

# Kinetic molecular theory essay sample



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Use the postulates of the kinetic theory to explain the following:

i) Matter can exist in three states

ii) The pressure exerted by a confined gas decreases as its temperature is lowered

iii) A gas of low molecular mass will diffuse through air faster than a gas of high molecular mass even though both are at the same temperature.

The Kinetic Theory can be used to describe the three physical states of matter namely, solid, liquid and gas. In this theory, some basic assumptions have to be made:

a) all matter is made up of extremely small particles

b) these particles are in constant random motion

c) all collisions between these particles are elastic, and

d) mutual attractive forces exist between particles

The explanation below gives more information about the three states of matter:

i) solids

> particles are held together in a regular pattern by strong attractive forces.

> particles vibrate about in fixed positions.

## ii) liquids

> vibrating particles have sufficient energy to move from their

fixed positions to other parts within a liquid.

> liquids take the shape of their container.

## iii) gases

> particles have sufficient kinetic energy to help escape the

attractive forces from other particles.

> gases take up the complete volume of a container.

The kinetic theory provides vital information on the sciences we learn. An example of this is the topic on “ heating and cooling” in physics. Besides, the kinetic energy theory may also be used in application to many other things, one of which is in relation to gas laws.

Pressure is explained by the Kinetic Theory as arising from the force exerted by collision of gas molecules with the walls of the container.

An experiment was conducted by a French scientist, Jacques Charles to see the effect of temperature on the pressure of a gas being confined in a container. It was found that when the temperature went down, the pressure also went down and vice-versa with the temperature going up. The kinetic theory explains that a lost in temperature means a lost in average kinetic energy has occurred. Therefore, the particles will collide with the container

at a lower frequency and less momentum. However, if the pressure is needed to be kept constant, the volume of the container must be decreased as the temperature goes lower and vice-versa.

To calculate this relationship, the combined gas law is used which has an equation of:-

$P \times V = \text{constant}$  Note: Temperature must always be in Kelvin.

$$T \text{ } ^\circ\text{C} + 273 = \text{K}$$

whereby:

P= Pressure

V= Volume

T= Temperature (K)

Gases will occupy any available space if not confined by a container. They will also mix with other gases if no barriers keep them apart/separated.

Diffusion is the moving of gas into space or the mixing of a gas with another. For example, when perfume diffuses through a room. The particles will move around in straight lines till they hit the walls of the container and are deflected into another path. Diffusion occurs because of the vast amount of space between the gas particles and the kinetic energy of the gas particles.

Different gases are made up of particles of different masses. Professor Graham proposed that the rates of diffusion are indirectly proportional to the square root of the masses of the particles. In other words, gases are made

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up of smaller particles which diffuse faster than gases which have bigger particles. This principle is known as Graham's Law. As the average kinetic energy of one gas particle is  $\frac{1}{2}mv^2$ , which is the same for every gas at the same temperature, less massive gas particles will travel faster than heavier particles.