4/8/20

1. Which rigid cylinder contains the same number of gas molecules at STP as a 2.0-liter rigid cylinder containing $H_2(g)$ at STP?

A) 1.0-L cylinder of $O_2(g)$
B) 2.0-L cylinder of $CH_4(g)$
C) 1.5-L cylinder of $NH_3(g)$
D) 4.0-L cylinder of He(g)

2. 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?

A) *A* and *C*
B) *A* and *B*
C) *B* and *C*
D) *B* and D

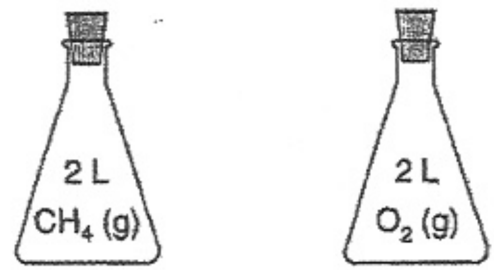
3. A sample of oxygen gas is sealed in container X. A sample of hydrogen gas is sealed in container Z. Both samples have the same volume, temperature, and pressure. Which statement is true?

A) Container X contains fewer gas molecules than container Z.
B) Container X contains more gas molecules than container Z.
C) Containers X and Z both contain the same number of gas molecules.
D) Containers X and Z both contain the same mass of gas.

4. At the same temperature and pressure, 1.0 liter of CO(g) and 1.0 liter of $CO_2(g)$ have

A) equal masses and the same number of molecules
B) equal volumes and the same number of molecules
C) different volumes and a different number of molecules
D) different masses and a different number of molecules

5. Each stoppered flask below contains 2 liters of a gas at STP.



Each gas sample has the same

A) density
B) number of atoms
C) number of molecules
D) mass

6. Equal volumes of all gases at the same temperature and pressure contain an equal number of

A) molecules
B) atoms
C) protons
D) electrons

7. According to the kinetic molecular theory, the particles of an ideal gas

A) are arranged in a regular, repeated geometric pattern
B) have no potential energy
C) have strong intermolecular forces
D) are separated by great distances, compared to their size

8. Which statement describes the particles of an ideal gas?

   A) The volume of the particles is negligible.
   B) There are forces of attraction between the particles.
   C) The particles move in well-defined, circular paths.
   D) When the particles collide, energy is lost.

9. According to the kinetic molecular theory, which statement describes the particles in a sample of an ideal gas?

   A) The force of attraction between the gas particles is strong.
   B) The motion of the gas particles is random and straight-line.
   C) The separation between the gas particles is smaller than the size of the gas particles themselves.
   D) The collisions between the gas particles cannot result in a transfer of energy between the particles.

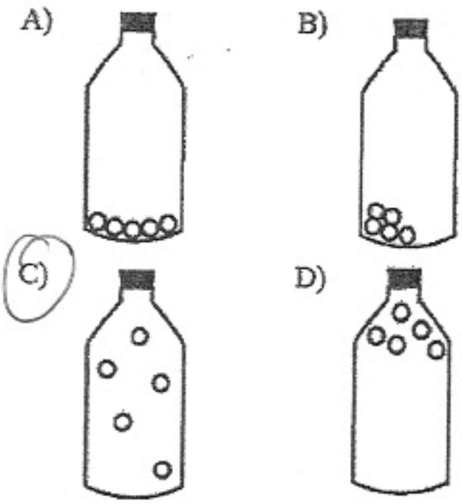
10. Standard pressure is equal to

   A) 1 atm
   B) 273 kPa
   C) 1 kPa
   D) 273 atm

11. 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?

   A) The volume of the gas decreases.
   B) The number of gas molecules increases.
   C) The average velocity of the gas molecules increases.
   D) The number of collisions between gas molecules per unit time decreases.

12. Which diagram best represents a gas in a closed container?



13. The concept of an ideal gas is used to explain

   A) the mass of a gas sample
   B) why some gases are diatomic
   C) why some gases are monatomic
   D) the behavior of a gas sample

14. Under which conditions does a real gas behave most like an ideal gas?

   A) at high temperatures and high pressures
   B) at low temperatures and low pressures
   C) at low temperatures and high pressures
   D) at high temperatures and low pressures

15. Two basic properties of the gas phase are

   A) a definite shape and a definite volume
   B) no definite shape but a definite volume
   C) no definite shape and no definite volume
   D) a definite shape but no definite volume

Problem Set A: Combined Gas Law I

1. A gas has a volume of 50. mL at a temperature of 10.0 K and a pressure of 760. mm Hg. What will be the new volume when the temperature is changed to 20.0 K and the pressure is changed to 380. mm Hg?

$V_1 = 50.\text{mL}$
$T_1 = 10.0\text{K}$
$P_1 = 760.\text{mmHg}$
$V_2 = ?$
$T_2 = 20.\text{K}$
$P_2 = 380.\text{mmHg}$

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{760.\times 50.}{10.0} = \frac{380.\times V_2}{20.0}$$

$$\frac{760\,000}{3800} = \frac{3800\times V_2}{3800}$$

$$200.\text{mL} = V_2$$

2. The volume of a sample of a gas at 273 K is 100.0 L. If the volume is decreased to 50.0 L at constant pressure, what will be the new temperature of the gas?

$V_1 = 100.0\text{L}$
$T_1 = 273\text{K}$
$V_2 = 50.0\text{L}$
$T_2 = ?$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{100.0}{273} = \frac{50.0}{T_2}$$

$$\frac{100.0T_2}{100.0} = \frac{13650}{100.0}$$

$$T_2 = 136.5\text{K}$$

3. A gas has a volume of 2.00 L at 323 K and 3.00 atm. What will be the new volume if the temperature is changed to 273 K and the pressure is changed to 1 atm?

$V_1 = 2.00\text{L}$
$T_1 = 323\text{K}$
$P_1 = 3.00\text{atm}$
$V_2 = ?$
$T_2 = 273\text{K}$
$P_2 = 1.00\text{atm}$

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{3.00\times 2.00}{323} = \frac{1.00\times V_2}{273}$$

$$\frac{1638}{323} = \frac{323V_2}{323}$$

$$5.1\text{mL} = V_2$$

4. What will be the new volume of 100. mL of gas if the Kelvin temperature and the pressure are both halved? (Make up your own values)

$V_1 = 100.\text{mL}$
$P_1 = 2.0\text{atm}$
$T_1 = 300\text{K}$
$V_2 = ?$
$P_2 = 1.0\text{atm}$
$T_2 = 150\text{K}$

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{2.0\times 100.}{300} = \frac{1.0\cdot V_2}{150}$$

$$\frac{30000}{300} = \frac{300\cdot V_2}{300}$$

$$100.\text{mL} = V_2$$