

- 5) What is the difference between an empirical formula and a molecular formula?
- 6) What is the empirical formula for the substance with the molecular formula of $C_2H_4Br_2$? _____
- 7) Balance the following equations using the *lowest whole number* coefficients:
- a) _____ $Fe_2(SO_4)_3$ + _____ $Ba(NO_3)_2$ \rightarrow _____ $Fe(NO_3)_3$ + _____ $BaSO_4$
- b) _____ C_3H_8O + _____ O_2 \rightarrow _____ H_2O + _____ CO_2
- c) _____ $Ca(OH)_2$ + _____ H_3PO_4 \rightarrow _____ $Ca_3(PO_4)_2$ + _____ H_2O

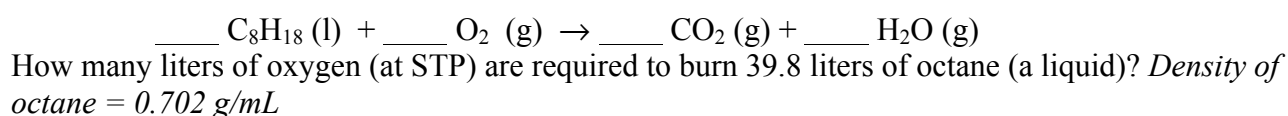
II. Moles Calculations

- 8) How many molecules of $Ca(ClO_3)_2$ are there in 8.41 g of $Ca(ClO_3)_2$?
- 9) How many grams of N_2O gas are there in 59.2 L of N_2O gas at STP?
- 10) What is the density (g/L) of CO_2 gas at STP. (*Hint: Assume you have 1 mole of CO_2 gas*)
- 11) Aluminum has a density of 2.71 g/cm^3 . What is the volume of one Al atom? (*hint: molar mass?*)
- 12) An unknown sample contains only C & H. If 26.8 g of the sample contains 4.90 g H, what is its % composition?
- 13) What is the percent composition (by mass) of $Sr_3(PO_4)_2$?

- 14) Xylose is an important sugar that is the building block for wood fibers.
- Xylose contains 40.0 % carbon, 6.67 % hydrogen and 53.3% oxygen (all by mass). What is its empirical formula?
 - The molar mass of xylose is 150 g/mol. What is its molecular formula?

III. Stoichiometry Calculations

- 15) Liquid octane (C_8H_{18}) burns in oxygen according to this unbalanced equation (balance it):



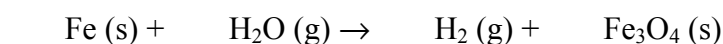
- 16) This reaction is carried out: $\underline{\hspace{1cm}} P_4 (s) + \underline{\hspace{1cm}} Cl_2 \rightarrow \underline{\hspace{1cm}} PCl_3$ (balance!)
0.130 moles of P_4 is reacted with 1.392 moles of Cl_2 . What is the limiting reactant? Show a calc and a sentence to explain.
- 17) Hydrofluoric acid solutions cannot be stored in glass containers because HF reacts readily with silica (SiO_2) in glass to produce hexafluorosilicic acid (H_2SiF_6): $SiO_2 (s) + 6 HF (aq) \rightarrow H_2SiF_6 (aq) + 2 H_2O (l)$
Suppose 45.2 g SiO_2 and 88.2 g HF are mixed together and 91.5 g H_2SiF_6 are produced.
- What is the theoretical yield of H_2SiF_6 (in grams)?
 - What is a limiting reactant? Why was it important to determine the limiting reactant in this question?
 - How many grams of the excess reactant are left unreacted?

d) What is the percent yield of H_2SiF_6 ?

IV. Extra Review—More practice of the more difficult types of calculations

18) Suppose 6.00 L of hydrogen gas is reacted with excess nitrogen gas at standard temperature and pressure to form ammonia by the following balanced chemical equation: $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$
If the ammonia gas produced is cooled until it liquefies, what volume of liquid ammonia should be collected? *Density of liquid ammonia = 0.674 g/mL*

19) Hydrogen is generated by passing hot steam of iron, which oxidizes to form Fe_3O_4 , in the following *unbalanced* equation:



Suppose 9.78 L of hydrogen gas is produced at STP when 21.5 g Fe reacts with 15.6 g H_2O .

a) What is the theoretical yield of hydrogen gas (in L, at STP)?

b) What is the percent yield of hydrogen gas?

c) How many grams of the excess reactant are left over?

20) What is the molecular formula for the organic compound with a molar mass of 208.2 g/mole and the following percent composition: 46.15 % carbon, 7.75% hydrogen and 46.11% oxygen?

Answers: 7a) 1.3, 2.3; 7b) 2.9, 8.6; 7c) 3.2, 1.6; 8) 2.45 × 10⁻²² mol Ca(ClO₃)₂; 9) 116 g N₂O; 10) 1.96 g/L; 11) 1.65 × 10⁻²³ cm³; 12) 81.7% C, 18.3% H; 13) 58.05% Sr, 13.68% P, 28.27% O; 14a) CH₂O; 14b) C₅H₁₀O₅; 15) 2.25, 16, 18; 68, 500 L O₂; 16) 1.6, 4; P₄; 17a) 106 g H₂SiF₆; 17c) 1.1 g SiO₂; 17d) 86.3%; 18) 4.51 mL NH₃; 19a) 3.4, 4.1; 11.5 L H₂; b) 85.0%; 19c) 6.4 g excess; 20) C₈H₁₆O₆