Chemistry in a Bag

Type of Lesson:	Content with Process: Focus on constructing knowledge through active learning.	
IPC Content TEKS:	(8) Science concepts. The student knows that changes in matter affect everyday life.	The student is expected to: 8A Distinguish between physical and chemical changes in matter such as oxidation, digestion, changes in state, and [stages in the rock cycle.] 8C Investigate and identify the law of conservation of mass
Learning Goal/ Instructional Goal:	Students observe distinct signs of a chemical reaction and observe that the mass of reactants equals the mass of the products (The Law of Conservation of Mass). *Instructional objectives:* • Given a list and description of changes of matter students differentiate between physical changes and chemical changes. • Students write a story of a typical day and include at least five chemical and five physical changes. • Given the mass of the reactants students determine the mass of the products in a chemical reaction and explain their results.	
Key Question:	What is the difference between a chemical and a physical change? What are the signs of a chemical reaction? Does the mass change when a chemical reaction takes place in a closed container?	
Related Process TEKS:	**(1) Scientific processes.** The student, for at least 40% of instructional time, conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices	The student is expected to: (A) demonstrate safe practices during field and laboratory investigations; and (B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.
	(2) Scientific processes. The student uses scientific methods during field and laboratory investigations.	The student is expected to: (A) plan and implement experimental procedures including asking questions, formulating testable hypotheses, and selecting equipment and technology; (B) collect data and make measurements with precision; (C) organize, analyze, evaluate, make inferences, and predict trends from data; and (D) communicate valid conclusions.
	(3) Scientific processes. The student uses critical thinking and scientific problem solving	The student is expected to: (A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;

	to make informed decisions.	(B) draw inferences based on data related to promotional materials for products and services; (C) evaluate the impact of research on scientific thought, society, and the environment; (D) describe connections between physics and chemistry and future careers; and (E) Research and describe the history of physics, chemistry, and contributions of scientists.
To the Teacher:	Physical and chemical changes happen all around us (even in us!) all the time. In this activity you will try to observe and identify the types of changes taking place. Physical and chemical changes happen all around us (even in us!) all the time. In this activity you will try to observe and identify the types of changes taking place. In a chemical change, elements recombine to form new chemical compounds with new and different properties. In a physical change, the form of a substance or some if its physical properties may change, but its chemical composition stays unchanged. The elements or compounds involved in the change keep their identity. Some examples of physical changes are: cutting paper, changes of state, melting, and dissolving. There are some distinct signs that a chemical change has taken place. These signs include: formation of a(n) : gas, odor, color change, precipitate, and a change in temperature. Some examples of a chemical change are: food spoiling, burning paper, digestion of food, baking a cake, and a candle burning. This is a hands-on investigation of the signs of a chemical reaction. This activity can be done with readily available chemicals. Each student gets to participate in this safe and memorable activity for about 10 cents each! **<u>Chemical Availability:</u>** **Calcium chloride** – available from builder supply stores (Home Depot) as a drying agent and sold under the name Damp Rid. Costs about $3 for 48 oz. (enough for about 200 students) **Sodium bicarbonate** – available from grocery store, Arm & hammer $2.50 for a 48 oz. Box (enough for about 200 students) **Phenol red** – available in 1.0 oz. bottle from swimming pool supply stores (and some dept. store garden departments) for about $1.50. This can be highly diluted (we use 1 part phenol red to 10-15 parts isopropyl alcohol). A 1 oz phenol red diluted to 16 oz will take care of about 100 students. **Baggies** – try the smaller size Ziploc snack bags. Freezer bags are a little stronger, but hard to get in the small size. They run less than 5 cents per bag. **Film cans** – free from any photo developer **Disposal/cleanup** – this can be washed down the drain with plenty of water. Save film can for other uses. **Observations** – this activity involves color change, gives off gas, produces heat and the later takes in heat. **Molecular formulas** – calcium chloride $CaCl_2$ Sodium bicarbonate $NaHCO_3$ Water H_2O

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Multiple Intelligences:	*Logical-Mathematical Intelligence*	Consists of the ability to detect patterns, reason deductively and think logically. This intelligence is most often associated with scientific and mathematical thinking.

Materials:

- plastic Ziploc bags
- Sodium bicarbonate
- Calcium chloride
- Film canister or plastic vial
- Universal indicator (phenol red)

SAFETY NOTE:

- **Warning: You must wear goggles and aprons at all times during this lab activity.**
- **Read the activity before starting the investigation.**
- **Each person must help clean up.**
- **The plastic bag must be sealed fully so that the contents do not fly out during the reaction.**

Engagement:

1. Conduct a quick chemical reaction to get the attention and interest of the students. One possibility might be the "Wine into Water" chemistry demonstration. You could call it the "Mysterious Color Change" demonstration.
2. Prepare two beakers containing clear liquids. One must be a base and one must be an acid. Obtain phenolphthalein from the chemistry department. It is a clear liquid indicator that turns purple-pink in a base and clear in an acid or neutral substance. Place a few drops of this indicator into the weak acid. Pour some of the stronger base into the acid beaker until it turns pink. Pour more acid into the beaker so it loses color. If you put the mixture on the overhead in a small dish, the students can see bubbling. When the acid and base are perfectly neutralized, a salt and water are produced. If the neutral liquid is put into a small dish and the water is evaporated, a salt will appear. If obtaining phenopthalein is not possible, a short dramatic reaction will lead into the discussion that follows.
3. Ask students to help you generate a list of possible things that might take place when two or more chemicals are mixed together.

Explore:

1. Place a scoop of the calcium chloride and one scoop of the sodium bicarbonate in the zip loc bag. Mix the dry ingredients. Stop and observe any changes.

2. Fill the film can about half full with water and put a drop of the 'universal indicator' in it.

3. Place open film can right side up in the zip-loc bag that contains the calcium chloride and sodium bicarbonate. Squeeze most of the air out of the baggie and seal the zip-loc.

4. Measure and record the mass of the bag with all the chemicals.

5. Tip over the film can inside the baggie so the liquid chemicals mix with the dry chemicals. Carefully and calmly observe as many changes as you can. Some changes may take a few minutes to occur. Keep observing.

6. Without allowing any air to escape from the bag, measure and record the mass of the bag.

Explain:

1. Mass of bag and chemicals before the reaction:_____
2. Describe the appearance of each chemical: Students should make detailed qualitative observations of each of these chemicals. These observations should include color, smell, texture, etc…

    - Calcium chloride –
    - Sodium bicarbonate –
    - Indicator –

- Water –

3. Dry chemicals:
   a. What changes occurred when the calcium chloride was mixed with the sodium bicarbonate? *Students should say that there were not any observable changes except that a mixture was created.*

   b. Was this a physical change or was it a chemical change? *Physical*

4. Liquid chemicals:

   a. What changes occurred when the 'indicator' was mixed with the water? *None*

   b. Was this a physical change or was it a chemical change? *physical*

5. When mixed:

   a. What changes occurred immediately and a few minutes later? B*ubbling, the bag inflates, the bag becomes hot and then cold, there is a color change, and there is an odor.*

   b. Was this a physical change or was it a chemical change? *A chemical change*

   c. Mass of bag: _____

6. Compare the mass before and after the reaction. Explain any similarities or differences in mass before and after the reaction*. The masses should be very close. The final mass may be a little smaller due to the fact that some air (gas) could have escaped from the bag. The law that explains why the masses are equal is The Law of Conservation of Mass. This law states that matter can not be created or destroyed. The original chemicals reacted chemically and new chemicals were created*.

7. Use a periodic table to find the symbol, atomic mass, atomic number for each of the following elements.

Element	Symbol	Atomic number	Atomic mass
Calcium			
Sodium			
Carbon			
Hydrogen			
Oxygen			

Elaborate:

- Ask students to investigate further and determine which chemical caused the color change and why.
- As students to investigate which chemical caused the bag to heat up.
- Ask students to investigate using the internet some the uses of calcium chloride.

Evaluate:

POINTS	Scientific Accuracy	Reasoning	Communication	Collaboration
4 **Excellent**	I can accurately identify signs of chemical reaction. I can accurately distinguish between a chemical and a physical change. I can accurately explain why the mass of the reactants always equals the mass of the reactants in a chemical reaction when it takes place in a closed system.	I analyzed the data accurately and answered analysis questions accurately.	I communicated answers to the investigation questions completely and thoroughly using correct grammar. I shared my ideas about the investigation in the whole group discussion and with my teammates.	I worked very well with my group. Each person had a lot of input and participated in the investigation.
3 **Good**	I can identify signs of chemical reaction. I can distinguish between a chemical and a physical change. I can explain why the mass of the reactants always equals the mass of the reactants in a chemical reaction when it takes place in a closed system.	I analyzed the data somewhat accurately and answered analysis questions somewhat accurately.	I communicated answers to the investigation questions and using correct grammar. I shared some of my ideas about the investigation in the whole group discussion and with my teammates.	I worked well with my group. Each person had input and participated in the investigation.
2 **Fair**	I can sometimes identify signs of chemical reaction. I can sometimes distinguish between a chemical and a physical change. I can sometimes explain why the mass of the reactants always equals the mass of the reactants in a chemical reaction when it takes place in a closed system.	I analyzed the data with some errors and answered analysis questions with some errors.	I communicated answers to the investigation questions and with grammatical errors. I shared a few of my ideas about the investigation in the whole group discussion and with my teammates.	I worked somewhat well with my group. Each person had some input and participated in the investigation.
1 **Poor**	I cannot identify signs of chemical reaction. I cannot distinguish between a chemical and a physical change. I cannot explain why the mass of the reactants always equals the mass of the reactants in a chemical reaction when it takes place in a closed system.	I analyzed the data incorrectly and answered analysis questions incorrectly.	I communicated answers to the investigation questions and with many grammatical errors. I did not share my ideas about the investigation in the whole group discussion and with my teammates.	I did not work well with my group. A few people had input and participated in the investigation.

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	Subtotal: ____	Subtotal: ____	Subtotal: ____	Subtotal: ____	**TOTAL: _____/16 pts**

TAKS-like Items:

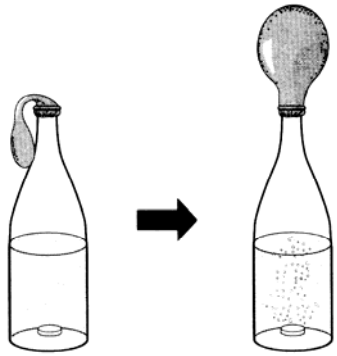
1. During a laboratory investigation, a student combined three chemicals in a plastic Ziploc bag. After mixing the chemicals for a minute, the student noticed the bag increased in size and it felt very warm. Without knowing the chemical formula, this is an example of a –

   A physical change
   B chemical change
   C single replacement reaction.
   D double replacement reaction.

2. Which piece of evidence best shows there was a reaction that took place?

   A The teacher said
   B a gas was produced
   C the density of the liquid
   D the density of the solid

3. Two students conducted an experiment to measure the amount of gas produced by an Alka-Seltzer tablet in water. After putting the system together, they measured the mass of the apparatus and Alka-Seltzer tablet. After they dropped the Alka-Seltzer tablet in the bottle, a reaction took place and a gas was produced. Predict the mass of the apparatus after the reaction took place.



106 g **_____?**

   A 63 g
   B 96 g
   C 106 g
   D 156 g

4. The Law of Conservation of Mass states that mass is neither created nor destroyed in an ordinary chemical reaction. When an iron nail rusts, it seems to get heavier in mass. Does the iron nail follow the Law of Conservation of Mass?

A No, rusting is an exception to the Law of Conservation of Mass.

B No, since rusting is a chemical change it does not follow the Law of Conservation of Mass.

C Yes, the iron rearranges its protons so that the masses are the same before and after the reaction and rusting follows the Law of Conservation of Mass.

D Yes, iron chemically combines with the oxygen in the air so if you add the oxygen into the mass of the chemicals before the reaction, the mass after the reaction is the same.

5. When wood burns, a small amount of ashes is made. Why is the mass of the wood before the fire not equal to the mass of the ashes after the reaction?

A The mass of the wood has been destroyed.

B The mass of the wood and the oxygen that allowed it to burn will equal the mass of the ashes and the gas given off during the burning.

C The mass of the wood and the ashes equals the mass of the oxygen and the smoke given off during the time that the wood burned.

D The wood has holes in it so it is actually lighter in mass than it appears. The mass of just the wood will equal the mass of just the ashes after the burning.

6. How does the Law of Conservation of Mass apply to a burning candle?

A The amount of wax before the reaction equals the amount of energy afterwards.

B The mass of the wick before the reaction equals the mass of the smoke afterwards.

C The mass of the wick, wax that burned and the oxygen that helped the flame before the reaction equals the mass of the smoke and the gases released after the reaction.

D The mass of the molecules of the candle before the reaction equals the mass of the candle and burned wick after the reaction.

7. Which of the following reactions best illustrates the Law of Conservation of Mass?

A $H_2O_2 \rightarrow H_2O + O_2$

B $Na + CuS \rightarrow Na_2S + 2\ Cu$

C $K + AgCl \rightarrow KCl + Ag$

D $NaOH + 2\ HCl \rightarrow NaCl + H_2O$

8. When sodium chloride reacts with calcium oxide to form sodium oxide plus calcium oxide, which of the following equations shows the Law of Conservation of Mass?

A $NaCl + CaO \rightarrow Na_2O + Ca\ Cl_2$

B $4NaCl + CaO \rightarrow 2\ Na_2O + CaCl_2$

C $2NaCl + CaO \rightarrow Na_2O + CaCl_2$

D $3NaCl + 2\ CaO \rightarrow Na_2O + 3\ CaCl_2$

9. In the following reaction: $2NaN_3$ decomposes to form $2Na + 3N_2$. If 500 grams of NaN_3 decomposes to form 323.20 grams of N_2. How much Na is produced?

A 100 grams

B 176.80 grams

C 323.20 grams

D 500 grams

10. Which chemical equation shows the Law of Conservation of Mass?

A $2\ H_20 \rightarrow H_2 + O_2$

B $Zn + HCl \rightarrow ZnCl_2 + H_2$

C $Al_4C_3 + 3H_2O \rightarrow CH_4 + 4\ Al\ (OH)_3$

D $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

11. When 127 grams of copper reacts with 32 grams of oxygen gas to form copper (II) oxide, there is no copper or oxygen left over. What is the mass of the copper (II) oxide produced?

A 32 grams

B 95 grams

C 127**.** 32 grams

D 159 grams

References/Resources/Websites:

- What is matter?
  http://www.nyu.edu/pages/mathmol/textbook/whatismatter.html