Chemistry 30 (Grade 12)

Designed to help students achieve the Saskatchewan curricular outcomes for Chemistry 30 in an individualized learning system, this resource includes seven workbook units with corresponding score keys, tests, and test keys. Students will need to use two texts, ***Basic Chemistry for Christian Schools*** by John S. Wetzel, published by Bob Jones University Press, and ***Chemistry,*** 4th Edition, by Elizabeth A. Lacy and Rachel Santopietro, also published by Bob Jones University Press, in conjunction with the workbook units in order to complete them successfully. Both textbooks are required as the newer edition is necessary for the updated units.

Upon completion of each unit, the student should be able to:

Workbook A

- Define matter.
- Understand the difference between physical and chemical properties of matter and the difference between physical and chemical changes in matter.
- Classify matter (elements, compounds, and mixtures).
- Discuss the states of matter.
- Use SI units and prefixes.
- Convert a measurement to a different unit through unit analysis.
- Apply the rules of significant figures in calculations.
- Use scientific notation.
- Identify protons, neutrons, and electrons as components of an atom.
- Express isotopes using isotopic notation.
- Calculate atomic mass values when given the percentage of each isotope of an element.
- Understand and use the periodic table.
- Determine the molecular mass/formula mass of a given compound.
- Understand the differences between ionic, covalent, and metallic bonding.
- Describe the physical properties of ionic, covalent, and metallic compounds.
- Understand the concept of a mole.
- Use Avogadro's number to relate atomic mass units to grams.
- Determine the molar mass of a given compound.
- Use the molar mass of a compound to convert between moles and grams.

Workbook B

- Express the concentration of a solution in moles of solute per litre of solution.
- Manipulate the relationship which links the mass of solute, volume of solution, and concentration of solution, so that given two, the other can be determined.
- Manipulate the relationship which links original concentration, volume of diluent, and concentration of diluted solution, so that given two, the other may be determined.
- Relate concentrations expressed as ppm or ppb to those expressed as mol x L-1.
- Use solubility charts to determine the solubility of various substances.
- Describe how to perform tests on solutions to determine which ions or ion groups are present.
- Describe how to separate ions in solution by selective precipitation.

Workbook C

- Consider the implications for a system when the rates of the forward and the reverse reactions that define the system are equal.
- Discuss non-chemical analogies which illustrate or simulate equilibria.
- Distinguish between dynamic equilibria and steady-state processes.
- Understand why Le Chatelier's principle works.
- Use Le Chatelier's principle to predict how various equilibrium systems will shift.
- Describe how the common ion effect influences the solubility of a solute.
- Write the equilibrium constant expression for a chemical reaction using the general equation.
- Analyze graphs of the concentrations of reactants and products with respect to time in a chemical reaction which is approaching equilibrium.
- Interpret Keq values to determine whether products or reactants are favoured once equilibrium has been reached.
- Solve problems involving the equilibrium constant expression for a chemical reaction, with concentrations expressed in mol x L-1.
- Recognize that Keq values are dependent upon temperature but are independent of concentration.

Workbook D

- Observe some physical and chemical characteristics of acids and bases.
- Construct an operational definition of an acid and a base.
- Describe the Bronsted-Lowry conceptual definition of acids and bases.
- Identify the conjugate bases formed in acid dissociation.
- Recognize substances which are amphiprotic.
- Compare the strengths of the dissociations in the dissociation series for a polyprotic acid.
- Write the equilibrium constant expression for the dissociation of water.
- Explain how a logarithm scale differs from an arithmetic scale.
- Estimate the PH of solutions.
- State the general neutralization equation.
- Write equations for specific neutralization reactions.
- Solve mathematical problems involving data from titrations.
- Use information from Ka tables to calculate pH values in solutions.

Workbook E

- Trace the historical development of the model of the atom.
- Understand the value of representing scientific understanding of the atom using various types of models, including the molecular formula, structural formula, space-filling molecular model, ball-and-stick molecular model, and Lewis structure.
- See how evidence and experimentation inform the development and refinement of theories in Chemistry.
- Explain the relationship between the position of an element on the periodic table and its number of valence electrons with reference to the octet rule.
- Explain the formation of ions and predict their charge in group 1 and 3 elements and non-metals, based on an understanding of valence electrons and the octet rule.
- Draw Lewis structures (electron dot structures) for group 1 and 2 elements and non-metals, and their ions, based on an understanding of valence electrons.
- Discuss the role of valence electrons in the formation of covalent and ionic bonds, including the connection to metals and non-metals.

- Predict the arrangement of atoms and draw Lewis structures to represent covalent-bonded and ionic-bonded molecules.
- Predict the geometry and draw the shapes of molecules with a single central atom using valence shell electron pair repulsion.
- Predict the nature of chemical bonds within a molecule using the property of electronegativity.
- Predict the polarity of molecules using the property of electronegativity and VESP theory.
- Differentiate between the different types of intermolecular and intramolecular forces.
- Recognize that a material's chemical and physical properties are dependent on the type of bonds and the forces between atoms, molecules, or ions.
- Identify and describe some properties of ionic and molecular compounds, metals, and network covalent substances.

Workbook F

- Recognize the prevalence and diversity of organic compounds in daily life.
- Explain how the valence structure of carbon leads to the large number and diversity of organic compounds in nature.
- Compare the advantages of using different models to represent organic molecules.
- Recognize the importance of isomerization in materials science and biological applications.
- Provide the IUPAC names and illustrate the structural formulas of a variety of branched and straight chain hydrocarbons.
- Write the molecular and structural formula and provide the IUPAC name for a representative sample of straight chain alkanes, alkenes, and alkynes, with up to 10 carbon atoms in a molecule.
- Identify various classes of organic compounds based on functional groups.
- Describe the applications of the various classes of organic compounds, including compounds important to biological systems.
- Provide examples of consumer and industrial products that are derived from the refining of fossil fuels.
- Describe the process of polymerization and explain the significance of some natural and synthetic polymers.
- Determine the suitability of materials for use in specific applications.

Workbook G

- Define oxidation and reduction in terms of transfer of electrons.
- Write half reactions and net ionic equations involving oxidation-reduction.
- Use a table to compare reduction potentials of half-reactions.
- Identify and investigate means of protecting metals against corrosion.
- Determine the direction of electron flow in an electrochemical cell.
- Measure the voltage in several electrochemical cells.
- Calculate the potential difference in volts of electrochemical cells, using a standard reduction potential table.
- Examine applications of electrochemistry.
- Distinguish between an electrochemical cell and an electrolytic cell.