W1	Learning Area	SCIENCE	Grade Level	10
	Quarter	FOURTH	Date	

I. LESSON TITLE	BEHAVIOR OF GASES
II. MOST ESSENTIAL LEARNING COMPETENCIES (MELCs)	Investigate the relationship between: - volume and pressure at a constant temperature of a gas
III. CONTENT/CORE CONTENT	Boyle's Law and Applications

IV. LEARNING PHASES AND LEARNING ACTIVITIES

I. Introduction (Time Frame: 1 day)

Gas is a state of matter that seems to be hard to understand because their physical characteristics are not readily seen. However, when we vary their temperature and pressure, their behavior can easily be predicted.

General Properties of Gas

Gas has no definite shape and volume. Their volume is the volume of their container because they occupy all spaces available in their container. They are compressible when pressure is exerted and they also exert pressure. Gases expand when heated and contract when cooled. The intermolecular force of attraction between their particles is negligible, thus, they diffuse easily.

Measurable Properties of Gas

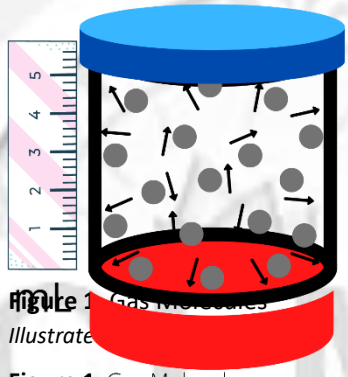


Figure 1. Gas Molecules
Illustrated by: Rax Chavez

Volume

The volume of a gas is equal to the volume of its container. This is because the gas occupies all spaces available in its vessel. The common units of volume used in gas measurements are liter (L), milliliter (mL), cubic meter (m3) and cubic centimeter (cm3).

Pressure

The pressure of a gas is the force exerted by the gas molecules on the walls of its container divided by the surface area of the container. The Earth's atmosphere exerts pressure on us at 1.013 x10^5 N/m^2 or 1 atm (atmosphere). Atmospheric pressure decreases as altitude increases. The common units of pressure and their equivalent are as follow:

1 atm = 1.013 x10^5 N/m^2 = 1.013 x10^5 Pa
1 atm = 760 torr = 760 mmHg
1 atm = 14.696 psi

Temperature

The temperature of a gas is the average kinetic energy of the particles of gas. It is usually determined using a thermometer. It is usually expressed in degree Celsius (°C), degree Fahrenheit (°F) and Kelvin (K). However, only Kelvin is used in computations involving temperature of gas. The following are the useful formulas in converting units of temperature:

°C = (°F -32) / 1.8 °F = 1.8°C + 32 K = °C + 273

Standard Conditions of a Gas

The standard condition for a gas is also known as STP or the Standard Temperature and Pressure. The standard temperature is the melting of an ice which is 0°C or 273K. The standard pressure is the average pressure of the atmosphere at sea level which is equal to 1 atm. One mole of gas occupies a volume of 22.4 L.

D. Development (Time Frame: 1 day)

We can further understand the behavior of gases by understanding some relationships among the mentioned properties.

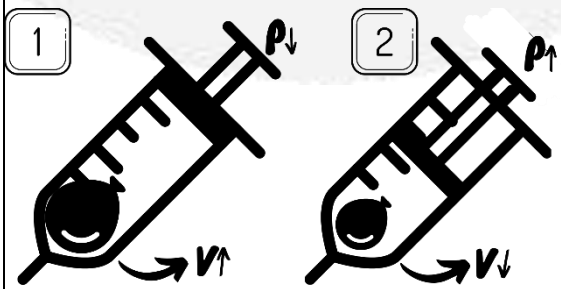


Figure 2. Volume-Pressure Relationship
Illustrated by: Rax Chavez

If you have a big syringe and a balloon at home, you may try this activity. Refer to the figure below. Inflate a balloon so it will fit inside the syringe. Place the balloon inside the syringe and push and pull the plunger. Remember that you need to cover or hold onto the hole at the other end of the syringe. Can you observe what happens to the balloon?

You will observe that as you push the plunger down, the size of the balloon gets smaller and when you pull the plunger, the size of the balloon gets back to normal. This only shows the inverse relationship between the volume and the pressure of a gas in an enclosed container. As you push the plunger, you increase the pressure, and the volume of the gas inside the balloon decreases. When you pull the plunger, you decrease the pressure, and so the volume of the gas inside the balloon increases.

IV. LEARNING PHASES AND LEARNING ACTIVITIES

Boyle's Law

$$V \alpha \frac{k}{P}$$

V = volume
P = pressure
k = temperature

Therefore,

$$VP = k$$

If a gas is brought into 2 different conditions, the product of volume and pressure is constant.

$$V_1P_1 = V_2P_2$$

V_1 = initial volume
V_2 = final volume
P_1 = initial pressure
P_2 = final pressure

Sample Problem 1.

Two liters of gas is confined in a container under a pressure of 760 mm Hg. What would be the new volume if the pressure is increased to 1,520 mm Hg?

$$V_1P_1 = V_2P_2$$

$$(2\ L)(760\ mm\ Hg) = (V_2)(1{,}520\ mm\ Hg)$$

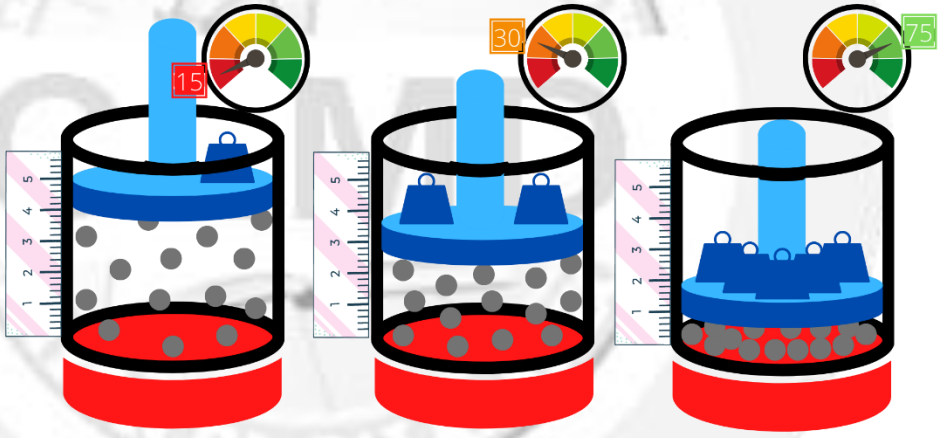
$$V_2 = \frac{(2\ L)(760\ \cancel{mm\ Hg})}{1{,}520\ \cancel{mm\ Hg}}$$

$$V_2 = \mathbf{1\ L}$$

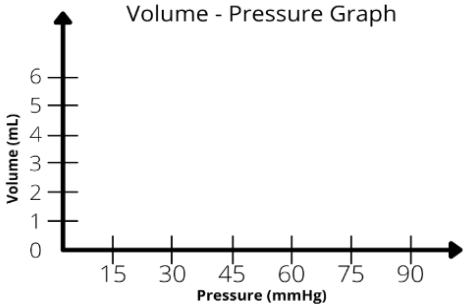
Learning Task 1. Graphing

Directions: Study the figures below. Plot the volume, pressure and temperature on each of the graphs. Connect the plotted points and interpret the relationship of the variables.

A. Volume and Pressure at Constant Temperature



Illustrated by: Rachael Chavez



Interpretation:

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_____

_____

E. Engagement (Time Frame: 1 day)

Learning Task 2. Boyle's Law Model

Objective: Create your own model for Boyle's Law.
Materials: 2 pieces balloon, 1 plastic bottle, scissors
Procedure:

1. Cut off the bottom portion of the bottle.
2. Take one balloon. Cut off its narrow end or its opening. The part left should look like a shower cap.
3. Stretch this part of the balloon to cover the bottom part of your bottle. This will serve as the membrane.
4. Take the other balloon. Fold the opening of this balloon around the rim of the bottle to hang it upside down.
5. Now that your model is ready, slightly pull the balloon membrane of the bottle and observe what happens to the balloon hanging in the rim.
6. Let go of the membrane and observe again.

Observations: _____

_____

IV. LEARNING PHASES AND LEARNING ACTIVITIES

Model:

Figure A. Pulling the balloon membrane.
Photo by: Rax Chavez

Figure B. Letting go of the balloon membrane.

A. Assimilation (Time Frame: 1 day)

Learning Task 3. Breathe In... Breathe out

Among the relationships of volume, pressure and temperature of gas, which do you think explains why our lungs expand as they fill with air? Prove your answer.

_____

_____

_____

V. ASSESSMENT (Time Frame: 1 day)

(Learning Activity Sheets for Enrichment, Remediation, or Assessment to be given on Weeks 3 and 6)

Problem Solving

Solve the following problems and show your complete solution.

1. An argon gas occupies 56.2 L at 760 torr. If the volume of gas is decreased to ¼ of the original volume, calculate its final pressure.

2. At 0°C and 5 atm, a given sample of gas occupies 75 L. The gas is compressed to a final volume of 30 L at 0°C. What is the final pressure?

VI. REFLECTION (Time Frame: _____)

- Communicate your personal assessment as indicated in the Learner's Assessment Card.

Personal Assessment on Learner's Level of Performance

Using the symbols below, choose one which best describes your experience in working on each given task. Draw it in the column for Level of Performance (LP). Be guided by the descriptions below:

☆ - I was able to do/perform the task without any difficulty. The task helped me in understanding the target content/ lesson.

✓ - I was able to do/perform the task. It was quite challenging, but it still helped me in understanding the target content/lesson.

ʔ – I was not able to do/perform the task. It was extremely difficult. I need additional enrichment activities to be able to do/perform this task.

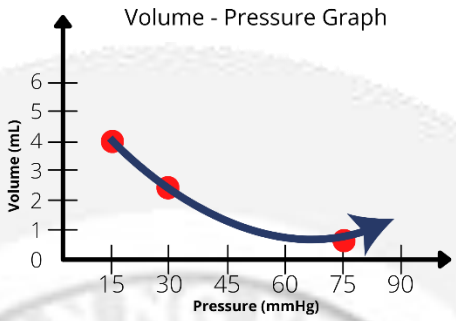
Learning Task	LP	Learning Task	LP	Learning Task	LP	Learning Task	LP
Number 1		Number 3		Number 5		Number 7	
Number 2		Number 4		Number 6		Number 8	

IV. LEARNING PHASES AND LEARNING ACTIVITIES	
VII. REFERENCES	Grade 10 Science Learner's Material pages 351-399

Prepared by:	RACHAEL B. CHAVEZ and MARY GRACE M. MARINDA	**Checked by:**	NICANOR O. REYES II JOCELYN M. MANSET

KEY TO CORRECTION

Learning Task 1.



Interpretation: As pressure increases, volume decreases.

Learning Task 2.

When the balloon membrane is pulled, the balloon at the top of the bottle is inflated. When you let go, the balloon gets back to normal. It's because when the membrane is pulled, the pressure inside the bottle decreases, and the volume increases. Since the pressure outside the bottle is greater than the inside, the air gets inside the balloon at the top to even the pressure inside and out.

Learning Task 3.

As one inhales the diaphragm muscles contract, causing the thoracic cavity to expand. The expansion increases the volume and results in the decrease of pressure.

W2	Learning Area	SCIENCE	Grade Level	10
	Quarter	FOURTH	Date	

I. LESSON TITLE	BEHAVIOR OF GASES
II. MOST ESSENTIAL LEARNING COMPETENCIES (MELCs)	Investigate the relationship between: - volume and temperature at a constant pressure of a gas - explains these relationships using the kinetic molecular theory
III. CONTENT/CORE CONTENT	Charles' Law and Applications

IV. LEARNING PHASES AND LEARNING ACTIVITIES

I. Introduction (Time Frame: 1 day)

Kinetic Molecular Theory

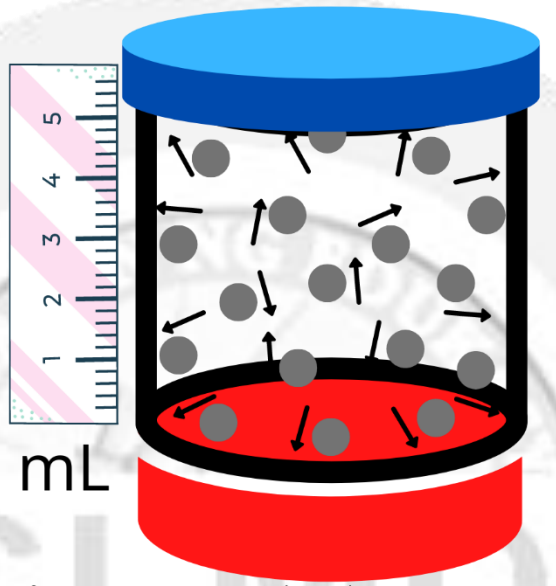


Figure 1. Gas Molecules
Illustrated by: Rax Chavez

The behavior of gases is determined by the behavior of its individual particles. To explain behavioral properties of gases, The Kinetic Molecular Theory was formulated. According to this theory, gas has the following characteristics:

1. Gas is made up of particles that continuously move in random and straight-line motion.
2. The spaces between these particles are so wide that the force of attraction is negligible, thus, they diffuse easily and mix readily with other gases.
3. The collision of particles to each other and to the walls of its container is perfectly elastic. This means that they don't lose or gain energy as they collide.
4. The average kinetic energy of a gas is directly proportional to its absolute temperature. This means that when the temperature is high, particles of gas are rapidly moving or colliding to each other.

Learning Task 1. Why? Oh Why?

Identify the part of the Kinetic Molecular Theory that explains the following observations:

1. You smell the food being cooked by your mother.
2. Party balloons burst when exposed to sunlight.
3. LPG tanks should be stored in cool areas.

D. Development (Time Frame: 1 day)

The volume of a gas is also affected by its temperature. Try to do another experiment. Place an inflated balloon inside a wide-mouthed container half-filled with a boiling water. Cover the container and observe what happens to the balloon. Refer to the figure below.

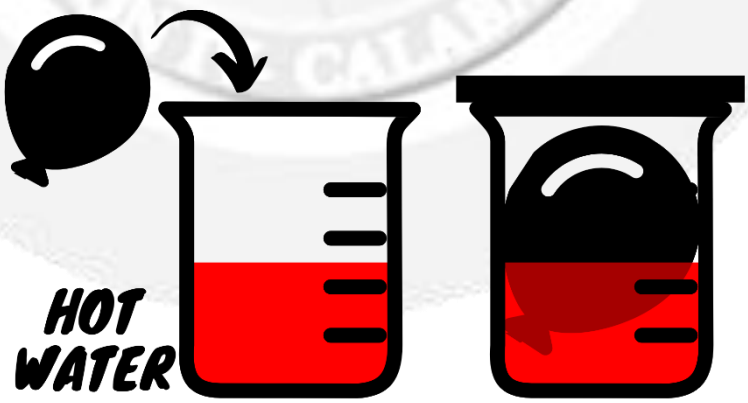


Figure 3. Volume-Temperature Relationship
Illustrated by: Rax Chavez

You will observe that after placing the inflated balloon in a container with very hot water, the balloon will expand or increase in volume. Removing the balloon from this container will bring back the balloon to its original size. You may also observe the balloon after placing it inside a freezer. You will see that it decreases in volume. This only shows that gas expands at high temperature.

This relationship between the volume of a gas and its temperature was discovered by Jacques Charles in 1787. He discovered that keeping the pressure constant, the volume of a gas varies on changing its temperature. This became known as Charles' Law.

Charles' Law states that at constant pressure the volume of a confined gas is directly proportional to its absolute temperature. This only means that the volume of a gas increases as its temperature increases. This is the explanation behind the hot air balloons and flat tires during summer.

IV. LEARNING PHASES AND LEARNING ACTIVITIES

Charles' Law

$V \alpha Tk$

V = volume
T = temperature
k = pressure

Therefore,

$$\frac{V}{T} = k$$

If a gas is brought into 2 different conditions, the quotient of volume and temperature is constant.

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

V_1 = initial volume
V_2 = final volume
T_1 = initial temperature
T_2 = final temperature

Sample Problem 2.

A sample of gas occupies a 500 mL container at 0°C. What would be the temperature of this gas if its particles are compressed about half of the container?

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{(500\ mL)}{(0°C + 273)} = \frac{(500\ mL / 2)}{(T_2)}$$

$$T_2 = \frac{(250\ \cancel{mL})\ (273\ K)}{500\ \cancel{mL}}$$

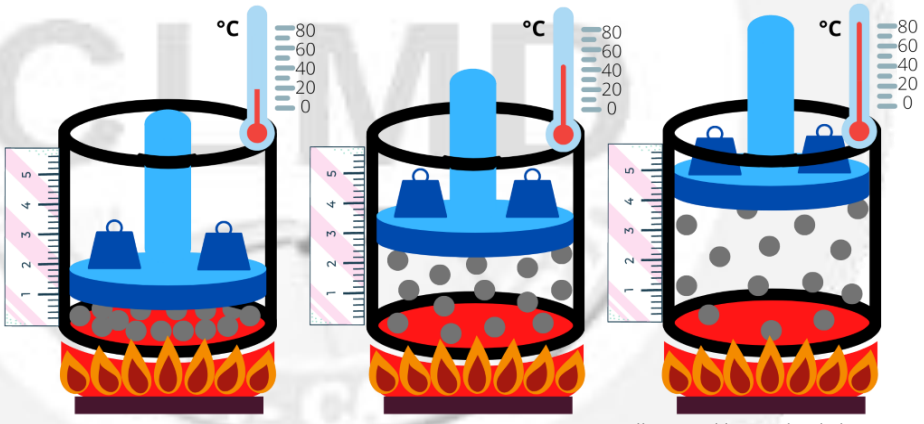
$$= 136.5\ K - 273$$

$$T_2 = \mathbf{-136.5°C}$$

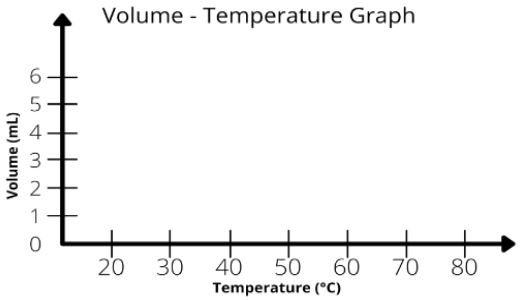
Learning Task 2. Graphing

Directions: Study the figures below. Plot the volume, pressure and temperature on each of the graphs. Connect the plotted points and interpret the relationship of the variables.

A. Volume and Temperature at Constant Pressure



Illustrated by: Rachael Chavez



Interpretation:

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_____

E. Engagement (Time Frame: 1 day)

Learning Task 3. An Open Letter

Write an open letter addressed to all cigarette smokers, factory and smoke-belching vehicle owners informing them about their contributions to air pollution. Discuss the effects they give to other people and to our environment. The letter must be persuasive and must make them realize how their activities contribute to climate change. Use a separate sheet of paper.

A. Assimilation (Time Frame: 1 day)

Learning Task 4.

When do tires become flat more often, during warm weather or cold weather? Explain and prove your answer.

_____
_____
_____
_____

IV. LEARNING PHASES AND LEARNING ACTIVITIES

V. ASSESSMENT (Time Frame: 1 day)

(Learning Activity Sheets for Enrichment, Remediation, or Assessment to be given on Weeks 3 and 6)

Problem Solving

Solve the following problems and show your complete solution.

1. Under constant pressure condition, a sample of hydrogen gas initially at 85°C and 7.2 L is cooled until its final volume is 4.1 L. What is the final temperature?

2. Determine the change in volume if 60 ml of gas at 33 °C is cooled to 15°C.

VI. REFLECTION (Time Frame: 1 day)

- Communicate your personal assessment as indicated in the Learner's Assessment Card.

Personal Assessment on Learner's Level of Performance

Using the symbols below, choose one which best describes your experience in working on each given task. Draw it in the column for Level of Performance (LP). Be guided by the descriptions below:

☆ - I was able to do/perform the task without any difficulty. The task helped me in understanding the target content/ lesson.

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VII. REFERENCES Grade 10 Science Learner's Material pages 351-399

Prepared by:	RACHAEL B. CHAVEZ and MARY GRACE M. MARINDA	Checked by:	NICANOR O. REYES II JOCELYN M. MANSET

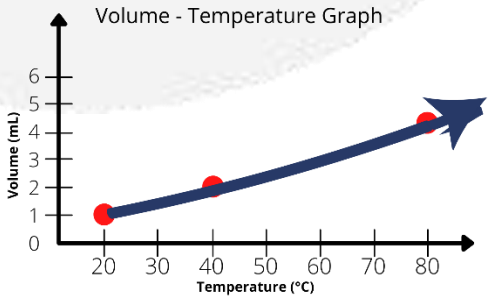
KEY TO CORRECTION

Learning Task 1. *(Answers may vary as long as the following concept of Kinetic Molecular Theory is there.)*

1. The spaces between these particles are so wide that the force of attraction is negligible, thus, they diffuse easily and mix readily with other gases.

2 and 3. The average kinetic energy of a gas is directly proportional to its absolute temperature. This means that when the temperature is high, particles of gas are rapidly moving or colliding to each other.

Learning Task 2.



Interpretation: As temperature increases, volume increases.

Learning Task 3. *(Answers may vary)*

Learning Task 4. *(Answers may vary)*

W3	Learning Area	SCIENCE	Grade Level	10
	Quarter	FOURTH	Date	

I. LESSON TITLE	BIOMOLECULES
II. MOST ESSENTIAL LEARNING COMPETENCIES (MELCs)	Recognize the major categories of biomolecules such as carbohydrates, lipids, proteins, and nucleic acids
III. CONTENT/CORE CONTENT	Carbohydrates, Proteins, Lipids, Nucleic Acid

IV. LEARNING PHASES AND LEARNING ACTIVITIES

I. Introduction (Time Frame: 1 day)

There are carbon-containing compounds which are essentials to life. These compounds are called biomolecules. These biomolecules are the following: carbohydrates, lipids, proteins, and nucleic acids. Carbohydrates and lipids are generally made up of carbon, hydrogen and oxygen. Proteins and nucleic acids and some derivatives of carbohydrates and lipids also contain nitrogen.

To motivate and check if you still remember your discussion about biomolecules in grade 9, try to answer this short quiz.

Direction: Analyze each question carefully then choose the letter of the correct answer.

1. Which of the following is NOT a major source of protein?
   A. fish B. egg C. milk D. vegetable

2. Which of the following contains the most lipids?
   A. Banana B. champorado C. olive oil D. cheese

3. Which of the following is a correct pair?
   A. glucose: disaccharide
   B. sucrose: monosaccharide
   C. starch: polysaccharide
   D. triglyceride: polysaccharide

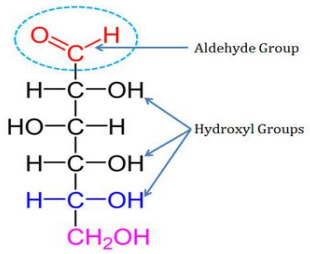
4. Which is a correct pair of an example of protein and its function?
   A. enzymes: speed up reactions in the body and eventually used up in the process.
   B. collagen: provides strength and flexibility to connective tissues.
   C. actin and myosin: supplies amino acids to baby mammals
   D. hemoglobin: helps regulate blood sugar levels

5. Which of the biomolecules contain other elements aside from carbon, hydrogen, and oxygen?
   A. carbohydrates, lipids
   B. proteins, lipids
   C. nucleic acids, proteins
   D. nucleic acids, lipids

D. Development (Time Frame: 1 day)

A. CARBOHYDRATES

They are molecules made from aldehydes and ketones containing numerous hydroxyl groups. All carbohydrates contain carbon, hydrogen, and oxygen. The general empirical structure for carbohydrates is $(CH_2O)_n$. They are the most abundant organic molecules in nature and also referred to as "saccharides". The carbohydrates which are soluble in water and sweet in taste are called as "sugars".



Structural Formula
https://en.wikipedia.org/wiki/Talk:Carbohydrate

Functions

Living organisms use carbohydrates as accessible energy to fuel cellular reactions. They are the most abundant dietary source of energy (4kcal/gram) for all living beings. Here are other functions of carbohydrates.

- Carbohydrates along with being the chief energy source, in many animals, are instant sources of energy. Glucose is broken down by glycolysis/ Kreb's cycle to yield ATP.
- Serve as energy stores, fuels, and metabolic intermediates. It is stored as glycogen in animals and starch in plants.
- Stored carbohydrates act as an energy source instead of proteins.
- Carbohydrates are intermediates in the biosynthesis of fats and proteins.
- Carbohydrates aid in the regulation of nerve tissue and the energy source for the brain.
- In animals, they are an important constituent of connective tissues.
- Carbohydrates that are rich in fiber content help to prevent constipation

Carbohydrates may be classified into the following: monosaccharides, disaccharides and polysaccharides.

IV. LEARNING PHASES AND LEARNING ACTIVITIES

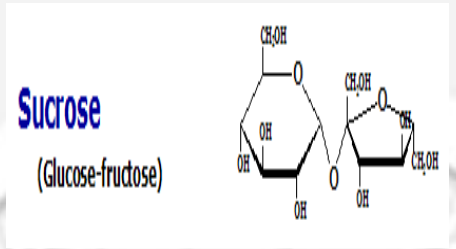
Monosaccharides

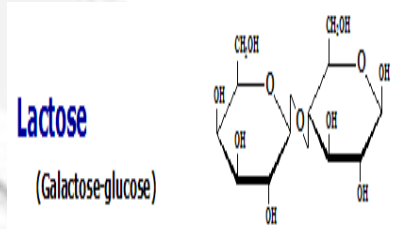
From the prefix "mono" which means one, monosaccharide is the simplest sugar and the basic subunit of a carbohydrate. These compounds are white solids at room temperature. Because they have polar, hydroxyl (-OH) groups in their molecular structures, they are very soluble in water. The most common monosaccharides are **glucose** (also called dextrose), fructose or fruit sugar and galactose (sugar in milk).

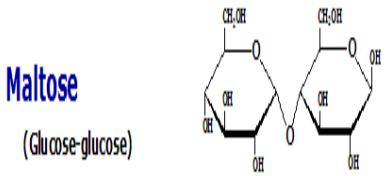
Disaccharides

Disaccharides consist of two monosaccharides that are chemically combined. The sugar we use to sweeten coffee is a disaccharide. It is also called sucrose or table sugar. When two glucose molecules are combined, maltose is formed. Another important disaccharide is Lactose or milk sugar. Lactose is made up of a sugar called galactose and glucose. **Maltose** (or malt sugar) is an intermediate in the intestinal digestion (i.e., hydrolysis) of glycogen and starch, and is found in germinating grains (and other plants and vegetables)

Structural Formula







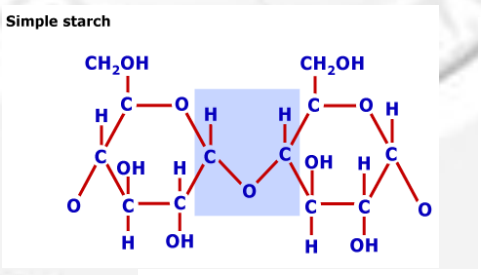
https://byjus.com/chemistry/disaccharides

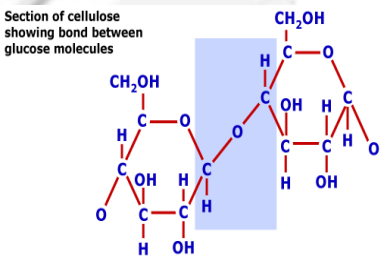
Polysaccharides

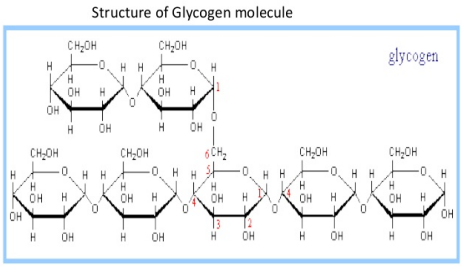
Polysaccharides are polymers containing numerous monosaccharide monomers. There are three common polysaccharides—starch, glycogen, and cellulose. Starch is the chief storage form of carbohydrates in plants and the most important source of carbohydrate in human nutrition. *Starch* is made up of two types of polysaccharides: amylose, which is a coiled or helical structure, and amylopectin, which is branched. Plants make starch. *Glycogen* is a polysaccharide that is similar to starch because it is also composed of alpha glucose units. It differs from starch since glycogen shows a higher degree of branching and is a polysaccharide that is made by animals. **Glycogen** is the major carbohydrate storage form in animals, and corresponds to **starch** in plants. It occurs mainly in **liver** (up to 6-8% wet weight), and **muscle** (where it rarely exceeds 1% of wet weight). The glucose molecules in *cellulose* chains are arranged in such a way that hydrogen bonds link hydroxyl groups of adjacent glucose molecules to form insoluble fibrous sheets. These sheets of cellulose are the basic components of plants.

Polysaccharides

Structural Formula





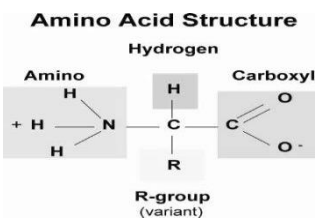


https://courses.ecampus.oregonstate.edu/ans312/one/carbs_story.htm

https://www.toppr.com/ask/question/explain-the-structure-of-glycogen/

B. PROTEIN

Proteins are polymers of amino acids. They have many functions in the body. One of which is found as structural materials in hair, nails and connective tissues. Proteins are made up of the elements carbon, hydrogen, oxygen, nitrogen and sulfur. Enzymes are proteins that act as biological catalysts. Egg white, fish, meat, and cheese are foods rich in proteins. They are the second most common molecules found in the human body (after water) and make up about 10% to 20% of the mass of a cell. *Amino acids* are the building blocks of proteins. Of the 20 amino acids found in human protein, only 11 can be synthesized by the body and 9 have to be supplied by the foods we eat. These 9 amino acids are also called essential amino acids.



Adults only need to obtain eight of them: valine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine and tryptophan. The ninth amino acid - histidine - is only essential for infants. Your body doesn't store amino acids, so it needs a regular daily supply of these essential building blocks. Non essential is a slightly misleading label because these amino acids actually fill essential roles, but since they're synthesized by your body, they're not an essential part of your diet. Of the 11 nonessential amino acids, eight are called conditional amino acids.

IV. LEARNING PHASES AND LEARNING ACTIVITIES

E. Engagement (Time Frame: 1 day)

Learning Task 1. Test for Carbohydrates

We can detect the presence of carbohydrates in food samples based on color reactions after adding a certain chemical. Iodine solution or tincture of iodine and Benedict's solution are used to food samples to test the presence of carbohydrates. Lugol's iodine solution or tincture of iodine changes from yellow to blue or black in the presence of starch. If the substance that you test contains sugar, Benedict's solution will change color. Positive Test: Benedict's solution changes from blue to green (very small amount of reducing sugar), to yellow (higher amount of reducing sugar) to orange or brick red (highest amount of reducing sugar). The change in color is due to the formation of the brick red precipitate, Cu_2O.

Procedure:

1. This activity will be using given data as assumed results from the activity.
2. The tables below contain food samples that after a certain chemical was added into it, the color of each sample changed (color reaction).
3. Given the color reaction of each food sample, decide whether the sample tested positive (+) or negative (-).
4. Take note of the given positive color reaction for a specific test. Use this as your reference.
5. Use a separate paper to copy the tables below and write your answer.

TABLE A. Iodine Test for Starch (positive - color blue or black)

Food Sample	Color of the sample after adding Lugol's Iodine Solution	Iodine Test for Starch If positive, **write +** If negative, **write -**
Food sample 1	blue	
Food sample 2	blue	
Food sample 3	yellowish	
Food sample 4	blue - black	
Food sample 5	Dark yellow	

TABLE B. Benedict's Test for Reducing Sugar (positive - green - yellow - brick red)

Food Sample	Color of the sample after adding Benedict's Solution and putting it in a water bath.	Benedict's Test for Reducing Sugar If positive, **write +** If negative, **write -**
Food sample 1	blue	
Food sample 2	orange	
Food sample 3	yellow - orange	
Food sample 4	dark red	
Food sample 5	green	

Based on the data table, answer the following questions:

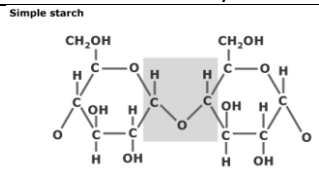
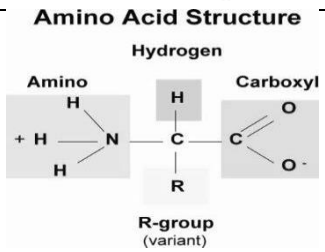
1. Based on the results in the test for starch (carbohydrates), which food samples tested positive?

2. Based on the results in the test for Reducing Sugar (carbohydrates), which food sample tested negative?

A. Assimilation (Time Frame: 1 day)

Learning Task 2. Let's Categorize!

On a separate sheet of paper, given the structural formula, complete the table by providing the needed information regarding the different biomolecules.

Biomolecule	Building blocks	Classification or Types	Structural Formula / model
			
			

IV. LEARNING PHASES AND LEARNING ACTIVITIES

V. ASSESSMENT (Time Frame: 1 day)

(Learning Activity Sheets for Enrichment, Remediation, or Assessment to be given on Weeks 3 and 6)

Learning Task 3. Write THE LETTER OF YOUR ANSWER on the space before each number.

_____1. Which of the following groups are all classified as polysaccharide?

a. sucrose, glucose and fructose
c. glycogen, sucrose and maltose
b. maltose, lactose and fructose
d. glycogen, cellulose and starch

_____2. Amino acids are the building blocks of which group of biomolecules?

a. Proteins b. carbohydrates c. lipids d. nucleic acid

_____3. Which of the following is the major function of carbohydrates?

1. structural framework 2. storage 3. energy production

a. 1 only b. 2 only c. 3 only d. 1 & 3 only

_____4. In which organs are glycogen stored in the body?

a. liver and spleen
c. liver and bile
b. liver and muscle
d. liver and adipose tissue

_____5. Which of the following bio molecules contain carbon, hydrogen, and oxygen?

a. Proteins b. carbohydrates c. lipids d. nucleic acid

VI. REFLECTION (Time Frame: 1 day)

- Communicate your personal assessment as indicated in the Learner's Assessment Card.

Personal Assessment on Learner's Level of Performance

Using the symbols below, choose one which best describes your experience in working on each given task. Draw it in the column for Level of Performance (LP). Be guided by the descriptions below:

☆ - I was able to do/perform the task without any difficulty. The task helped me in understanding the target content/ lesson.
✓ - I was able to do/perform the task. It was quite challenging, but it still helped me in understanding the target content/lesson.
ʔ – I was not able to do/perform the task. It was extremely difficult. I need additional enrichment activities to be able to do/perform this task.

Learning Task	LP	Learning Task	LP	Learning Task	LP	Learning Task	LP
Number 1		Number 3		Number 5		Number 7	
Number 2		Number 4		Number 6		Number 8	

VII. REFERENCES DepEd G10 Science Learner's Material pages 443 – 474

Prepared by:	HEDWIG PRECIOUS S. GOFREDO	**Checked by:**	NICANOR O. REYES II JOCELYN M. MANSET

W4	Learning Area	SCIENCE	Grade Level	10
	Quarter	FOURTH	Date	

I. LESSON TITLE	BIOMOLECULES
II. MOST ESSENTIAL LEARNING COMPETENCIES (MELCs)	Recognize the major categories of biomolecules such as carbohydrates, lipids, proteins, and nucleic acids
III. CONTENT/CORE CONTENT	Carbohydrates, Proteins, Lipids, Nucleic Acid

IV. LEARNING PHASES AND LEARNING ACTIVITIES

I. Introduction (Time Frame: 1 day)

There are carbon-containing compounds which are essentials to life. These compounds are called biomolecules. These biomolecules are the following: carbohydrates, lipids, proteins, and nucleic acids. Carbohydrates and lipids are generally made up of carbon, hydrogen and oxygen. Proteins and nucleic acids and some derivatives of carbohydrates and lipids also contain nitrogen.

To motivate and check if you still remember your discussion about the two biomolecules: carbohydrates and proteins, try to answer this short quiz.

Direction: Analyze each question carefully then choose the letter of the correct answer.

1. In which organs are glycogen stored in the body?
a. liver and spleen
b. liver and muscle
c. liver and bile
d. liver and adipose tissue

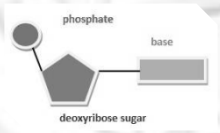
2. Based on the results in the test for starch (carbohydrates), which food samples tested positive?
a. food samples 1, 2, & 4
b. food samples 3 & 5
c. food samples 1 & 2 only
d. all the food samples

3. Which of the following groups are all classified as polysaccharide?
a. sucrose, glucose and fructose
b. maltose, lactose and fructose
c. glycogen, sucrose and maltose
d. glycogen, cellulose and starch

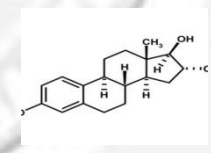
4. Based on the results in the test for Reducing Sugar (carbohydrates), which food sample tested negative?
a. food sample 1
b. food sample 3
c. food sample 2
d. food sample 5

5. Using the illustrations below, identify the biomolecule that represents Carbohydrates.

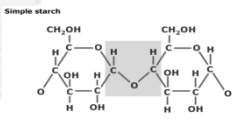
A



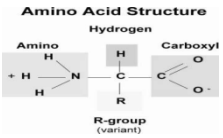
B



C



D



D. Development (Time Frame: 1 day)

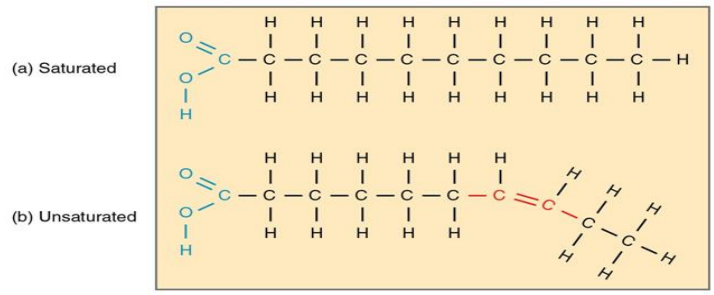
Today, we will continue our discussion on biomolecules. The other two types of biomolecules are Lipids and Nucleic Acid.

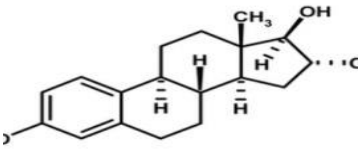
A. LIPIDS

They are water insoluble molecules (hydrophobic or water-fearing) that are composed of carbon, hydrogen and oxygen. Aside from carbohydrates, lipids are another class of biomolecules that have the "job" of storing energy for later use. The most abundant of the lipids are the fats and oils, also called triglycerides. Fats and oils are triglycerides that come from the combinations of glycerol and three fatty acids. Lipids are also found in hormones and cell membrane components. Waxes are lipids that come from the combinations of a long-chain alcohol and a fatty acid. Steroids are another class of lipids whose molecules are composed of fused rings of atoms. The most important steroid is cholesterol.

Lipids are the polymers of fatty acids that contain a long, non-polar hydrocarbon chain with a small polar region containing oxygen. The lipid structure is explained in the diagram below:

IV. LEARNING PHASES AND LEARNING ACTIVITIES

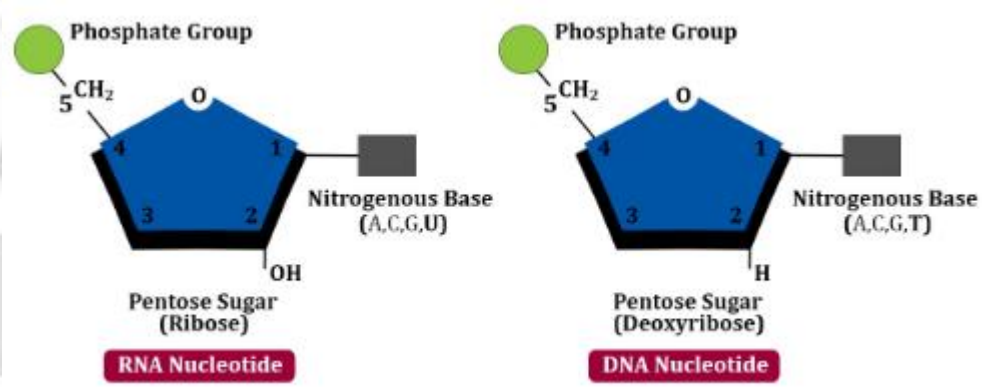




https://byjus.com/biology/lipids/

B. NUCLEIC ACID

Nucleic acids are molecules that code for hereditary traits by controlling the production of protein. Like proteins, nucleic acids are long chains of polymers consisting of simpler units or monomers. There are two kinds of nucleic acids: DNA, or deoxyribonucleic acid; and RNA, or ribonucleic acid. DNA found mainly in the cell nuclei contains the genetic information that codes for the sequences of amino acids in proteins. RNA is found in many places in the cell and carries out the synthesis of proteins. The monomers of nucleic acids are *nucleotides*. They are made up of three parts: a five-carbon sugar (pentose), a phosphate group, and a ring-shaped base containing nitrogen.

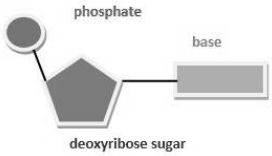
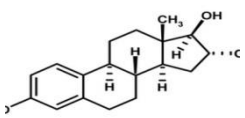


https://mysciencesquad.weebly.com/26-dna--rna-structure.html

E. Engagement (Time Frame: 1 day)

Learning Task 1. Let's Categorize!

On a separate sheet of paper, given the structural formula, complete the table by providing the needed information regarding the different biomolecules.

Biomolecule	Building blocks	Classification or Types	Structural Formula / model
			
			

IV. LEARNING PHASES AND LEARNING ACTIVITIES

Assimilation: (Time Frame 1 day)

Learning Task 2.

A. Calorie is actually a unit of heat energy. However, our body really fuels sees energy in the form of heat. Heat Energy is what really fuels our body in the same way that gasoline fuels your car's energy.

Calories are provided by fats, carbohydrates, and proteins. Fats have the highest concentration of calories. On the average, that is nine calories per gram of pure fat. Proteins and carbohydrates each have four calories per gram of pure protein or pure carbohydrate on the average. So understanding the role of calories in your diet can help you balance your calories in with your calories out and help you achieve weight management goals.

Nutrition Facts

Serving Size 1 cup (228g)
Servings Per Container 2

Amount Per Serving

Calories 260 Calories from Fat 120

	% Daily Value*
Total Fat 13g	**20%**
Saturated Fat 5g	**25%**
Trans Fat 2g	
Cholesterol 30mg	**10%**
Sodium 660mg	**28%**
Total Carbohydrate 31g	**10%**
Dietary Fiber 0g	**0%**
Sugars 5g	
Protein 5g	

Vitamin A 4% • Vitamin C 2%
Calcium 15% • Iron 4%

* Percent Daily Values are based on a 2,000 calorie diet. Your Daily Values may be higher or lower depending on your calorie needs:

	Calories:	2,000	2,500
Total Fat	Less than	65g	80g
Sat Fat	Less than	20g	25g
Cholesterol	Less than	300mg	300mg
Sodium	Less than	2,400mg	2,400mg
Total Carbohydrate		300g	375g
Dietary Fiber		25g	30g

Calories per gram:
Fat 9 • Carbohydrate 4 • Protein 4

Sample Nutritional Label

On the sample Nutrition Facts label, the serving size of this food is 1 cup and there are 2 servings in this container.

There are 260 calories per serving of this food. If you eat the entire container of this product, you will eat 2 servings. That means you double the calories. If you eat 2 servings, will you have eaten over 500 calories? Explain your answer.

_____

_____

_____

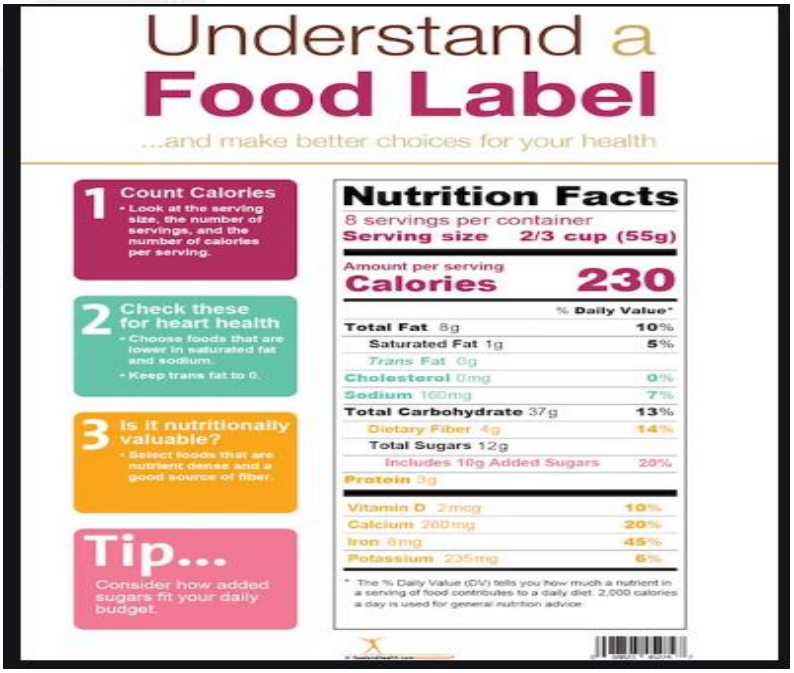
_____

_____

_____

Use a separate paper to write your answer.

B. Read the tips on how to make better choices for your health. Collect at least three (3) food wrappers that are usually included in your daily meal and paste in the bond paper. Examine and compare its nutritional facts. Decide which is most nutritious and best for your health and explain why.



https://foodandhealth.com/nutrition-label-math/

IV. LEARNING PHASES AND LEARNING ACTIVITIES

V. ASSESSMENT (Time Frame: 1 day)

(Learning Activity Sheets for Enrichment, Remediation, or Assessment to be given on Weeks 3 and 6)

Learning Task 3. Write THE LETTER OF YOUR ANSWER on the space before each number.

_____1. Nutritional chemists have found that burning 1 gram of fat releases twice the amount of heat energy as burning 1 gram of starch. Based on this information, which type of biomolecule would cause a person to gain more weight?

a. Carbohydrate b. fat c. proteins d. nucleic acid

_____2. Lipids are insoluble in water because lipid molecules are _____.

a. Hydrophilic b. Neutral c. hydrophobic d. Zwitterions

_____3. Aside from carbohydrates, another class of biomolecules that have the "job" of storing energy for later use.

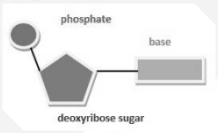
a. Proteins b. carbohydrates c. lipids d. nucleic acid

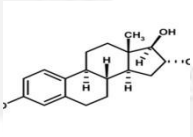
_____4. Biomolecules that code for hereditary traits by controlling the production of protein.

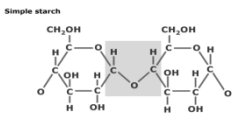
a. Proteins b. carbohydrates c. lipids d. nucleic acid

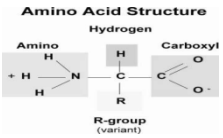
_____5. Using the illustrations below, identify the biomolecule that represents Lipids.

A B C D



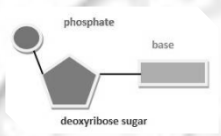


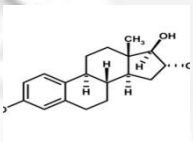


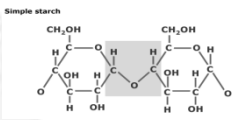


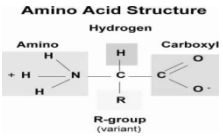
_____6. Using the illustrations below, identify the biomolecule that represents Nucleic acid.

A B C D









VI. REFLECTION (Time Frame: 1 day)

- Communicate your personal assessment as indicated in the Learner's Assessment Card.

Personal Assessment on Learner's Level of Performance

Using the symbols below, choose one which best describes your experience in working on each given task. Draw it in the column for Level of Performance (LP). Be guided by the descriptions below:

☆ - I was able to do/perform the task without any difficulty. The task helped me in understanding the target content/ lesson.

✓ - I was able to do/perform the task. It was quite challenging, but it still helped me in understanding the target content/lesson.

ʔ – I was not able to do/perform the task. It was extremely difficult. I need additional enrichment activities to be able to do/perform this task.

Learning Task	LP	Learning Task	LP	Learning Task	LP	Learning Task	LP
Number 1		Number 3		Number 5		Number 7	
Number 2		Number 4		Number 6		Number 8	

VII. REFERENCES	DepEd G10 Science Learner's Material pages 443 – 474

Prepared by:	HEDWIG PRECIOUS S. GOFREDO	**Checked by:**	NICANOR O. REYES II JOCELYN M. MANSET

W5	Learning Area	SCIENCE	Grade Level	10
	Quarter	FOURTH	Date	

I. LESSON TITLE	CHEMICAL REACTION
II. MOST ESSENTIAL LEARNING COMPETENCIES (MELCs)	Apply the principles of conservation of mass to chemical reaction
III. CONTENT/CORE CONTENT	Types of Chemical Reaction

IV. LEARNING PHASES AND LEARNING ACTIVITIES

I. Introduction (Time Frame: 1 day)

Chemical changes occur all the time and everywhere, most organism depend on this, and those changes have significant role to perform most of biological process for them to survive. Any process in which chemical change occurs is known as a **chemical reaction**. Most commercial products like shampoo, soap, and detergent produced by industries are very useful to mankind, but some are not beneficial, irresponsible use of product such as fertilizer, herbicides, and pesticides has negative impact to our environment and even to ourselves.

As we go on with the topic, you should be able to write chemical equation and classify them according to its type, understand chemical notation and apply the principle of conservation of mass to chemical reaction.

Learning Task 1

Identify the reactant needed in the following chemical equation, choose your answer from the box. Do this in your answer sheet.

Na	O_2	S	Cl	H_2O	SO_3	Mg	Al	$(OH)_2$	$(PO_4)_3$

1. _____ + _____ ⟶ $Mg(OH)_2$
2. _____ + _____ ⟶ NaCl
3. _____ + _____ ⟶ H_2SO_4
4. _____ + _____ ⟶ $Al(PO_4)_3$
5. _____ + _____ ⟶ SO_2

D. Development (Time Frame: 1 day)

Chemical reaction is a process in which one or more substances (reactant) are converted to one or more different substances (product). The reactant is a substance that is present at the start of chemical reaction and mostly found at the left-hand side of the equation, while the substance found on the right-hand side of an equation is called product. Chemical equation is a chemist's shorthand way of writing chemical reactions. Instead of writing them into words, they use symbols in order for them to make it easier and understandable. Here are some other symbols used in writing chemical equations and the way on how they read it.

The plus sign (+) on the left side of an arrow read as "combine with, added to, or react with" The arrow sign (⟶) means "will produce or yield ". The arrow also indicates the direction of the reaction. In the example of "one atom of sodium added to one atom of chlorine will produce one mole of sodium chloride" in chemical equation it is written like this Na + Cl ⟶ NaCl. Information on the physical states may be included in the chemical equation. Thus (/) liquid state (s) a solid (g) a gas and it is written in the lower right side of the substances near the subscript ex. CO2(g). The arrows up and down ↑ ↓ after the chemical symbols in the product, represent gaseous product is released and formation of precipitate, respectively. The symbol △ written above the arrow is read as "when heat is applied".

In the given example 2Mg + HCl $\xrightarrow{\triangle}$ $MgCl_2$ + H_2(g) ↑, it is read as "two atoms of magnesium added to one mole of hydrochloric acid, when heat is applied will produce one mole of magnesium chloride and one mole of hydrogen gas released".

IV. LEARNING PHASES AND LEARNING ACTIVITIES

Type	General Formula	Example
1. **Combination/Synthesis Reaction**. A reaction when two or more reactants unite to form a single product	A + B ⟶ AB	Na+Cl ⟶ NaCl
2. **Decomposition Reaction** Single compound is broken down to two or more elements or compound (opposite of composition)	AB ⟶ A + B	$2H_2$ ⟶ O_2+ $2H_2$
3. **Single Displacement Reaction.** This is when one element is replaced by another element from a compound.	A+BC ⟶ AC+B	Mg + HCl ⟶ MgCl + H_2
4. **Double Displacement Reaction.** This is when the positive ion (cations) and the negative ions (anions) of different compounds switch places forming two entirely different compounds.	AB+CD ⟶ AD+BC	NaOH + KCl ⟶ NaCl + KOH
5. **Combustion Reaction** This is when oxygen gas combines with hydrocarbon to form water and carbon dioxide	Hydrocarbon + Oxygen= water and carbon dioxide	C_4H_{10}+O_2 ⟶ CO_2 + H_2O
6. **Acid-Base Reaction** Same as double displacement happens when Acid and base react with each other produced salt and water.	Acid + Base = Salt and Water	HCl + NaOH ⟶ NaCl + H_2O

E. Engagement (Time Frame: 1 day)

Learning Task 2

Identify the types of chemical reaction represented by each equation. Write your answer in your answer sheet.

1. FeO + Al ⟶ Al_2O_3 + Fe _____
2. $NaNO_3$ ⟶ $NaNO_2$ + O_2 _____
3. N_2 + H_2 ⟶ NH_3 _____
4. Al + $Fe(NO_3)_2$ ⟶ $Al(NO_3)_3$ + Fe _____
5. SO_2 + H_2O ⟶ H_2SO_4 _____
6. $Mg(OH)_2$ + HCl ⟶ $MgCl_2$ + H_2O _____
7. HCl + Al $(OH)_3$ ⟶ $AlCl_3$ + H_2O _____
8. NaOH + KNO_3 ⟶ $NaNO_3$ + KOH _____
9. CH_4 + O_2 ⟶ CO_2 + H_2O _____
10. $2H_2$ + O_2 ⟶ $2H_2O$ _____

A. Assimilation (Time Frame: 1 day)

Learning Task 3

List down at least 5 evidences that chemical reaction took place. Give 2 examples per evidence.

Evidences of Chemical Reaction	Examples

IV. LEARNING PHASES AND LEARNING ACTIVITIES

V. ASSESSMENT (Time Frame: 1 day)

(Learning Activity Sheets for Enrichment, Remediation, or Assessment to be given on Weeks 3 and 6)

Learning Task 4

Choose the letter of the correct answer and write it in your answer sheet.

_____ 1. A chemist shorthand way of representing chemical reaction.
A. Chemical property B. Equation C. Formula D. Symbol

_____ 2. When acid and base react with each other, it produced water and _____.
A. carbon dioxide B. fire C. salt D. smoke

_____ 3. A process in which one or more substances are converted to one or more different substances is called chemical_____?
A. equation B. formula C. reaction D. symbol

_____ 4. Any substance that is present at the start of chemical reaction.
A. Arrow sign B. Product C. Reactant D. Symbol

_____ 5. The arrow sign in the chemical equation is read as _____.
A. added to B. B. combined with C. form precipitate D. will produce

_____ 6. When hydrocarbon reacts with oxygen, they will produce carbon dioxide and _____.
A. Air B. Hydrogen C. Oxygen D. Water

_____ 7. A type of chemical reaction wherein Single compound is broken down to two or more elements and compound.
A. Acid-Base B. Combination C. Decomposition D. Displacement

_____ 8. In the equation $N_2 + H_2 \rightarrow NH_3$, NH_3 is?
A. Equation B. Product C. Reactant D. Subscript

_____ 9. A type of reaction when two or more reactants unite to form a single product.
A. Acid-Base B. Combination C. Combustion D. Decomposition

_____10. The plus sign symbol found at the left side of chemical equation is read as _____.
A. Burning B. Combined with C. Heat is applied D. Will produce

VI. REFLECTION (Time Frame: 1 day)

- Communicate your personal assessment as indicated in the Learner's Assessment Card.

Personal Assessment on Learner's Level of Performance

Using the symbols below, choose one which best describes your experience in working on each given task. Draw it in the column for Level of Performance (LP). Be guided by the descriptions below:

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Learning Task	LP	Learning Task	LP	Learning Task	LP	Learning Task	LP
Number 1		Number 2		Number 3		Number 4	

VII. REFERENCES DepEd G10 Science Learner's Material pages 400-421

Prepared by:	ELPIDIO L. VIDALLO JR.	**Checked by:**	NICANOR O. REYES II JOCELYN M. MANSET

W6	Learning Area	SCIENCE	Grade Level	10
	Quarter	FOURTH	Date	

I. LESSON TITLE	BALANCING EQUATION
II. MOST ESSENTIAL LEARNING COMPETENCIES (MELCs)	Apply the principles of conservation of mass to chemical reaction
III. CONTENT/CORE CONTENT	Balancing Equation

IV. LEARNING PHASES AND LEARNING ACTIVITIES

I. Introduction (Time Frame: 1 day)

In some cases, the chemical equation is not always written in the state of balance. It means that the number of each element in both sides of the equation is not the same. Balanced chemical equation shows that the amount of reactant and product must be equal to satisfy the Law of Conservation of Mass. This means that the total mass of the reactant must be equal to the total mass in the product.

In this module, you must know the basic things to remember before you go on in balancing chemical equations, this module helps you understand Chemical Notation that gives you an idea on how to count atoms given in the chemical formula, and apply the principle of Law of Conservation of Mass in Chemical Reaction.

Learning Task 1.

Considered the chemical equation below, identify and count the number of each element in the reactant and product. Write your answer in your answer sheet.

example: $H_2 + O_2 \longrightarrow H_2O$

Element	Reactant	Product
H	2	2
O	2	1

1. $CH_4 + O_2 \quad CO_2 + H_2O$

Element	Reactant	Product
C		
H		
O		

2. $NaNO_3 \longrightarrow NaNO_2 + O_2$

Element	Reactant	Product
Na		
N		
O		

3. $Zn + HCl \quad ZnCl_2 + H_2$

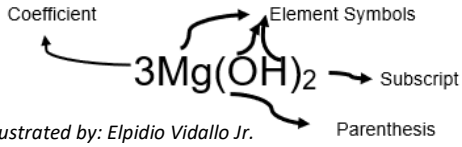
Element	Reactant	Product

4. $Fe + H_2O \longrightarrow H_2 + Fe_3O_4$

Element	Reactant	Product

D. Development (Time Frame: 1 day)

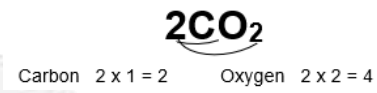
Chemical Notation is a standard way of writing chemical formula, used by Chemists to express the proportionate number of atoms in each element present in the compound. It includes Element Symbols, Coefficient, Subscript and Parenthesis.



Illustrated by: Elpidio Vidallo Jr.

Coefficient is a numerical number attached in front of the chemical formula, denoting the number of molecules or mole in a compound.

Here's a simple example 1



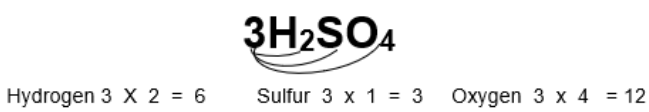
Illustrated by: Elpidio Vidallo Jr.

In this example the coefficient is 2. This notation means "two mole of carbon dioxide." The coefficient serves as the multiplier of all the subscripts; even 1 is not written as the subscript of carbon, thus the number of carbon atom is equal to two and the number of oxygen atom is 4.

Subscript is a number written in the lower right side of the chemical formula, shows the number of atoms of each type in the molecules. A subscript is used only if there is more than one atom given in a compound.

Here's a simple example 2

3 moles of Sulfuric Acid



Illustrated by: Elpidio Vidallo Jr.

Parentheses are used to form subgroups of atoms within molecules. It is useless in the chemical formula if the subscript is not present. The subscript outside the parentheses means that you multiply that subscript by the numbers of atoms inside.

Here's a simple example 3 4 mole of Magnesium Carbonate

Illustrated by: Elpidio Vidallo Jr.

Magnesium 4 x 1 = 4 since magnesium is outside the parentheses no need to multiply it by 2, only carbon and oxygen atoms are needed.

Thus; Carbon 4 x 1 x 2 = 8 and Oxygen is 4 x 3 x 2 = 24

Balancing Chemical Equation
Inspection Method

Steps	Example
1. Write down the unbalanced equation.	$Fe + NaBr \longrightarrow FeBr_3 + Na$
2. Determine how many atoms of each element are present on each side of an arrow.	Fe = 1, Na = 1, Br = 1 | Fe = 1, Na = 1, Br = 3
3. Apply the Law of conservation of mass to get the same number of atoms of every element on each side of the equation. Supply the appropriate coefficient before the symbol of the chemical formula.	$Fe + 3NaBr$ | $FeBr_3 + 3Na$ Fe = 1, Na = 3, Br = 3 | Fe = 1, Na = 3, Br = 3

Note, in balancing chemical equations you do not change or omit the subscript. All you must do is to supply the right coefficient to balance the chemical equation. Changing or deleting the subscript of the formula will change the identity of the component.

Remember that in supplying numerical coefficients, it is better to do it one at a time. Basically, you look at how many atoms you have in each side of the equation and add coefficients to the molecules to balance out the number of atoms, that's why it is known as the **Inspection Method.**

IV. LEARNING PHASES AND LEARNING ACTIVITIES

E. Engagement (Time Frame: 1 day)

Learning Task 2

Use coefficients to balance the following equation, and determine what types of Chemical reaction takes place in the given below. Write your answer in your answer sheet.

1. $\_\_H_2 + O_2 \longrightarrow \_\_H_2O$
2. $Zn + \_\_HCl \longrightarrow ZnCl_2 + H_2$
3. $\_\_Al + \_\_Fe(NO_3)_2 \longrightarrow \_\_Al(NO_3)_3 + \_\_Fe$
4. $\_\_NaNO_3 \longrightarrow \_\_NaNO_2 + O_2$
5. $NaOH + KNO_3 \longrightarrow NaNO_3 + KOH$

A. Assimilation (Time Frame: 1 day)

Learning Task 3

I. Fill in the blanks with the most appropriate term:

A _____ _____ tells the story of a chemical reaction. _____ are the starting substances in the reaction while _____ are the new substances that are formed. The large numbers in front of some of the formulas are called _____. These numbers are used to _____ the equation because chemical reactions must obey the Law of _____ of Mass. The number of atoms of each element on both sides of the equation must be _____ because mass cannot be _____ or _____. When balancing equations, the only numbers that can be changed are _____; remember that _____ must never be changed to balance an equation.

II. II. Balance the following equations. Show your solution.

1. $Al + O_2 \longrightarrow Al_2O_3$

2. $C_3H_8 + O_2 \longrightarrow CO_2 + H_2O$

3. $Al(NO_3)_3 + NaOH \longrightarrow Al(OH)_3 + NaNO_3$

IV. LEARNING PHASES AND LEARNING ACTIVITIES

V. ASSESSMENT (Time Frame: 1 day)

(Learning Activity Sheets for Enrichment, Remediation, or Assessment to be given on Weeks 3 and 6)

Learning Task 4

Choose the letter of the correct answer, write your answer on your answer sheet.

_____ 1. A number written in the lower right side of the chemical formula, show the number of atoms of each type in the molecules.
A. coefficient B. parenthesis C. subscript D. superscript

____ 2. State that the total mass of the reactant must be equal to the total mass in the product.
A. Law of conservation of mass C. Law of interaction
B. Law of gravity D. Law of reflection

____ 3. A numerical number attach in front of the chemical formula, denotes the number of molecules or mole in a compound.
A. coefficient. B. molecules C. subscript D. superscript

____ 4. A method used to balance out the number of each element in both side of the equation.
A. Inspection method C. Valence number
B. Redox reaction D. None of the above

____ 5. It is used to form subgroups of atom within a molecule.
A. coefficient B. parenthesis C. subscript D. superscript

____ 6. It is the standard way of writing chemical formula.
A. coefficient B. notation C. subscript C. superscript

____ 7. Which of the following set of coefficients would balance the given equation? __Al + __$Fe(NO_3)_2$ → __$Al(NO_3)_3$ + __Fe
A. 2,2,3,3 B. 2,3,2,3 C. 3,2,3,2, D. 3,3,2,2

____ 8. In the chemical formula $Mg(NO_3)_2$, the numerical coefficient is equal to_____.
A. 1 B. 2 C. 3 D. 6

____ 9. In the compound $Mg(NO_3)_2$, how many atoms of oxygen is present?
A. 1 B. 2 C. 3 D. 6

____ 10. How about the number of nitrogen? (refer to number 9)
A. 1 B. 2 C. 3 D. 6

VI. REFLECTION (Time Frame: _____)

- Communicate your personal assessment as indicated in the Learner's Assessment Card.

Personal Assessment on Learner's Level of Performance

Using the symbols below, choose one which best describes your experience in working on each given task. Draw it in the column for Level of Performance (LP). Be guided by the descriptions below:

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Learning Task	LP	Learning Task	LP	Learning Task	LP	Learning Task	LP
Number 1		Number 2		Number 3		Number 4	

VII. REFERENCES DepEd G10 Science Learner's Material pages 400-421

Prepared by:	ELPIDIO L. VIDALLO JR.	**Checked by:**	NICANOR O. REYES II JOCELYN M. MANSET

W7	Learning Area	SCIENCE	Grade Level	10
	Quarter	FOURTH	Date	

I. LESSON TITLE	FACTORS AFFECTING CHEMICAL REACTIONS
II. MOST ESSENTIAL LEARNING COMPETENCIES (MELCs)	Explain how the factors affecting rates of chemical reactions are applied in food preservation, control of fire, pollution, corrosion and materials production
III. CONTENT/CORE CONTENT	Factors Affecting Chemical Reactions

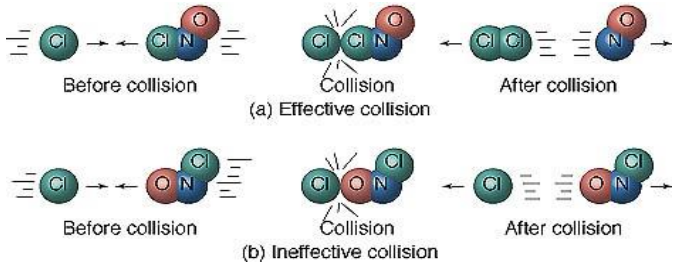
IV. LEARNING PHASES AND LEARNING ACTIVITIES

I. Introduction (Time Frame: 1 day)

Chemical reactions are an integral part of technology, of culture, and indeed of life itself. Burning fuels, smelting iron, making glass and pottery, brewing beer, and making wine and cheese are among many examples of activities incorporating chemical reactions that have been known and used for thousands of years. Chemical reactions abound in the geology of Earth, in the atmosphere and oceans, and in a vast array of complicated processes that occur in all living systems.

Chemical reactions must be distinguished from physical changes. Physical changes include changes of state, such as ice melting to water and water evaporating to vapor. If a physical change occurs, the physical properties of a substance will change, but its chemical identity will remain the same. No matter what its physical state, water (H_2O) is the same compound, with each molecule composed of two atoms of hydrogen and one atom of oxygen. However, if water, as ice, liquid, or vapor, encounters sodium metal (Na), the atoms will be redistributed to give the new substances molecular hydrogen (H_2) and sodium hydroxide (NaOH). By this, we know that a chemical change or reaction has occurred.

Learning Task 1: Race to the Finish Line



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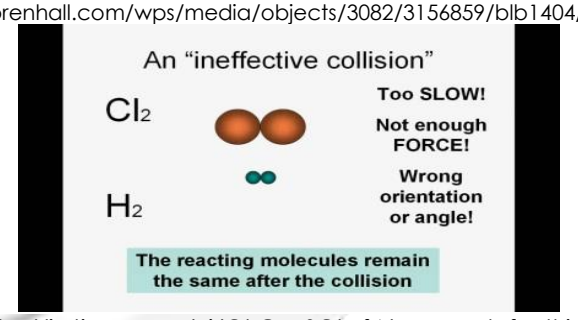

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Guide Questions:

1. What causes a chemical reaction?
   _____
2. What must happen for a chemical reaction to take place?
   _____
3. Describe fruitful/ effective collision resulting to formation of products.
   _____

D. Development (Time Frame: 1 day)

Collision Theory

Collision Theory explains how collision between reactant molecules may or may not result in a successful chemical reaction.

Based on this theory, not all collisions between the molecules which result in the formation of products, only occur when the following two conditions are met:

a. The colliding molecules should possess a minimum kinetic energy known as activation energy, to start a chemical reaction.
b. The reactant molecules should be in correct orientation when they collide.

Activation energy is needed to break the bond between reactant molecules to form new bonds leading to formation of products.

Factors Affecting Reaction Rate

1. **Temperature**

The higher the temperature, the more particles gain energy and cause them to move faster. The faster the particles move, there is an increasing tendency to collide frequently and produce more energy. Through this activation energy is more likely to exceed. As a result, there will be a higher rate of successful reaction.

2. **Concentration/ pressure**

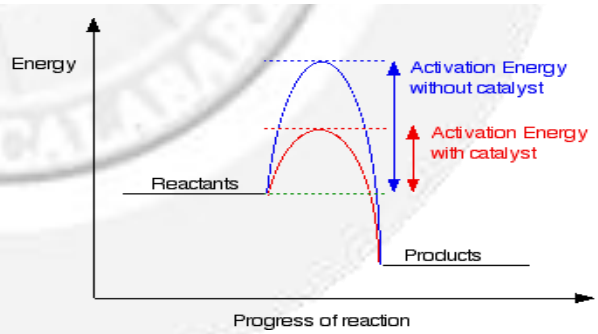
Concentration and pressure are normally considered as factors because both of them refer to how many particles there are per unit volume. When concentration/ pressure increases, there will be more particles present per unit of volume which makes collisions more frequent. As a result, there will be a higher rate of successful reaction.

3. **Surface area**

For a given mass of a solid, large lumps have smaller surface area to volume ratios than smaller lumps or powders. If a large lump is divided or ground into a powder: the area of exposed surface increases. The higher the surface area the higher the reaction rate.

4. **Catalysts**

Catalysts are substances that speed up a reaction.



https://www.chemguide.co.uk/physical/basicrates/energyprofiles.html (access March 1 2021)

Catalyst decreases the activation energy and it provides alternative pathways and this means that there will be a higher proportion of successful collisions. One of the most common sources of catalyst is the transition metals like Cobalt and Nickel.

IV. LEARNING PHASES AND LEARNING ACTIVITIES

E. Engagement (Time Frame: 1 day)

Learning Task 2

Write TRUE on the space provided if the statement is correct. Correct the underlined word, if the statement is false.

_____1. Catalysts speed up the chemical reactions but are not changed by them.

_____2. Heat, light or change in odor can indicate a physical change.

_____3. Activation energy is the minimum energy required for reactions to start.

_____4. Low temperature speeds up reaction rates.

_____5. A low concentration of chemicals slows reaction rate.

A. Assimilation (Time Frame: 1 day)

Learning Task 4.

Explain how the factors affect rates of chemical reactions.

V. ASSESSMENT (Time Frame: 1 day)

(Learning Activity Sheets for Enrichment, Remediation, or Assessment to be given on Weeks 3 and 6)

Choose the letter of the correct answer.

_____1. It explains how collision between reactant molecules may or may not result in a successful chemical reaction.
a. Collision Theory c. Evolution Theory
b. Tension Theory d. Plate tectonic theory

_____2. The following are the factors affecting reaction rate except_____.
a. Temperature c. surface area
b. Catalysts d. Stress

_____3. The higher the temperature, the _____ the reaction rate.
a. Higher c. both
b. Lower d. none of the above

_____4. These are substances that speed up a reaction
a. Temperature c. surface area
b. Catalysts d. concentration/ pressure

_____5. Catalyst _____ the activation energy and it provides an alternative pathway.
a. Increases c. both
b. Decreases d. none of the above

VI. REFLECTION (Time Frame: 1 day)

- Communicate your personal assessment as indicated in the Learner's Assessment Card.

Personal Assessment on Learner's Level of Performance

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Number 1		Number 3		Number 5		Number 7	
Number 2		Number 4		Number 6		Number 8	

VII. REFERENCES	Grade 10 Science learners Material pages 422-436 https://www.britannica.com/science/chemical-reaction

Prepared by:	MELODY C. ANHAO	**Checked by:**	NICANOR O. REYES II JOCELYN M. MANSET

W8	Learning Area	SCIENCE	Grade Level	10
	Quarter	FOURTH	Date	

I. LESSON TITLE	FACTORS AFFECTING CHEMICAL REACTIONS
II. MOST ESSENTIAL LEARNING COMPETENCIES (MELCs)	Explain how the factors affecting rates of chemical reactions are applied in food preservation, control of fire, pollution, corrosion and materials production
III. CONTENT/CORE CONTENT	Factors Affecting Chemical Reactions

IV. LEARNING PHASES AND LEARNING ACTIVITIES

I. Introduction (Time Frame: (1 day)

In our previous discussion, several factors can influence the chemical reaction rate. These factors can be temperature, concentration/pressure, surface area and catalysts. It is actually useful to predict whether an action will affect the rate at which a chemical reaction proceeds.

In general, a factor that increases the number of collisions between particles will increase the reaction rate and a factor that decreases the number of collisions between particles will decrease the chemical reaction rate.

Learning Task 1. Making Connections.

1. Analysis of set of pictures linking to acid rain.

https://www.petersommer.com/blog/archaeology-history/antikythera-shipwreck-exhibition

a. What effect does acid rain has on limestone or marble statues? _____

_____

https://www.+connecticutvalleybiological.com/acid-rain-and-the-environment-acidity-and-plant-growth-p-15860.html

b. What effect does acid rain has on plant growth? _____

D. Development (Time Frame: 1 day)

$$2\,NHO_2 + H_2O \longrightarrow \boxed{NHO_2 + HNO_3}$$

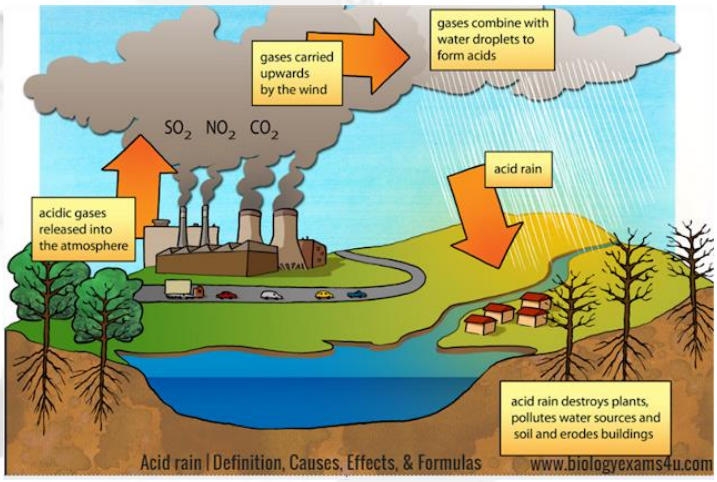
Nitrogen Dioxide + Water — Nitrous Acid + Nitric Acid

Nitric Oxide NO_2, a product of combustion of gasoline in automobiles is one of the culprits in the formation of acid rain. Referring to the equation above, analyze how nitric oxide converted to nitric acid.

_____

_____

_____.



https://www.biologyexams4u.com/2018/07/acid-rain-definition-causes-and-effects.html#.YKHqCLUzbIU

An example of chemical reaction that has an environmental concern is the acid rain. Acid rain has been leading significant cause of destruction in our environment. In infrastructure, it is the cause of corrosion of metals in alloys like steel in buildings, bridges and transport vehicles. This is due to the displacement reaction of active metals with hydrogen in acids.

Materials with historical and cultural values such as monuments and statues are also destroyed by acid rain. They are mostly made up of limestone and marble which like metals from a chemical reaction with acids, lead to their dissolution.

Marine life is also affected by acid rain. It causes the pH of bodies of water to decrease; this change in pH will increase marine life mortality, retard fish growth, decrease egg production and embryo survival. Acid rain also tends to dissolve vital minerals in the soil. Crops grown in these depleted soils give poor yields, of they grow at all.

In areas of high automobile traffic, such as in large cities, the amount of nitrogen oxides emitted into atmosphere can be quite significant. In urban areas, the main source of acid rain is from automobiles. Other sources are the thermal power plants and coal mining industries. Gas emissions like CO2, CO, SO2, NO2 and NO from these sources react with water vapor in the air producing acids. Rain contaminated with these acids are what we know now as acid rain.

Removing the offending oxides from exhaust and using alternate energy sources are much preferred courses of action at the present time. One of the most important means of reducing sulfur emissions is the switch to low sulfur fuels. Another is the scrubbing of stack gases before they are released to the atmosphere.in this process, the stack gases percolate through a solution that absorbs the oxides of sulfur. The solution is renewed frequently, and waste sulfur can be recovered from spent solution.

IV. LEARNING PHASES AND LEARNING ACTIVITIES

Learning Task 2. Analyzing the issue.

1. What Natural processes can contribute to acid rain?
2. How is acid rain produced?
3. What adverse effect can acid rain pose on living organisms and its environment?
4. Who should be responsible for cleaning up the pollution problem?
5. What measures are taken to address the problem?

E. Engagement (Time Frame: 1 day)

Learning Task 3

1. Using any form of media, prepare a visual presentation of a chemical reaction involved in:

a. Food processing and preservation
b. Fire control
c. Corrosion control
d. Photochemical smog
e. Haber process
f. Catalytic converter
g. Car air bag
h. Formation of ozone layer in the stratosphere
i. Formation of acid rain.

2. Research on how the chemical reaction of the following poses useful or harmful effects to life and the environment.

	4	3	2	1
Identifying the important information	Determined what concepts and relationships are important in a complex system of abstract and concrete information	Can usually tell what concepts and relationships are important in a system.	Sometimes, having trouble in telling the difference between important and unimportant concepts and relationships in a system	Often get important and unimportant information mixed up.
Making inferences	Used what he/she knows about the subject along with his/her personal experiences and knowledge to make reasonable inferences. Used his/ her inferences to draw conclusions.	Analyzed new information and make reasonable inferences	With help, he/she can make inferences, but sometimes his/ her inferences are not based on good reasons	Usually cannot make inferences about what he/she had learned.
Evaluating sources	He/she used several strategies for evaluating the reliability of a variety of different kinds of sources	Used some strategies for evaluating sources	Sometimes, he/she used information that is not reliable.	Cannot tell the difference between reliable and false information.

IV. LEARNING PHASES AND LEARNING ACTIVITIES

A. Assimilation (Time Frame: 1 day)

Learning Task 4.

Having known all chemical reactions that affect our environment, enumerate ways on how you can help in preventing these.

V. ASSESSMENT (Time Frame: 1 day)

(Learning Activity Sheets for Enrichment, Remediation, or Assessment to be given on Weeks 3 and 6)

Choose the letter of the correct answer.

_____1. It leads the significant destruction in our environment
- a. Acid rain
- b. Water Cycle
- c. Oxygen cycle
- d. Hydrogen cycle

_____2. The following are the causes of acid rain except _____.
- a. Reforestation
- b. Pollution
- c. Automobiles
- d. increase of CO_2

_____3. It is the substance that must be added top Nitrogen oxide to produce nitric acid.
- a. water
- b. hydrogen peroxide
- c. Chlorine
- d. none of the above

_____4.. Nitric acid and _____ are the product of nitrogen oxide and water
- a. Nitrous Acid
- b. Citric acid
- c. Sulfuric acid
- d. All of the above

_____5. Acid rain causes the pH of bodies of water to_____.
- a. Decreases
- b. Increases
- c. both
- d. none of the above

VI. REFLECTION (Time Frame: 1 day)

- Communicate your personal assessment as indicated in the Learner's Assessment Card.

Personal Assessment on Learner's Level of Performance

Using the symbols below, choose one which best describes your experience in working on each given task. Draw it in the column for Level of Performance (LP). Be guided by the descriptions below:

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VII. REFERENCES

Grade 10 Science learners Material pages 422-436

https://www.britannica.com/science/chemical-reaction

Prepared by:	MELODY C. ANHAO	**Checked by:**	NICANOR O. REYES II JOCELYN M. MANSET