Science 14 – Unit A

Unit Plan



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**Unit Overview:**

Whether in the home or in the workplace, the safe handling of chemicals requires an understanding of the properties of pure substances and mixtures. Students will actively investigate the properties of a variety of samples that include mixtures and solutions, elements, and compounds encountered in everyday life. Students will investigate the atom as the basic building block of matter. Students will also investigate the classification of elements on the periodic table.

During this unit, students will predict, observe, and record changes in the states of matter caused by heating and cooling. The idea of heat as a form of energy comes into play in this unit. Students will learn that the state or phase of matter can be changed by subjecting matter to heating and cooling (the addition and reduction of heat).

This unit provides students with an understanding of how there are a lot of chemicals that we use on a regular basis. For example, in order to live, you have to drink the chemical called water and breathe the chemical called oxygen. Some of the chemicals you use at home are useful but dangerous if not used properly.

The unit summarizes the nature of the atom and matter. Throughout this unit, students learn that everything is composed of matter. By the end of this unit, I expect my students to understand how to be safe in a science laboratory. I also expect them to know how to classify the different types of matter and how to classify different elements.

**Themes:** Matter, atoms, and the periodic table

**Focusing Questions:**

1. How do we use properties to classify matter?
2. How can an understanding of the properties of matter be used practically?
3. What is the underlying structure of matter that helps us to classify and understand matter?

**Key Concepts:**

The following concepts are developed in this unit and may also be addressed in other units at other grade/course levels. The intended level and scope of treatment is defined by the outcomes below.

* Safe handling, storage and disposal of household chemicals
* Workplace Hazardous Materials Information System (WHMIS) and consumer product symbols
* Solutions and solubility of household substances
* Dilution and concentration
* Preparing solutions
* Separating mixtures
* Acids and bases
* The periodic table: Metals, nonmetals, and metalloids
* Elements and compounds
* Corrosion and rusting

**Rationale:**

This unit focuses on matter and the nature of matter. Through looking at atoms as the building unit of life, students will find that everything is composed of atoms. Students will study how matter constructs everything in life. This unit will allow students to explore the various properties of matter. Because of the extensive use of the lab throughout this unit, students will be gain essential skills that is extremely important in a lab setting for use outside in the community. Students will learn the importance of: proper weighing, observation skills, self-direction, and personal well being in a potentially dangerous environment, amongst other important skills in the lab setting.

**General and Specific Learning Outcomes for Science, Technology, and Society (STS) and Knowledge:**

1. Classify various forms of matter, including commonly used household substances, on the basis of their properties, and relate these properties to their safe use, storage and disposal

* Describe the need for safety precautions that should be followed when handling, storing and disposing of substances at home and in the laboratory; and explain the WHMIS and consumer product symbols for labeling substances (e.g., flammable, corrosive, reactive, health hazard)
* Describe the importance of mixtures and solutions in household products (e.g., baking soda, soaps, paints)
* Compare and contrast the properties of pure substances and mixtures (e.g., brass and zinc, stainless steel and iron, acetic acid and vinegar, pure water and salt water), and relate this information to practical applications (e.g., salting icy roads, adding antifreeze to car radiators)
* Outline the steps in separating the components of mechanical mixtures and solutions on the basis of their properties (e.g., filtration of mechanical mixtures, distillation of solutions such as crude oil)
* Differentiate between physical and chemical properties of matter
* Apply the particle model of matter to explain the physical properties of the phases of matter

2. Describe solutions and solubility, solutes and solvents; and then describe how these concepts are applied to the production of prepared foods and other useful materials

* Provide examples of insoluble and soluble mixtures (e.g., oil and water, vinegar and water)
* Define, operationally, solute, solvent, solution and solubility; and express concentration in terms of mass per volume
* Provide examples of the effect of temperature change on solubility, and explain this effect on the basis of the particle model of matter (e.g., concentration of brines for pickling and syrups for canning)
* Link concentration changes and the concept of dilution to changes in the ratio of the amount of solute to the amount of solvent (e.g., investigate how concentrated products, such as orange juice, evaporated milk or instant coffee are made)
* Compare the volume of waste packaging produced from consumer use of the concentrated and diluted forms of products (e.g., orange juice, fabric softener), and relate this to the need for recycling and environmental preservation
* Identify acid and base solutions in the home, job site and laboratory (e.g., vinegar, soda pop, shampoo, battery acid, household ammonia, antacids, dish soap, hydrochloric acid, sodium hydroxide) on the basis of their general properties; i.e., they conduct electricity, change colour of acid/base indicators and neutralize one another
* Describe, in general terms, the pH scale as an indicator of acidity or basicity; i.e., a pH of less than 7 indicates an acid, a pH of 7 indicates a neutral solution, and a pH of greater than 7 indicates a base
* Describe and investigate the corrosive effects of the following environmental factors: acids, bases, salts, humidity and temperature (e.g., corrosion of iron by acid rain and spray from ocean water)
* List the potential dangers of mixing common household and industrial chemicals (e.g., mixing ammonia cleaners with bleach, adding muriatic [hydrochloric] acid to caustic soda, adding water to acid)

3. Describe the properties of elements and compounds, and use the periodic table to identify trends in properties

* Differentiate among metals, nonmetals and metalloids on the basis of properties (e.g., luster, conductivity, malleability, brittleness, state of matter)
* Use the periodic table to locate names and properties of elements
* Name and write chemical formulas for common elements (e.g., aluminum, copper, iron, nitrogen, hydrogen, oxygen) and simple compounds (e.g., water, glucose, table salt, carbon dioxide, iron oxide, vinegar, methane, propane), and describe the uses of elements and compounds in society
* Demonstrate the difference between elements and compounds on the basis of a decomposition reaction (e.g., electrolysis of water)

**Skills Outcomes:**

1. Ask questions about relationships between and among observable variables, and plan investigations to address those questions.
2. Conduct investigations into the relationships between and among observations, and gather and record qualitative and quantitative data.
3. Analyze qualitative and quantitative data, and develop and assess possible explanations.
4. Work collaboratively on problems; and use appropriate language and formats to communicate ideas, procedures and results.

\* Most outcomes (STS, Knowledge, and Skills) will be formatively assessed throughout the unit through experiments/demonstrations and questioning.

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| Unit OverviewBiology 14 – Unit A | | | | |
| Unit Overview Investigating Properties of Matter | | | | |
|  |  |  |  |  |
| Day 1 | Day 2 | Day 3 | Day 4 | Day 5 |
| Introduction/ Expectations, Unit overview,  Safety procedures in the lab.  WHMIS | Properties of matter: mixtures, solutions, pure substances | Soluble and insoluble mixtures | Concentration change and dilution | Acid/Bases |
| Day 6 | Day 7 | Day 8 |  |  |
| Corrosive Effects | Periodic Table  Metals/Nonmetals | Naming Chemical Compounds |  |  |
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**Daily Schedule:** 75 minutes/class

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| **Lesson** | **Learning Outcomes** | **Concept** | **Time** | **Activities and Strategies** | **Assessment** |
| **1**  **(75min)** | 1. Describe the need for safety precautions that should be followed when handling, storing and disposing of substances at home and in the laboratory; and explain the WHMIS and consumer product symbols for labelling substances (e.g., flammable, corrosive, reactive, health hazard) | Introduction/ Expectations/ Unit Overview**/ Safe procedures in lab** | 5 min | Unit overview: Expectations |  |
| 10 min | Overview safety procedures in the laboratory setting. Proper lab behaviour | Observation, discussion, and questioning |
| 15 min | Activity: Have students make a map outlining lab essential equipment |  |
| 25 min | Discuss labeling on household chemicals and chemicals from school lab. | Guided discussion, and questioning |
| 15 min | Demonstration: Setting up students for next class.  Unburnable: Money Trick | Discussion |
| 5 min | **Closure:** *Review:* Safety expectations (If time permits)  Clean-up |  |

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| **2**  **(75min)** | 1. Differentiate between physical and chemical properties of matter 2. Compare and contrast the properties of pure substances and mixtures and relate this information to practical applications 3. Outline the steps in separating the components of mechanical mixtures and solutions on the basis of their properties. | Properties of matter: mixtures, solutions, and pure substances | 5 min | *Review:* Proper behaviour in a laboratory setting |  |
| 10 min | Handout notes: detailing the difference between pure substances and mixture | Questioning and discussion. |
| 20 min | Activity: Have students write whether substance is a pure substance or mixture  Have students make a list of household items and label it as a mixture or pure substance | Participation, discussion, and questions. |
| 30 min | **Lab: Sodium Polyacrylate Mixed with water** |  |
| 5 min | **Closure:** *Review:* Pure substances and mixtures. (If time permits)  Clean-up | Discussion |
| **3**  **(75min)** | 1. Provide examples of insoluble and soluble mixtures and, in general terms, account for the difference. 2. Know the effect of temperature change on solubility. | Soluble and Insoluble Mixtures: | 5 min | *Review:* Mixtures and Pure Substances | Discussion |
| 20 min | Activity: Have students put whether a solution is soluble in water | Participation, discussion and questions |
| 30 min | **Lab: Solubility** |  |
| 10 min | **Closure:** *Clean-up and solubility* |  |

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| **4**  **(75min)** | 1. Link concentration changes and the concept of dilution to changes in the ratio of the amount of solute to the amount of solvent | Concentration Change and Dilution | 5min | Review: Solubility and Insolubility | Discussion |
| 25 min | Activity: Get students to talk about dilution and taste | Guided notes and discussion. |
| 30 min | **Lab: Taste Test** |  |
| 5min | **Closure:** *Clean-up* |  |
| **5**  **(75min)** | 1. Identify acid and base solutions in the home, job site and laboratory on the basis of their general properties; i.e., they conduct electricity, change colour of acid/base indicators and neutralize one another 2. Describe, in general terms, the pH scale as an indicator of acidity or basicity; i.e., a pH of less than 7 indicates an acid, a pH of 7 indicates a neutral solution, and a pH of greater than 7 indicates a base | Acids/Bases | 15 min | Introduce the properties of acids and bases. | Discussion and questioning |
| 30 min | Activity: Litmus Paper Test |  |
| 20 min | **Lab: Phenolphthalein Test** |  |
| 10 min | **Closure:** *Clean Up* |  |
| **6**  **(75min)** | 1. Describe and investigate the corrosive effects of the following environmental factors: acids, bases, salts, humidity and temperature. | Corrosive Effects of Acids and Bases | 5min | *Review:* Acids and Bases   * pH <7 = Acid * PH >7 = Base |  |
| 10 min | Effects that the environment has on cars and buildings. | Discussion and Questioning |
| 20 min | Lab: Effect of acids and bases have on coins. | Discussion and Questioning |
| 15 min | Demonstration: Power of Sulfuric Acid  <https://www.youtube.com/watch?v=kcDSngXldB0> |  |
| 5 min | **Closure:** Clean-up |  |
| **7**  **(75min)** | 1. Use the periodic table to locate names and properties of elements. 2. Differentiate among metals, nonmetals and metalloids on the basis of properties | **Periodic Table; Metals and Non-metals** | 5 min | *Introduction: Periodic Table* | Questioning and discussion |
| 20 min | Activity: Have students look up one element from the periodic table and write it on a notecard. |  |
| 25 min | **Lab: Observations of what happens to metals after mixed with non-metals** |  |
| 15 min | **Closure:** *Review:* The Periodic Table  Clean-up |  |
| **8**  **(75min)** | 1. Name and write chemical formulas for common elements (e.g., aluminum, copper, iron, nitrogen, hydrogen, oxygen) and simple compounds (e.g., water, glucose, table salt, carbon dioxide, iron oxide, vinegar, methane, propane), and describe the uses of elements and compounds in society. | Naming chemical formulas | 10 min | *Review:* Periodic Table | Class discussion |
| 20 min | Basis of naming chemical formulas:  1st – Metal  2nd – Non-metal |  |
| 35 min | Worksheet: Have students try to name chemical compounds on a worksheet. |  |
| 5 min | **Closure:** *Review:* How to name chemical compounds |  |

Unit plan class timeline can be adjusted based on student performance on activity and lab.

Unit plan is subject to change at teacher’s discretion.

**Materials and Equipment**

**Lesson 1 – Introduction**

* Dollar bill
* Lighter

**Lesson 2 – Properties of Matter**

* Beakers, graduated cylinders, other lab equipment
* Sodium polyacrylate
* Different household solutions

**Lesson 3 – Soluble and Insoluble Solutions**

* Different solutions (eg. Oil, paint, vinegar, etc.)
* Beakers, graduated cylinders, other lab equipment

**Lesson 4 – Concentration Change and Dilution**

* Beakers, graduated cylinders, other lab equipment
* Tang, Kool-Aid or other powdered beverage

**Lesson 5 – Acids/Bases**

* Beakers, graduated cylinders, other lab equipment
* Litmus Paper
* Phenolphthalein Test

**Lesson 6 – Corrosive Effects of Acids and Bases**

* Beakers, graduated cylinders, other lab equipment
* Coins
* Sugar
* Sulfuric Acid

**Lesson 7 – Periodic Table**

* Periodic Table
* Beakers, graduated cylinders, other lab equipment
* Different metals and non-metals

**Lesson 8 – Naming Chemical Formulas**

* Periodic Table
* Worksheet

Provision for Diverse Learners

* Due to the nature of Science 14, extra time and instruction will be given during laboratory periods. I will give personal attention to students that seem to be struggling with concepts in the classroom.

Evaluation:

* Assessment will be based off assignments turned in and given on a daily basis.
* No formal test will be given on the advisement of the Cooperating Teacher.