Name _____ AP Chem ___/___/___

Chapter 5 Homework #3

Circle and write the letter of the correct answer on the line for each of the following.

1._____ A sample of gas in a closed container has its initial pressure doubled and its temperature held constant. Which of the following is true?
(A) The volume of the gas doubles (B) The density of the gas doubles
(C) The density of the gas halves (D) The size of the molecules doubles
(E) The average kinetic energy of the molecules doubles

2._____ A helium filled balloon rises. Which of the following choices is the best explanation for the phenomenon?
(A) The density of the helium filled balloon is less than the surrounding air.
(B) The inside of the balloon is warmer than the outside air.
(C) Helium molecules have greater kinetic energy than the outside air.
(D) The pressure beneath the balloon is greater than the pressure above the balloon.
(E) The molecules are small enough to effuse rapidly, causing the balloon to rise.

3._____ $C_3H_7OH(s) \rightarrow H_2O(g) + C_3H_6(g)$
A chemist places 0.10 moles of $C_3H_7OH(s)$ in a 2.0 L flask. The flask is heated and $C_3H_7OH(s)$ decomposes completely according to the equation above. The flask's temperature is 500. K; calculate the approximate total pressure in the flask.
(A) 8.0 atm (B) 50. atm (C) 25 atm (D) 2.0 atm (E) 4.0 atm

4._____ Two flexible containers for gases are at the same temperature and pressure. One holds 0.50 gram of hydrogen and the other holds 8.0 grams of oxygen. Which of the following statements regarding these gas samples is FALSE?
(A) The volume of the hydrogen container is the same as the volume of the oxygen container.
(B) The number of molecules in the hydrogen container is the same as the number of molecules in the oxygen container.
(C) The density of the hydrogen sample is less than that of the oxygen sample.
(D) The average kinetic energy of the hydrogen molecules is the same as the average kinetic energy of the oxygen molecules.
(E) The average speed of the hydrogen molecules is the same as the average speed of the oxygen molecules.

5._____ As the temperature is raised from 20°C to 40°C, the average kinetic energy of neon atoms changes by a factor of
(A) ½ (B) $(313/293)^{1/2}$ (C) 313/293 (D) 2 (E) 4

6._____ Which of the following is the same for one mole samples of ideal monatomic gases at standard temperature and pressure?
(A) The total kinetic energy of the molecules (B) The density of the sample
(C) The number of collisions per second of molecules with the wall (D) The average speed of the molecules
(E) The root-mean-square speed of the molecules

7._____ At 25 °C, a sample of NH_3 (molar mass 17 grams) effuses at the rate of 0.050 mole per minute. Under the same conditions, which of the following gases effuses at approximately one-half that rate?
(A) O_2 (molar mass 32 grams) (B) He (molar mass 4.0 grams) (C) CO_2 (molar mass 44 grams)
(D) Cl_2 (molar mass 71 grams) (E) CH_4 (molar mass 16 grams)

8._____ A rigid metal tank contains oxygen gas. Which of the following applies to the gas in the tank when additional oxygen is added at constant temperature?
(A) The volume of the gas increase. (B) The pressure of the gas decreases.
(C) The average speed of the gas molecules remains the same. (D) The total number of gas molecules remains the same.
(E) The average distance between the gas molecules increases.

9._____ A sample of an ideal gas is cooled from 50.0 °C to 25.0 °C in a sealed container of constant volume. Which of the following values for the gas will decrease?
I. The average molecular mass of the gas II. The average distance between the molecules
III. The average speed of the molecules

(A) I only (B) II only (C) III only (D) I and III (E) II and III

10._____ Equal numbers of moles of He(g), Ar(g), and Ne(g) are placed in a glass vessel at room temperature. If the vessel has a pinhole-sized leak, which of the following will be true regarding the relative values of the partial pressures of the gases remaining in the vessel after some of the gas mixture has effused?
(A) $P_{He} < P_{Ne} < P_{Ar}$ (B) $P_{He} < P_{Ar} < P_{Ne}$ (C) $P_{Ne} < P_{Ar} < P_{He}$
(D) $P_{Ar} < P_{He} < P_{Ne}$ (E) $P_{He} = P_{Ar} = P_{Ne}$

11._____ Argon gas initially at 25ºC is heated to 50ºC in a closed container. Which statement is correct?
(A) The average kinetic energy of the argon atoms does not change. (B) The average kinetic energy of the argon atoms doubles.
(C) The pressure of the gas decreases by about 50 percent. (D) The pressure of the gas doubles.
(E) The pressure of the gas increases by about 8 percent.

12._____ 100 grams of $O_2(g)$ and 100 grams of He(g) are in separate containers of equal volume. Both gases are at 100ºC. Which of the following statements is true?
(A) Both gases would have the same pressure.
(B) The average kinetic energy of the O_2 molecules is greater than that of the He molecules.
(C) The average kinetic energy of the He molecules is greater than that of the O_2 molecules.
(D) There are equal numbers of He molecules and O_2 molecules.
(E) The pressure of the He(g) would be greater than that of the $O_2(g)$.

13._____ Which one of the following is NOT an assumption of the kinetic theory of gases?
(A) Gas particles are negligibly small. (B) Gas particles are in constant motion.
(C) Gas particles don't attract each other. (D) Gas particles undergo elastic collisions.
(E) Gas particles undergo a decrease in kinetic energy when passed from a region of high pressure to a region of low pressure.

14._____ Which of the following would express the approximate density of carbon dioxide gas at 0°C and 2.00 atm pressure (in grams per liter)?
(A) 2 g/L (B) 4 g/L (C) 6 g/L (D) 8 g/L (E) none of the above

15._____ At 25°C, a sample of NH_3 (molar mass 17 grams) effuses at the rate of 0.050 mole per minute. Under the same conditions, which of the following gases effuses at approximately double that rate?
(A) O_2 (molar mass 32 grams) (B) He (molar mass 4.0 grams) (C) CO_2 (molar mass 44 grams)
(D) Cl_2 (molar mass 71 grams) (E) CH_4 (molar mass 16 grams)

16._____ A sample of 0.0100 mole of oxygen gas is confined at 37°C and 0.216 atmosphere. What would be the pressure of this sample at 15°C and the same volume?
(A) 0.0876 atm (B) 0.175 atm (C) 0.201 atm (D) 0.233 atm (E) 0.533 atm

17._____ A sample of 3.30 grams of an ideal gas at 150.0 °C and 1.25 atmospheres pressure has a volume of 2.00 liters. What is the molar mass of the gas? The gas constant, R, is 0.0821 L atm mol^{-1} K^{-1}).
(A) 0.0218 gram/mole (B) 16.2 grams/mole (C) 37.0 grams/mole
(D) 45.8 grams/mole (E) 71.6 grams/mole

18._____ A sample of 0.1973 mole of nitrogen gas is confined at 37° C and 0.216 atmosphere. What would be the pressure of this sample at 15° C and the same volume?
(A) 0.0876 atm (B) 0.175 atm (C) 0.201 atm (D) 0.233 atm (E) 0.533 atm

19._____ A sample of 5.16 grams of an ideal gas at 150.0 °C and 1.25 atmospheres pressure has a volume of 2.00 liters. What is the molar mass of the gas?
(A) 0.0218 gram/mole (B) 16.2 grams/mole (C) 37.0 grams/mole (D) 45.8 grams/mole (E) 71.6 grams/mole

20._____ A gas has a volume of 4.0 L at a pressure of 0.80 atm. What is the volume if the pressure is changed to 0.20 atm at constant temperature?
(A) 1.0 L (B) 2.0 L (C) 8.0 L (D) 16 L (E) 6 L

21. _____Equal numbers of moles of $CO_2(g)$, $SO_2(g)$, and $H_2O(g)$ are placed in a glass vessel at 400. K. If the vessel has a pinhole-sized leak, which of the following will be true regarding the relative values of the partial pressures of the gases remaining in the vessel after some of the gas mixture has effused?
(A) $P_{CO2} < P_{SO2} < P_{H2O}$ (B) $P_{CO2} < P_{H2O} < P_{SO2}$ (C) $P_{SO2} < P_{CO2} < P_{H2O}$
(D) $P_{H2O} < P_{CO2} < P_{SO2}$ (E) $P_{CO2} = P_{SO2} = P_{H2O}$

22._____ A 0.239 g sample of a gas in a 100-mL flask exerts a pressure of 1520 mmHg at 14 °C. What is the gas?
(A) chlorine (B) nitrogen (C) krypton (D) xenon (E) oxygen

23._____ A sample of neon gas has a volume of 333 mL at 30.°C and a certain pressure. What volume would it occupy if it were heated to 60.°C at the same pressure?
(A) 366 mL (B) 399 mL (C) 333 mL (D) 666 mL (E) 167 mL

24._____ Hydrogen gas is collected over water at 21°C. At 21°C the vapor pressure of water is 18.7 torr. If the barometric pressure is 758 torr what is the pressure of hydrogen gas?
(A) 758 torr (B) 777 torr (C) 739 torr (D) 48.2 torr (E) 18.7 torr

25._____ Calculate the root mean square velocity of a sample of 10.0 grams of helium atoms at 55.0 °C.
(A) 45.2 m/s (B) 142 m/s (C) 1010 m/s (D) 1110 m/s (E) 1430 m/s

26._____ When a sample of oxygen gas in a closed container of constant volume is heated until its Celsius temperature is doubled, which of the following is also doubled?
(A) The density of the gas (B) The potential energy of the molecules (C) The pressure of the gas
(D) The average velocity of the gas molecules (E) None of the above

27._____ Helium is often found with methane, CH_4. How do the diffusion rates of helium and methane compare at the same temperature? Methane diffuses:
(A) ½ as fast as helium. (B) four times as fast as helium. (C) twice as fast as helium.
(D) at the same rate as helium. (E) ¼ as fast as helium.

28._____ Under which conditions will a gas behave most ideally?
(A) high P and low T (B) low P and low T (C) low P and high T
(D) high P and high T (E) a gas will behave ideally at all conditions

29._____ Xenon gas initially at 35ºC is heated to 105ºC in a closed container. Which statement is correct?
(A) The average kinetic energy of the xenon atoms does not change. (B) The average kinetic energy of the xenon atoms triples.
(C) The pressure of the gas increases by 23 percent. (D) The pressure of the gas triples.
(E) The pressure of the gas increases by about 8 percent.

30._____ Which gas has a density of 2.58 $g \cdot L^{-1}$ at 10.°C and 1.5 atm?
(A) Ar (B) Ne (C) CO (D) CH_4 (E) Kr

31._____ A gas mixture at 27°C and 760 mm Hg contains 1.0 g each of He, O_2, N_2 and CO. How do their average molecular speeds compare?
(A) $He = O_2 = N_2 = CO$ (B) $O_2 < N_2 = CO < He$ (C) $He < CO = N_2 < O_2$
(D) $CO < O_2 < N_2 < He$ (E) $He < O_2 < CO < N_2$

32._____ Which of the following would express the approximate density of sulfur dioxide gas at 0°C and 3.00 atm pressure (in grams per liter)?
(A) 2.2 g/L (B) 4.3 g/L (C) 6.5 g/L (D) 8.6 g/L (E) 5.5 g/L

33._____ $2Li(s) + 2HCl\ (aq) \rightarrow H_2(g) + 2LiCl(aq)$
Calculate the volume of Hydrogen produced if 3.55 grams of Li react with excess HCl if the pressure is 0.98 atm and the temperature is 29.0 °C.
(A) 6.50 L (B) 13.0 L (C) 3.25 L (D) 44.9 L (E) 89.8 L

34._____ Three balloons are each filled to a volume of 40.0 L with Ar, Kr, and Xe, respectively. Which statement is true under the same conditions of temperature and pressure?
(A) The balloons contain the same mass of gas. (B) All gases have the same kinetic energy.
(C) The densities of the three gases are the same. (D) The gases will all effuse at the same rate.
(E) All gases have the same root mean square velocity.

35._____ A flask contains 0.25 mole of $SO_2(g)$, 0.50 mole of $CH_4(g)$, and 0.50 mole of $O_2(g)$. The total pressure of the gases in the flask is 800 mm Hg. What is the partial pressure of the $SO_2(g)$ in the flask?
(A) 800 mm Hg (B) 600 mm Hg (C) 250 mm Hg (D) 200 mm Hg (E) 160 mm Hg

Questions 36–38 refer to the following gases at 0˚C and 1 atm.
(A) Ne (B) Xe (C) O_2 (D) CO (E) NO

36._____ Has an average atomic or molecular speed closest to that of N_2 molecules at 0˚C and 1 atm.

37._____ Has the greatest density.

38._____ Has the greatest rate of effusion through a pinhole.

39._____ A 2 L container will hold about 4 g of which of the following gases at 0˚C and 1 atm?
(A) SO_2 (B) N_2 (C) CO_2 (D) C_4H_8 (E) NH_3

40._____ Which of the following gasses shows most ideal behavior at 25°C and 1 atm?
(A) Ar (B) Cl_2 (C) He (D) CH_4 (E) O_2

41._____ At approximately what temperature will 40. Grams of argon gas at 2.0 atm occupy avolume of 22.4 L?
(A) 1,200 K (B) 600 K (C) 550 K (D) 270 K (E) 140 K

42._____ $8H_2(g) + S_8(s) \rightarrow 8H_2S(g)$
When 25.6 g of $S_8(s)$ reacts completely with an excess of $H_2(g)$ according to the equation above, the volume of $H_2S(g)$, measured at 0°C and 1.00 atm, produced is closest to:
(A) 30 L (B) 20 L (C) 10 L (D) 5 L (E) 2 L

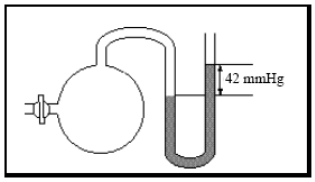
43._____ At which of the following temperatures and pressures would a real gas be most likely to deviate from ideal behavior?

	Temperature (K)	Pressure (atm)
(A)	100	50
(B)	200	5
(C)	300	0.01
(D)	500	0.01
(E)	500	1

44._____ Of the following gases, which has the greatest average molecular speed at 298 K?
(A) $Cl_2(g)$ (B) NO(g) (C) $H_2S(g)$ (D) HCN(g) (E) $PH_3(g)$

45._____ A sample of neon gas has a volume of 248 mL at 30.°C and a certain pressure. What volume would it occupy if it were heated to 60.°C at the same pressure?
(A) 226 mL (B) 273 mL (C) 278 mL (D) 496 mL (E) 124 mL

46._____ A gas is collected in the flask shown here. What is the pressure exerted by the gas if the atmospheric pressure is 735 mmHg?
(A) 42 mmHg (B) 693 mmHg (C) 735 mmHg (D) 777 mmHg (E) 84 mmHg



47._____ A sample of oxygen gas and a sample of an unknown gas are weighed separately in the same evacuated flask. Use the data given to find the molar mass of the unknown gas (assume experiments are carried out at the same pressure and temperature).

Mass of evacuated flask	124.46 g
Mass of flask + oxygen	125.10 g
Mass of flask + unknown gas	125.34 g

(A) 22 g/mol (B) 38 g/mol (C) 44 g/mol (D) 84 g/mol (E) 66 g/mol

48._____ A gas mixture at 27°C and 760 mm Hg contains 1.0 g each of He, H_2, N_2 and CO_2. How do their average molecular speeds compare?
(A) $He = H_2 = N_2 = CO_2$ (B) $CO_2 < H_2 = N_2 < He$ (C) $He < H_2 < N_2 < CO_2$
(D) $CO_2 < N_2 < He < H_2$ (E) $H_2 < He < N_2 < CO_2$

49._____ Which pair of gases has the same average rate of diffusion at 25°C?
(A) He and Ne (B) N_2 and O_2 (C) N_2O and CO_2 (D) NH_3 and HCl (E) SF_6 and Xe

50._____ Which noble gas effuses approximately twice as fast as Kr?
(A) Ne (B) Ar (C) Xe (D) Rn (E) He

50._____ Helium is often found with methane, CH_4. How do the diffusion rates of helium and methane compare at the same temperature? Helium diffuses
(A) sixteen times as fast as methane. (B) four times as fast as methane. (C) twice as fast as methane.
(D) at the same rate as methane. (E) half as fast as methane.

51._____ A gas has a volume of 6.0 L at a pressure of 0.80 atm. What is the volume if the pressure is changed to 0.20 atm at constant temperature?
(A) 1.5 L (B) 3.0 L (C) 12 L (D) 24 L (E) 0.96 L

52._____ A 0.239 g sample of a gas in a 100-mL flask exerts a pressure of 600 mmHg at 14 °C. What is the gas?
(A) chlorine (B) nitrogen (C) krypton (D) xenon (E) oxygen

53._____ What pressure (in atm) will be exerted by a 1.00 g sample of CH_4, in a 4.25 L flask at 115°C?
(A) 0.139 (B) 0.330 (C) 0.467 (D) 7.50 (E) 8.46

54._____ A gas in a closed, flexible container is slowly cooled from 50 °C to 25 °C. What is the ratio of the final volume of the gas to its initial volume? Assume ideal behavior.
(A) 2/1 (B) 1.08/1 (C) 0.923/1 (D) 0.5/1 (E) 1.5/1

55._____ The mass of 560 cm^3 of a gas at 0˚C and 1 atm is 1.60 g. Which gas could it be?
(A) O_2 (B) CO_2 (C) SO_2 (D) Cl_2 (E) Xe

56._____ Oxygen, which is 16 times as dense as hydrogen, diffuses:
(A) 1/16 times as fast. (B) 1/4 times as fast. (C) 4 times as fast.
(D) 16 times as fast (E) equally as fast as hydrogen.

57._____ Which gas has a density of 0.71 $g \cdot L^{-1}$ at 0°C and 1 atm?
(A) Ar (B) Ne (C) CO (D) CH_4 (E) Kr

58._____ What is the molar mass of a gas that has a density of 5.66 $g.L^{-1}$ at 35°C and 745 mm Hg?
(A) 127 (B) 135 (C) 141 (D) 143 (E) 146

60._____ A sample of C_2H_6 gas initially at 50 °C and 720 mmHg is heated to 100 °C in a container of constant volume. What is the new pressure (in mmHg)?
(A) 360 (B) 540 (C) 623 (D) 831 (D) 1440

61._____ What is the molar mass of a gas if 10.0 grams of it occupy 4.48 liters at 273 K and 1.00 atm?
(A) 2.00 g/mol (B) 4.00 g/mol (C) 25.0 g/mol (D) 50.0 g/mol (E) 100. g/mol

62._____ Three balloons are filled with the same number of atoms of He, Ar, and Xe, respectively. Which statement is true under the same conditions of temperature and pressure?
(A) The balloons contain the same mass of gas.
(B) All balloons have the same volume.
(C) The densities of the three gases are the same.
(D) The average speed of the different types of atoms is the same.
(E) All gases have the same root mean square velocity.

63._____ Which property is the same for 1.0 g samples of H_2 and CH_4 in separate 1.0 L containers at 25 °C?
(A) pressure (B) number of molecules (C) average molecular velocity
(D) average molecular kinetic energy (E) none of the above

64._____ A flask contains a mixture of Ne(g) and Ar(g). There are 0.250 mol of Ne(g) which exerts a pressure of 205 mmHg. If the Ar(g) exerts a pressure of 492 mmHg, what mass of Ar(g) is in the flask?
(A) 4.16 g (B) 12.1 g (C) 24.0 g (D) 95.9 g (E) 102 g