**Course Outline**

Students will keep a journal throughout the course that will be collected at the end as an assessment. (Guidelines on following page)

1. **Candy Atom Lab**
   1. 1-2 Periods
2. **Phase Change Lab**
   1. 2-3 Periods
3. **Hot Chocolate Lab**
   1. 1 Period
4. **Artificial Snow Lab**
   1. 1-2 Periods
5. **Ice Cream Lab**
   1. 2-3 Periods

**Journal Guidelines**

Throughout this project, you will keep a journal dedicated to all the information presented in the unit. This will be turned in after the completion of the unit for a grade in addition to a grade for class participation in labs.

1. **Candy Atom Lab**
   1. Record Lab Questions
   2. Draw a picture of your model and label it
2. **Phase Change Lab**
   1. Record answers to vocabulary (worksheet)
   2. Record your ideas to the critical thinking questions (worksheet)
3. **Hot Chocolate Lab**
   1. Record questions asked by your teacher in the lab
   2. What would happen if you changed the ratio between the liquid and powder?
4. **Artificial Snow Lab**
   1. Write your post-lab discussion question answers
5. **Ice Cream Lab**
   1. Follow provided instructions

**1. Candy Atom Model**

**Purpose**:

To educate about the composition of atoms and elements using various candies and a paper plate. Each student requires a paper plate and a marker, as well as one plastic bag of assorted candy.

**Materials**:

-Three types of small candies (ie. gummy bears, m&m’s and gumdrops

- paper plate

- sharpie marker

- bag with numbers 1 through 40

- periodic table

**Procedure**:

1) Have students bring bags of small candies (for themselves or to share) or the teacher will provide candy.

2) Next, students will randomly pull a number from the bag. This is the atomic number of the atom they will build.

3) To determine the number of neutrons, students will subtract the atomic number from the atomic mass (point out atomic mass)- remember to round down (this may require a calculator). The atomic number represents the number of protons and electrons. Make sure there is one electron for every proton.

4) To construct the ‘atom’, students will draw a circle in the middle of the plate, 2 inches in diameter with a ring around the outside. ‘Protons and Neutrons’ will be in the middle and ‘electrons’ will be arranged on the line. Label each component (see picture).

5) **EAT THE CANDY**

**Lab Discussion Questions**

1. What charge do Protons, neutrons and electrons hold?
2. For each Proton, how many electrons are there?
3. In your candy atom, how many protons, neutrons and electrons are there?

How are protons and electrons similar to magnets?

**2. Phase Change Lab**

**Concepts Addressed:**

* What are solids, liquids, and gases?
* What is boiling?
* What are phase changes?
* How are physical changes and chemical changes different?
* How does temperature affect something?

**Materials:**

* 2.5 Cups of Water
* 2 Packages of Jell-O Gelatin (Any Flavor)
* Kettle
* Large Bowl (for mixing boiling water and gelatin powder)
* Large Pan (for Jell-O)
* Refrigerator

**Procedure:**

1. **Boil 2.5 cups of water.**
   1. Tell students about boiling, the process of heating a liquid until it becomes a gas. Show them the steam and tell them that it is the water becoming a gas. Describe physical changes (Changes that do not affect the composition of the object, but change an aspect such as appearance) and chemical changes (Changes that alter the object’s composition). Ask them to tell you if it is a physical or chemical change. It is a physical change because it does not alter the chemical make-up.
2. **Mix water and 2 packages of Jell-O Gelatin in a large bowl. Stir until completely dissolved.**
   1. While the powder is dissolving, ask them if this is a physical or chemical change. It is a chemical change because it alters the composition of the substance by adding gelatin to it.
3. **Carefully pour into pan. Place pan in refrigerator.**
   1. Ask the students to predict what will occur.
4. **Refrigerate for 3 hours or until firm.**
5. **Present it to students.**
   1. Tell them that it went from a liquid to a solid because of the cold temperature of the refrigerator.
6. **Enjoy!**

**Phase Change Lab (Worksheet)**

**Vocabulary:**

*Match the words to their definitions.*

A \_\_\_\_\_\_\_\_\_\_\_\_ is the shifting of one material from one state to another such as water freezing to form ice. In our experiment, we boiled water to turn it from a \_\_\_\_\_\_\_ to a \_\_\_\_\_\_\_(water vapor). This is a \_\_\_\_\_\_\_\_ change because it does not affect what the object is made of. \_\_\_\_\_\_\_\_\_\_ changes affect the composition of the object such as burning paper to turn it into ash.



**Critical Thinking:**

*Answer these to the best of your ability using the knowledge gained through the lab.*

1. What do you think would happen if you froze the gelatin liquid? Would it behave more like a “hard” solid (like rock) or a “soft” solid (like putty) when it is frozen?
2. What is the difference between a physical and chemical change?
3. Brainstorm examples of physical and chemical changes.
4. What is a phase change you see in your daily life?

**3. Hot Chocolate Lab**

**Concepts Addressed:**

* What does dissolving mean?
* Is matter conserved in a reaction?
* How are physical changes and chemical changes different?

**Materials:** *(for 3-5 children)*

* 3/4 Cups of Water (or Milk)
* 2 Tablespoons of Hot Chocolate Mix
* Kettle
* Cups

**Procedure:**

1. **Warm the water**
2. **Add Hot Chocolate Mix to the water.**
   1. Ask them what they think will happen.
3. **Begin stirring.**
   1. Ask the students what process is occurring.
4. **After it dissolves, pour into individual cups.**
   1. Ask them where the mix went. Tell them that although it seems to have disappeared, the hot chocolate mix is still there.
5. **Distribute the Hot Chocolate to each student.**
6. **Enjoy!**

**4. Artificial Snow**

**Background**

Often times ski resorts make artificial snow in large quantities in order to make up for a deficit during a dry season. Although they use a slightly different method of pushing the highly absorbent polymer through a high pressurized nozzle, the principles are the same.

**Concepts**

* Physical reaction: The substances don’t change chemically even if their physical appearance does.

**Materials**

* Sodium Polyacrylate - Can be found in:
  + disposable diapers
  + crystal form at garden centers (used to keep soil moist)
  + purchase separately
* Water
* Salt
* Bowl
* Mixing Spoon

**Procedure**

* Harvest the Sodium Polyacrylate
* Mix with 100mL of water (distilled if you can get it)
* Stir until the water is mostly absorbed and a snow-like or slushy texture is formed
  + Add salt to remove some of the water and make the snow drier
* Enjoy! (DO NOT EAT THE SNOW! It is toxic when consumed.)
  + The students may take the “snow” home to play with, but if it is left out for too long the water will evaporate and it will become normal sodium polyacrylate. They may add more water if the wish to keep their snow for longer.
* OPTIONAL: Place in a refrigerator to make the snow feel more realistic

**Post-Lab Discussion Questions**

1. In comparison to the phase changes lab you did earlier, were the changes that you witnessed in this lab physical changes, or chemical changes, why?
2. What caused the sodium polyacrylate to double in size when mixed with water?
3. What did you do to make the snow more slushy, what made the snow drier?

**5. Ice cream Lab**

Objective: Create a chemical reaction by lowering the freezing temperature of water to below zero allowing ice cream to form. You will be placed into groups of 3 and will participate in making your own soft serve ice cream. The purpose of this lab is to observe and understand the chemistry behind this lab that makes the ice cream freeze so fast.

Concepts:

* Freezing temperature of water
* Effects of salt on ice

Form a hypothesis: How long do you think it will take for the ice cream to form?

How low do you think the temperature will drop?

Materials:

* Ice chips, table salt - 2 small Ziploc bags
* 1 gallon size freezer Ziploc bag - thermometer
* mittens/ towel - 230 mL of milk/cream mixture

Procedure:

**Station 1-** Add 230 mL of milk/cream solution to small size Ziploc bag and seal bag tightly. Place inside second Ziploc bag and seal tightly. Make sure the solution is double bagged and sealed before moving to next station.

**Station 2-** Add salt using pre-marked cup to gallon size Ziploc bag. Place the double bagged milk/cream solution inside the gallon size Ziploc bag.

**Station 3-** Add 400 mL of ice chips to the gallon size Ziploc bag mixing thoroughly with the salt. Seal the gallon size bag tightly and shake slightly to distribute salt and ice together throughout. Return to your desk:

1. At your desk, you will measure the initial temperature of the ice in the gallon bag. Seal the gallon bag securely.

2. Gently rock the gallon bag from side to side. It’s best to hold it by the top seal or have gloves on the bag so you hands do not get too cold from handling the bag.

3. Continue to rock the bag for the next 20 minutes and take the temperature of the ice/salt mixture every 5 minutes. Record your results in the data table.

4. Remove the gallon size Ziploc bag after 20 minutes. Empty the salt/ice mixture into the sink and discard the Ziploc bags. Open the ice cream, get a spoon and enjoy!

**Complete the following on a separate piece of paper or in your notebook:**

Results/Data:

|  |  |  |
| --- | --- | --- |
| Time (min) | Temperature ◦ C | Cream consistency |
| 0 - Initial |  |  |
| 5 |  |  |
| 10 |  |  |
| 15 |  |  |
| 20 |  |  |

Conclusion: Was your hypothesis correct?

Graph Data: Graph a Time (min) vs. Temperature (◦ C) graph to visually show the change in temperature during the 20 minutes (Line Graph).

Post lab questions:

1. How did salt affect the freezing point of water?
2. Explain how ice on a sidewalk melts when salt is spread on it, even though the temperature of the ice remains below 0◦ C, the freezing point of water.

(hint: the temperature change when salt is added to ice)

Reflection: On the same piece of paper or in your notebook, write a one paragraph reflection of your group’s collaboration. Include what you thought was done well and what you think your group can improve on.

Enjoy your ice cream!!