**Unit 1: Investigation 1 (2 Days)**

**REPRESENTING PATTERNS**

***CCSS: 8-F 2, F-BF 1, F-IF 3***

**Overview**

Students explore patterns in the molecular structure of hydrocarbons and represent patterns using tables, graphs, equations, and verbal descriptions. Students are introduced to the value of representing patterns using multiple representations.

**Assessment Activities**

**Evidence of Success: What Will Students Be Able to Do?**

Identify patterns from real world contexts. Represent patterns using tables, graphs, and equations, and use patterns to solve problems.

**Assessment Strategies: How Will They Show What They Know?**

**Exit Slip 1.1** asks student to identify a pattern, represent the pattern using a table and graph, and use the pattern to solve a problem.

**Journal Entry** prompts students to identify which representation of patterns is the best for pattern recognition.

**Launch Notes**

Begin this investigation with a quick review of our known solar system – one sun, eight planets, and at least 146 moons. A good starting point is NASA’s Solar System Exploration website at <http://solarsystem.nasa.gov/planets/profile.cfm?Object=SolarSys>. Since this investigation begins with an activity concerned with Saturn’s moon Titan, showing a short video about Titan would be engaging. See <http://saturn.jpl.nasa.gov/multimedia/flash/Titan/index.html>.

**Closure Notes**

Conduct a whole classroom discussion in which students describe the four different representations of patterns. Students should be encouraged to indicate their preferences and their opinions on to the advantages and disadvantages of each representation. **Exit Slip 1.1** may be used in advance of or at the conclusion of the class discussion.

**Teaching Strategies**

1. Following the video or solar system review, show students a list of hydrocarbons (methane, propane, butane, and ethanol) and ask students if they have heard of these hydrocarbons and know how they are used? Ask students why the discovery of hydrocarbons on other planets is relevant? In **Activity 1.1.1 Exploring Patterns with Hydrocarbons**, students work in groups to explore the relationship between carbon atoms and hydrogen atoms in hydrocarbon molecules. Students represent patterns using multiple representations. After the group activity, provide students an opportunity to share their answers and opinions.

**Group Activity**

Arrange students in pairs or small groups and have them work together to complete **Activity 1.1.1 Exploring Patterns with Hydrocarbons**. To assist students visualize hydrocarbon molecules, allow students to build physical models using molecular structure kits or colored Styrofoam balls and toothpicks.

**Differentiated Instruction (For Learners Needing More Help)**

**Activity 1.1.1a Using eChem to Model Molecules** provides students with an opportunity to create three-dimensional models of hydrocarbons.

1. In **Activity 1.1.2 Burning Hydrocarbons**, students explore the amount energy that is released through burning hydrocarbons. A table presents the amount of energy that is released from completely burning a fixed amount of each hydrocarbon (the data values are approximate so they will clearly be linear).

Students will wonder what the unit kJ/mole represents. A kJ/mole is the amount of energy, measured in units called kilojoules, released when one mole (a unit measuring a defined amount of any chemical molecule) of a hydrocarbon is burned. You may have the class participate in an Internet search to find a more complete description of this unit of energy. Students look for a pattern in the data, complete the table and draw a graph using the data values. Once students have completed the activity worksheet, have them share answers. Students should be able to verbally describe the pattern.

1. **Activity 1.1.3 Organic Alcohols** extends the exploration of hydrocarbons through a study of organic alcohols. Similar to Activity 1.1.1, students represent patterns using a table, graph, verbal description and equation. Students are introduced to chemical formulas for organic alcohol molecules.

**Differentiated Instruction (Enrichment)**

Some students will discover as they create the models that there are actually two different structures of butane. The structure with the branch in the middle is called isobutane (the other is just butane), which is sometimes used in camp stoves. Ask students if they think the two chemical substances are identical or if they might have slightly different properties even though they have the same number of carbon and hydrogen atoms. Have them search for references that compare the two. Do they have the same chemical formula?

**Journal Entry**

What four ways did you represent patterns in hydrocarbons? Which representation made it easier for you to understand the pattern?

**Resources and Materials**

* **Activity 1.1.1** – Exploring Patterns with Hydrocarbons
* **Activity 1.1.1a** – Using eChem to Model Molecules
* **Activity 1.1.2** – Burning Hydrocarbons
* **Activity 1.1.3** – Organic Alcohols
* **Exit Slip 1.1** – Tables Together
* Titan video: <http://saturn.jpl.nasa.gov/multimedia/flash/Titan/index.html>
* NASA Solar System Exploration: <http://solarsystem.nasa.gov/planets/profile.cfm?Object=SolarSys>
* Molecular modeling kit
* Styrofoam spheres in black (carbon), yellow (hydrogen), and red (oxygen)
* Alternative: Gum drops
* Toothpicks
* Student journals
* LCD Projector
* Teacher computer with Internet access and speakers
* Computer Lab or student computers for Excel exploration
* Calculators

**Photo Credits**

* Artist’s Rendition of Hyugens Probe on the Surface of Titan (Activity 1.1.1) was copied from [www.nasaimages.org](http://www.nasaimages.org)
* Image of eChem applet (Activity 1.1.1a) was copied from <http://www.sciencegeek.net/eChem/eChem.html>
* Images of organic alcohols (Activity 1.1.3) were generated and copied from eChem at <http://www.sciencegeek.net/eChem/eChem.html>