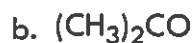


Moles and stoichiometry practice problems (from Chapter 3 in Brady, Russell, and Holum's *Chemistry, Matter and its Changes, 3rd Ed.*)

- 1) How many moles of sodium atoms correspond to 1.56×10^{21} atoms of sodium?
- 2) How many moles of Al atoms are needed to combine with 1.58 mol of O atoms to make aluminum oxide, Al_2O_3 ?
- 3) How many moles of Al are in 2.16 mol of Al_2O_3 ?
- 4) How many moles of H_2 and N_2 can be formed by the decomposition of 0.145 mol of ammonia, NH_3 ?
- 5) What is the total number of molecules in 0.260 mol of glucose, $\text{C}_6\text{H}_{12}\text{O}_6$?
- 6) What is the mass of 1.00 mol of each of the following elements?
 - a. Sodium
 - b. Sulfur
 - c. Chlorine
- 7) Determine the mass in grams of each of the following:
 - a. 1.35 mol Fe
 - b. 0.876 mol Ca
 - c. 1.25 mol $\text{Ca}_3(\text{PO}_4)_2$
 - d. 1.45 mol $(\text{NH}_4)_2\text{CO}_3$
- 8) Calculate the number of moles of each compound:
 - a. 21.5 g CaCO_3
 - b. 1.56 g NH_3
 - c. 16.8 g $\text{Sr}(\text{NO}_3)_2$
 - d. 6.98 mg Na_2CrO_4

9) Calculate the percentage composition by mass of each element in the following compounds:



10) Phencyclidine is $\text{C}_{17}\text{H}_{25}\text{N}$. A sample suspected of being this illicit drug was found to have a percentage composition of 83.71% C, 10.42% H, and 5.61% N. Do these data acceptably match the theoretical data for phencyclidine?

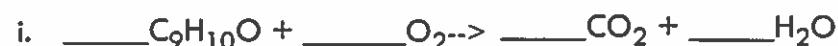
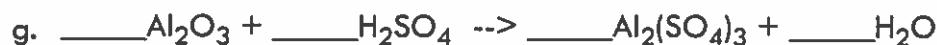
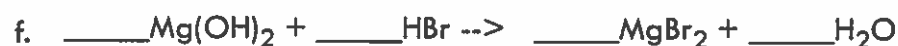
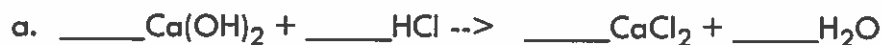
11) How many grams of O are combined with 7.14×10^{21} atoms of N in the compound N_2O_5 ?

12) Quantitative analysis of a sample of sodium pertechnetate with a mass of 0.896g found 0.111g Na and 0.477g technetium (Tc). The remainder was oxygen. Calculate the empirical formula of sodium pertechnetate, $\text{Na}_x\text{Tc}_y\text{O}_z$.

13) A substance was found to be composed of 22.9% Na, 21.5% B, and 55.7% O. What is the empirical formula of this compound?

14) Write the equation that expresses in acceptable chemical shorthand the following statement: "Iron can be made to react with molecular oxygen (O_2) to give iron oxide with the formula Fe_2O_3 "

15) Balance the following reactions:



16) Chlorine is used by textile manufacturers to bleach cloth. Excess chlorine is destroyed by its reaction with sodium thiosulfate, $\text{Na}_2\text{S}_2\text{O}_3$:



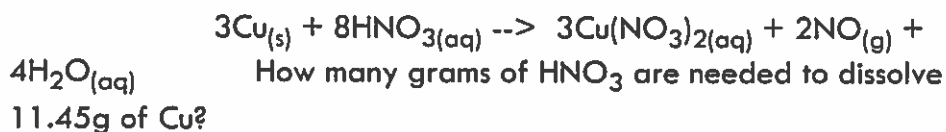
a. How many moles of $\text{Na}_2\text{S}_2\text{O}_3$ are needed to react with 0.12mol of Cl_2 ?

b. How many moles of HCl can form from 0.12mol of Cl_2 ?

c. How many moles of H_2O are required for the reaction of 0.12mol of Cl_2 ?

d. How many moles of H_2O react if 0.24mol HCl is formed?

17) In *dilute* nitric acid, HNO_3 , copper metal dissolves according to the following equation:



18) The reaction of powdered aluminum and iron(II)oxide,



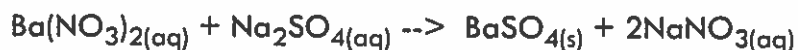
produces so much heat the iron that forms is molten. Because of this, railroads use the reaction to provide molten steel to weld steel rails together when laying track. Suppose that in one batch of reactants 4.20mol Al was mixed with 1.75mol Fe_2O_3 .

a. Which reactant is the limiting reactant?

b. Calculate the mass of iron (in grams) that can be formed from this mixture of reactants.

19) Silver nitrate, AgNO_3 , reacts with iron(III) chloride, FeCl_3 , to give silver chloride, AgCl , and iron(III) nitrate, $\text{Fe}(\text{NO}_3)_3$. A solution containing 18.0g AgNO_3 was mixed with a solution containing 32.4g FeCl_3 . How many grams of which reactant *remains* after the reaction is over?

20) Barium sulfate, BaSO_4 , is made by the following reaction:



An experiment was begun with 75.00g of $\text{Ba}(\text{NO}_3)_2$ and an excess of Na_2SO_4 . After collecting and drying the product, 63.45g BaSO_4 was obtained. Calculate the theoretical yield and percent yield of BaSO_4 .