

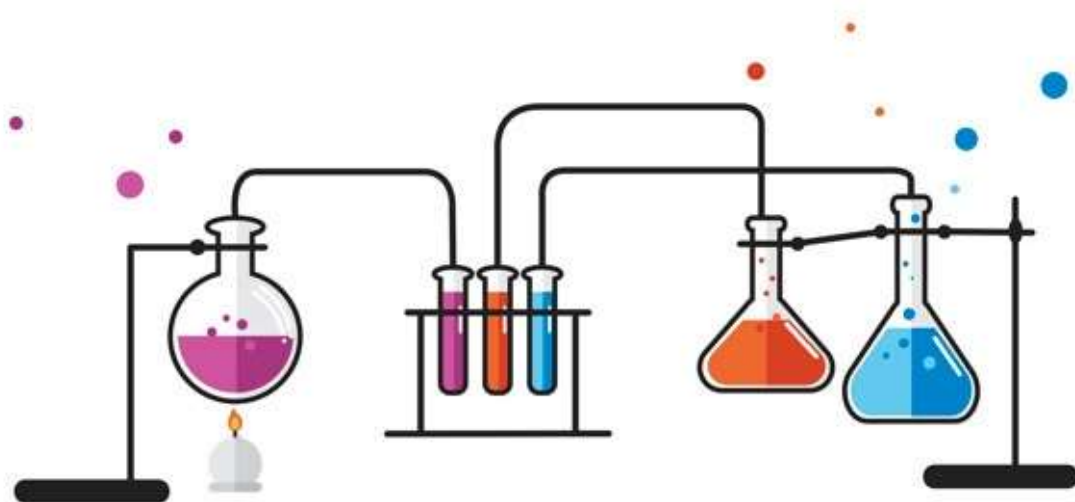
**SHS  
STEM**



# **General Chemistry 2**

**Quarter 1- Module 1**

**Kinetic Molecular Model**



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**General Chemistry 2 (SHS-STEM)**  
**Quarter 1 – Module 1: Kinetic Molecular Model**

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Regional Director: Gilbert T. Sadsad

Asst. Regional Director: Jessie L. Amin

**Development Team of the Module**

Writers: Kent Lexinn Ian M. Cantal

Zendle Ann O. Barrameda

Editors/Reviewers: Agnes B. Barsaga  
Arlen B. Bertiz  
Ronaldo C. Reyes  
Noel V. Ibis



**Regional Center Site, Rawis, Legazpi City 4500**



0917 178 1288



region5@deped.gov.ph

0917 178 1288  
0917 178 1288





## **Use kinetic molecular model to explain properties of liquids and solids**

### **LEARNING OBJECTIVES:**

At the end of the module, you will be able to:

1. State what kinetic molecular theory is;
2. Enumerate the postulates of KMT; and,
3. Explain the properties of solids and liquids using kinetic molecular model.



This Self-Directed Module in General Chemistry 2 is designed to use kinetic molecular model in explaining the properties of liquids and solids.

After completing the activities in this material, you should be able to state the kinetic molecular theory, enumerate its postulates and explain the properties of liquids and solids using the kinetic molecular model.

Good luck and have an awesome journey as you go through the different activities in this module!

#### GIVE THIS A TRY



Draw a star (★) if the statement is correct and a triangle (▲) if the statement is incorrect.

- \_\_\_\_\_ 1. Liquid particles are constantly moving.
- \_\_\_\_\_ 2. Solid particles vibrate at a certain frequency.
- \_\_\_\_\_ 3. Matter is made of particles that are constantly in motion.
- \_\_\_\_\_ 4. Liquids have definite volume and shape.
- \_\_\_\_\_ 5. Solid particles move.



## Learning Activities

### A. Engage

Re-arrange the following words to form the definition of kinetic molecular theory:

***behavior model explain the of matter used to***

### B. Explore

I – Fill in the blanks: Try to fill out the missing words on the sentences below about the postulates of Kinetic Molecular Theory. You can choose your answer from the box below.

1. Matter is made of \_\_\_\_\_ that are constantly in motion. This energy in \_\_\_\_\_ is called \_\_\_\_\_.
2. The amount of \_\_\_\_\_ energy in a substance is related to its \_\_\_\_\_.
3. There is space between \_\_\_\_\_. The amount of space in between particles is related to the substance's \_\_\_\_\_ of matter.
4. Phase changes happen when the \_\_\_\_\_ of the substance changes sufficiently.

temperature  
state

particles

kinetic energy

particles

motion  
solar

temperature

potential energy

kinetic

energy

## II – Comparing the illustration of solid and liquid particles.



Guide question:

- Based on the activity on Part I of explore, how can you compare the properties of the two materials above?

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### Remember This



Let us now discuss your answers on the activity above.

1. Matter is made of **particles** that are constantly in motion. This is energy in motion.
  - This is true in both solids and liquids. Even the solid particles move, but not very far.
2. The amount of **kinetic** energy in a substance is related to its **temperature**.
  - In your Grade 10 lessons about gas laws, you learned how temperature and kinetic energy are related to each other; they are

directly related. If the temperature is high, it means that kinetic energy is also high.

- In the case of solids and liquids, liquid particles have more kinetic energy since they can freely flow.

3. There is space between **particles**. The amount of space in between particles is related to the substance's **state** of matter.

- Again, this is true for both solids and liquids. Even solid particles have spaces between but only very limited as compared to gases.

4. Phase changes happen when the **temperature** of the substance changes sufficiently.

- What happens when ice is exposed in a hot environment? Or even when you just place it on a table? It melts right? Why do you think so?

Can you write your answer below?

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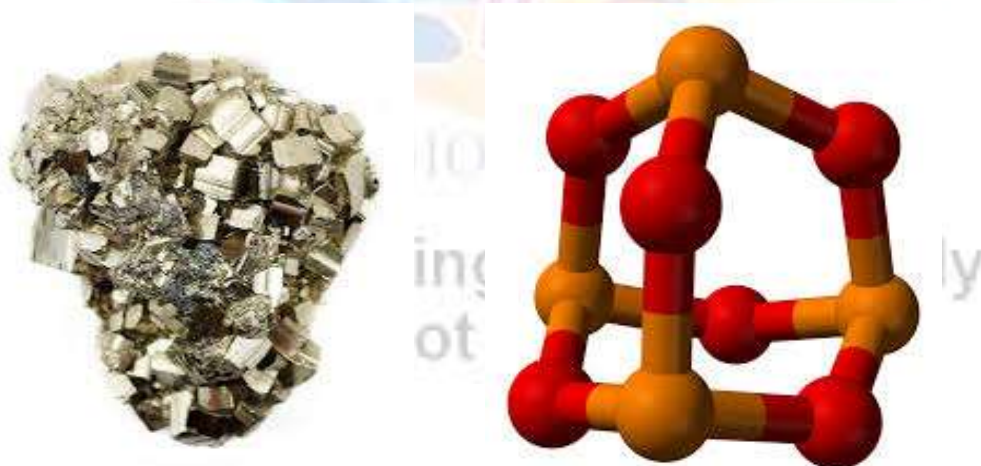


Read the lesson summary below and try to answer the following questions: (pictures maybe inserted for every concept mentioned)

- Liquids and solids are quite a different story compared to gases. The principal difference between the condensed states (liquids and solids) and the gaseous state is the distance between molecules.



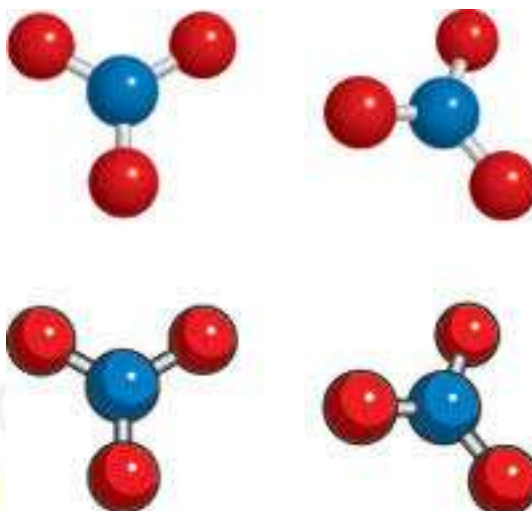
- In a liquid, the molecules are so close together that there is very little empty space. If you can still recall your lesson in junior high school, liquids are much more difficult to compress than gases, and they are also much denser under normal conditions. Molecules in a liquid are held together by one or more types of attractive forces, which will be discussed in the next modules.
- A liquid also has a definite volume, because molecules in a liquid do not break away from the attractive forces. The molecules can, however, move past one another freely, and so a liquid can flow, can be poured, and assumes the shape of its container.
- In a solid, molecules are held rigidly in position with virtually no freedom of motion. Many solids are characterized by long-range order; that is, the molecules are arranged in regular configurations in three dimensions. There is even less empty space in a solid than in a liquid. Thus, solids are almost incompressible and possess definite shape and volume.



One of these images is of pyrite crystals in their naturally occurring cubic form; the other is the structure of phosphorus trioxide (colorless crystal used as dehydrating agent) on molecular scale. What properties of solids do you notice?



## EXTEND



One is a photo of water in a swimming pool; the other is of liquid water on the molecular level. What properties are evident in these two pictures?



1. Which of the following best defines Kinetic Molecular Theory?
  - a. It is used to justify the gas laws
  - b. It is a model used to explain why ice melts
  - c. It is a model used to explain the behavior of matter
  - d. It is a hypothesis that compared the three states of matter
2. Can you enumerate at least 2 postulates in the Kinetic Molecular Theory?

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3. Find any material that you see in your house to complete the table below:

Substance	State of Matter	Description of Molecular Motion	Picture of Molecular Motion

### Your Vocabulary List



- **Density** is a measure of mass per unit of volume.
- **Molecule** is a group of two or more atoms.
- **Phosphorus trioxide** is a volatile crystalline compound that appears as white crystalline solid.
- **Pyrite** is a brass-yellow mineral with a bright metallic luster. It has a chemical composition of Iron Sulfide ( $\text{FeS}_2$ ) and is the most common sulfide mineral.



**A. Directions: Read all the items carefully and encircle the letter corresponding to your correct answer.**

1. Kinetic Molecular Theory is used to explain the \_\_\_\_\_ of \_\_\_\_\_.
  - a. behavior, particles
  - b. behavior, matter
  - c. speed, particles
  - d. speed, matter
2. Juan observed the ice as it melts on the table. He wondered what happened to the movement of the particles present on the ice. Which of the following concepts can help Juan?
  - a. The movement of the particles become slower as phase change happens.
  - b. The movement of the particles become slower because there are spaces between particles.
  - c. The movement of the particles become faster because the temperature of the ice changes sufficiently as phase change happens.
  - d. The movement of the particles become faster because the particles in ice is faster than the particles in water.

3. Based on the KMT, what happens to the kinetic energy of the particles as temperature increases?
- a. KE increases
  - b. KE decreases
  - c. KE remains the same
  - d. KE is constant
4. Which of the following is TRUE about the properties of solids?
- a. Molecules are not held rigidly in position.
  - b. Many solids are characterized by long-range order; that is, the molecules are arranged in regular configurations in three dimensions.
  - c. There is even less empty space in a liquid than in a solid.
  - d. Solids are almost incompressible and possess definite shape and volume
5. Which of the following is NOT true about the properties of liquids?
- a. Liquids are incompressible
  - b. The molecules in liquid can move past one another freely
  - c. Liquid can flow, can be poured, and assumes the shape of its container
  - d. In a liquid, the molecules are so close together that there is very little empty space.

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**B. Complete the table below.**

<b>Substance</b>	<b>State of Matter</b>	<b>Description of Molecular Motion</b>	<b>Picture of Molecular Motion</b>
Mineral Water			
Stone			

### **Your Assignment:**

1. Enumerate at least two substances in your house and identify its state.
2. Explain their properties using the Kinetic Molecular Theory. You may use the postulates that were stated in our discussion.



## References

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- Religioso, T. (2008). *You and the Natural World of Chemistry*. Quezon City. Phoenix Publishing House, Inc

### B. Guides:

- Prototype and Contextualized Daily Lesson Plans in Science 5  
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### C. Websites:

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- <https://pubchem.ncbi.nlm.nih.gov>
- <https://geology.com>
- <https://study.com>

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### Pre-test:

1. ★ 2. ★ 3. ★ 4. ▲ 5. ★

### Evaluate:

1. C

#### 2. Postulates of KMT:

- Matter is made of particles that are constantly in motion. This energy in motion.
- The amount of kinetic energy in a substance is related to its temperature.
- There is space between particles. The amount of space in between particles is related to the substance's state of matter.
- Phase changes happen when the temperature of the substance changes sufficiently.

#### Post Test

A.

1. B

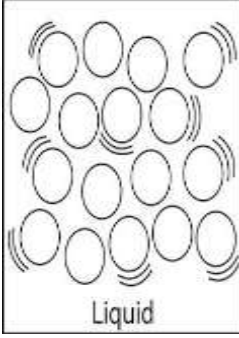
2. C

3. A

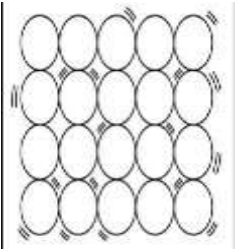
4. D

5. A

B.

Substance	State of Matter	Description of Molecular Motion	Picture of Molecular Motion
Mineral Water	LIQUID	Has a definite volume, because molecules in a liquid do not break away from the attractive forces. <u>The molecules can, however, move past one another freely, and so a liquid can flow, can be poured, and assumes the shape of its container.</u>	



Stone	<b>SOLID</b>	<p>Molecules are held rigidly in position with virtually no freedom of motion.</p> <p><u>Many solids are characterized by long-range order; that is, the molecules are arranged in regular configurations in three dimensions.</u></p>	 <p>Solid</p>
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