Phys Sc 430
Year-end Review of Moles

1. Two of something is a pair, 12 of something is a dozen, 20 of something is a score, and _____ of something is a *mole.*

   6.02×10^{23}

2. What is the molar mass of helium? Include the proper unit.

   He = 4.0 g/mole

3. What is the molar mass of $Cu(NO_3)_2$?

   63.5 + 2(14) + 2(3)(16) = 187.5 g/mole

4. What is the total of the molar masses represented by: $2\ H_2 + O_2$?

   2(2)(1) + 2(16) = 36 g

5. Find the mass of 3.4 moles of NaBr.

   3.4 moles(23 + 80 g/mole) = 350.2 g

6. How many moles are there in 35.5 g of Cl_2?

   35.5 g(mole/71g) = 0.5 moles

7. Determine the simplest formula of a compound containing 37.5% C, 12.5% H, and 50.0% O by mass.

   For every 100 g of the sample you will have 37.5g of C, 12.5 g H, and 50.0g O. Convert to moles by dividing each by its molar mass:

   3.125 moles of C
   12. 5 moles of H
   3.125 moles of O

   But a formulas cannot have decimals, so divide through by the smallest number:

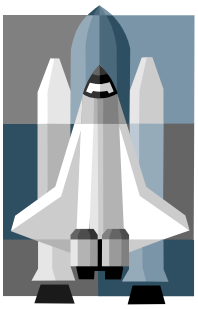
   3.125 moles of C/3.125 = 1
   12. 5 moles of H/3.125 = 4
   3.125 moles of O/3.125 = 1, so simplest possible formulas = CH_4O

8. Only one isotope of this element exists. One atom of this isotope has a mass of 9.123×10^{-23} g. Identify the element.

1 atom(mole/[6.02 X 10^{23} atoms]) = 1.661129568 X 10^{-24} moles

9.123 X 10^{-23} g/ (1.661129568 X 10^{-24} moles) = 54.9 g/mole = Mn

9. The reusable solid rocket boosters of the U.S. space shuttle use a mixture of aluminum and ammonium perchlorate for fuel:



$3\ Al_{(s)} + 3\ NH_4ClO_{4(s)} \rightarrow Al_2O_{3(s)} + AlCl_{3(s)} + 3\ NO_{(g)} + 6\ H_2O_{(g)}$

a. Let's pretend that some engineer calculated that to generate enough thrust we needed to produce 2500 kg of steam [$H_2O_{(g)}$]. What total mass of solids must react to generate this amount of gas?

2 500 000 g (mole/18 g) = 138888.9 moles
Ratio of Al or $NH_4ClO_{4(s)}$ to water is 3/6, so you need
69444.45000 moles of Al and 69444.45000 moles of $NH_4ClO_{4(s)}$ =
69444.45000 moles(27g/mole) + 69444.45000 moles(117.5g/mole) = 1 X 10^7 g =10 000 kg

b. How many molecules of water will accompany the release of 132.5 g of $AlCl_3$?

132.5 g(mole/132.5 g) = 1.0 mole $AlCl_3$

From equation, the ratio of $AlCl_3$ to water is 1 to 6, so you will get 6 moles of water or 6 moles X 6.02 X 10^{23} molecules/mole = 3.6 X 10^{24} molecules of water

10. When a mixture of silver metal and sulphur is heated, Ag_2S is formed:

$16\ Ag_{(s)} + S_{8(s)} \rightarrow 8\ Ag_2S_{(s)}$

a. How many moles of silver must react to produce 2 moles of silver (I)sulphide?

Ratio is 16/8, so you need 2(2) = 4 moles of Ag.

b. What mass of $Ag_2S_{(s)}$ will be produced from mixing a mole of silver with a mole of sulphur?-----What mass of which reactant will be left unreacted?

1 mole of Ag will only react with 1/16 = .06250000000 moles of sulphur, so we will have 1 – 0.0625 = 0.9375 moles = 0.9375(8*32) = 240 g of leftover sulphur.
From the ratio, 1*(8/16) = 0.5 moles of $Ag_2S_{(s)}$ = 0.5moles(248g/mole) = 124 g.