

BIG CHEM: Unit 8 - Gasses
Problem Set #8

Due: Thursday, March 6th 2008
Mr. Darlington

- 1 Based on the Popular Science article, "Speed: Formula None," and the description of how suction works from class, describe how a sucker car works. You do not need to describe the role of air flow in your description, however you do need to discuss pressure differences and the effect they have on forcing the race car to the ground. Include with your description a diagram that illustrates in picture form, your explanation.
- 2 Explain using a diagram and words the role pressure differences play in drinking a beverage through a straw.
- 3 Explain using a diagram and words how the first barometer was made.
- 4 Describe the four assumptions of the ideal gas law. Under what conditions do real gases behave like ideal gases?
- 5 *Below you are given 5 of the 6 variables of the combined gas law. Solve for the unknown variable using the techniques demonstrated in class.*
*** Note: SP stands for standard pressure and ST stands for standard temperature.*
 - a Initial: 36 mL, SP, ST. Final: 96.6 kPa, 35.0°C.
 - b Initial: 2.0 L, 95.3 kPa, -45°C. Final: SP, ST.
 - c Initial: 4.5 L, 1.035 atm, 375 K. Final: 1.100 atm 350. K.
 - d Initial: 16.5 mL, 107.3 kPa, 26.5°C. Final: 18.0 mL, 104.4 kPa.
 - e Initial: 14.8 mL, 1.123 atm, 75.5°C. Final: 16.5 mL, 70.2°C.
 - f Initial: 5.322 L, 100.0°C. Final: 4.895 L, 104.2 kPa, 98.5°C.
- 6 *Ideal gas law problems*
 - a What volume will an ideally behaving gas containing 1.00 mole of particles occupy at STP?
 - b What is the volume, in liters, of 0.250 mole of gas exerting a pressure of 0.200 atmosphere at 600. K?
 - c What is the volume of 20.0 mol of gas at 20.0°C and 200. kPa? [NOTE: 1 atm = 101.3 kPa]
 - d How many grams of oxygen occupy 150. mL at 25.0°C and 0.250 atm?
 - e At what pressure will 99.0 g of steam (H₂O) occupy 61.6 L at 125°C?
- 7 *Applying the gas laws*
 - a What is the new volume of a gas if 50 mL at 81.0 kPa has its pressure increased to 101.3 kPa? (Temperature is constant.)
 - b 720 mL of H₂ gas at 0°C and 126.6 kPa is changed to S.T.P. What will be its new volume ?
 - c 440 mL of N₂ gas at 127°C is cooled to 27°C, while its pressure is kept constant. What is the new volume ?
 - d One thousand four hundred liters of N₂ gas at a pressure of 1.25 atmospheres has its pressure changed to 17.5 atmospheres. What will be its new volume at the new pressure? (Temperature is constant.)
 - e Hydrogen gas occupies 400 mL at 27°C. Find the volume it will occupy if the temperature is increased to 57°C? (Pressure is constant.)
 - f What is the pressure that must be exerted on 300 mL of a gas collected at STP so that its confined to a volume of 190 mL? (Constant temp.)
 - g If 260 mL of O₂ gas is collected at 21°C and 101.3 kPa, what volume would this gas occupy at STP?
 - h 65 liters of a gas at 52°C is to be expanded to 72 liters. To what temperature must this gas be changed? (in degrees Celsius)
- 8 *Applying Avogadro's law*
 - a What is the volume of 7.15 mol of fluorine at STP?
 - b What is the mass of 3.00 L of hydrogen gas at STP?
 - c How many moles of sulfur dioxide occupy 56.0 mL at STP?
 - d What is the volume of 6.60 E -2 g of carbon dioxide at STP?
 - e What is the mass of 112 mL of argon at STP?
 - f What is the volume of 7.10 kg of chlorine gas at STP?
 - g What is the volume of 0.0150 mol of hydrogen chloride at STP?
 - h How many moles of neon occupy 3.36 L at STP?
- 9 *Gas stoichiometry. Consider burning reactions to be synthesis reactions with oxygen gas to form an oxide and water.*
 - a If 35.0 L of propane (look up its formula) burns, how many liters of carbon dioxide will form at the same temperature and pressure?
 - b If 250. mL of oxygen at STP are consumed when magnesium burns, how many grams of magnesium oxide form?
 - c Hydrogen peroxide (H₂O₂) decomposes into oxygen gas and water.
How much space does the oxygen occupy if 40.8 g of hydrogen peroxide decomposes at -13°C and 2.40 atm?
 - d Most of the carbon dioxide in the blood is carried as carbonic acid [H₂CO₃]. It decomposes in the alveoli to release carbon dioxide and water.
How many grams of carbonic acid would have to decompose to release 15.0 mL of carbon dioxide into the lungs at 37°C and 1 atm?
 - e The Hindenburg, a German airship kept afloat by 1.98 E 5 kL of hydrogen at STP, burned as it landed at the Lakehurst Naval Air Station in New Jersey in 1937.
Assuming all the hydrogen was consumed in the burning, how many kilograms of water formed?