Name _____ Date _____ Class _____

CHAPTER 11 REVIEW

Gases

SECTION 1

SHORT ANSWER **Answer the following questions in the space provided.**

1. b *Pressure* $= \frac{force}{surface\ area}$. For a constant force, when the surface area is tripled the pressure is

(a) doubled.
(b) a third as much.
(c) tripled.
(d) unchanged.

2. d, c, a, b Rank the following pressures in increasing order.

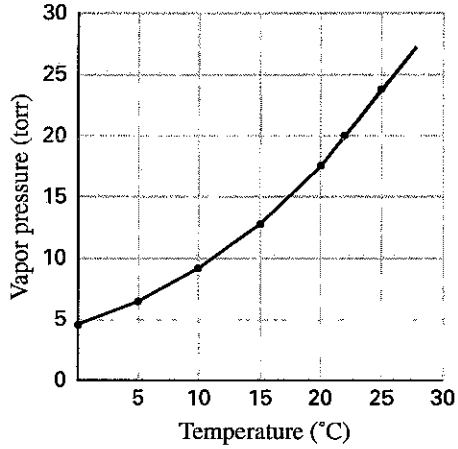
(a) 50 kPa **(c)** 76 torr
(b) 2 atm **(d)** 100 N/m^2

3. Explain how to calculate the partial pressure of a dry gas that is collected over water when the total pressure is atmospheric pressure.

Subtract the vapor pressure of water at the given collecting temperature from the atmospheric pressure taken during the collection of the gas.

PROBLEMS **Write the answer on the line to the left. Show all your work in the space provided.**

4. a. Use five to six data points from **Appendix Table A-8** in the text to sketch the curve for water vapor's partial pressure versus temperature on the graph provided below.



No **b.** Do the data points lie on a straight line?

10 torr **c.** Based on your sketch, predict the approximate partial pressure for water at 11°C.

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SECTION 1 continued

5. Convert a pressure of 0.200 atm to the following units:

152 **a.** mm Hg

20.3 **b.** kPa

6. When an explosive like TNT is detonated, a mixture of gases at high temperature is created. Suppose that gas X has a pressure of 50 atm, gas Y has a pressure of 20 atm, and gas Z has a pressure of 10 atm.

80 atm **a.** What is the total pressure in this system?

8.1×10^3 kPa **b.** What is the total pressure in this system in kPa?

7. The height of the mercury in a barometer is directly proportional to the pressure on the mercury's surface. At sea level, pressure averages 1.0 atm and the level of mercury in the barometer is 760 mm (30. in.). In a hurricane, the barometric reading may fall to as low as 28 in.

0.93 atm **a.** Convert a pressure reading of 28 in. to atmospheres.

3.8×10^2 mm Hg **b.** What is the barometer reading, in mm Hg, at a pressure of 0.50 atm?

c. Can a barometer be used as an altimeter (a device for measuring altitude above sea level)? Explain your answer.

Yes; a barometer can approximate an altimeter because the higher you climb into Earth's atmosphere, the lower the pressure recorded by the barometer.

Name _____ Date _____ Class _____

CHAPTER 11 REVIEW

Gases

SECTION 2

SHORT ANSWER **Answer the following questions in the space provided.**

1. State whether the pressure of a fixed mass of gas will increase, decrease, or stay the same in the following circumstances:

increase **a.** temperature increases, volume stays the same

decrease **b.** volume increases, temperature stays the same

decrease **c.** temperature decreases, volume stays the same

increase **d.** volume decreases, temperature stays the same

2. Two sealed flasks, A and B, contain two different gases of equal volume at the same temperature and pressure. Assume that flask A is warmed as flask B is cooled. Will the pressure in the two flasks remain equal? If not, which flask will have the higher pressure?

No, the pressure will not remain equal. If all other factors remain constant, flask A will have the higher pressure because it is at the higher temperature.

PROBLEMS **Write the answer on the line to the left. Show all your work in the space provided.**

3. A bicycle tire is inflated to 55 lb/in.^{2} at 15°C. Assume that the volume of the tire does not change appreciably once it is inflated.

a. If the tire and the air inside it are heated to 30°C by road friction, does the pressure in the tire increase or decrease? (Assume the volume of air in the tire remains constant.)

The pressure increases as the temperature rises (at fixed mass and constant volume).

b. Because the temperature has doubled, does the pressure double to 110 psi?

The pressure does not double.

c. What will the pressure be when the temperature has doubled? Express your answer in pounds per square inch.

57.9 psi

Name _____ Date _____ Class _____

SECTION 2 continued

4. 4.5 atm — A 24 L sample of a gas at fixed mass and constant temperature exerts a pressure of 3.0 atm. What pressure will the gas exert if the volume is changed to 16 L?

5. 16.7 mL — A common laboratory system to study Boyle's law uses a gas trapped in a syringe. The pressure in the system is changed by adding or removing identical weights on the plunger. The original gas volume is 50.0 mL when two weights are present. Predict the new gas volume when four more weights are added.

6. 1.03 L — A sample of argon gas occupies a volume of 950 mL at 25.0°C. What volume will the gas occupy at 50.0°C if the pressure remains constant?

7. 1.90×10^5 Pa — A 500.0 mL gas sample at STP is compressed to a volume of 300.0 mL and the temperature is increased to 35.0°C. What is the new pressure of the gas in pascals?

8. 1.27×10^3 mL — A sample of gas occupies 1000. mL at standard pressure. What volume will the gas occupy at a pressure of 600. mm Hg if the temperature remains constant?

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CHAPTER 11 REVIEW

Gases

SECTION 3

SHORT ANSWER **Answer the following questions in the space provided.**

1. ___c___ The molar mass of a gas at STP is the density of that gas

(a) multiplied by the mass of 1 mol.
(b) divided by the mass of 1 mol.
(c) multiplied by 22.4 L.
(d) divided by 22.4 L.

2. ___c___ For the expression $V = \frac{nRT}{P}$, which of the following will cause the volume to increase?

(a) increasing P
(b) decreasing T
(c) increasing T
(d) decreasing n

3. Two sealed flasks, A and B, contain two different gases of equal volume at the same temperature and pressure.

___True___ **a.** The two flasks must contain an equal number of molecules. True or False?

___False___ **b.** The two samples must have equal masses. True or False?

PROBLEMS **Write the answer on the line to the left. Show all your work in the space provided.**

4. Use the data in the table below to answer the following questions.

Formula	Molar mass (g/mol)
N_2	28.02
CO	28.01
C_2H_2	26.04
He	4.00
Ar	39.95

(Assume all gases are at STP.)

___all five gases___ **a.** Which gas contains the most molecules in a 5.0 L sample?

___He___ **b.** Which gas is the least dense?

___CO and N_2___ **c.** Which two gases have virtually the same density?

___1.25 g/L___ **d.** What is the density of N_2 measured at STP?

Name _____ Date _____ Class _____

SECTION 3 continued

5. 0.25 mol **a.** How many moles of methane, CH_4 are present in 5.6 L of the gas at STP?

0.25 mol **b.** How many moles of gas are present in 5.6 L of any ideal gas at STP?

4.0 g **c.** What is the mass of the 5.6 L sample of CH_4?

6. 5.8 mol **a.** A large cylinder of He gas, such as that used to inflate balloons, has a volume of 25.0 L at 22°C and 5.6 atm. How many moles of He are in such a cylinder?

23 g **b.** What is the mass of the He calculated in part **a**?

7. When C_3H_4 combusts at STP, 5.6 L of C_3H_4 are consumed according to the following equation:

$$C_3H_4(g) + 4O_2(g) \rightarrow 3CO_2(g) + 2H_2O(l)$$

0.25 mol **a.** How many moles of C_3H_4 react?

1.0 mol of O_2
0.75 mol of CO_2
0.50 mol of H_2O **b.** How many moles of O_2, CO_2, and H_2O are either consumed or produced in the above reaction?

10. g **c.** How many grams of C_3H_4 are consumed?

17 L **d.** How many liters of CO_2 are produced?

9.0 g **e.** How many grams of H_2O are produced?

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CHAPTER 11 REVIEW

Gases

SECTION 4

SHORT ANSWER **Answer the following questions in the space provided.**

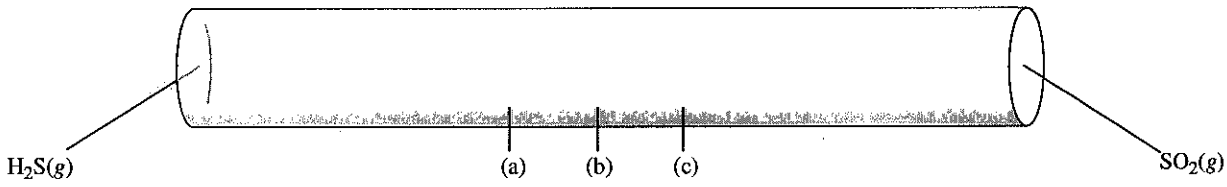
1. b, d, c, a List the following gases in order of increasing rate of effusion. (Assume all gases are at the same temperature and pressure.)

(a) He **(b)** Xe **(c)** HCl **(d)** Cl_2

2. Explain your reasoning for the order of gases you chose in item 1 above. Refer to the kinetic-molecular theory to support your explanation and cite Graham's law of effusion.

All gases at the same temperature have the same average kinetic energy. Therefore, heavier molecules have slower average speeds. Graham's law states that molecular speeds vary inversely with the square roots of their molar masses. Thus, the gases are ranked from heaviest to lightest in molar mass.

3. c The two gases in the figure below are simultaneously injected into opposite ends of the tube. At which labeled point should they just begin to mix?



4. State whether each example describes effusion or diffusion.

effusion **a.** As a puncture occurs, air moves out of a bicycle tire.

diffusion **b.** When ammonia is spilled on the floor, the house begins to smell like ammonia.

diffusion **c.** The smell of car exhaust pervades an emissions testing station.

5. Describe what happens, in terms of diffusion, when a bottle of perfume is opened.

The molecules of the perfume randomly diffuse into the air and mix with the air molecules. At the same time, some molecules from the air diffuse into the bottle and mix with the perfume molecules.

Name _____ Date _____ Class _____

SECTION 4 continued

PROBLEMS **Write the answer on the line to the left. Show all your work in the space provided.**

6. 1:9 **a.** The molar masses of He and of HCl are 4.00 g/mol and 36.46 g/mol, respectively. What is the ratio of the mass of He to the mass of HCl rounded to one decimal place?

3:1 **b.** Use your answer in part **a** to calculate the ratio of the average speed of He to the average speed of HCl.

400 m/s **c.** If helium's average speed is 1200 m/s, what is the average speed of HCl?

7. 202 g/mol An unknown gas effuses through an opening at a rate 3.16 times slower than neon gas. Estimate the molar mass of this unknown gas.

Name _____ Date _____ Class _____

CHAPTER 11 REVIEW

Gases

MIXED REVIEW

SHORT ANSWER **Answer the following questions in the space provided.**

1. Consider the following data table:

Approximate pressure (kPa)	Altitude above sea level (km)
100	0 (sea level)
50	5.5 (peak of Mt. Kilimanjaro)
25	11 (jet cruising altitude)
< 0.1	22 (ozone layer)

a. Explain briefly why the pressure decreases as the altitude increases.

As the altitude increases, there are fewer gas molecules above; therefore, there are fewer gas molecules to exert their pressure.

b. A few places on Earth are below sea level (the Dead Sea, for example). What would be true about the average atmospheric pressure there?

It would exceed 100 kPa at places below sea level.

2. Explain how the ideal gas law can be simplified to give Avogadro's law, expressed as $\frac{V}{n} = k$, when the pressure and temperature of a gas are held constant.

Rearrange $PV = nRT$ to obtain $\frac{V}{n} = \frac{RT}{P}$. Because every value for $\frac{RT}{P}$ is the same, its overall value is constant; therefore, $\frac{V}{n} = k$.

PROBLEMS **Write the answer on the line to the left. Show all your work in the space provided.**

3. Convert a pressure of 0.400 atm to the following units:

304 **a.** torr

4.05×10^4 **b.** Pa

Name _____ Date _____ Class _____

MIXED REVIEW continued

4. 226 mL A 250. mL sample of gas is collected at 57°C. What volume will the gas sample occupy at 25°C?

5. 0.7 L H_2 reacts according to the following equation representing the synthesis of ammonia gas:

$$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$$

If 1 L of H_2 is consumed, what volume of ammonia will be produced at constant temperature and pressure, based on Gay-Lussac's law of combining volumes?

6. 3.15×10^3 kPa A 7.00 L sample of argon gas at 420. K exerts a pressure of 625 kPa. If the gas is compressed to 1.25 L and the temperature is lowered to 350. K, what will be its new pressure?

7. 2.1×10^3 L Chlorine in the upper atmosphere can destroy ozone molecules, O_3. The reaction can be represented by the following equation:

$$Cl_2(g) + 2O_3(g) \rightarrow 2ClO(g) + 2O_2(g)$$

How many liters of ozone can be destroyed at 220. K and 5.0 kPa if 200.0 g of chlorine gas react with it?

8. 32 g/mol A gas of unknown molar mass is observed to effuse through a small hole at one-fourth the effusion rate of hydrogen. Estimate the molar mass of this gas. (Round the molar mass of hydrogen to two significant figures.)