

Some questions for review of CH 6,7,8

To receive full credit, be sure to **show your work**. *Show the equation you are using* and solve for the unknown parameter. Make sure your numerical answers have the proper number of significant figures, have units, and that your units are consistent (e.g. *temperature is in Kelvin degrees for all gas law problems*). **Do not just give the answer.**

Helpful equations:

$$\Delta G = \Delta H - T\Delta S$$

$$0 \text{ degrees K} = -273^\circ\text{C}$$

$$1.00 \text{ atm} = 760 \text{ mm of Hg}$$

$$\text{Combined gas law: } P_1V_1/T_1 = P_2V_2/T_2$$

$$\text{Ideal gas law: } PV = nRT \quad R = 0.0821 \text{ L}\cdot\text{atm}/\text{mol}\cdot\text{K} ; R = 62.4 \text{ L}\cdot\text{mmHg}/\text{mol}\cdot\text{K}$$

Standard Temperature and Pressure (**STP**) 0°C and 1 atm

Avogadro's Law: 1 mole of a gas at STP occupies 22.4 L; **Avogadro's number** 6.02×10^{23}

1.(10) On hot days, you may have noticed that potato chip bags seem to “inflate” even though they have not been opened. If I have a 252 mL bag, and I leave it in my hot car and it expands to a volume of 305 mL at a new temperature of 50°C , what was the original temperature of the bag (in $^\circ\text{C}$)? Assume constant pressure and show your work.

2.(10) Assume you have 38.5 g of O_2 gas. If the molar mass is 32.0 g/mol, how many moles of O_2 are there? What is the volume of this gas in liters at STP?

3.(10) Scuba divers who suffer from decompression sickness are often placed in a hyperbaric chamber that contains a mixture of 21% O_2 and 79% He at 8.2 atm. What is the partial pressure of oxygen in the hyperbaric chamber in **atm and in mm Hg**?

4.(12) The following reaction is at equilibrium and the reactants and products are all gases.

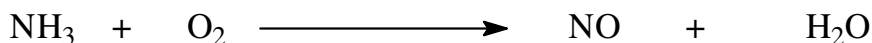


Is this an *endothermic* or *exothermic* reaction? _____

Explain how the following changes will affect the equilibrium-shifts reaction toward product (P), reactant (R) or no change (N).

- a) a catalyst is added _____
- b) the reaction is heated _____
- c) N₂ is added _____
- d) NO₂ is added _____
- e) pressure is increased _____

5.(24) The combustion reaction of ammonia with oxygen to form nitrogen monoxide and water vapor is shown below:



- a) **Balance the reaction** with coefficients.
- b) What are the **molecular weights** (molar masses) of NH₃ and H₂O? Express your answers to 3 significant figures.
- c) How many **moles of O₂** are needed to react with 0.835 mol of NH₃?
- d) How many **moles of H₂O** should be produced from 0.835 mol of NH₃ (assuming excess oxygen)?
- e) How many **grams of H₂O** should be formed in this reaction (using your answer from d)?
- f) How many **molecules of H₂O** should be formed under these conditions?

6.(10) A helium container of the type used to fill balloons has a volume of 180 L and a pressure of 150 atm at 25°C. How many **moles** of helium are in the tank? (Assume He is an *ideal gas*.)

7.(10) The reaction of $\text{H}_{2(g)}$ with $\text{Cl}_{2(l)}$ to give $\text{HCl}_{(g)}$ has a $\Delta H = -44.0 \text{ kcal/mol}$ and a $\Delta S = 0.037 \text{ kcal/mol}\cdot\text{K}$.

a) Write the balanced equation for this reaction.

b) Calculate ΔG at -10°C . Is the reaction spontaneous at this temperature? _____

c) Is this reaction exothermic or endothermic? _____