Chemistry CP

Name:

Review Sheet—Gases (Chapters 10 and 11)

Section:

After studying chapters 10 and 11, you should be able to:

- Describe the motion of particles of a gas according to the kinetic theory.
- Relate that the temperature of a substance is a measure of the kinetic energy of the particles in that substance.
- Distinguish between real and ideal gases.
- Interpret gas pressure in terms of kinetic theory.
- Convert between different units of pressure, given the conversion factors.
- State the pressure and temperature at standard conditions (STP).
- Calculate the volume of gas formed from a reaction at standard conditions (STP).
- Calculate pressure or volume from the pressure-volume relationship of a contained gas at constant temperature.
- Calculate temperature or volume from the temperature-volume relationship of a contained gas at constant pressure.
- Calculate temperature or pressure from the temperature-pressure relationship of a contained gas at constant volume.
- Calculate pressure, volume, or temperature from the temperature-pressure-volume relationships of confined gases.
- Calculate the total pressure of a mixture of gases or the partial pressure of a gas in a mixture of gases.
- Calculate the amount of gas at any specified conditions of pressure, volume, and temperature.
- Explain, using kinetic theory, why molecules of small mass diffuse more rapidly than molecules of large mass.

Essential Skills from Previous Chapters

Stoichiometry calculations
Calculating gfm
Gram-mole conversions

Useful information

R = 0.0821 L atm /mol K or R = 8.31 L kPa/mol K
1 atm = 760 torr = 760 mm Hg = 101.3 kPa

Problems for you to try:

1. Under what conditions would a real gas behave MOST like an ideal gas? LEAST like an ideal gas?

2. Why does a gas in a closed container exert pressure?

3. What is the relationship between Kelvin temperature and the average kinetic energy of gas molecules?

4. Convert these temperatures to Kelvin:
   a) 14°C b) -124°C c) 672 °C d) 56°C

5. Convert these temperatures to °C.
   a) 4 K b) 171 K c) 522 K d) 304 K

6. A 225 mL sample of gas is collected at 58°C. What volume would this sample occupy at standard temperature?

7. A cylinder contains 430. mL of gas at a pressure of 105.0 kPa. Keeping the temperature constant, the volume in the cylinder is changed to 280 mL. What is the pressure at this volume?

8. A gas has a volume of 3.04 mL at 12°C and a pressure of 99.7 kPa. What pressure will cause the gas to have a volume of 3.25 mL at 25°C?

9. What volume would 654 mL of gas at 6°C and 65.3 kPa occupy at 4°C and 108.7 kPa?

10. Freon-12 (CCl_2F_2) was a widely-used refrigerant. A sample of Freon-12 filled a 2230 L container at a pressure of 4.85 kPa and –1.36°C. Calculate the volume of the gas at 1.38 kPa and 5.5°C.

11. Helium, argon, and oxygen are mixed in a gas sample. What is the total pressure of the sample if the partial pressures of He, Ar, and O_2, respectively, are 532 torr, 14 torr, and 174 torr?

CHALLENGE PROBLEM

12. A chemist collects 372 mL of gas over water at 40°C and 111.0 kPa. What volume would the dry gas occupy at 2°C and 98.0 kPa? The vapor pressure of water at 40°C is 7.4 kPa.
    a) Calculate the pressure of the dry gas.
    b) Use your answer from part (a) as P_1 in the combined gas law.

13. What pressure in atmospheres is exerted by 0.622 mol of gas contained in a 9.22 L vessel at 16°C?

14. What is the gfm of a gas if 8.11 g occupy 2380 mL at 109.1 kPa and 10.0°C?

15. Consider the following unbalanced equation: ____ $C_2H_4(g)$ + ___$O_2(g)$ → ___$CO_2(g)$ + ___$H_2O(g)$
    What volume of oxygen gas is required to react completely with 7.4L of $C_2H_4(g)$ at STP?

16. For the following pairs of gases, which would diffuse farther in the same amount of time?
    a) H_2 or He b) Ne or Ar c) O_2 or F_2 d) Br_2 or Kr

Answers to selected problems
6. 186 mL
7. 160 kPa
8. 97.5 kPa
9. 390. mL
10. 8040 L
12. 346 mL
13. 1.60 atm
14. 73.7 g/mol