**IDX G10 Chemistry S**

**Study Guide Issue #S1 Finals**

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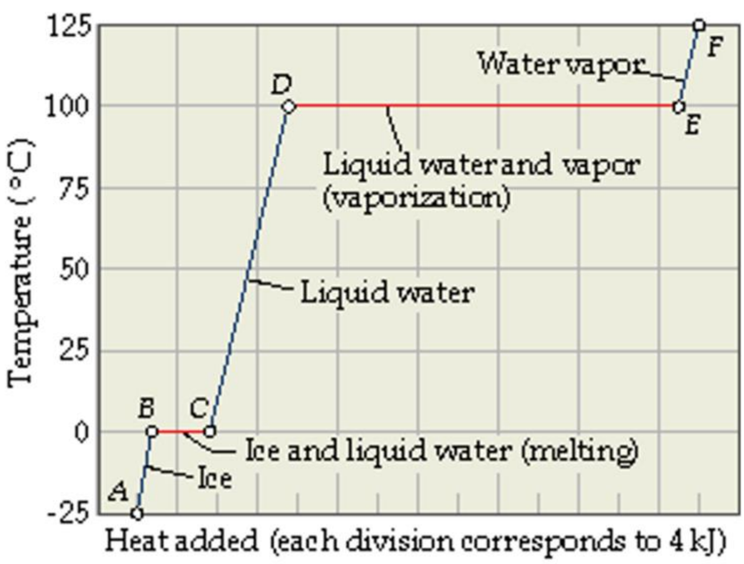
**Chapter 13**

- Kinetic energy: The energy an object has because of its motion
- 3 fundamental assumptions about gas
    - The particles in a gas are small, insignificant volume.
        - Within gas, the particles are relatively far apart compared with the distance between particles in a liquid or solid.
        - Between the particles, there is empty space.
- The motion of particles in a gas is rapid, constant, and random.
    - The particles travel in straight-line paths until they collide with another particle.
    - The particles change direction only when they rebound from collisions.
- All collisions between particles in a gas are perfectly elastic.
- During an elastic collision, kinetic energy is transferred without loss from one particle to another.

- The total kinetic energy remains constant.
- Gas pressure: results from the force exerted by a gas per unit surface area of an object.
- Vacuum: An empty space with no particles and no pressure.
    - If no particles are present, no collisions can occur. Consequently, there is no pressure.
- Atmospheric pressure: The collisions of atoms and molecules in air with objects.
    - Atmospheric pressure decreases as you climb a mountain because the density of Earth's atmosphere decreases as the elevation increases.
- Barometer: device that is used to measure atmospheric pressure.
- The SI unit of pressure is the pascal (Pa).
- One standard atmosphere (atm) is the pressure required to support 760 mm of mercury in a mercury barometer at 25°C.
- Potential energy: in this chapter, it refers to the stored portion of the energy as a substance is heated, which doesn't raise the temperature of the substance.
- The remaining absorbed energy does speed up the particles, that is, increases their kinetic energy.
- In the graph below, the process of heating water and it's relevancy with kinetic and potential energy could be demonstrated.



**AB**: Temperature of ice rises steadily, $E_k$ of $H_2O$ molecules increase.

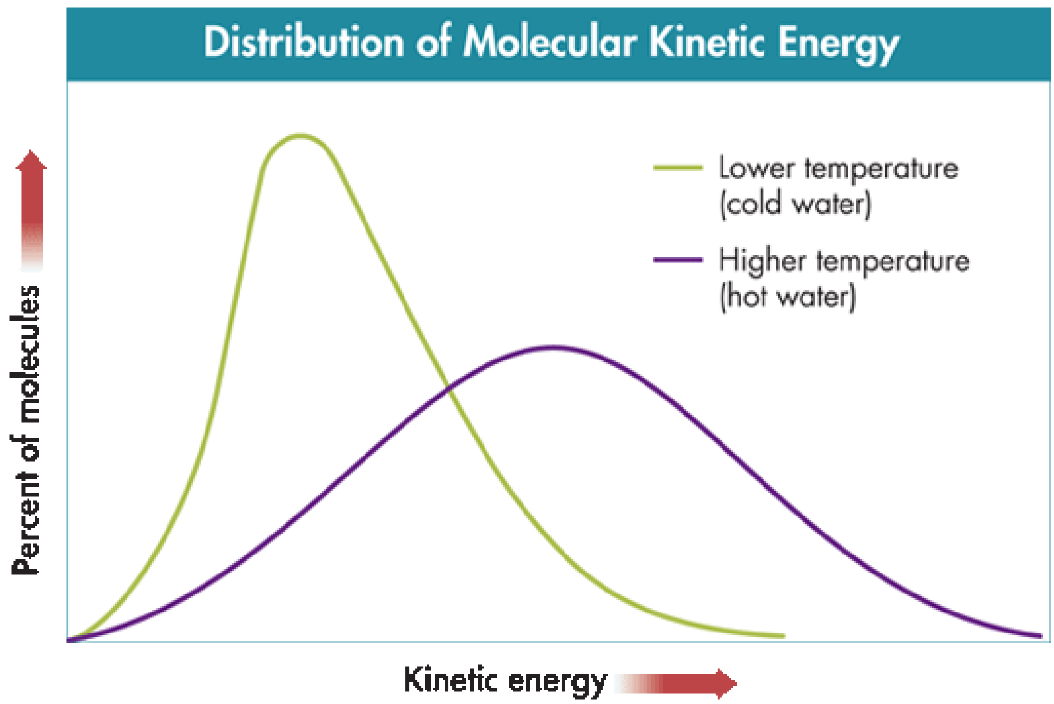
**BC**: Temperature remains constant, $E_p$ increases but $E_k$ doesn't change.

**CD**: Temperature of liquid water increases, $E_k$ of $H_2O$ molecules increase.

**DE**: Temperature remains constant, $E_p$ increases but $E_k$ doesn't change.

**EF**: Temperature of steam (gaseous water) increases, $E_k$ increases.

- Average kinetic energy: used when discussing the kinetic energy of a collection of particles in a substance.
  - The particles in any collection of atoms or molecules at a given temperature have a wide range of kinetic energies. Whereas the average kinetic energy varies in deference to different temperatures. (shown in the graph below)
  - At any given temperature, the particles of all substances, regardless of physical state, have the same average kinetic energy.




Most of the molecules have intermediate kinetic energies, close to the average value. Notice that the molecules at the higher temperature have a wider range of kinetic energies.

- Absolute zero (0 K, or –273.15°C): the temperature at which the motion of particles theoretically ceases.
    - No temperature can be lower than absolute zero.
    - Absolute zero has never been produced in the laboratory

**Things that need to be remembered**

- **1** atm = **101.3** kPa (unit for thousands of Pa) = **760** mm Hg
- Average kinetic energy of gas particles is directly proportional to the absolute temperature (in Kelvin)
- $T$ Celsius = $T$ Kelvin − 273.15