Unit Plan

Science 10

Fall 2015 at Catholic Central High School, Lethbridge

Unit A:
Energy and Matter in Chemical Change

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Unit A: Energy and Matter in Chemical Change

STSK GLO1: Describe the basic particles that make up the underlying structure of matter, and investigate related technologies

STSK GLO2: Explain, using the periodic table, how elements combine to form compounds, and follow IUPAC guidelines for naming ionic compounds and simple molecular compounds

STSK GLO3: Identify and classify chemical changes, and write word and balanced chemical equations for significant chemical reactions, as applications of Lavoisier's law of conservation of mass

Key Concepts:

- Safety
- Particle model of matter
- WHMIS symbols, pure substances, mixtures and solutions
- Reactants, products, conservation of mass, periodic table, elements, compounds, atomic theory, ionic and molecular compounds
- Acids and bases
- How chemical substances meet human needs
- International Union of Pure and Applied Chemistry (IUPAC) nomenclature
- Evidence of chemical change
- Role and need for classification of change
- Writing and balancing equations
- Law of conservation of mass and the mole concept

Chapter A1:
The understanding that particles make up the underlying structure of matter has led to advancements in technology.

- Safety
- Properties
- Matter

Chapter A2: Elements combine to form many substances, each with its own set of properties.

- Periodic Table
- Atomic Structure
- Classification
- Ionic
- Molecular
- Acids
- Bases
- Chemical society

Chapter A3: Chemical change is a process that involves recombining atoms and energy flows.

- Chemical change
- Chemical equations
- 5 chemical reaction types
- Moles

Focusing Questions

- How has knowledge of the structure of matter led to other scientific advancements?
- How do elements combine?
- Can these combinations be classified and the products be predicted and quantified?
- Why do scientists classify chemical change, follow guidelines for nomenclature and represent chemical change with equations?

Unit A Summary

Overview: Chemical changes involve energy and transformations of matter. A knowledge of the underlying structure of matter and the basic chemical species is important in understanding chemical changes. As students explore the properties of molecular and ionic compounds, including acids and bases, they begin to appreciate the need for a classification scheme and a system of nomenclature. Students classify, name compounds and write balanced chemical equations to represent chemical changes. As well, students are introduced to the law of conservation of mass and the mole concept.

Rationale:

Science 10 Unit A is a chemistry unit that focuses on energy and matter in chemical change. This unit builds on grade 7 heat and temperature, grade 8 mix and flow of matter, grade 9 matter and chemical change, and grade 9 environmental chemistry.

The first chapter is important for safety in the workforce as it includes laboratory safety, how to read an MSDS, and WHMIS symbols. The historical component helps student to understand a practical application of chemistry in meeting people's basic needs. This chapter is also important for introducing properties and chemical reactions, which are crucial concepts built on in later chapters.

The second chapter familiarizes students with the periodic table and atomic structure, which builds the foundation for the formation and naming of ionic and molecular compounds, acids, and bases. This chapter ties back to a practical application using the real-world example of our chemical society.

The third chapter involves chemical change broken down into learning about balanced chemical equations, and then five major types of chemical reactions. The skills of working with these equations must be learned in Science 10 in order to be successful in Chemistry 20 and 30, or the chemistry units of Science 20 and 30.

Everyone learns differently so I must to teach to everyone's different needs. I will use PowerPoint presentations to provide visuals for students and use collaborative and independent learning strategies along with kinesthetic activities to help students be engaged and better recall content. I hope that my approaches will be meaningful to the students to cultivate lifelong learners interested in the sciences.

The assessment consists of formative homework checks, assignments, a project, a lab, chapter tests and one unit test that are the same for all CCH Science 10 classes.

Learning Outcomes

Outcomes for Science, Technology and Society (STS) and Knowledge
Students will:

STSK GLO1: Describe the basic particles that make up the underlying structure of matter, and investigate related technologies

- **1.1** identify historical examples of how humans worked with chemical substances to meet their basic needs *(e.g., how pre-contact First Nations communities used biotic and abiotic materials to meet their needs)*
- **1.2** outline the role of evidence in the development of the atomic model consisting of protons and neutrons (nucleons) and electrons; i.e., Dalton, Thomson, Rutherford, Bohr
- **1.3** identify examples of chemistry-based careers in the community *(e.g., chemical engineering, cosmetology, food processing)*

STSK GLO2: Explain, using the periodic table, how elements combine to form compounds, and follow IUPAC guidelines for naming ionic compounds and simple molecular compounds

- **2.1** illustrate an awareness of WHMIS guidelines, and demonstrate safe practices in the handling, storage and disposal of chemicals in the laboratory and at home
- **2.2** explain the importance of and need for the IUPAC system of naming compounds, in terms of the work that scientists do and the need to communicate clearly and precisely
- **2.3** explain, using the periodic table, how and why elements combine to form compounds in specific ratios
- **2.4** predict formulas and write names for ionic and molecular compounds and common acids *(e.g., sulfuric, hydrochloric, nitric, ethanoic)*, using a periodic table, a table of ions and IUPAC rules
- **2.5** classify ionic and molecular compounds, acids and bases on the basis of their properties; i.e., conductivity, pH, solubility, state
- **2.6** predict whether an ionic compound is relatively soluble in water, using a solubility chart
- **2.7** relate the molecular structure of simple substances to their properties *(e.g., describe how the properties of water are due to the polar nature of water molecules, and relate this property to the transfer of energy in physical and living systems)*
- **2.8** outline the issues related to personal and societal use of potentially toxic or hazardous compounds *(e.g., health hazards due to excessive consumption of alcohol and nicotine; exposure to toxic substances; environmental concerns related to the handling, storage and disposal of heavy metals, strong acids, flammable gases, volatile liquids)*

STSK GLO3: Identify and classify chemical changes, and write word and balanced chemical equations for significant chemical reactions, as applications of Lavoisier's law of conservation of mass

- **3.1** provide examples of household, commercial and industrial processes that use chemical reactions to produce useful substances and energy *(e.g., baking powder in baking, combustion of fuels, electrolysis of water into H2(g) and O2(g))*
- **3.2** identify chemical reactions that are significant in societies *(e.g., reactions that*

maintain living systems, such as photosynthesis and respiration; reactions that have an impact on the environment, such as combustion reactions and decomposition of waste materials)
• **3.3** describe the evidence for chemical changes; i.e., energy change, formation of a gas or precipitate, colour or odour change, change in temperature
• **3.4** differentiate between endothermic and exothermic chemical reactions *(e.g., combustion of gasoline and other natural and synthetic fuels, photosynthesis)*
• **3.5** classify and identify categories of chemical reactions; i.e., formation (synthesis), decomposition, hydrocarbon combustion, single replacement, double replacement
• **3.6** translate word equations to balanced chemical equations and vice versa for chemical reactions that occur in living and nonliving systems
• **3.7** predict the products of formation (synthesis) and decomposition, single and double replacement, and hydrocarbon combustion chemical reactions, when given the reactants
• **3.8** define the mole as the amount of an element containing 6.02 . 1023 atoms (Avogadro's number) and apply the concept to calculate quantities of substances made of other chemical species (*e.g., determine the quantity of water that contains 6.02 . 1023 molecules of H2O*)
• **3.9** interpret balanced chemical equations in terms of moles of chemical species, and relate the mole concept to the law of conservation of mass

Skill Outcomes (focus on problem solving)
Students will:

Initiating and Planning

Ask questions about observed relationships, and plan investigations of questions, ideas, problems and issues
• **IP1** define and delimit problems to facilitate investigation
• **IP2** design an experiment, identifying and controlling major variables *(e.g., design an experiment to differentiate between categories of matter, such as acids, bases and neutral solutions, and identify manipulated and responding variables)*
• **IP3** state a prediction and a hypothesis based on available evidence and background information *(e.g., state a hypothesis about what happens to baking soda during baking)*
• **IP4** evaluate and select appropriate instruments for collecting evidence and appropriate processes for problem solving, inquiring and decision-making *(e.g., list appropriate technology for classifying compounds, such as litmus paper or conductivity tester)*

Performing and Recording

Conduct investigations into relationships between and among observable variables, and use a broad range of tools and techniques to gather and record data and information
• **PR1** carry out procedures, controlling the major variables and adapting or extending procedures *(e.g., when performing an experiment to illustrate conservation of mass, demonstrate an understanding of closed and open systems and control for loss or gain of matter during a chemical change)*
• **PR2** use library and electronic research tools to collect information on a given topic *(e.g., information on compounds we use and their toxicity, using standard references, such as the*

Merck Index, as well as Internet searches)
• **PR3** select and integrate information from various print and electronic sources or from several parts of the same source *(e.g., collect information on research into subatomic matter, research how pre-contact First Nations communities used available materials such as brain tissue for tanning hides)*
• **PR4** demonstrate a knowledge of WHMIS standards by selecting and applying proper techniques for the handling and disposal of laboratory materials *(e.g., recognize and use Material Safety Data Sheets [MSDS] information)*
• **PR5** select and use apparatus, technology and materials safely *(e.g., use equipment, such as Bunsen burners, electronic balances, laboratory glassware, electronic probes and calculators correctly and safely)*

Analyzing and Interpreting

Analyze data and apply mathematical and conceptual models to develop and assess possible solutions
• **AI1** describe and apply classification systems and nomenclature used in the sciences *(e.g., investigate periodicity in the periodic table, classify matter, and name elements and compounds based on IUPAC guidelines)*
• **AI2** apply and assess alternative theoretical models for interpreting knowledge in a given field *(e.g., compare models for the structure of the atom)*
• **AI3** compare theoretical and empirical values and account for discrepancies *(e.g., measure the mass of a chemical reaction system before and after a change, and account for any discrepancies)*
• **AI4** identify and explain sources of error and uncertainty in measurement, and express results in a form that acknowledges the degree of uncertainty *(e.g., measure and record the mass of a material, use significant digits appropriately)*
• **AI5** identify new questions or problems that arise from what was learned *(e.g., how did ancient peoples discover how to separate metals from their ores?; evaluate the traditional Aboriginal method for determining alkaline properties of substances)*

Communication and Teamwork

Work as members of a team in addressing problems, and apply the skills and conventions of science in communicating information and ideas and in assessing results
• **CT1** communicate questions, ideas and intentions; and receive, interpret, understand, support and respond to the ideas of others *(e.g., use appropriate communication technology to elicit feedback from others)*
• **CT2** represent large and small numbers using appropriate scientific notation
• **CT3** select and use appropriate numeric, symbolic, graphical and linguistic modes of representation to communicate ideas, plans and results (*eg. use appropriate SI units and IUPAC nomenclature*)

Attitude Outcomes

Students will be encouraged to have:

- **Interest in Science**

Show interest in science-related questions and issues, and pursue personal interests and career possibilities within science-related fields *(e.g., apply concepts learned in the classroom to everyday phenomena related to energy; show interest in a broad scope of science-related fields in which energy plays a significant role)*

- **Mutual Respect**

Appreciate that scientific understanding evolves from the interaction of ideas involving people with different views and backgrounds *(e.g., appreciate Aboriginal technologies of the past and present that use locally-available materials and apply scientific principles; recognize that science and technology develop in response to global concerns, as well as to local needs)*

- **Scientific Inquiry**

Seek and apply evidence when evaluating alternative approaches to investigations, problems and issues *(e.g., assess problem using a variety of criteria; respect alternative solutions; honestly evaluate limitations of their designs; be persistent in finding the best possible answer or solution to a question or problem)*

- **Collaboration**

Work collaboratively in carrying out investigations and in generating and evaluating ideas *(e.g., select a variety of strategies, such as group brainstorming, active listening, paraphrasing and questioning, to find the best possible solution to a problem; work as a team member when assigning and performing tasks; accept responsibility for problems that arise)*

- **Stewardship**

Demonstrate sensitivity and responsibility in pursuing a balance between the needs of humans and a sustainable environment *(e.g., recognize that their choices and actions, and the choices and actions that technologists make, can have an impact on others and on the environment)*

- **Safety**

Show concern for safety in planning, carrying out and reviewing activities *(e.g., demonstrate concern for self and others in planning and carrying out experimental activities and the design of devices; select safe methods for collecting evidence and solving problems)*

Links to Mathematics:

Not considered prerequisites:

- Data collection and analysis (from grade 9 statistics and probability)
- Measurement and unit conversions
- Rates and Proportions
- Graph analysis
- Solving equations
- Slope
- Powers and exponents
- Scale diagrams