Kinetic Molecular Theory

Why?

The kinetic-molecular theory is a model or a mental image of how particles of matter behave. Knowledge of the kinetic-molecular theory allows us to predict the action of solids, liquids and gases and understand how the changes of state occur.

Learning Objectives

- Identify the basic differences between particle behavior in the solid, liquid and gaseous phases.
- Develop an understanding of the postulates of the kinetic-molecular theory.

Success Criteria

- Recognize the differences on the atomic-molecular level between solids, liquids, and gases.
- Identify the origin of gas pressure.
- Identify how temperature affects molecular motion.
- Apply the kinetic molecular theory to predict the outcome of everyday situations.

Prerequisites

- Temperature
- Pressure
- Volume
- Kinetic energy
- Potential energy

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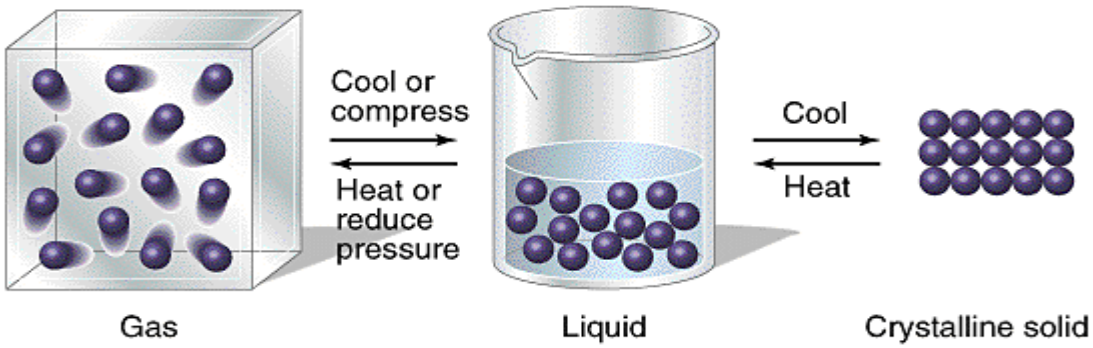
Model 1 Representation of Atoms in Different Phases



http://itl.chem.ufl.edu/2045_s00/lectures/lec_f.html

Key Questions

1. What are the key characteristics of atoms and molecules in gases, liquids, and solids? In Table 1 below, describe the characteristics of particles for each phase of matter based on Model 1. Be specific with regard to spacing, the potential of particles for movement, and whether or not the particles will fill the container.

Table 1. Characteristics of the Phases of Matter

	SOLID	LIQUID	GAS
SPACING			
POTENTIAL FOR MOVEMENT			
FILLING A CONTAINER			

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2. In which phase of matter is there the least spacing between particles?

3. In which phase of matter is there the most potential for movement?

4. Which phase of matter does not have a definite shape yet the particles will not fill the container?

5. In terms of spacing, what would be necessary to change from a solid to a liquid? What is this process called and how is this accomplished?

6. In terms of spacing, what would be necessary to change a liquid to a gas? What is this process called and how is this accomplished?

7. In terms of spacing, what would be necessary to change a liquid to a solid? What is this process called and how is this accomplished?

Model 2

POSTULATES OF THE KINETIC MOLECULAR THEORY

1. Gases consist of tiny particles (atoms or molecules).
2. These particles are so small, compared with the distances between them that the volume (size) of the individual particles can be assumed to be negligible (zero).
3. The particles are in constant random motion, colliding with the walls of the container. These collisions with the walls cause the pressure exerted by the gas.
4. The particles are assumed to not attract nor repel each other.
5. The average kinetic energy of the gas particles is directly proportional to the Kelvin temperature of the gas.

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Key Questions

1. What causes a gas to exert pressure when confined in a container?

2. How does the total volume of gas particles compare to the volume of the space between the gas particles?

3. As the temperature of a gas decreases, what change occurs in the amount of kinetic energy?

4. What property of gas particles is measured by temperature?

5. What is the relationship between temperature and molecular motion?

6. In terms of the kinetic-molecular theory of gases, how can increase in the temperature of a gas confined in a rigid container cause an increase in the pressure of the gas?

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Applications

1. There is a government warning on all aerosol cans that states: Do not store at a temperature above 120° F (50°C).

a) Explain why this warning is required in terms of the relationship between temperature and pressure and the kinetic molecular theory.

b) What could happen if the can were to be heated above 120° F (50°C)?

2. What would happen to a completely inflated balloon if it were taken from inside a house to the outside in the middle of January in Minnesota? Explain this prediction in terms of the Kinetic Molecular Theory.

3. Why do the manufacturers of tires suggest that tire pressure be checked before a car has been driven any distance?

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