Name: ___________________________________ **Date:** ________

Chemistry ~ *Ms. Hart* **Class:** Anions or Cations

8.9 Ideal Gases – Kinetic Molecular Theory WS

Objective: SWBAT define an ideal gas.

The Kinetic Molecular Theory (KMT) of Gases

- Defines the assumptions made about gases in order to simplify our understanding about the behavior of gases

	Postulate	Representation
1		
2		
3		
4		
5		

Brainstorm… In reality gases are complicated because…	PRACTICE: Which statement describes the particles of an ideal gas according to the kinetic molecular theory? (1) The gas particles are arranged in a regular geometric pattern. (2) The gas particles are in random, constant, straight-line motion. (3) The gas particles are separated by very small distances, relative to their sizes. (4) The gas particles are strongly attracted to each other.

REAL GASES ACT LIKE IDEAL GASES WHEN AT:

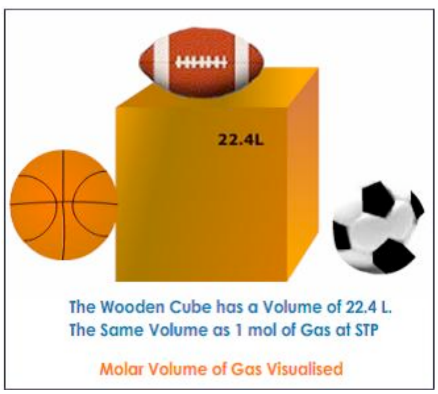
Condition	Reason

RECAP:

	Temperature	Pressure	Volume
Definition			
Units			

How do we count gas particles?

- 1 mole (6.022×10^{23} particles or molecules) of gas ALWAYS TAKES UP 22.4 L of space at STP
- At the same temperature, pressure, and volume, every gas has the same amount of particles REGARDLESS OF IDENTITY.



PRACTICE:
Which two samples of gas at STP contain the same total number of molecules?
(1) 1 L of $CO(g)$ and 0.5 L of $N_2(g)$
(2) 2 L of $CO(g)$ and 0.5 L of $NH_3(g)$
(3) 1 L of $H_2(g)$ and 2 L of $Cl_2(g)$
(4) 2 L of $H_2(g)$ and 2 L of $Cl_2(g)$

<u>In-class Practice:</u>
Directions: Answer the following questions based on your knowledge of chemistry.

1. The concept of an ideal gas is used to explain
   (1) the mass of a gas sample
   (2) the behavior of a gas sample
   (3) why some gases are monatomic
   (4) why some gases are diatomic

2. The kinetic molecular theory assumes that the particles of an ideal gas
   (1) are in random, constant, straight-line motion
   (2) are arranged in a regular geometric pattern
   (3) have strong attractive forces between them
   (4) have collisions that result in the system losing energy

3. A real gas behaves more like an ideal gas when the gas molecules are
(1) close and have strong attractive forces between them
(2) close and have weak attractive forces between them
(3) far apart and have strong attractive forces between them
(4) far apart and have weak attractive forces between them

4. Under which conditions of temperature and pressure would helium behave most like an ideal gas?
(1) 50 K and 20 kPa
(2) 50 K and 600 kPa
(3) 750 K and 20 kPa
(4) 750 K and 600 kPa

5. Under which conditions of temperature and pressure would a sample of $H_2(g)$ behave most like an ideal gas?
(1) 0°C and 100 kPa
(2) 0°C and 300 kPa
(3) 150°C and 100 kPa
(4) 150°C and 300 kPa

6. At the same temperature and pressure, 1.0 liter of CO (g) and 1.0 liter of CO_2 (g) have
(1) equal masses and the same number of molecules
(2) different masses and a different number of molecules
(3) equal volumes and the same number of molecules
(4) different volumes and a different number of molecules

7. A sample of oxygen gas is sealed in container X. A sample of hydrogen gas is sealed in container Z. Both samples have the same volume, temperature, and pressure. Which statement is true?
(1) Container X contains more gas molecules than container Z.
(2) Container X contains fewer gas molecules than container Z.
(3) Container X and Z both contain the same number of gas molecules.
(4) Containers X and Z both contain the same mass of gas.

8. The table below shows data for the temperature, pressure, and volume of four gas samples

Data for Four Gas Samples

Gas Sample	Temperature (K)	Pressure (atm)	Volume (mL)
A	100.	2	400.
B	200.	2	200.
C	100.	2	400.
D	200.	4	200.

Which two gas samples have the same total number of molecules?
(1) A and B
(2) A and C
(3) B and C
(4) B and D

9. A sealed, rigid l.0-liter cylinder contains He gas at STP. An identical sealed cylinder contains Ne gas at STP. These two cylinders contain the same number of

(1) atoms
(2) electrons
(3) ions
(4) protons

HOMEWORK:

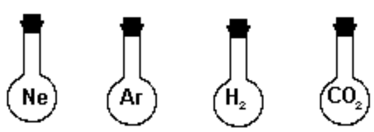
1. An ideal gas is made up of gas particles that
   (1) have volume
   (2) can be liquified
   (3) attract each other
   (4) are in random motion

2. A sample of a gas is contained in a closed rigid cylinder. According to kinetic molecular theory, what occurs when the gas inside the cylinder is heated?
   (1) The number of gas molecules increases.
   (2) The number of collisions between gas molecules per unit time decreases.
   (3) The average velocity of the gas molecules increases.
   (4) The volume of the gas decreases.

3. Equal volumes of $SO_2(g)$ and $O_2(g)$ at STP contain the same number of
   (1) atoms
   (2) molecules
   (3) electrons
   (4) protons

4. One reason that a real gas deviates from an ideal gas is that molecules of the real gas have
   (1) a straight line motion
   (2) no net loss of energy on collision
   (3) a negligible volume
   (4) forces of attraction for each other

5.



The diagram represents four 500-milliliter flasks. Each contains the gas represented by the symbol. All gas samples are at STP. Each flask contains the same number of
   (1) atoms, only
   (2) molecules, only
   (3) atoms and molecules
   (4) atoms but different number of molecules

6. Which of the following gases behaves most like an ideal gas?
   (1) $H_2(g)$
   (2) $O_2(g)$
   (3) $NH_3(g)$
   (4) $CO_2(g)$

7. A sample of $H_2(g)$ and a sample of $N_2(g)$ at STP contain the same number of molecules. Each sample must have
   (1) the same volume, but a different mass
   (2) the same mass, but a different volume
   (3) both the same volume and the same mass
   (4) neither the same volume nor the same mass

8.

Sample	Substance	Temperature (K)	Pressure (atm)	Volume (L)
A	He	273	1	22.4
B	O_2	273	1	22.4
C	Ne	273	2	22.4
D	N_2	546	2	44.8
E	Ar	546	2	44.8

The table shows the temperature, pressure, and volume of five samples. Which sample contains the same number of molecules as sample *A*?
   (1) *E*
   (2) *B*
   (3) *C*
   (4) *D*

9. Suppose you have two balloons, one filled with helium and the other with carbon dioxide. The pressure, temperature, and volume of the two gases are identical.
   a) Why is the mass of the carbon dioxide balloon greater?

   b) What do you know about the number of atoms in the balloons?