



UTAH GOVERNOR'S OFFICE OF **ENERGY DEVELOPMENT**

Where do the Particles go? A Model of Combustion.

Grade/Subject: 8th-grade Integrated Science

Strand/Standard 8.1.6 Develop a model to describe how the total number of atoms does not change in a chemical reaction, indicating that matter is conserved. Emphasize demonstrations of an understanding of the law of conservation of matter. Balancing equations and stoichiometry will be learned at the high school level. (PS1.B)

Lesson Performance Expectations (description):

- Students will develop a model of combustion showing that mass does not change in the process.

Materials:

- Materials for Glass jar demonstration
 - 1 pint glass jar with lid, no rim needed
 - 1 candle that will fit into the jar
 - 1 piece of clay
 - 1 long-stemmed lighter
 - Scale that measures in 10th of a gram
- Materials for the lab per group of 4 students.
 - 1 wax candle
 - 1 long-stemmed lighter
 - 1 pie plate
 - 1 piece of clay
 - 1 straw
- Video [link](#) for conservation of matter. (6.45 min)
- Students will use their phones for slow-motion videoing.

Time: 45 minutes

Teacher Background Information:

- Matter is anything that has mass and takes up space. It includes molecules, atoms, fundamental particles, and any substance that these particles make up. Matter can not be created nor destroyed. Matter can change form through physical and chemical changes, but through any of these changes, matter is conserved. The same amount of matter exists before and after the change. This concept is called the Law of Conservation of Mass.
- Boundary, the balancing of equations will be taught in high school.
- In a physical change, a substance's physical properties may change, but its chemical makeup does not.
- Refer to [this article](#) for the jumping flame demonstration
- Wood and paper undergo incomplete combustion when burned.
- Natural Gas undergoes almost complete combustion when burned. The Law of Conservation of Mass applies.

Student Background Knowledge:

- Students should understand that matter is composed of different particles and that gases and particles (solids) are given off when matter is burned.
- Students need to know what properties of matter are. Properties of matter are the traits or characteristics of a substance. Properties include all the ways you can describe something using your five senses as well as what the substance can or cannot react with chemically.
- Students should know what a chemical reaction is. A chemical reaction is when atoms in molecules are rearranged to create new molecules. Students do not need to know about chemical reactions in detail. They need to know what a chemical reaction is and how they work on paper in terms of reactants and products. Combustion is when oxygen reacts with a fuel to produce carbon dioxide and water. When this happens energy is released.

Teacher Step by Step: A 3-D lesson should insist that students think deeply. Provide time and space for the students to experience the phenomenon and ask questions.

1. **Introduce *Phenomenon*:** Show [this](#) video clip of paper burning (:32 sec.).
2. Ask students what questions they have and record them on the student sheet. Give the students time to share some of their questions.
3. Have students draw a model of what they think is happening to the particles of paper as it burns.
4. Show the students the demonstration of a candle in a jar. Place a blob of clay to the bottom of a glass bottle and stand the candle in the clay. Put on the lid. Record the mass of the bottle, candle and lid.



5. Take the lid off and quickly light the candle putting the lid back on. After the candle has gone out, record the mass.
6. Ask students what questions they have and record them.
7. Have students draw a model.
8. Show the video [Matter Cannot be Destroyed](#) (6:58 min). Students will write a statement about the number of particles (atoms) when they go through a chemical change of combustion. Reinforce that this process is called the Conservation of Matter.
9. This next part can be done as a demonstration or an activity with the students.
 - a. For demonstration, read this [article](#) and make sure to practice. See step 6 in the student hand out sheet.
 - b. For the activity, challenge students to relight the candle without touching the lighter flame to the wick of the candle. Hand out the materials, candle, pie pan, straw, long stemmed lighter and clay. Secure the candle to the pie pan with the clay. Light the candle and let it burn at least one minute. Blow out the candle using a quick puff of air with the straw and try to relight it with the flame at various positions: on the candle wick, to the side of the candle wick, and above the wick. The students will record their results and construct an explanation. See step 7 in the student hand out sheet.
10. Students will construct a claim, evidence and reasoning statement.

Assessment of Student Learning. Students will construct a model of and write a statement explaining the Law of Conservation of Matter in their own words.

Standardized Test Preparation:

1. A candle becomes smaller as it burns. Where has the mass gone?
 - a. The atoms have been destroyed by burning.
 - b. The atoms have changed into new atoms that are smaller.
 - c. The atoms have combined with other atoms and left as a gas.*
 - d. The atoms have formed a liquid that is less dense than the solid.

2. What does placing a lid on a jar with a burning candle and finding its mass as it burns show?
 - a. Mass is neither gained or lost during burning.*
 - b. Heat from a candle can reduce the mass of a jar.
 - c. Candles can burn without air.
 - d. Vapor from a candle is flammable.

3. A piece of magnesium metal has a mass of 1.3 g. A flame lights the magnesium and a bright light and smoke is given off. A white substance is left behind and has a mass of .6 g. Why does this substance weigh less?
 - a. The white substance is less dense than the magnesium.
 - b. The smoke removed mass from the burning magnesium.*
 - c. The magnesium loses mass when heated.
 - d. The magnesium shrunk in volume to be half its original size.

4. A candle can be relit after it is extinguished by placing a match above the wick. What substance is catching on fire?
 - a. Vaporized candle wax.*
 - b. Particles from the wick.
 - c. Water vapor from the wax.
 - d. Oxygen remaining above the wick.

Extension of lesson and Career Connections:

- Extensions can include other combustion reactions such as investigating how different fossil fuels burn. A piece of coal takes a very long time to burn but propane burns very quickly.
- Have students look up different careers in the Oil and Natural Gas Industry. [Oil and Gas Workforce](#)