Kinetic Molecular Theory (KMT) of Gases states:

1. Gases are composed of teeny-tiny particles that are far, far apart
2. Collisions of gas particles are perfectly elastic
3. Particles of a gas are in constant, rapid, random, straight-line motion
4. No forces of attraction or repulsion affect gas particles
5. $KE = \frac{1}{2} m u^2$

Temperature is defined as the average kinetic energy of a material

Deviations from ideal gas behavior are caused by:

High pressures: press particles too close and forces of attraction are significant

Low temperatures: particles move too slowly and forces of attraction become significant

Dalton's Law of Partial Pressures states:

$P_T = P_1 + P_2 + P_3 + \ldots + P_n$

Find the pressure of dry oxygen gas if the oxygen is first collected over water at 20°C when the atmospheric pressure is 101.3 kPa. (P_{vap} H_2O at 20°C = 2.3 kPa)

$P_T = P_{O_2} + P_{H_2O}$

$P_{O_2} = P_T - P_{H_2O}$

$P_{O_2} = 101.3\text{ kPa} - 2.3\text{ kPa} = \underline{99.0\text{ kPa}}$

Graham's Law states: $\frac{m_a}{m_b} = \frac{u_b^2}{u_a^2}$ or $\frac{u_a}{u_b} = \sqrt{\frac{m_b}{m_a}}$

Find the ratio of the rates of diffusion of He and SO_2.

$$\frac{u_a}{u_b} = \sqrt{\frac{m_b}{m_a}}$$

$$\frac{u_{He}}{u_{SO_2}} = \sqrt{\frac{m_{SO_2}}{m_{He}}} = \sqrt{\frac{64.064\,u}{4.00260\,u}} = \sqrt{16.055} = 4.0007$$

or, He diffuses 4.0007 times faster than SO_2

Go on to the next page.

Changes of State and Equilibrium ($H_2O_{(l)} \rightleftharpoons H_2O_{(g)}$)

Changes of state are (dynamic or static) dynamic in nature.

Entropy: a measure of the number of possible ways the energy of a system can be distributed

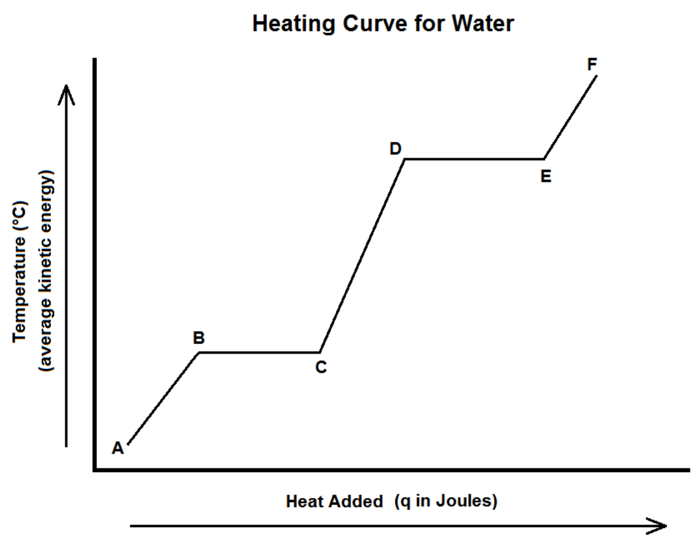
As water changes from a liquid to a gas, bonds are broken

the kinetic energy (KE) remains nearly constant

the potential energy (PE) increases significantly

and the entropy (ΔS) increases significantly

Heating Curves



Name the process occurring at

AB ice heats up BC ice melts CD water heats up

DE water vaporizes EF steam heats up

What states of matter exist at

AB solid only BC solid and liquid CD liquid only

DE liquid and gas EF gas only

Go on to the next page.

The following questions refer to the Heating Curve on the previous page.

At which segments is the temperature changing?

AB, CD, and EF

At which segments is the potential energy changing?

BC and DE

At which segments is the entropy changing?

BC and DE

At which segments are bonds being broken?

BC and DE

Using the 2011 Reference Table T, write heat equations for:

melting ice $q = m H_f$

heating water $q = m C \Delta T$

vaporizing water $q = m H_v$

Using the 2011 Reference Table B, write the values for the following constants:

H_f = 334 J g^{-1} C = 4.18 J g^{-1} K^{-1} H_v = 2260 J g^{-1}

Name each of the following constants:

H_f heat of fusion C specific heat capacity

H_v heat of vaporization

How much heat is required to melt 45.0 g of ice at 0.0°C and then raise the temperature of the water to 60.0°C?

melting $q = m H_f$ = 45.0 g x 334 J g^{-1} = 15 030 J

heating water $q = m C \Delta T$ = 45.0 g x 4.18 J g^{-1} K^{-1} x 60.0 K = 11 286 J

Total = 15 030 J + 11 286 J = 26 316 J or 26 300 J = 26.3 kJ

This is the last page.