Name _____ **AP Chem** ___/___/___

Chapter 5 Homework #2

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

1. B $S(s) + 3\ F_2(g) \rightarrow SF_6(g)$

For the reaction above at standard temperature and pressure, the volume of F_2 required to produce 0.500 mole of SF_6 is:

(A) 67.2 liters (B) 33.6 liters (C) 22.4 liters (D) 11.2 liters (E) 1.5 liters

2. E A sample of 1.00 mole of hydrogen gas is mixed with 5.00 mole of helium gas. If the total pressure of the system is 3.00 atmospheres, the partial pressure of the helium gas is:

(A) 0.500 atm (B) 1.00 atm (C) 1.50 atm (D) 2.00 atm (E) 2.50 atm

3. C The density of a certain gas was measured to be 2.68 grams per liter at 3.00 atm. and 27°C. What is the molecular mass of the gas?

(A) 16.0 (B) 20.0 (C) 22.0 (D) 60.0 (E) 132

4. A At the same temperature, the RMS speed of O_2 gas is how many times that of SO_2 gas?

(A) 1.4 (B) 2 (C) 4 (D) .5 (E) .25

5. D The density of oxygen gas at 25°C and 4.0 atmospheres pressure is approximately

(A) 1.3 gram/liter (B) 2.6 gram/liter (C) 3.2 gram/liter (D) 5.2 gram/liter (E) 7.3 gram/liter

6. D A hydrocarbon with an empirical formula CH_2 is found to have a mass of 5.01 grams at a pressure of 1.00 atm, a temperature of 0°C., and a volume of 2.00 liters. A possible formula for this hydrocarbon is:

(A) CH_2 (B) C_2H_4 (C) C_3H_6 (D) C_4H_8 (E) C_5H_{10}

7. C 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?

X. The density of the gas. X. 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

8. D Collisions between gas particles and container walls result in a measurable pressure. Pressure varies:

I. Directly with Kelvin temperature ✓ II. Inversely with the volume of the container ✓

III. Directly with the concentration of gas particles. ✓

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

9. D A 66.0g sample of solid CO_2 vaporizes completely to fill an empty plastic bag to a final volume of 22.4 L at 0° C. What is the final pressure in the sealed bag?

(A) 380 mm Hg (B) 507 mm Hg (C) 760 mm Hg (D) 1140 mm Hg (E) 1520 mm Hg

10. B A mixture of nitrogen and helium gases containing 4.00 grams of helium, exerts a total pressure of 800. mm Hg. If the partial pressure of the nitrogen gas is 480 mm of Hg, what is the mass of the nitrogen gas in the mixture?

(A) 21.0 g (B) 42.0 g (C) 56.0 g (D) 28.0 g (E) 6.00 g

11. B The density of an unknown gas is 4.20 grams per liter at 3.00 atmospheres pressure and 127 °C. What is the molecular weight of this gas?

(A) 14.6 (B) 46.0 (C) 88.0 (D) 94.1 (E) 138

12. C A 2.00-liter sample of nitrogen gas at 27 °C and 600. millimeters of mercury is heated until it occupies a volume of 5.00 liters. If the pressure remains unchanged, the final temperature of the gas is

(A) 68 °C (B) 120 °C (C) 477 °C (D) 677 °C (E) 950. °C

13. C A hydrocarbon gas with an empirical formula CH_2 has a density of 1.88 grams per liter at 0 °C and 1.00 atmospheres. A possible formula for the hydrocarbon is

(A) CH_2 (B) C_2H_4 (C) C_3H_6 (D) C_4H_8 (E) C_5H_{10}

14. C A compound is heated to produce a gas whose molecular weight is to be determined. The gas is collected by displacing water in a water-filled flask inverted in a trough of water. Which of the following is necessary to calculate the molecular weight of the gas, but does NOT need to be measured during the experiment?
(A) Mass of the compound used in the experiment (B) Temperature of the water in the trough (C) Vapor pressure of the water
(D) Barometric pressure (E) Volume of water displaced from the flask

15. B Hydrogen gas is collected over water at 24°C. The total pressure of the sample is 755 millimeters of mercury. At 24°C, the vapor pressure of water is 22 millimeters of mercury. What is the partial pressure of the hydrogen gas?
(A) 22 mm Hg (B) 733 mm Hg (C) 755 mm Hg (D) 760 mm Hg (E) 777 mm Hg

16. A Which of the following is true at the triple point of a pure substance?
(A) The vapor pressure of the solid phase always equals the vapor pressure of the liquid phase.
(B) The temperature is always 0.01 K lower that the normal melting point.
(C) The liquid and gas phases of the substance always have the same density and are therefore indistinguishable.
(D) The solid phase always melts if the pressure increases at constant temperature.
(E) The liquid phase always vaporizes if the pressure increases at constant temperature.

17. E A hot-air balloon rises. Which of the following is the best explanation for this observation?
(A) The pressure on the walls of the balloon increases with increasing temperature.
(B) The difference in temperature between the air inside and outside the balloon produces convection currents.
(C) The cooler air outside the balloon pushes in on the walls of the balloon.
(D) The rate of diffusion of cooler air is less than that of warmer air.
(E) The air density inside the balloon is less than that of the surrounding air.

18. A Which of the following gases deviates most from ideal behavior?
(A) SO_2 (B) Ne (C) CH_4 (D) N_2 (E) H_2

19. A $NH_4NO_3(s) \rightarrow N_2O(g) + 2\,H_2O(g)$
A 0.03 mol sample of $NH_4NO_3(s)$ is placed in a 1 L evacuated flask, which is then sealed and heated. NH_4NO_3 decomposes completely according to the balanced equation above. The total pressure in the flask measured at 400 K is closest to which of the following?
(A) 3 atm (B) 1 atm (C) 0.5 atm (D) 0.1 atm (E) 0.03 atm

20. E Equal masses of He and Ne are placed in a sealed container. What is the partial pressure of He if the total pressure in the container is 6 atm?
(A) 1 atm (B) 2 atm (C) 3 atm (D) 4 atm (E) 5 atm

21. A At standard temperature and pressure, a 0.50 mol sample of H_2 gas and a separate 1.0 mol sample of O2 gas have the same:
(A) average molecular kinetic energy (B) average molecular speed (C) volume
(D) effusion rate (E) density

22. B Three gases in the amounts shown in the table to the right are added to a previously evacuated rigid tank. If the total pressure in the tank is 3.0 atm at 25°C, the partial pressure of $N_2(g)$ in the tank is closest to
(A) 0.75 atm (B) 0.50 atm (C) 0.33 atm (D) 0.25 atm (E) 0.17 atm

Gas	Amount
Ar	0.35 mol
CH_4	0.90 mol
N_2	0.25 mol

23. E At 25°C, C_2H_6 effuses at a rate of 0.55 mol/minute. Which gas would have a rate of effusion approximately one-fast as fast?
(A) He (B) CH_4 (C) NO (D) N_2O_3 (E) Cl_2O_3

24. C An ideal gas in a rigid sealed container is heated from 330 K to 430 K. Which of the following DO NOT change?
I. The density of the gas II. The average distance between molecules III. The average speed of the molecules
(A) I only (B) III only (C) I & II only (D) I & III only (E) I, II, & III

25. C What is the total pressure after 2.00 moles of $H_2(g)$, 1.00 mole of $O_2(g)$, 2.00 moles of $N_2(g)$ and 1.00 mole $CO_2(g)$ are injected into a rigid 22.4 L container 273 K?
(A) 760 mmHg (B) 2280 mmHg (C) 4560 mmHg (D) 9120 mmHg (E) 63,500 mmHg

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Chapter 5 Homework #3

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

1. B 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

$P_1V_1 = P_2V_2$
$(1)(2) = (2)V_2$
$V_2 = 1$ volume

2. A 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. E $C_3H_7OH(s) \rightarrow H_2O(g) + C_3H_6(g)$
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. E 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. C 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. A 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. D 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. C 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. C 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

KE = temp. more moles = more pressure

10. A 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. E Argon gas initially at 25°C is heated to 50°C 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. E 100 grams of $O_2(g)$ and 100 grams of He(g) are in separate containers of equal volume. Both gases are at 100°C. 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 $O_2(g)$.
more moles = more

13. E 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. B 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. B 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. C 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. D 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. C 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. E 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 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. D 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. B 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 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. C 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. E 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. E 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. A 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. C 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. C Xenon gas initially at 35°C is heated to 105°C 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. A Which gas has a density of 2.58 g L^{-1} at 10.°C and 1.5 atm?
(A) Ar (B) Ne (C) CO (D) CH_4 (E) Kr

31. B 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. D 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. A $2Li(s) + 2HCl(aq) \rightarrow H_2(g) + 2LiCl(aq)$
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. B 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. E 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. D Has an average atomic or molecular speed closest to that of N_2 molecules at 0°C and 1 atm.

37. B Has the greatest density.

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

39. C 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. C 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. C 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. B $8H_2(g) + S_8(s) \rightarrow 8H_2S(g)$

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. A 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

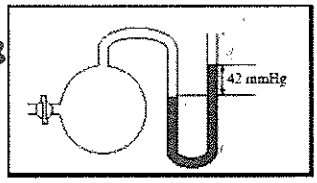
44. D Of the following gases, which has the greatest average molecular speed at 298 K?

(A) $Cl_2(g)$ (B) NO(g) (C) $H_2S(g)$ (D) HCN(g) (E) $PH_3(g)$

45. B 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. D 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. C 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. D 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. C 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. A Which noble gas effuses approximately twice as fast as Kr?

(A) Ne (B) Ar (C) Xe (D) Rn (E) He