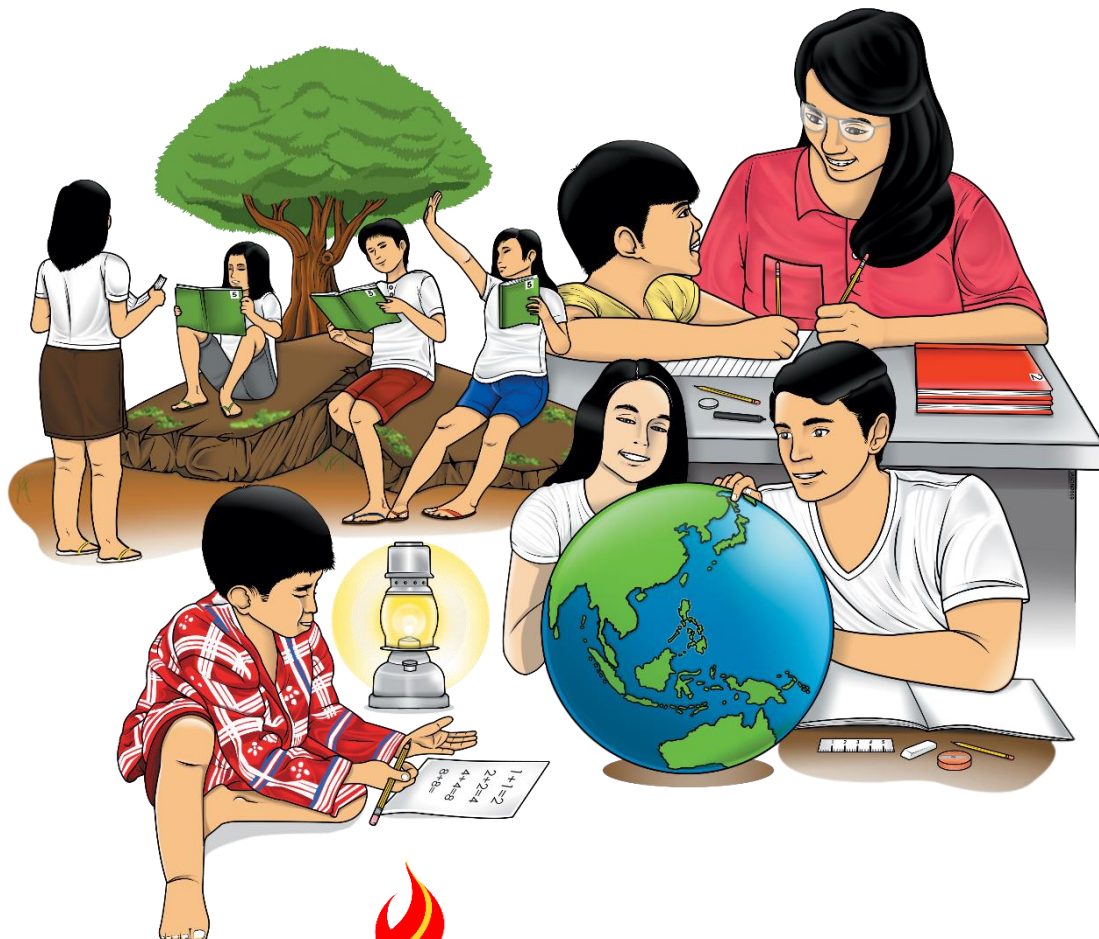


Science

Quarter 4 – Module 4: Factors Affecting the Rates of Chemical Reactions



Science Grade 10
Alternative Delivery Mode
Quarter 4 Module 4: Factors Affecting the Rates of Chemical Reactions
First Edition, 2020

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Science

Quarter 4 – Module 4: Factors Affecting the Rates of Chemical Reactions

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

Where can you find chemical reactions? Chemical reactions can be observed around us. You see a block of wood burning, an iron rusting, a metal bridge corroding, and dried leaves decaying. Some of these events happen so fast like the burning of wood. Others we can notice after a few weeks like the decaying of leaves. The corroding metal bridge may take time before we can see that there are some changes in its appearance. How fast or how slow a chemical reaction occur will vary. Some reactions are fast like burning while some are slow like rusting.

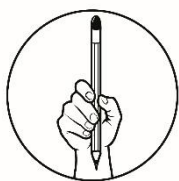
This module will provide you with information and simple activities that will help you understand the reasons behind the rates of chemical reactions.

After going through this module, you are expected to:

1. Explain how the factors affecting rates of chemical reactions are applied in food preservation and materials production, control of fire, pollution, and corrosion. **(S10MT-IVh-j-24).**

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. It is better to be slow but sure than to hurry and miss the concepts you are supposed to learn.
3. Use a separate 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 Earth that you had in the lower years. Use the concept discussed in the lesson to explain the results of activities or performance task.
5. Be honest. When doing the activities, record only what you have really observed. Take the assessments after each activity, but do not turn to the Answer Key page unless you are done with the entire module.
6. Don't 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.
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.



What I Know

Directions: Carefully read each item. Write only the letter of the best answer for each question. Use a separate sheet of paper for your answers.

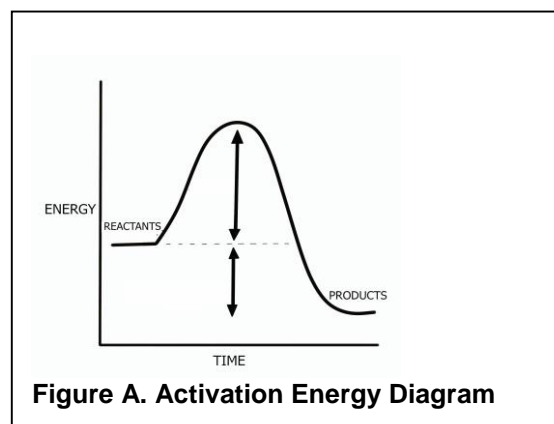
1. In 1888, who suggested that particles must possess a certain minimum amount of kinetic energy in order to react?
 - a. Amadeo Avogadro
 - b. Antoine Lavoisier
 - c. John Dalton
 - d. Svante Arrhenius
2. Which of the following states that atoms or molecules must collide with enough energy in order for chemical reaction to occur?
 - a. Activated Complex
 - b. Activation Energy
 - c. Collision Theory
 - d. Law of Conservation of Mass
3. The rate of chemical reaction is affected by several factors. Which of the following would **not** increase the rate of reaction?
 - a. adding catalyst
 - b. increasing the concentration of reactants
 - c. increasing the volume of the container
 - d. raising the temperature
4. The reacting molecules should possess the minimum energy called activation energy. How does the activation energy work?
 - a. It breaks the bonds between the reacting molecules.
 - b. It converts the reactants into the activated complex.
 - c. It forms the bonds between the product molecules.
 - d. It makes the reacting particles collide.
5. How will the crushing of a solid and turning it into a powder increase reaction rate?
 - a. The activation energy barrier will be lowered.
 - b. The orientation of colliding particles will be improved.
 - c. The particles will collide with more energy.
 - d. The powdered form has more surface area.

6. Which refers to the measure of the number of particles of solute contained in a given volume of solution?

- a. Concentration
- b. Catalyst
- c. temperature
- d. particle size

7. Reactants require an amount of energy in a period of time to produce products. Based on Figure A. Activation Energy Diagram, which of the following refers to the peak of the energy diagram for a chemical reaction?

- a. Activated Complex
- b. Activation Energy
- c. Collision Theory
- d. Law of Conservation of Mass



8. Perishable goods that are not stored in a refrigerator show signs of spoilage in less than a day. Which of the following is **not** a possible cause of this spoilage?

- a. amount of goods
- b. change in temperature
- c. oxygen in air
- d. presence of microorganisms

9. Why does the rate of reaction increase when the temperature is also increased?

- a. Activation energy is lowered.
- b. Reactant molecules collide less frequently.
- c. Reactant molecules collide less frequently and with greater energy per collision.
- d. Reactant molecules collide more frequently and with greater energy per collision.

10. Some reactions take place very slowly even with a high concentration of reactants. These reactions are hastened using a substance. What do you call the substance that increases the rate of reaction without being used up during the chemical reaction?

- a. catalyst
- b. molecule
- c. product
- d. reactant

11. Particle size is one of the factors which affects reaction rates. Which statement(s) is/are **true** about particle size?

- I. As the temperature rises, the molecules move faster and therefore collide more and have greater chances to react with each other.
- II. The smaller pieces have a greater surface area, thus, providing much greater contact among the reactants and affecting more collisions. When solid reactants are present in small pieces, reaction rates increase.

III. As the temperature rises, the molecules move faster and therefore collide more and have greater chances to react with each other.

- a. I only
- b. II only
- c. II and III only
- d. I, II and III

12. Treating clothes stains with higher amounts of *calamansi* extract or laundry bleach removes the stains faster. What factor influences this situation?
- a. concentration of the reactants
 - b. presence of catalyst
 - c. size of the reactants
 - d. temperature
13. Which of the following statements about rates of reactions is **false**?
- a. Adding a catalyst speeds up chemical reaction.
 - b. Bigger size particles of the reactants lead to faster reaction rates.
 - c. Higher temperature reactions result to faster reaction rates.
 - d. Increasing the concentration of a reactant may increase the rate of reaction.
14. To address the need for the availability of fruits at all times, Filipino farmers use various ripening agents by applying using *kalburo*, or placing leaves of *kakawate* or acacia together with the fruits. Which of the following factors explain why this is possible?
- a. Catalyst
 - b. concentration of reactants
 - c. particle size
 - d. temperature
15. Collisions may occur between any two molecules at any given time. Which of the following is **not** a key concept of the collision theory?
- a. Particles must collide in order to react.
 - b. Particles must collide with the proper orientation.
 - c. Particles must collide with sufficient energy to reach the activated complex in order.
 - d. Particles must move slowly when they collide, otherwise they simply “bounce off” one another.

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.

Have fun in learning about the Factors Affecting the Rates of Reaction! God bless you!

Lesson

1

Factors Affecting the Rates of Chemical Reaction



What's In

In the previous topic, you have learned that for a chemical reaction to occur, there has to be evidences to take place. There are different types of chemical reactions.

Do the following activity below to recall the important concepts of the previous module.

Directions: Read the following statements about chemical reactions. Put (✓) if the statement is *correct* and (✗) if the statement is *wrong*. Write your answers on a separate sheet of paper.

- ___ 1. When a physical change occurs, there is no new substance formed.
- ___ 2. Products are substances that are used up to form new substances in a chemical reaction.
- ___ 3. The positive sign (+) is the symbol used to show combination of reactants or products.
- ___ 4. Double Replacement Reaction is when one element replaces another element from a compound. The more active element takes the place of the less active element in a compound.
- ___ 5. In a chemical reaction, the total mass of the reactants is equal to the total mass of the products.

Have you ever watched children playing “Pukpok Palayok”? It is a fun game played during Filipino fiestas and traditional parties. The player is blindfolded while holding a stick. The player is told to walk in line toward where the pot or *palayok* is hanging. The player will try to hit it. A hit on the “*palayok*” or pot with a stick could result in breaking the pot, releasing a lot of items from it.



Figure.1 Children playing Pukpok Palayok
Illustrator: Medralyn L. Tamayo

There is a collision between the stick and the pot as shown in Figure 1.

When the person holding the stick hits the pot, there is a release of new items from the pot. The person holding the stick exerts energy on hitting the pot. The impact of the stick on the pot is the collision. When the stick hits the pot, the pot will break releasing items in it. Energy is needed to break the pot. This game is close in illustrating the collision theory. To release the goods inside the pot, the player must hit the pot, with sufficient energy.

Collision Theory states that atoms or molecules must collide with enough energy in order to react.

Figure 2 is an illustration of the Collision theory.

The reactants in a chemical reaction must also collide to form a new product. The reactant molecules must come together in a collision in order to react and produce molecules.

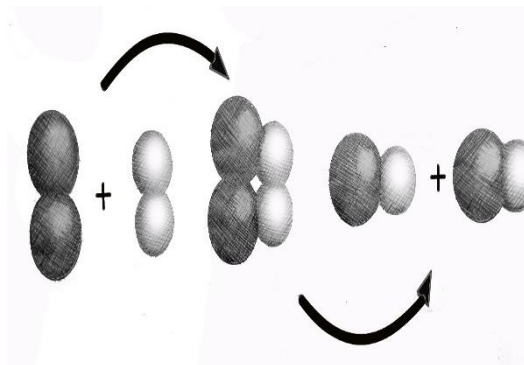


Figure 2. Collision Theory
Illustrator: Medralyn L. Tamayo

When molecules collide, a certain minimum energy called **activation energy** is required for a reaction to occur. This was suggested in 1888 by Svante Arrhenius.

Activation energy is needed to break the bonds of the reactants to form new products or new substances.

In the diagram (Figure 3), you could see that the reactants required an amount of energy in a period of time to produce products. The activated complex is located at the peak of the energy diagram for a reaction.

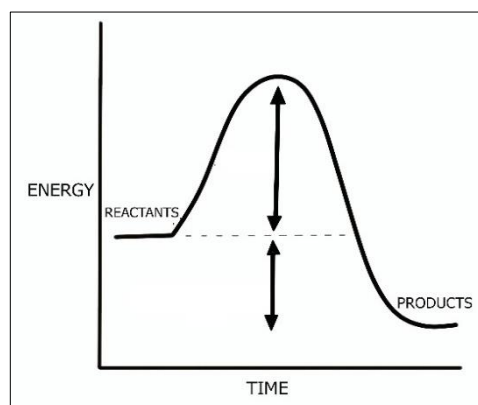


Figure 3. Activation Energy Diagram
Illustrator: Medralyn L. Tamayo, adapted with modifications from http://staff.um.edu.mt/jgri1/teaching/che2372/notes/10/10_17.gif

The chemical industries study a lot of ways how to manufacture products faster without sacrificing quality. Food industries look for ways to slow down reactions, thus, slow food spoilage. Practices like fishes being dried and salted can extend their shelf life. On the other hand, fruits need to be sold immediately and some mango vendors find ways on how to ripen it faster.

The speed or rate of chemical reactions is altered or changed by the following factors:

1. Particle size or surface area of reactants
2. Concentration of the reactants
3. Temperature
4. Presence of catalyst



What's New

Activity 1. The Rate of Dissolving Detergent Bar and Powder

What you need:

detergent bar	detergent powder
2 identical containers	water

What you have to do:

1. Get two identical containers and fill these with water. Make sure that water levels for both containers are the same.
2. Put the detergent bar and detergent powder in each container at the same time. Do not stir.
3. After 2 minutes, stir the container slowly and observe.

Guide Questions:

1. Which dissolves faster, detergent bar or detergent powder? _____
2. What could be the possible reason on the difference of the dissolving rate between the detergent bar and powder? Why is this so? _____

Activity 2. Nailed It

What you need:

2 empty plastic cups
Vinegar
Tablespoons

2 pcs of half inch iron nails
water
Markers

What you have to do:

1. Label the cups. Write Cup 1 and Cup 2.
2. For Cup 1, pour 3 tablespoons of vinegar and 3 tablespoons of water.
3. For Cup 2, pour 6 tablespoons of vinegar and 3 tablespoons of water.
4. Place one nail in each cup.
5. Let the nails soak for 5 days.
6. Notice the difference in each nail after 5 days.

Note: This activity takes a long time to get the result. While waiting for the result, proceed first to the next activity.

Table 1. Effect of Concentration on Reaction Rate

Guide Questions:

1. What is the difference between the two nails after two days?

2. How will you explain these differences?

Activity 3.

3.1 Which Dissolves Faster?

What you need:

chocolate powdered drink hot water cold water 2 identical glass
spoon

Caution: Be careful on handling hot water. Ask for assistance.

What you have to do:

1. Fill one glass with cold water and another glass with hot water.
2. Put 2 spoons of chocolate powdered drink into each glass. Stir.
3. Observe.

Guide Questions:

1. Is there any noticeable difference between hot water and cold water? _____
2. Which has a faster reaction, hot or cold water? _____
3. What is the effect of temperature on reaction rate? _____

3.2 Food and Temperature

What you need:

Paper and pen

What you have to do:

1. Cite at least 2 temperature related food preservation method that you always do at home. _____
2. Give a brief description on each method. _____
3. What do you think is the effect of temperature with food preservation?

Activity 4. Keeping It Fresh

What you need:

Paper and pen

What you have to do:

Read and answer the guide questions.

Everyone enjoys eating fresh fruits and vegetables. Farmers want to keep their harvests fresh during long trips of selling across the country. You may just want your sliced fruits such as apples fresh from few hours before eating.

However, when fruits or vegetables are cut, discoloration occurs. This process is called enzymatic browning. The area where the fruit or vegetable that was cut and exposed to air produces has turned to brown in color quickly. This process is different from rotting. Sliced fruits and vegetables such as apples, potatoes and eggplants undergo this kind of chemical reaction when exposed to air.

Once you cut the fruit, you open up some of the cells. The enzyme then has access to oxygen in the air and it does its thing, turning the fruit brown. This is the same thing that causes brown spots in apples when you drop them.

The easiest way to prevent browning is to put the sliced fruit or vegetable in water so that the enzyme does not have access to oxygen. Refrigeration can also slow enzymatic browning. At temperatures below 7 °C, the enzyme activity is inhibited but not inactivated.

Guide Questions:

1. Why do some fruits and vegetables turn brown when exposed to air?

2. Cite at least 3 other examples of fruits and vegetables that undergoes browning when exposed to air. _____

3. Suggest other ways that slows or prevents the browning of some sliced fruits and vegetables. _____



What Is It

Here are the several factors that affect the rate of chemical reactions.

1. Particle Size or Surface Area

Why is there a need to chop a large firewood into smaller pieces or to its desirable sizes before using it to build a fire in a wood stove? Smaller pieces of firewood burn easily compared to large pieces of wood. If we do not chop the wood, it will take more time for the wood to burn.

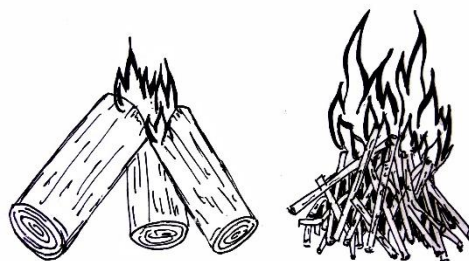


Figure 4. Large and small firewood
Illustrator: Medralyn L. Tamayo

In barbequing, large chunks of charcoal is used to slowly cook the meat. The desired temperature is to produce an ember that will provide sustained heating, not fire. Small chunks of charcoal produces fire rather than the right amount of heat.

When solid reactants are present in small pieces, reaction rates can increase. The smaller pieces have a greater surface area, thus, providing much greater contact among the reactants and effecting more collisions.

2. Concentration

Another important factor influencing the frequency of collision is concentration. **Concentration** is the measure of the number of particles of solute contained in each volume of solution.

Corrosion is another chemical change that happens all around us. Corrosion results in the deterioration of the metal. One of the most common forms of corrosion is the rusting of iron metals when it is exposed to air and moisture. It results in the formation of a red or orange flakes on the surface of iron. These flakes can be removed, exposing another layer of the metal for rusting.

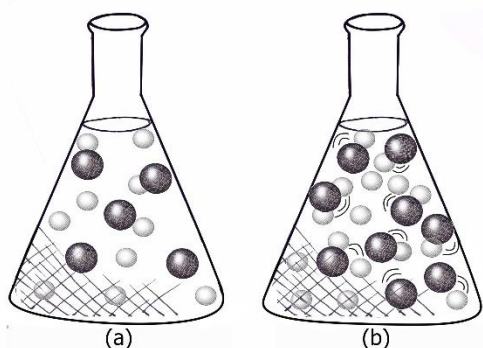


Figure 5. (a) Particles in a lower concentration;(b) Particles in a higher concentration

Illustrator: Medralyn L. Tamayo, adapted with modifications from
<https://epos.myesr.org/posterimage/esr/e-cr2018/141702/media/734054>

From the previous activity, when the concentration of acid is increased, the corrosion rate is likewise increased.

Look at Figure 5. *The greater the number of particles, the greater the collision.* When there are a great number of particles, there is a high concentration leading to greater chances of collision. Thus, a reaction will occur.

Treating clothes stains with higher amounts of *calamansi* extract or laundry bleach removes the stains faster.

3. Temperature

In real life, we cannot see molecules. We can feel its presence by tasting, feeling (skin and as eye irritation) and smelling. Way to visualize how particles are affected by temperature is shown in Figure 6.

On Figure 6, Effect of Temperature on particles, as the temperature rises, the molecules in hot water (b), move faster and therefore collide more and have greater chances to react with each other than in the cold water (a). Increasing the temperature increases the rate of reaction. Therefore, heating allows more frequent collisions among particles. Most frequent collisions will lead to sufficient energy that will provide necessary activation energy for the reaction to start.

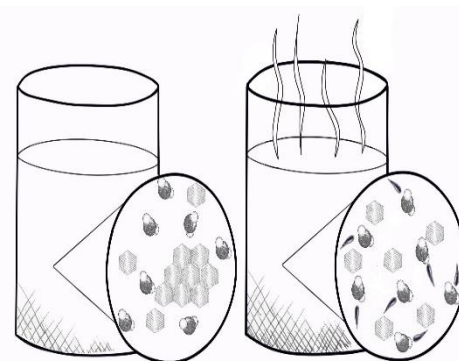


Figure 6. Effect of Temperature on particles (a) cold water (b) hot water

Illustrator: Medralyn L. Tamayo, adapted with modifications from https://www.visionlearning.com/img/library/large_images/image_11053.png

In food preservation, temperature plays a big role in extending the shelf life of foods. This is the reason why perishable foods are chilled or frozen. Decreasing the temperature lowers the rate of spoilage items. Another way to lengthen the shelf life of food is drying. Drying lowers the moisture or water content in food in order to prevent the growth microorganism like bacteria, yeast and molds.

4. Catalyst

Suggested ways cited on the previous activity prevents apples and some fruits from quickly turning brown. The suggested ways slow down the process or even prevented it.

The rate of chemical reactions can be altered. The substance that alters the rate or speed of chemical reactions is called a **catalyst**. Generally, a catalyst is used to speed up a chemical reaction but there are also catalysts that slows down a reaction. These are known as **inhibitors**.

One example of a chemical reaction with a catalyst is the decomposition of hydrogen peroxide (Agua Oxinada) to produce oxygen gas and water with the catalyst manganese (IV) oxide (MnO_2). Hydrogen peroxide (H_2O_2) (see Figure 7) is decomposed naturally and will produce oxygen gas when left exposed but will take a longer time. However, when small amount of MnO_2 is added, bubbles can be seen immediately signifying that there is reaction happening. When lighted match is placed near the mouth of the test tube, it will be reignited.

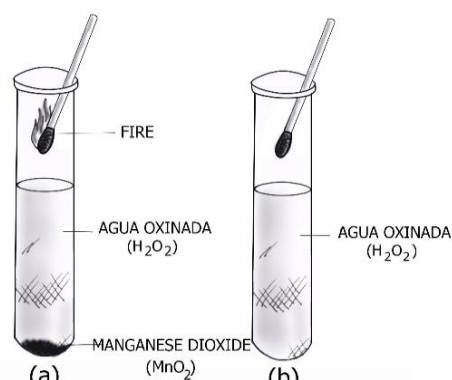


Figure 7. Decomposition of hydrogen peroxide
Illustrator: Medralyn L. Tamayo

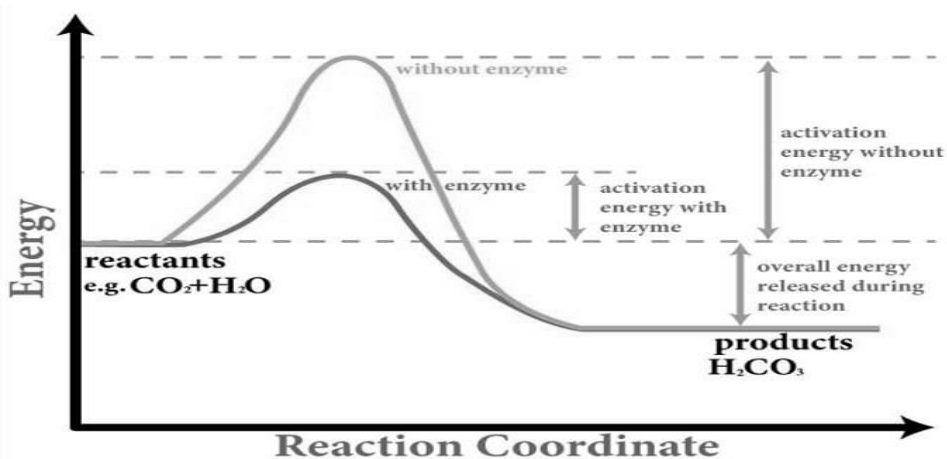
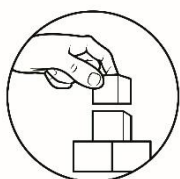


Figure 8. Effect of a catalyst (enzyme) on the activation energy of a reaction

*Illustrator: Medralyn L. Tamayo,
adapted with modifications from
https://en.wikipedia.org/wiki/File:Activation2_updated.svg*

A catalyst alters the speed of reaction by changing the activation energy. Figure 8 shows a diagram how the enzyme that acts as the catalyst speeds up a chemical reaction works by decreasing the activation energy.



What's More

Now you have learned the factors which affect the rate of chemical reactions. Here are some enrichment activities for you to work on to strengthen the basic concepts you have learned from our lesson.

I. Enrichment Activity 1

Directions: Identify which situation would have a higher reaction rate (Situation X or Y). State the factor that affects the rate of reaction. Use a separate sheet of paper for your answers.

	Situation X	Situation Y	Situation with a higher reaction rate (X or Y)	Factor affecting the rate of reaction
1	low number of particles = less collisions	high number of particles = more collisions		
2	with catalyst	without catalyst		
3	1 g of sugar (cubes)	1 g of sugar (grains)		
4	95 °C glass of water	23 °C glass of water		
5	Paracetamol liquid gel	Paracetamol tablet		

II. Enrichment Activity 2

Chemistry in Action

Read the following situations on how the rates of chemical reaction is applied then substantially answer the questions that follow.

1. Corrosion damages buildings and monuments making it a serious environmental problem. It may be generally defined as deterioration of substances. Basically, it is an electrochemical process. Rusting is the common term for corrosion of iron and its alloys such as steel. One of the factors which affects corrosion is temperature. Steel and other metals corrode at a faster rate at higher temperature than at lower temperature.

Guide question:

Which house with metal roofing will be corroded more in a shorter period of time, a house roof with no trees or a house roof shadowed by trees? Why?

2. Statues made from calcium carbonate such as limestone and marble typically wear out slowly over time due to air pollutants. The presence of pollutants like sulfur dioxide results to the formation of acid rain, resulting to the wearing out of the statues. As the concentration of pollutants increases, deterioration of limestone occurs more rapidly.

Guide Question:

- a. In Fig. 8, what do you think is the difference between image A and image B when it comes to appearance?

- b. What do you think is the reason for the difference? _____

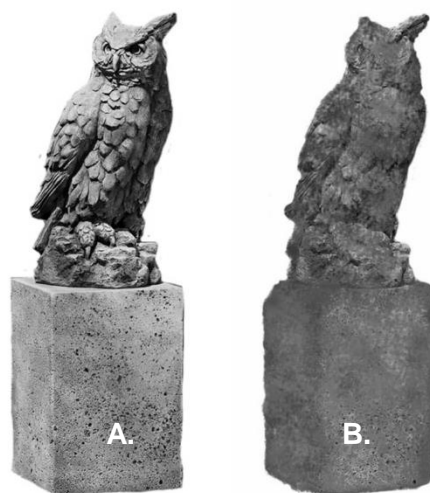


Fig. 8 Horned Owl Statue
Illustrator: Medralyn L. Tamayo,
adapted with modifications from
<https://www.campaniainternational.com/product/large-horned-owl?fbclid=IwAR1KPn9ScmKYvgEgoPcmiUZskJuxDdtTIMHuIEov->

3. American Astronauts died during the 1967 tragedy of Apollo I. A flash fire occurred inside the command module that contained 100 percent oxygen. According to the firemen, the explosion could have been avoided if the space capsule contained air and not pure oxygen. The flames spread quickly through the cabin. The last transmission ended 17 seconds after the start of the fire. All telemetry information was lost shortly after that. Emergency responders were dispatched quickly to help. The crew most likely perished within the first 30 seconds of smoke inhalation or burns. Resuscitation efforts were futile.

Guide Question:

The atmosphere of air that we live in is only 21 percent oxygen. What do you think might happen in atmosphere of 100 percent oxygen if something catches fire?



What I Have Learned

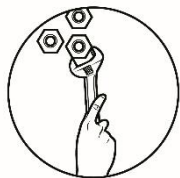
Great job! You are almost done with this module. Let's summarize what you have learned from the lesson and activities.

Part A. Choose the correct word/s inside the parenthesis. Use a separate sheet of paper for your answer.

- 1-2.** The reactants in a chemical reaction must 1. (break, collide) to form a new product. 2. (Activation Theory, Collision Theory) states that atoms or molecules must collide with enough energy in order to react.
- 3-4.** When molecules collide, a certain minimum energy called 3. (activation energy, collision energy) is required for a reaction to occur. This was suggested in 1888 by 4. (Antoine Lavoisier, Svante Arrhenius).
- 5.** Activation energy is needed to 5. (break, make) the bonds of the reactants to form new products or new substances.
- 6-7.** Reactants required an amount of 6. (energy, particles) in a period to produce products. The 7. (activated complex, reaction time) is located at the peak of the energy diagram for a reaction.
- 8-9.** The smaller pieces have a 8. (greater, smaller) surface area, thus, providing much 9. (greater, smaller) contact among the reactants and effecting more collisions.
- 10-11.** Increasing the temperature 10. (decreases, increases) the rate of reaction. As the temperature rises, the molecules move 11. (faster, slower) and therefore collide more and have greater chances to react with each other.
- 12-13.** A 12. (catalyst, reactant) is a substance that alter the rate of a chemical reaction without being used up in the reaction. The catalyst may be recovered 13. (changed, unchanged) at the end of the process.
- 14-15.** 14. (Concentration, Temperature) is the measure of the number of particles of solute in a given volume of solution. The 15. (greater, smaller) the number of particles, the greater the collision.

Part B. Create a paragraph indicating the applications of the factors affecting the rates of chemical reactions in:

- a) Food Preservation,
- b) Materials Production,
- c) Control of Fire,
- d) Pollution, and
- e) Corrosion



What I Can Do

Based on what you have learned, suggest ways on how to prolong the shelf life of a milkfish or *bangus*. Write your answer on a separate sheet of paper.

Your output on this part will be rated by your teacher using the following criteria:

Relevance	10 points
Accuracy	5 points
Mechanics	<u>5 points</u>
	20 points

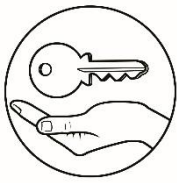


Assessment

1. What is the suggestion of Svante Arrhenius in 1888 about chemical reaction?
 - a. Activated complex is located at the peak of the energy diagram for a reaction.
 - b. Catalyst may be recovered unchanged at the end of the process.
 - c. Particles must possess a certain minimum amount of kinetic energy in order to react.
 - d. Smaller pieces have a greater surface area, thus, providing much greater contact among the reactants and effecting more collisions.
2. Which of the following statements **best** describes Collision Theory?
 - a. Atoms or molecules must collide with sufficient amount of energy in order to react.
 - b. Catalyst can be recovered unchanged at the end of the process
 - c. Increasing the concentration of a reactant increases the rate of reaction.
 - d. Smaller pieces have a greater surface area, thus, providing much greater contact among the reactants and effecting more collisions.
3. How will you increase the rate of a chemical reaction?
 - a. add catalyst
 - b. decrease the concentration of reactants
 - c. decrease the temperature of reactants
 - d. increase the surface area of reactants
4. The amount of energy required to break the bonds between the reacting molecules is known as _____.
 - a. Activated Complex
 - b. Activation Energy
 - c. Collision Theory
 - d. Law of Conservation of Mass

5. One of the factors that affect the rate of chemical reaction is concentration of solution. Describe this factor.
- It is the measure of the number of particles of solute in a given volume of solution.
 - It is located at the peak of the energy diagram for a reaction.
 - It is the amount of energy needed for molecules to react.
 - It is needed to break the bonds of the reactants to form new products or new substances.
6. What refers to the peak of the energy diagram for a chemical reaction?
- Activated Complex
 - Activation Energy
 - Collision Theory
 - Law of Conservation of Mass
7. How will crushing a solid into a powder increase reaction rate?
- The activation energy barrier will be lowered.
 - The orientation of colliding particles will be improved.
 - The particles will collide with more energy.
 - The powdered form has more surface area.
8. The rate of reaction increases as the temperature increases. Which of the following statements provides the **best** explanation for this?
- At higher temperature, the particles have more energy, move faster and collide more often.
 - At lower temperature, the particles do not collide with each other.
 - Higher temperature has higher activation energy.
 - Increasing the temperature increases the number of particles, so they collide more often.
9. When a lit match touches the wick of a candle, it begins to burn. When the match is removed, the candle continues to burn. The match _____.
- behaves as a catalyst
 - increases the concentration
 - lowers the activation energy barrier
 - supplies the activation energy
 - e.
10. Manganese (IV) dioxide acts as a catalyst in the decomposition of hydrogen peroxide. How does a catalyst increase the rate of reaction?
- increasing the concentration of reactant(s)
 - decreasing the concentration of reactant(s)
 - increasing the activation energy of the overall reaction
 - decreasing the activation energy of the overall reaction

11. Particle size is a factor which affects reaction rates. Which statement(s) is/are **not true** about particle size?
- I. As the temperature rises, the molecules move faster and therefore collide more and have greater chances to react with each other.
 - II. The smaller pieces have a greater surface area, thus, providing much greater contact among the reactants and effecting more collisions. When solid reactants are present in small pieces, reaction rates increase.
 - III. As the temperature rises, the molecules move faster and therefore collide more and have greater chances to react with each other.
- a. I only
 - b. II only
 - c. I and III only
 - d. I, II and III
12. Perishable goods that are not properly stored show signs of spoilage in less than a day. Which of the following is **not** a possible cause of this spoilage?
- a. amount of goods
 - b. change in temperature
 - c. oxygen in air
 - d. presence of microorganisms
13. Filipino farmers use different natural ripening agents such as the use of *kalburo*, leaves of *kakawate* and acacia leaves. This practice intends to address the need for the availability of fruits all the time. What factor affecting the rate of reactions influences this situation?
- a. catalyst
 - b. concentration of reactants
 - c. particle size
 - d. temperature
14. The following statements describe concentration of solution as a factor that affects the rate of reaction. Which among the given statement is **NOT** correct?
- a. Increased concentration of solution leads to an increased rate of reaction.
 - b. The greater the number of particles, the greater the collision.
 - c. When there is a great number of particles, there is a high concentration leading to greater chances of collision.
 - d. When solid reactants are present in small pieces, reaction rates can decrease.
15. To remove clothes stains faster, one either uses higher amounts of calamansi extract or laundry bleach. What factor influences this situation?
- a. concentration of the reactants
 - b. presence of catalyst
 - c. size of the reactants
 - d. temperature



Answer Key

What I Know

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

What's New

Activity 1
 1. Detergent Powder
 2. Particle size;
 Smaller particles of the
 detergent will dissolve faster
 than the larger particle size

Activity 2
 1. The iron nail in Cup 2 is
 more rusted than the iron
 nail in Cup 1.
 2. The higher the amount of
 vinegar, the more rust is
 produced on the iron nail.

Activity 3
 A. 1. Yes
 2. hot
 3. The higher the
 temperature, the faster the
 reaction.
 B. 1. Answers may vary.
 2. Answers may vary.
 3. Answers may vary.

Activity 4
 1. because of enzymatic
 browning
 2. Answers may vary.
 3. Answers may vary.

What's In

1. ✓
2. x
3. ✓
4. x
5. ✓

What's More

Enrichment Activity 1
 1. Y, Particle size
 2. X, Catalyst
 3. Y, Particle size
 4. X, Temperature
 5. X, Particle size

Enrichment Activity 2
 1. roof fully exposed to the hot
 sun rays
 2. a) Image A is more damaged
 than image B.
 b) Image A is more exposed to
 air pollutants than image B.

What I have Learned

1. Collide
2. Collision Theory
3. Activation Energy
4. Svante Arrhenius
5. Break
6. Energy
7. Activated Complex
8. Greater
9. Greater
10. Increases
11. Faster
12. Catalyst
13. Unchanged
14. Concentration
15. Greater

Assessment

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

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