaluation

A detailed set of Science Department Policy Statements is required to be kept in the front of each student's notebook for all Science courses. These policies include specific expectations and obligations for students and parents in regard to absenteeism due to illness, appointments, school sponsored field trips and athletic activities, as well as parent approved unscheduled holidays. They also detail specific safety expectations.
All students enrolled in all Science courses are required by September 30 of each school year to pass a Safety Examination with a score of 100 % and to return to their Science teacher a Safety Contract read and signed by both the student and parent. Students unable to fulfil this obligation are prohibited from participation in any laboratory activities until these requirements are met. An "LSS SCIENCE SAFETY" stamp on the front index page of the student's notebook is annual certification that these safety requirements are complete.

Students are required to sign the front page of this set of policy statements indicating that they have been read and understood ! Parents and students are strongly encouraged to review these policies together.

Students are graded according to achievement in the following, each indicating growth in the areas of knowledge, skills, processes, and attitudes of or about science:

Safety in the science laboratory and practical laboratory skills
Formal laboratory reports
Assignments, worksheets, projects, and notebook organization
Quizzes, major examinations, and a final examination

The grades of all regular academic and enriched Science 11 & 12 courses with the exception of Provincially Examinable courses are calculated as follows:

Class Work	25-30 %
Quizzes and Exams	70-75 %

All students in AP Chemistry may be required to write a final examination !

Important information specific to this course

Students and parents may access my Chemistry Information Web Site located at http://www.geocities.com/gwdisney/CHEMINFOHOMEPAGE.html

Evaluation for this course is based on a modified mastery learning approach.
Students are permitted to rewrite one quiz during each term.
Students are permitted to rewrite one major examination during the year.

Students choosing to repeat an examination or quiz must turn in prior to rewriting a complete set of corrections with all work shown for their initial attempt. The repeat version of the quiz or examination is not the same as the original version but examines the same concepts. It must be written outside of regular class time.

Students are provided with extensive answer keys and a study guide including numerous sample test questions. Students also receive extensive sets of past College Board Advanced Placement Exams, Canadian Institute of Chemists Exams, and SFU Prize Chemistry Exams.

All students are required to write the CIC National Chemistry Exam and are encouraged to attempt other external exams. Students who achieve a minimum 80 % standing are strongly encouraged to write the College Board Advanced Placement Exam. However this exam is optional and results are not incorporated into the student's school mark. The $ 75 US cost of this exam is the responsibility of the student. Students achieving a 4 or 5 out of 5 on the AP College Board Exam may earn advanced standing at many North American universities and colleges including those in British Columbia.

For further information please contact me at telephone # 604-534-4171 local 250 or by email at gdisney@sd35.bc.ca