

# From Alchemy to Reality: How Can We Create New Substances?

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Teacher:

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Class:

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**Physical Science**  
**Unit 3**  
Exit Tickets

# Lesson 1 Exit Ticket: Changes

Kayla performs a series of experiments in science class. She wrote down observations about what she saw after each reaction.

1. Use Kayla's observations to classify each change as physical or chemical. [5]

Reaction	Observations	Physical or Chemical change?
1	Ice melted into water when heat was added.	
2	Wood gave off smoke after being burned.	
3	Bread was broken down into crumbs when crushed.	
4	Two clear liquids turned cloudy when combined.	
5	A cut apple turned brown after sitting outside for an hour.	

2. Which of the following statements about chemical reactions is true? [1]

- A. Chemical reactions produce solids, liquids, or gases.
- B. Chemical reactions produce solids and gases, but not liquids.
- C. Chemical reactions occur between liquids but not between gases or solids.
- D. Chemical reactions occur between solids and liquids but not between solids and gases.

3. True or false: Chemical reactions always result in fire.

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Explain. [1]

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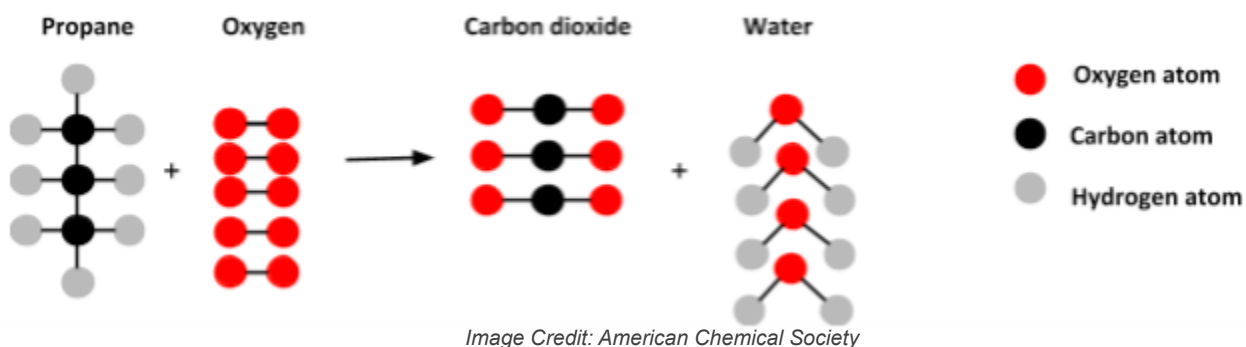
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## Lesson 2 Exit Ticket: Reactants and Products

Many people use a propane gas stove to cook when camping. When propane gas burns, a chemical reaction occurs. In this chemical reaction, propane reacts with oxygen to form carbon dioxide and water.

The model below represents what happens during the chemical reaction.



Use the model and what you know about chemical reactions to answer the question.

1. A group of friends on a camping trip want to increase the amount of carbon dioxide produced in the reaction. They list their ideas. Which would lead to an increase in the amount of carbon dioxide produced? [1]

II.	Increasing the amount of propane and oxygen
III.	Decreasing the amount of propane and oxygen
IV.	Increasing the amount of propane and decreasing the amount of oxygen
V.	Increasing the amount of oxygen and decreasing the amount of propane

- A. I
- B. II
- C. III
- D. IV
- E. I, II, and IV

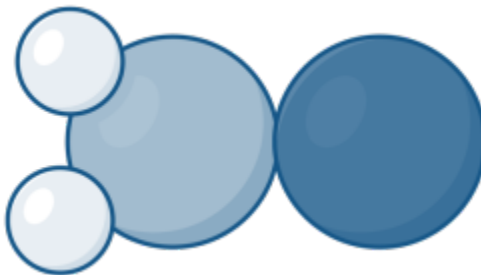
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## Lesson 2

Sulfur atoms are represented by gray circles, carbon atoms are represented by black circles, and oxygen atoms are represented by white circles.

2. Could the following diagram of a molecule be the yield of a chemical reaction between sulfur and oxygen? Explain and justify your response.



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# Lesson 3 Exit Ticket: Chemical Equations Revealed

**Directions:** Use the diagram below to answer the question.

Diagram 1

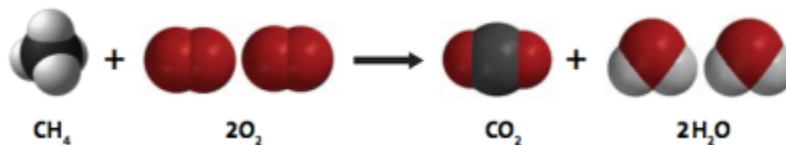


Image Credit: American Chemical Society

1. Complete Table 1 by counting the number of atoms on each side of the equation above. [2]

Table 1: Reactants and Products

Atom	Reactant Side	Product Side
Carbon		
Hydrogen		
Oxygen		

2. Does Diagram 1 represent a balanced chemical equation? [1] (Circle one) **Yes** **No**
3. Based on the diagram, in the reaction above, did physical or chemical changes occur? Explain and justify your response. [3]

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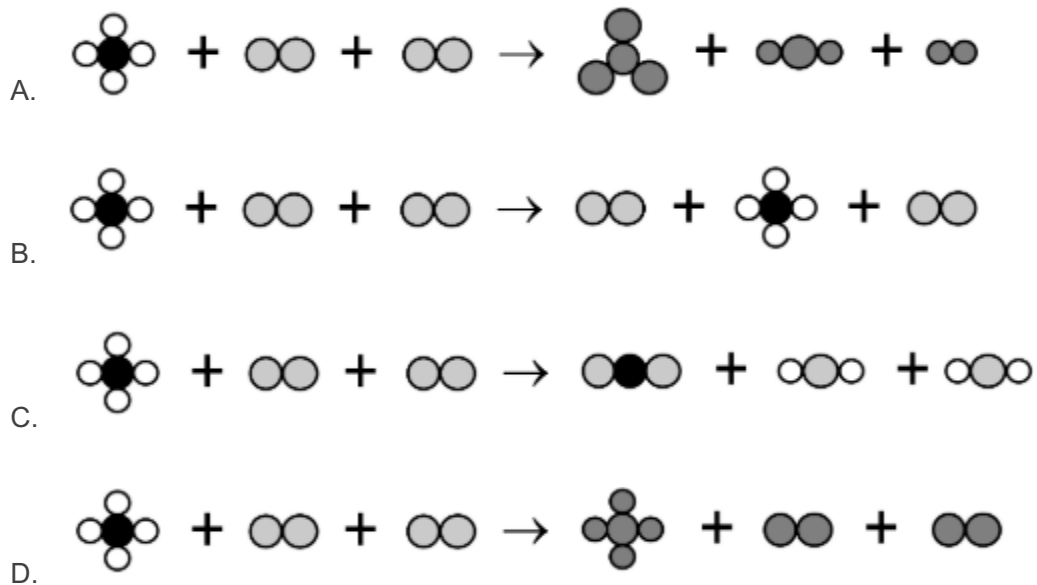
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### Lesson 3

In the models below, atoms are represented by circles, and molecules are represented by circles that are connected to each other. The different-colored circles represent different kinds of atoms.

4. Which of the following could represent a chemical reaction? [1]



# Lesson 5 Exit Ticket:

## The Law of Conservation of Mass

A scientist wrote on her notepad:

*I measured out 13 g of sodium hydroxide and 15 g of hydrochloric acid, and then combined the two reactants in a closed beaker. After mixing, I measured 15 g of table salt and 8 g of water as products.*

1. Do the scientist's findings follow the law of conservation of mass? [1]
  - A. Yes, the mass of the reactants is 28 while the mass of the products is 23 g.
  - B. Yes, the mass of the reactants is 23 while the mass of the products is 28 g.
  - C. No, the mass of the reactants is 28 while the mass of the products is 23 g.
  - D. No, the mass of the reactants is 23 while the mass of the products is 28 g.
  
2. The same scientist broke down carbon monoxide into carbon and oxygen. She started with 15 g of carbon monoxide. The reaction produced 8 g of carbon. How much oxygen would be produced, in grams if the reaction follows the law of conservation of mass? [1]
  - A. 22 g
  - B. 15 g
  - C. 8 g
  - D. 7 g

A student has two different liquids in open jars. She pours the liquid from one jar into the other jar, and she observes bubbles. After the bubbling stops, she finds that the total mass of the liquids is now less than the total mass of the liquids before they were mixed together.

3. How can her observation be explained? [2]

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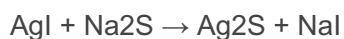
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## Lesson 6 Exit Ticket: Balancing Equations

1. Determine whether the chemical equations are balanced. Write "Yes" next to the ones that are balanced and "No" next to the ones that are not. [2]



Sometimes, two or more reactants are combined directly to form a single product. An example is the reaction in which sodium (Na) combines with chlorine ( $\text{Cl}_2$ ) to form sodium chloride, or table salt ( $\text{NaCl}$ ).

2. Write a balanced chemical equation that represents the above scenario. [2]



# Lesson 7 Exit Ticket: Mystery Powder

Miranda found a plastic cup containing an unknown powder in her science classroom. She poured half of the powder into Beaker 1 and the other half into Beaker 2. In Beaker 1, she dropped 10 droplets of water on the powder, and noticed fizzing. In Beaker 2, she dropped 10 droplets of chlorine and noticed a color change.

**Table 1: Properties of Elements at Room Temperature**

Element Symbol	State	Reactivity with Water and Chlorine
Ca	solid	reacts with water; reacts with chlorine to form $\text{CaCl}_2$
Cu	solid	does not react with water; reacts with chlorine to form $\text{CuCl}$ or $\text{CuCl}_2$
Ar	gas	does not react with metals or nonmetals
B	solid	does not react with water; reacts with Cl to form $\text{BCl}_3$

1. Based on the data provided, place a checkmark next to the element listed below that could be the unknown powder. [1]

- Ca
- Cu
- Ar
- B

2. Why did Miranda conduct tests to determine the identity of the substance instead of just looking at it carefully? Explain. [2]

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# Lesson 8 Exit Ticket:

## Energy Changes in Chemical Reactions

1. The list below describes five different reactions. Classify each reaction as endothermic (**EN**) or exothermic (**EX**) by writing the appropriate letters on the line next to the corresponding description. [3]
  - A. When two substances are mixed, a large amount of gas is produced. Over the course of the reaction, the temperature of the system rises 3 degrees
  - B. A cake bakes in an oven.
  - C. A log burns in a fireplace.
  - D. A combination of detergent powder and water feels hot to the touch.
  - E. A plant takes in energy from the sun to complete photosynthesis.
  
2. Label the statements about energy levels during reactions as true or false. [2]
  - A. When temperature is constant, kinetic energy stabilizes.
  - B. During exothermic reactions, potential energy is converted to kinetic energy.
  - C. Endothermic reactions use no energy.

# Lesson 9 Exit Ticket: Types of Chemical Reactions

1. Label each reaction in the table below. [3]

Reaction	Type of Reaction
$O_3 \rightarrow O + O_2$	
$2Na + Cl_2 \rightarrow 2NaCl$	
$Pb + FeSO_4 \rightarrow PbSO_4 + Fe$	

2. What type of reaction is shown below? [1]

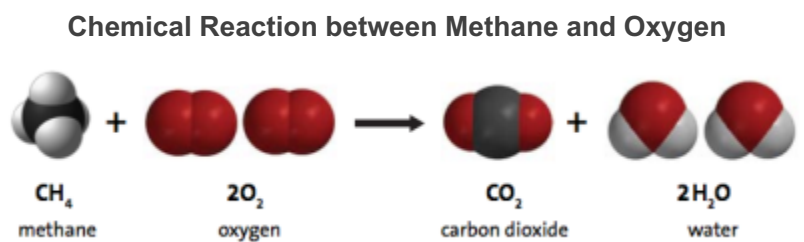


Image Credit: American Chemical Society

- A. Decomposition
- B. Synthesis
- C. Replacement
- D. Melting
- E. Combustion

# Lesson 10 Exit Ticket: Natural Resources and Synthetic Materials

1. Explain how the study of chemical reactions by scientists and engineers has directly affected you. Include information about *synthetic substances* in your response. [4]

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