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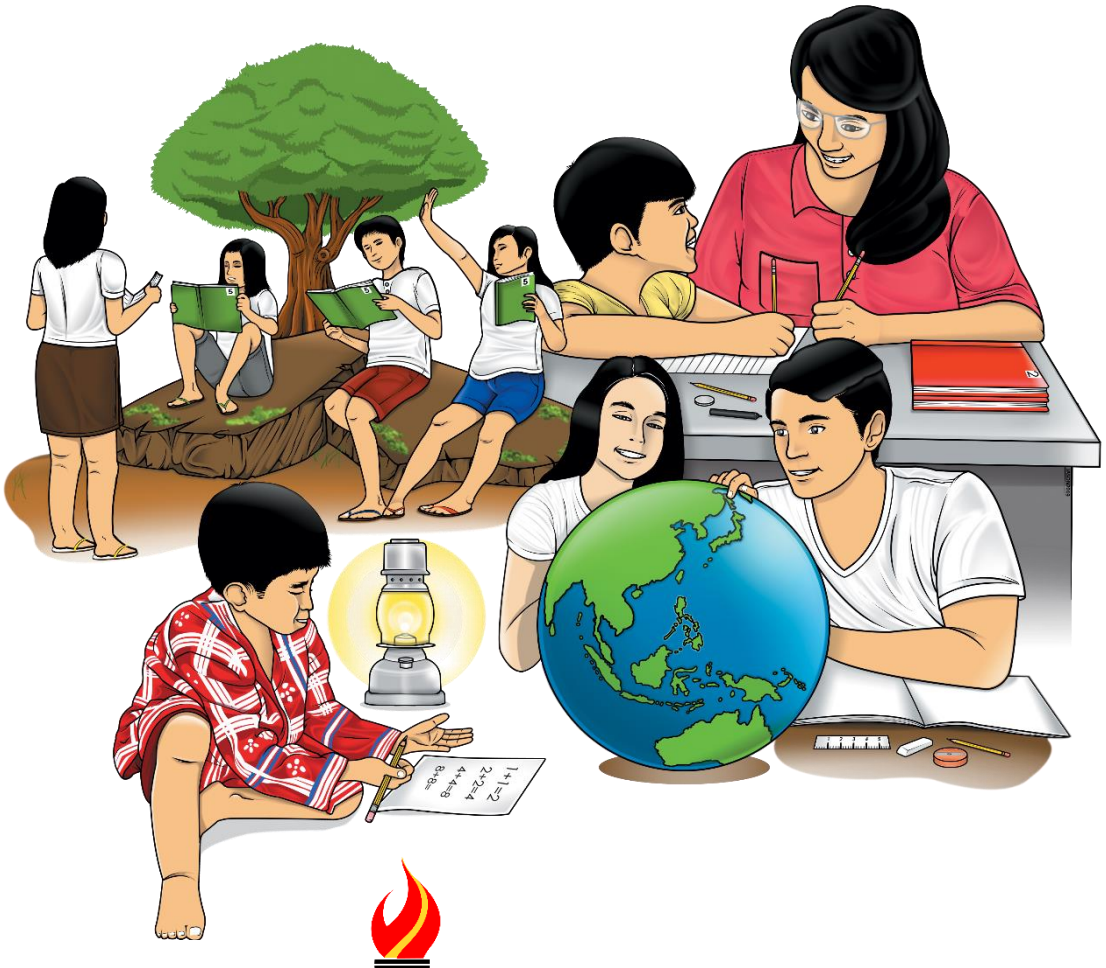
Science

Quarter 4 – Module 3:
Chemical Reaction



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Science

Quarter 4 – Module 3:
Chemical Reaction

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Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLM is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and tests. And read the instructions carefully before performing each task.

If you have any questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

What I Need to Know

Chemical reactions happen absolutely everywhere. Every minute, there are chemical reactions going on all around us. Do you know about any chemical reactions? Can you mention one or two examples? How do we know that a chemical reaction has taken place?

This module will provide you with information and simple activities that will help you understand how a chemical reaction emerges by applying the conservation of mass to chemical reaction.

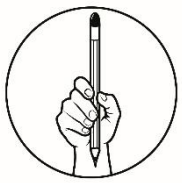
After going through this module, you are expected to:

1. apply the principles of conservation of mass to chemical reactions. (**S10MT-IVe-g-23)**

Going through this module can be a meaningful learning experience. All you need to do is make use of your time and resources efficiently. To do this, here are some tips for you:

1. **Take the pretest** before reading the rest of the module.
2. **Take time** in reading and understanding the lesson. Follow instructions carefully. Do all activities diligently. This module is designed for independent or self-paced study. It is better to be slow but sure than to hurry and miss the concepts you are supposed to learn.
3. **Use a clean sheet of paper** for your answers in each activity or assessment. Don't forget to write your name. Label it properly.
4. Try to **recall and connect the ideas** about the change that you had in the lower years. Use the concept discussed in the lesson to explain the results of activities or performance tasks. You may answer in English or a combination of your vernacular and English.
5. **Be honest.** When doing the activities, record only what you have really observed. Take the self-assessments after each activity, but do not turn to the Answer Key page unless you are done with the entire module.
6. **Do not hesitate to ask.** If you need to clarify something, approach or contact your teacher or any knowledgeable person available to help you. You may also look into other references for further information. There is a list of references at the back part of this module.
7. **Take the posttest** prepared at the end of the module, so you can assess how much you have learned from this module.
8. You can **check your answers** in the activities, self-assessments, and posttest after you finished the entire module to know how much you have gained from the lesson and the activities.

Before you proceed in studying this module, let us check how much you know about this topic. An answer key is provided at the end of the module. But do not try to look at it while answering. You can check your answer after you are done with the pre-test.



What I Know

Directions: Read each question carefully. Choose the letter of the correct answer. Use a separate sheet of paper for your answers.

1. Which of the following materials undergoes chemical change?
   a. Cutting of stainless metal plates
   b. crushing chunks of ice
   c. dissolving sugar in water
   d. rotting of tomatoes

2. Some changes are readily observable when chemical reactions take place. Which of the following evidences of chemical change explains the curdling of milk?
   a. evolution of heat and light
   b. evolution of gas
   c. formation of a precipitate
   d. production of mechanical energy

3. Chemical changes are always represented by chemical equation. What entities are usually located on the right hand side of a chemical equation?
   a. coefficient
   b. product/s
   c. reactant/s
   d. subscript

4. Which of the following is a shorthand notation that represents substances undergoing chemical reactions?
   a. chemical equation
   b. chemical formula
   c. empirical equation
   d. molecular formula

5. Notice that like mathematical equations, chemical equations also have signs. What symbol is used to indicate "reacts with"?
   a. arrow
   b. coefficient
   c. equal sign
   d. plus sign

6. What is/are the reactant(s) in the given reaction?

   $6O_2 + C_6H_{12}O_6 \rightarrow 6CO_2 + 6H_2O + ENERGY$

   a. $CO_2 + H_2O$
   b. $O_2 + C_6H_{12}O_6$
   c. CO_2
   d. $C_6H_{12}O_6$

7. Which of the following demonstrates that a new substance can be formed from chemical reaction?
   a. helium-filled balloon floating
   b. iron bending
   c. milk souring
   d. water evaporating

8. During chemical reaction, which of the following is **least likely** to occur?

   a. No changes are observed.
   b. Products usually have different properties.
   c. Visible chemical changes.
   d. It yields one or more products.

9. A chemical reaction is possible when two or more substances interact under favorable conditions. Which of the following is observed when quick lime and water are mixed?

   a. change in temperature of mixture
   b. evolution of hydrogen gas
   c. change in color
   d. production of light

10. A given chemical equation provides the necessary information on what is happening during chemical reaction. What does an arrow symbol pointing upward (↑) mean if this is seen in the equation?

    a. A gas was produced.
    b. A precipitate was formed.
    c. The container became hot.
    d. The substance was dissolved in water.

11. Which statement explains the Law of Conservation of Matter?

    a. In a chemical reaction, matter can only be created.
    b. In a chemical reaction, matter can only be destroyed.
    c. Matter can neither be created nor destroyed in a chemical reaction.
    d. Matter can either be created or destroyed in a chemical reaction.

12. What occurs when the reaction has oxygen as one of its reactant and produces carbon dioxide and water as its products?

    a. combination reaction
    b. combustion reaction
    c. double displacement
    d. single displacement

13. What type of chemical reaction is represented by the given equation?

$$A + B \rightarrow AB.$$

    a. combination
    b. combustion
    c. decomposition
    d. single displacement

14. What type of chemical reaction in which ions get exchanged between two reactants, resulting to the formation of a new compound?

    a. combination
    b. combustion
    c. single displacement
    d. double displacement

15. The reaction between hydrogen gas and oxygen gas forming water can be expressed in this equation, $H_{2(g)} + O_{2(g)} \rightarrow H_2O_{(l)}$. To balance the equation, what are the coefficients needed in the given order for hydrogen, oxygen and water?

a. 0, 2, 2
b. 2, 1, 2
c. 2, 0, 2
d. 2, 2, 2

Answer Key on page 19

How did you find the pretest? What was your score? If you got 15 items correctly, you may not take this module. But if your score is 14 and below, you must proceed with the module.

Lesson
1

Chemical Reaction

What's In

From your previous lessons, you learned that matter undergoes two types of changes. These are physical change and chemical change. **Physical change** involves only a change in the appearance but not in composition of the material. **Chemical change** involves not only change the appearance of the material but also its composition. Activity 1 will help you understand these two types of changes.

Directions: Consider the following examples of changes. Classify them as **Physical** or **Chemical** change. Write your answers on a separate sheet of paper.

Change	Type of Change
1. healing of wounds	
2. rotting of banana	
3. opening a carbonated soft drink	
4. dissolving sugar in water	
5. painting a piece of wood	
6. photosynthesis	
7. crushing chunks of ice	
8. milk turning sour	
9. ice cream melts under the sun	
10. cutting of stainless metal plate	

It is understood that the primary difference between physical change and chemical change is that, in physical change, there are changes in their physical appearance, but the identity remains the same. While chemical change, its composition is altered, forming a new substance.

Did you get all the correct answers? If yes, then you are ready for your next journey!

What's New

Now that you know the difference between the two changes of matter, how can you tell whether a change in matter involves a chemical reaction? Often, there is an evidence. What evidences/signs should be present to consider that a chemical reaction occurred?

Please do the Activity to help you identify those signs/evidences of chemical reaction.

Activity 1. Bubbles Out

What you need:

- baking soda
- vinegar
- clear glass / empty bottle
- spoon

What you have to do:

1. Get a clear glass or empty bottle.
2. Pour vinegar into the glass or empty bottle. Add 2 to 3 spoons of baking soda. See the figure.

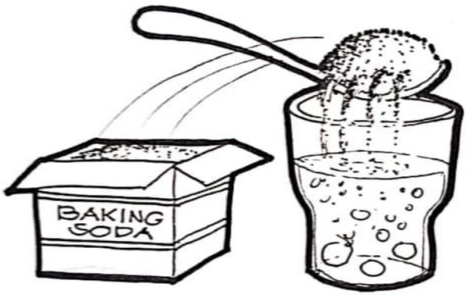


Figure 1. Chemical reaction of vinegar and baking soda

Illustrator: Christoper G. Macasias adapted with modifications
https://www.google.com/search?q=6.++image+of+the+reaction+of+baking+soda+and+vinegar

3. Observe the reaction of vinegar with the baking soda. Answer the following questions.
   a. What happened when vinegar was added to baking soda?
      _____
   b. What signs have you observed which signify a chemical reaction?
      _____

What Is It

What did you observe in the previous activity? Where you able to identify some signs evidences of a chemical reaction? What are these signs/evidences?

A chemical reaction is usually accompanied by one or combination of the following: the production of heat and light, the formation of a precipitate, the evolution of gas, a change in color of the material or there is a change in temperature. We can see that these events that are happening when a chemical reaction is taking place can readily be observed by the five senses.

Chemical reaction is a process in which one or more substances are converted to one or more different substances. In other words, chemical reaction is the process where a material is transformed into a new one, possessing a new composition.

Chemical changes are always represented by a chemical equation. A **chemical equation** is a symbolic representation of a chemical reaction. There are two parts of a chemical equation, the *reactants* and the *products*. ***Reactants*** are the substances before reaction and written on the left side of the chemical equation. ***Products*** are the substances resulting from the reaction and presented at the right side of the chemical equation. The reactants and products are separated by an arrow.

Take note that in writing chemical equations, certain symbols are used. Below is the list of symbols used in writing chemical equations.

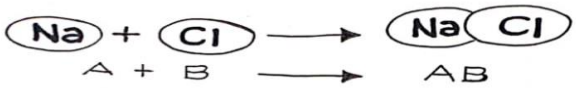
Symbol	Meaning
+	indicates that the substances are added or mixed.
→	means "yields", "makes", "produces", "forms" separates the reactants from the products.
↓	means that a precipitate is formed.
↑	indicates that a gas has evolved.
(s)	designates that the reactants or products are in solid form.
(l)	designates that the reactants or products are in liquid form.
(g)	designates that the reactants or products are in gas form.
(aq)	designates an aqueous solution; the substance is dissolved in water.
Δ	Indicates that heat is supplied.

Chemical reactions are categorized into 6 types.

TYPES of CHEMICAL REACTION

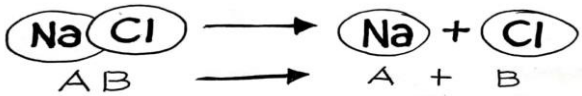
1. **Combination or Synthesis** - a reaction when two or more elements combine to form a single product.

   General equation: A + B → AB



   Example: Sodium + Chlorine gas → Sodium chloride
2. **Decomposition** - a single reactant breaks down into simpler ones. It is the opposite of combination reaction.

   General equation: AB → A + B



   Example: Sodium chloride → Sodium + Chlorine gas

3. **Single Displacement (Replacement)** – A substance; it can be an element or a compound; capable of replacing one of the atoms of a given compound.

   General equation: AB + C → AC + B

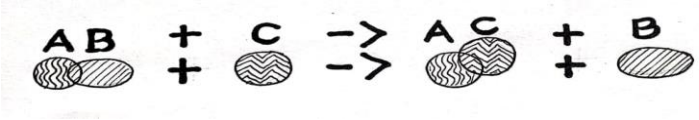


Figure 2. Single Displacement reaction

Illustrator: Christoper G. Macasias adapted with modifications
https://www.google.com/search?q=6.+image+of+single+replacement+reaction

Example: Potassium bromide + chlorine gas → Potassium chloride + bromine gas

$$KBr + Cl_2 \rightarrow KCl + Br_2$$

4. **Double Displacement (Replacement)** – a reaction in which **ions get exchanged between two reactants, resulting to the formation of a new compound.**

General equation: AB + CD → AD + CB

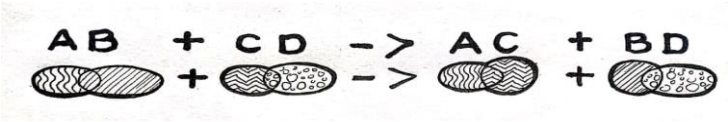


Figure 3. Double Displacement reaction

Illustrator: Christoper G. Macasias adapted with modifications https://www.google.com/search?q=6.+image+of+double+replacement+reaction

Example:
Silver nitrate + Magnesium chloride → Silver chloride + Magnesium nitrate

$AgNO3_{(aq)}$ + $MgCl_{2(s))}$ → $AgCl_{(s)}$ + $MgNO_{3(aq)}$

5. **Combustion (Burning) Reaction** – a reaction wherein oxygen gas combines with a hydrocarbon; a compound containing carbon and hydrogen atoms; forming carbon dioxide and water as the products.

General equation: $C_nH_n + O_2 \rightarrow CO_2 + H_2O$

Figure 4. Burning of log

Illustrator: Christoper G. Macasias adapted with modifications from https://www.google.com/search?q=image+of+with+burning+of+lo

6. **Acid-Base Reaction or Neutralization Reaction** - special kind of double displacement reaction that takes place when an acid and a base react. In general, the products of this reaction are salt and water.
General equation: Acid + Base → Salt + Water

HCl + NaOH → NaCl + H_20

Figure 5. Neutralization reaction

Illustrator: Christoper G. Macasias adapted with modifications from https://www.google.com/search?q=6.+image+of+Acid-Base+Reaction+or+Neutralization+Reaction

What's More

Now, let us strengthen your understanding of the concepts regarding chemical reaction. As you move along, discover and focus on what constitutes a chemical reaction. So if you are ready, answer the following enrichment activities and react into the world of chemical reaction. Have fun!

Activity 1. What's in a Reaction

Reactants are substances that serve as the starting material to form new substances in a chemical reaction. The **products** are the substances that were formed from the starting materials during the reaction process.

In this activity, you will distinguish reactants from products. Going back to Activity 1, Bubbles Out, the chemical reaction can be expressed as:

Baking soda (sodium bicarbonate) + vinegar (acetic acid) → sodium acetate + carbonic acid

a. We call the substances before the chemical reaction as reactants. What are the reactants in the bubbles out experiment?

_____

b. What do you think happened to the reactants during the chemical reactions?

_____

c. We call the substances produced during the chemical reaction, the products. What are the products of the bubbles out experiment?

_____

How did you find the activity? Is it easy for you to identify which are the reactants and the products? If yes, it is now time to test your knowledge by answering assessment number 1.

Assessment 1

Directions: Write only the letter of your choice. Use a separate sheet of paper for your answers

For questions 1 and two, refer to the equation given below:

Sucrose ($C_{12}H_{22}O_{11}$) + oxygen → carbon dioxide + water + heat

1. What are the reactants in the given equation?

   a. carbon dioxide and oxygen
   b. carbon dioxide and water
   c. oxygen and water
   d. sucrose and oxygen

2. What are the products in the equation?
   a. carbon dioxide and oxygen
   b. carbon dioxide, water and heat
   c. oxygen and water
   d. sucrose and oxygen

3. What do you refer to the substance that is produced from chemical reactions?
   a. mole
   b. letter
   c. product
   d. reactant

4. What do you refer to the substance that is used up during a chemical reactions?
   a. letter
   b. mole
   c. product
   d. reactant

5. How will the reactants and products be presented in a given chemical equation?
   a. Products are written on the left while reactants are on the right
   b. Products and reactants are both written on the left and the right.
   c. Reactants are written on the left and products are on the right
   d. All the given choices are correct. It depends on the chemical reaction.

In the next activity, you will learn the six types of chemical reactions.

Activity 2. Recognizing the Type of Chemical Reaction

There are many different types of chemical reactions that occur every day, and one method that could help us understand them is to categorize these chemical reactions into a few, general types.

Answer the second activity by strictly following the direction.

Directions: Classify the following unbalanced chemical equations according to the different types of reactions. Use the given code below to classify each reaction.

***Code**:* CR = Combination DR = Decomposition
SRR = Single Replacement DRR = Double Replacement
CoR = Combustion ABR = Acid-Base

1. _____ $O_2 + N_2 \rightarrow NO_2$
2. _____ $HBr + NaOH \rightarrow NaBr + H_2O$
3. _____ $MgI_2 + Mn(SO_3)_2 \rightarrow MgSO_3 + MnI_4$
4. _____ $AgNO_3 + Cu \rightarrow CuNO_3 + Ag$
5. _____ $CaSO_4 + Mg(OH)_2 \rightarrow Ca(OH)_2 + MgSO_4$
6. _____ $FeBr_3 + Na \rightarrow NaBr + Fe$
7. _____ $Li + F_2 \rightarrow LiF$
8. _____ $KClO_3 \rightarrow KCl + O_2$
9. _____ $H_2O \rightarrow H_2 + O_2$
10. _____ $CaCO_3 \rightarrow CaO + CO_2$

Good job! You are now ready to answer assessment no.2.

Assessment 2

Directions: Write only the letter of your choice. Use a separate sheet of paper for your answers.

1. Which of the following is an example of a combination reaction?
   a. $Li_{(s)} + F_{2(g)} \rightarrow LiF_{(s)}$
   b. $O_{2(g)} + N_{2(g)} \rightarrow NO_2$
   c. $KClO_{3(s)} \rightarrow KCl_{(s)} + O_{2(g)}$
   d. A & B

2. What type of reaction is represented by the following chemical equation?
   $Pb_{(s)} + FeSO_{4(aq)} \rightarrow PbSO_{4(s)} + Fe_{(s)}$
   a. Combination
   b. Decomposition
   c. Single replacement
   d. Double replacement

3. What general equation represents a decomposition reaction?
   a. $A + B \rightarrow AB$
   b. $A + BC \rightarrow AB + C$
   c. $AB \rightarrow A + B$
   d. $AB + CD \rightarrow AD + CB$

4. Which of the following is an example of a double replacement reaction?
   a. $CaSO_{4(aq)} + Mg(OH)_{2(aq)} \rightarrow Ca(OH)_{2(aq)} + MgSO_{4(aq}$
   b. $Cl_{2(g)} + NaBr_{(aq)} \rightarrow NaCl_{(aq)} + Br_{2(g)}$
   c. $FeBr_3 + Na \rightarrow Fe_{(s)} + NaBr$
   d. $Pb_{(s)} + FeSO_{4(aq)} \rightarrow PbSO_{4(s)} + Fe_{(s)}$

5. What common element is needed in order to produce water and carbon dioxide?
   a. carbon
   b. hydrogen
   c. nitrogen
   d. oxygen

How did you find the assessment?

In the next activity, you will see how mass is conserved during a chemical reaction, and how this is explained by the Law of Conservation of Mass.

Activity 3. Reactions on the Go

The law of conservation of mass is a scientific law popularized and systematized by the 18th-century French chemist Antoine Lavoisier.

According to this law**, matter cannot be created nor destroyed— it can only be changed.** This means that for substances undergoing chemical reaction, its total mass before a chemical reaction takes place and after a chemical reaction had occurred are the same.

In balancing chemical reactions, the number of atoms involved before and after the chemical reaction is conserved. Simply, the number of atoms are conserved.

As an example, when the element sodium, $Na_{(s)}$, combines with chlorine gas $(Cl_2)_{(g)}$, it forms sodium chloride, $NaCl_{(s)}$.

The balanced chemical equation for this reaction is:

$2\ Na_{(s)} + Cl_{2(g)} \rightarrow 2NaCl_{(s)}$

	Reactant side	Element	Product side	
2	1	Na	1	2
2	2	Cl	1	2

The balanced equation shows that the total number of atoms in the reactants is equal to the total number of atoms in the products.

Directions: **A**. Identify the reactants and products of the reaction. Check the Equation if the number of atoms on both sides are the same. Use a separate sheet of paper for your answers.

1. When aqueous sodium bromide reacts with chlorine gas, it produces sodium chloride and bromine gas.

$$Cl_{2(g)} + 2NaBr_{(aq)} \rightarrow 2NaCl_{(aq)} + Br_{2(g)}$$

a) What are the reactants in the equation above?

_____

b) What are the products?

_____

c) Check the equation if it conforms with the Law of Conservation of Mass.

	Reactant side	Element	Product side	

d) Is the reaction balanced? Explain.

_____

e) What is conservation of mass? How does it relate to this exercise?

_____

B. Balance the following chemical equations. Use a separate sheet of paper.

1. $NO_{2(g)} \rightarrow O_{2(g)} + N_{2(g)}$
2. $Pb_{(s)} + FeSO_{4(aq)} \rightarrow PbSO_{4(s)} + Fe_{(s)}$
3. $CaCO_{3(s)} \rightarrow CaO_{(s)} + CO_{2(g)}$
4. $MgI_{2(aq)} + Mn(SO_3)_{2(s)} \rightarrow MgSO_{3(s)} + MnI_{4(aq)}$
5. $AgNO_{3(aq)} + Cu_{(s)} \rightarrow Cu(NO_3)_{2\,(aq)} + Ag_{(s)}$

You did well! It is now time to answer assessment number 3. Do your best!

In this lesson, you are going to explain how to balance a chemical equation by using a real-life example, the chemical equation that occurs when iron rusts.

$$Fe + O_2 \rightarrow Fe_2O_3$$

Steps in Balancing Equation

1. *Identify the products and reactants*

   Remember, reactants are written on the left side of your equation while the products are on the right.

   For this equation, reactants are the metal iron, Fe, and oxygen gas, O_2, and the-product is Iron (III) oxide, Fe_2O_3.

2. *Write the number of atoms.*

   Next, you need to determine how many atoms of each element are present on each side of the equation. You can do this by looking at the subscripts or the coefficients.

   $$Fe + O_2 \rightarrow Fe_2O_3$$

	Reactant side	Element	Product side	
	1	Fe	2	
	2	O	3	

3. *Add coefficients.*

   A coefficient **is a whole number multiplier and** they are used to balance chemical equations. They show how many atoms or molecules of a substance are involved in a reaction. To balance a chemical equation, write appropriate coefficients to make sure that the number of atoms on both sides of the arrow are the same. Use the simplest whole number ratio.

In the equation below, a coefficient 2 is placed before Fe_2O_3 that makes 4 atoms of Fe atom and 6 atoms of O. In the reactant side, a coefficient 4 is placed before Fe atom and coefficient 3 is placed before O atoms that makes 4 atoms of Fe and 6 atoms of O.

$$\underline{4}\ Fe + \underline{3}\ O_2 \rightarrow \underline{2}Fe_2O_3$$

	Reactant side	Element	Product side	
4	~~1~~	Fe	~~2~~	4
6	~~2~~	O	~~3~~	6

4. *Apply the Law of Conservation of Mass* to get the same number of atoms of every element on each side of the equation. The equation is now balanced. They have the same number of atoms on both sides.

Do your best in answering assessment 3

Assessment 3

Direction: Read each item carefully. Write only the letter of the correct answer for each question. Use a separate sheet for your answers.

1. In a chemical reaction, what is the relationship between the total mass of the reactants and the total mass of the products?

   a. The mass of the products must be greater.
   b. The mass of the reactants must be greater.
   c. They must be equal.
   d. There is no general relationship between the two.

2. In balancing a chemical equation, which of the following are you allowed to do?

   a. add new substance
   b. change subscripts
   c. change superscripts
   d. write coefficient

3. Which of the following equations **does not** demonstrate the law of conservation of mass?

   a. $2Na + Cl_2 \rightarrow 2NaCl$
   b. $SnCl + 2FeCl_3 \rightarrow 2FeCl_2 + SnCl_4$
   c. $NaOH + HCl \rightarrow NaCl + H_2O$
   d. $Zn + 2HCl \rightarrow ZnCl_2 + H_2$

4. The reaction between sodium atom and chlorine gas forming table salt can be expressed in this equation, $Na_{(s)} + Cl_{2(g)} \rightarrow NaCl_{(s)}$. To balance the equation, what are the coefficients needed in the given order for sodium, chlorine and table salt?

   a. 0, 2, 2 b. 2, 0, 2 c. 2, 1, 2 d. 2, 2, 2

5. To balance the equation $NO_2 \rightarrow N_2 + O_2$, what are the coefficients needed in the given order for nitrogen and oxygen?

   a. 0, 2, 2 b. 2, 0, 2 c. 2, 1, 2 d. 2, 2, 2

Congratulations! You have made it!

What I Have Learned

Let us summarize what you have learned from the lessons and activities by choosing the correct word inside the parenthesis. Write you answer on a separate sheet of paper.

1 – 2. Matter is characterized by its properties which undergo changes. Such changes which do not produces any new substances after the reaction are called (*chemical changes, physical changes*). The changes which bring out the formation of new substances are referred as (*chemical changes, physical changes*).

3. The formation of bubbles is one of the evidences that a (*chemical equation, reaction*) has occurred.

4 – 6. A (*chemical equation, chemical formula*) communicates the mass relationships between reactants and products in a reaction. (Reactants, products.) are substances that are used to form new substances in a chemical reaction, while (reactants, products) are substances that are formed during the reaction process.

7. A/n (*arrow, plus sign*) points from the reactants to the products.

8-9 (*Combination, Combustion*) is a reaction when two or more elements combine to form a single product, whereas, (*combination, decomposition*) is the breaking down of substances into simpler ones with its equation,

$AB \rightarrow A + B$.

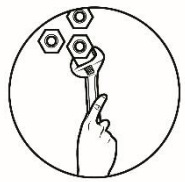
10–11. The (*single displacement, double displacement*) results in one element taking the place of another, while (*single displacement, double displacement*) is a reaction in which ions get exchanged between reactants which form a new compound.

12. A (*combination, combustion*) reaction is the combination of an element with oxygen to form an oxide.

13. According to the Law of (*Conservation of Mass, Definite Proportion*), matter cannot be created nor destroyed.

14. It is a number showing how many atoms or molecules of a given element of compound is involved in a chemical equation (*coefficient, subscript*).

15. To balance the chemical equation $2H_2 + O_2 \rightarrow H_2O$, water needs a coefficient of (2, 3).



What I Can Do

For sure you are now acquainted with chemical reactions. It is your turn to give your takeaways about chemical reaction.

On a piece of clean coupon bond, make a spider diagram showing different everyday chemical reactions.

Standards Rubric

You will be rated by your teacher according to the following criteria:

Originality and Creativity	5 points
Accuracy of Details and Information	5 points
Neatness of Work	5 points
TOTAL	**15 points**

Assessment

Directions: Read carefully each item. Write only the letter of the correct answer for each question. Use a separate sheet of paper for your answers.

1. What happens when some of the mass of a substance formed bubbles during a chemical reaction?
   a. absorbed into each other
   b. escapes as a gas
   c. nothing
   d. stays the same

2. Which given set is correct when incorporating symbols in presenting chemical equations?
   a. (aq), dissolved in water
   b. (g), grams
   c. (L), liter
   d. (t), temperature

3. What reactant is needed in the combustion reactions producing water and carbon dioxide?
   a. carbon
   b. hydrogen
   c. nitrogen
   d. oxygen

4. How many atoms of hydrogen (H), sulfur (S), and oxygen (O) are there in sulfuric acid (H_2SO_4)?
   a. H-1, S-2, O-8
   b. H-2, S-1, O-4
   c. H-2, S-4, O-4
   d. H-6, S-4, O-

5. Which statement explains the Law of Conservation of Matter?
   a. In a chemical reaction, matter can only be created.
   b. In a chemical reaction, matter can only be destroyed.
   c. Matter can neither be created nor destroyed in a chemical reaction.
   d. Matter can either be created or destroyed in a chemical reaction.

6. In the given chemical reaction, what will be the correct count for the atoms of the reactants?

   $CH_{4(g)} + 2O_{2(g)} \rightarrow CO_{2(g)} + 2H_2O_{(l)}$,

   a. 1 carbon atom, 4 hydrogen atoms, and 2 oxygen atoms
   b. 1 carbon atom, 4 hydrogen atoms, and 4 oxygen atoms
   c. 4 carbon atoms, 4 hydrogen atoms, and 2 oxygen atoms
   d. 4 carbon atoms, 4 hydrogen atoms, and 4 oxygen atoms

7. What will be the products when the given reaction is balanced?

$C_3H_{8(g)} + 5O_{2(g)}$,?

a. $2CO_{2(g)} + 3H_2O_{(l)}$
b. $3CO_{(g)} + 4H_2O_{(l)}$
c. $3CO_{2(g)} + 4H_2O_{(l)}$
d. $4CO_{2(g)} + 3H_2O_{(l)}$

8. A given chemical equation provides the necessary information on what is happening during chemical reaction. What does an arrow symbol pointing downward (↓) mean if this is seen in the equation?
   a. A gas was produced.
   b. A precipitate was formed.
   c. The container became hot.
   d. The substance was dissolved in water.

9. How will the reaction be written when solid phosphorus is combined with oxygen gas to form diphosphorus pentoxide?
   a. $P_{(s)} + O_{2\ (g)} \rightarrow PO_{2(g)}$
   b. $P_{(s)} + O_{(g)} \rightarrow P_2O_{5(g)}$
   c. $P_{(s)} + O_{2\ (g)} \rightarrow P_2O_{5(g)}$
   d. $P_2O_5 \rightarrow P_{2\ (s)} + O_{2(g)}$

10. A chemical reaction is possible when two or more substances interact under favorable conditions. Which of the following is observed when baking soda is added to vinegar?
    a. change in temperature.
    b. formation of a gas.
    c. change in color.
    d. Both A and B

11. According to the Law of Conservation of Mass, what is the total mass of the reacting substances?
    a. always equal to the total mass of the products.
    b. always less than the total mass of the products.
    c. always more than the total mass of the products.
    d. sometimes more and sometimes less than the total mass of the products.

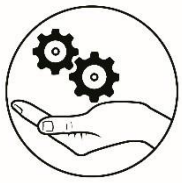
12. In a chemical equation, the symbol that takes the place of the words “reacts with” is?
    a. arrow
    b. coefficient
    c. equal sign
    d. plus sign

13. A student mixes two solutions, planning to produce carbon dioxide. Which of the following is the **best** evidence that a chemical reaction is producing carbon dioxide?
    a. color change
    b. formation of bubbles
    c. formation of a solid
    d. temperature change

14. Which of the following demonstrates that a new substance can be formed from a chemical reaction?
    a. helium-filled balloon floating
    b. iron bending
    c. milk souring
    d. water evaporating

15. Which of the following is the **best** evidence that rusting is a chemical property rather than a physical property of iron?
    a. Rust can form on any iron.
    b. Rust cannot turn back into iron.
    c. Rust does not look the same as iron.
    d. Rust forms slowly.

Congratulations for accomplishing this module! You may now look at the correct answers to all the activities and assessments. The Answer Key is found on page 23.



Additional Activities

Choose one from the following activities to be submitted to your teacher.

1. Make a jingle or song using your favorite tune. Make sure to use the concepts from your lesson on chemical reaction.

2. Create a poem that represent the different types of chemical reaction.

Answer Key

What I Know (Pretest)

1.	D	6. B	11. C
2.	C	7. C	12. B
3.	B	8. A	13. A
4.	A	9. A	14. D
5.	D	10. A	15. C

What's In

1. Chemical change
2. Chemical change
3. Physical change
4. Physical change
5. Chemical change
6. Chemical change
7. Physical change
8. Chemical change
9. Physical change
10. Physical change

What's New

1.a. When baking soda was added to the vinegar, bubbles are formed.
b. A chemical reaction takes place because there is an evolution of gas

Enrichment Activity 1

a. baking soda and vinegar
b. Answers may vary.
The reactants are used to make the products.
c. sodium acetate and carbonic acid

Assessment 1

1. D 2. B 3. C 4. D 5. C

Assessment 2

1.	D	4. A
2.	C	5. D
3.	C	

Enrichment Activity 2

1. CR
2. SRR
3. DRR
4. SRR
5. DRR
6. SRR
7. CR
8. DR
9. DR
10. DR

What I Have Learned

1. Physical change
2. Chemical change
3. Chemical reaction
4. Chemical equation
5. Reactants
6. Products
7. Arrow
8. Combination

Assessment (Posttest)

1.	B	6. B	11. A
2.	A	7. C	12. D
3.	A	8. B	13. B
4.	C	9. C	14. C
5.	C	10. D	15. B

Enrichment Activity 3

A.

1. a. Chlorine (Cl_2) and Sodium bromide (NaBr)

   b. Sodium chloride (NaCl) and Bromine(Br_2)

   c.

Kind of Atom	No. on the Left side	No. on the Right side
Cl	2 x 1 = 2	2 x 1 = 2
Na	2 x 1 = 2	2 x 1 = 2
Br	2 x 1 = 2	2

   d. Yes, because they have the same number of atoms on both reactants and products side.

   e. Conservation of mass says the total mass of the reactants must equal the total mass of the products.

   As long as the carbon dioxide was not allowed to escape, the change in mass that occurred during the reaction should be zero.

Assessment 3

1.	C	4. B
2.	D	5. B
3.	B	

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