1. Mole to Mole Conversions:
Objective: Given the moles or number of atoms of one species be able to predict the moles or atoms of another species consumed or produced from a balanced chemical equation.

(in class)
Analine, ($C_6H_5NH_2$)can be formed from nitro benzene ($C_6H_5NO_2$) by the following equation:

$$4C_6H_5NO_2 + 9Fe + 4H_2O \text{ ---> } 4C_6H_5NH_2 + 3\ Fe_3O_4$$

1.a. Write the conversion factor converting moles iron to moles analine

$$\left(\frac{4mol\,C_6H_5NH_2}{9\,mol\,Fe}\right)$$

1.b. How many moles of analine would be formed if 3.78moles of iron was consumed?

$$3.78mol\,Fe\left(\frac{4mol\,C_6H_5NH_2}{9\,mol\,Fe}\right)=1.68\,mol\,C_6H_5NH_2$$

(take home)
1.c. Write the conversion factor converting moles nitrobenzene to moles Fe_3O_4 .

$$\left(\frac{3\,mol\,Fe_3O_4}{4\,mol\,C_6H_5NO_2}\right)$$

1.d. Write the conversion factor describing the ratio of the consumption of iron to the consumption of nitrobenzene.

$$\left(\frac{9\,mol\,Fe}{4\,mol\,C_6H_5NO_2}\right)$$

1.e. How many moles of nitrobenzene would be needed to produce 4.678Mmoles of Fe_3O_4?

$$4.678Mmole\,Fe_3O_4\left(\frac{10^6\,mol\,Fe_3O_4}{Mmol\,Fe_3O_4}\right)\left(\frac{4mol\,C_6H_5NO_2}{3mol\,Fe_3O_4}\right)$$

$$=6.237x10^6\ mol\,C_6H_5NO_2\ or\ 6.237\,Mmol\,C_6H_5NO_2$$

1.f. How many moles of iron would be needed to consume $3.56x10^{22}$ molecules of nitrobenzene?

$$3.56x10^{22}\ molecule\,C_6H_5NO_2\left(\frac{mol\,C_6H_5NO_2}{6.022x10^{23}\ molecule}\right)\left(\frac{9\,mol\,Fe}{4\,mol\,C_6H_5NO_2}\right)=0.133\,mol\,Fe$$

1.g. How many atoms of iron are consumed if 3.59nmoles of water are consumed?

$$3.59nmol\,H_2O\left(\frac{10^{-9}\,mol\,H_2O}{nmol}\right)\left(\frac{9\,mol\,Fe}{4\,mol\,H_2O}\right)\left(\frac{6.022x10^{23}\,atom\,Fe}{Fe}\right)=4.86x10^{15}\,atom\,Fe$$

2. **Mass to Mass or Mass to Mole Conversions**

Objective: Given the mass one species be able to predict the mass another species consumed or produced from a balanced chemical equation.

Technique: This is a three step process which should be done in one equation which uses three conversion factors.

Conversion Factor #1: Use molar mass to convert mass of known material to moles.
Conversion Factor #2: Use coefficients of balanced reaction equation to convert moles of known material to moles of desired material.
Conversion Factor # 3: Use molar mass to convert moles of desired material to mass of desired material.

(in class)

Analine, ($C_6H_5NH_2$)can be formed from nitro benzene ($C_6H_5NO_2$) by the following equation:

$4C_6H_5NO_2 + 9Fe + 4H_2O$ ---> $4C_6H_5NH_2 + 3\ Fe_3O_4$
(123.105) (55.845) (18.016) (93.121g/mol) (231.535) g/mol

2.a. How many grams of analine would be formed if 3.78moles of iron was consumed?

$$3.78mol\ Fe\left(\frac{4mol\ C_6H_5NH_2}{9\,mol\ Fe}\right)\left(\frac{93.121g\ C_6H_5NH_2}{mol}\right)=156g\ C_6H_5NH_2$$

2.b. How many grams of nitrobenzene would be needed to produce 4.678 kg of Fe_3O_4?

$$4.678kg\ Fe_3O_4\left(\frac{10^3\ g\ Fe_3O_4}{kg}\right)\left(\frac{mol\ Fe_3O_4}{231.535g\ Fe_3O_4}\right)\left(\frac{4\,mol\ C_6H_5NO_2}{3mol\ Fe_3O_4}\right)\left(\frac{123.105g\ C_6H_5NO_2}{mol}\right)$$

$$=3.316x10^3\ g\ C_6H_5NO_2\ or\ 3.316kg\ C_6H_5NO_2$$

(take home)

2.c. How many grams of iron would be needed to consume $3.56x10^{22}$ molecules of nitrobenzene?

$$3.56x10^{22}\ molecule\ C_6H_5NO_2\left(\frac{mol\ C_6H_5NO_2}{6.022x10^{23}\ molecule}\right)\left(\frac{9\,mol\ Fe}{4\,mol\ C_6H_5NO_2}\right)\left(\frac{55.845g\ Fe}{mol}\right)=7.43g\ Fe$$

2.d. How many grams of iron are consumed if 3.59ng of water are consumed?

$$3.59ng\ H_2O\left(\frac{10^{-9}\ g\ H_2O}{ng}\right)\left(\frac{mol\ H_2O}{18.016g\ H_2O}\right)\left(\frac{9\,mol\ Fe}{4\,mol\ H_2O}\right)\left(\frac{55.845g\ atom\ Fe}{mol\ Fe}\right)=2.50x10^{-8}\ g\ Fe\ or\ 25.0ng\ Fe$$

2.e. How many grams of analine are produced if 22.45 g of Fe_3O_4 are also produced?

$$22.45g\ Fe_3O_4\left(\frac{mol\ Fe_3O_4}{231.535g\ Fe_3O_4}\right)\left(\frac{4\,mol\ C_6H_5NH_2}{3mol\ Fe_3O_4}\right)\left(\frac{93.121g\ C_6H_5NH_2}{mol}\right)=12.04g\ C_6H_5NH_2$$