Gas Kinetics

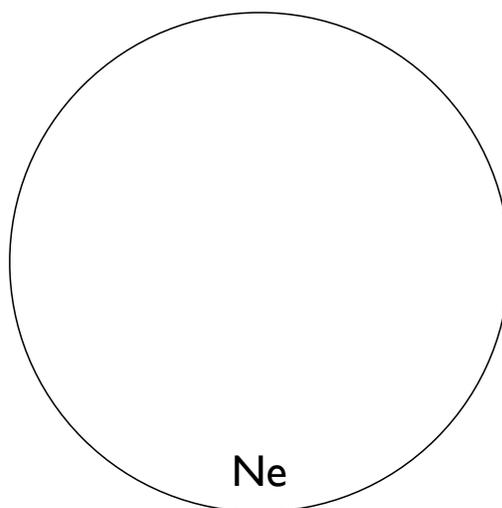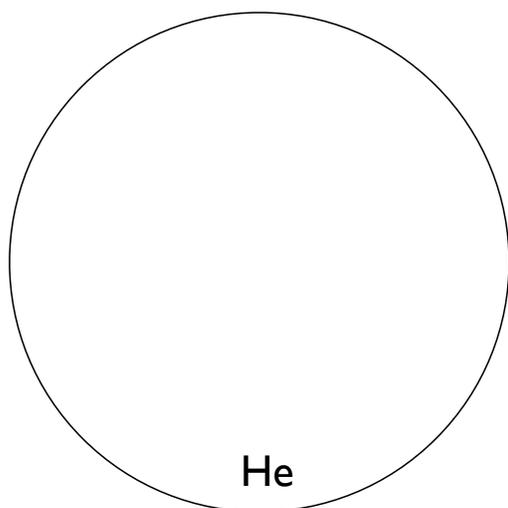
Gas Kinetics

Comparing the Speeds of Dissimilar Gases

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Gas Kinetics

Comparing the Speeds of Dissimilar Gases

- If two dissimilar gas samples have the same temperature then the <u>average kinetic energies</u> of the gas are equal
    - However, the <u>average speeds</u> of the molecules are not the same.
    - Why would this be true?
        - $E_k = \frac{1}{2}mv^2$
    - In order for kinetic energy to be equal at equal temperatures, lighter gas must be traveling at higher average speeds than heavier gases.

Gas Kinetics

Effusion & Diffusion

- Effusion
    - A gas escaping from a container through a small hole
- Diffusion
    - Spreading out and mixing of gases
- The rates of both of these processes depends on molecular speed
    - Since gases with smaller molar masses have higher average speeds, lighter gases will diffuse and effuse more rapidly than gases with higher molar masses

Gas Kinetics

Kinetic Molecular Theory

Ideal Gases

- The Theory of Moving Molecules
- Basic Assumptions
  - Gases consist of large numbers of randomly moving molecules
  - The volume of the gas molecules is insignificant compared to the volume the gas occupies
  - The IMF's between the gas molecules are insignificant because the molecules are far apart
  - Energy is transferred without loss between molecules during collisions - elastic
    - The average kinetic energy does not change with time as long as temperature doesn't change
  - The average kinetic energy is proportional to the absolute temperature
    - At any given temperature the molecules of all gases have the same average kinetic energy
    - $E_k = \frac{1}{2}mv^2$
- We, now, need to examine how kinetic theory supports our understanding of gases, relative to pressure and temperature changes.

Gas Kinetics

Linking Temperature, Pressure, and Volume

A volume increase at constant temperature
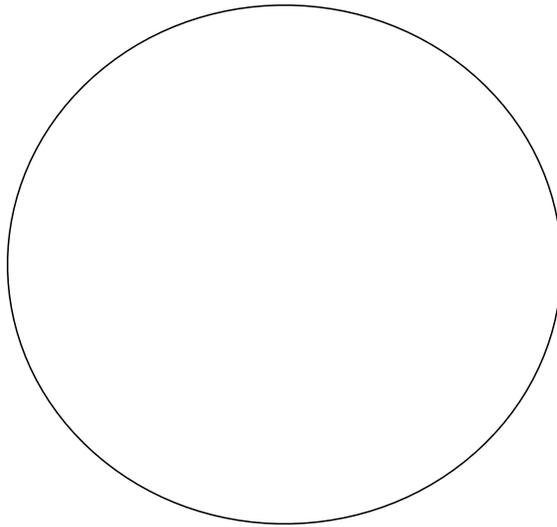   What happens to pressure?
       Why?
   What law does this represent?

A temperature increase at constant volume
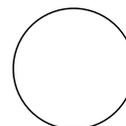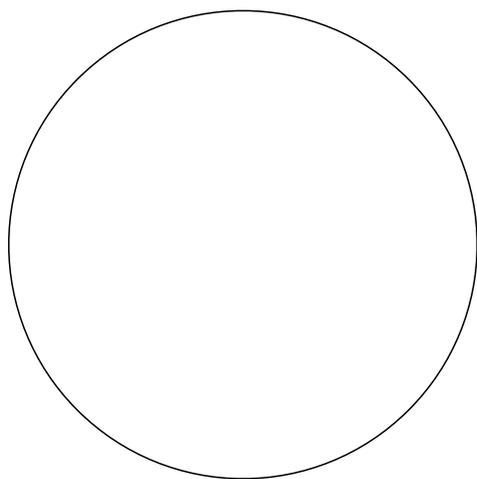   What happens to pressure?
       Why?

Real Gases

Non-Ideal Behavior

$$PV = nRT$$

- The behavior of ideal gases can be described using pivnert
  - Ideal gas have 2 characteristic simplifications from real gases
    - Mass, but no volume
    - No intermolecular forces
- Why can we treat gases as ideal?
- Under what conditions will they no longer behave ideally?

Gas Kinetics

Homework
- 10.75 / 10.76 / 10.79 / 10.80 / 10.81a / 10.89