1.(20)  When organic compounds are burned in $O_2$, they react to form $CO_2$ and $H_2O$.  The combustion of pentane is shown below.
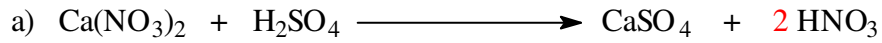
$$C_5H_{12} \ + \ 8\,O_2 \longrightarrow 5\,CO_2 \ + \ 6\,H_2O$$
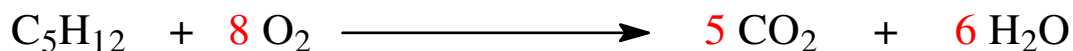
a)  Balance the above reaction.

b)  According to the balanced reaction, how many moles of $O_2$ are needed to burn 10 mol of $C_5H_{12}$?

  10 mol $C_5H_{12}$ x  8 mol $O_2$/1 mol $C_5H_{12}$  =  80 mol $O_2$

c)  If 1.4 mol of $C_5H_{12}$ reacts with excess $O_2$, how many moles of water will form?

  1.4 mol $C_5H_{12}$ x  6 mol $H_2O$/1 mol $C_5H_{12}$  =  8.4 mol $H_2O$

d)  If I use 8.0 moles of $C_5H_{12}$ and 8.0 moles of $O_2$ in this reaction, which reactant will have some remaining *unreacted* (which reactant is used in excess)?  $C_5H_{12}$  How many moles of this compound will be left over unreacted?  Since only 1.0 mole of $C_5H_{12}$ can react with 8.0 moles of $O_2$, you will have 7.0 moles of $C_5H_{12}$ left over.

2.(20)  The following questions refer to the chemical equation below.
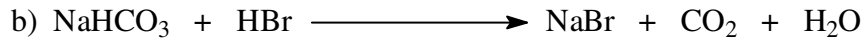
$$I_2 \ + \ 5\,Cl_2 \longrightarrow 2\,ICl_5$$
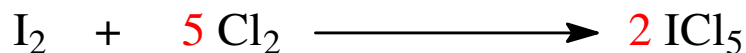
a)  Balance the equation.

b)  Assuming excess $Cl_2$ is available, how many moles iodine pentachloride will form from 2.5 moles of iodine?

  2.5 mol $I_2$ x  2 mol $ICl_5$/1 mol $I_2$  =  5.0 mol $ICl_5$

c)  How many molecules iodine pentachloride is this?

  5.0 mol $ICl_5$ x  6.02 x $10^{23}$ molecules $ICl_5$/1 mol $ICl_5$  =  3.01 x $10^{24}$ molecules $ICl_5$

d)  How many moles of chlorine are needed to react with 0.250 moles of iodine?

  0.250 mol $I_2$ x  5 mol $Cl_2$/1 mol $I_2$  =  1.25 mol $Cl_2$

e)  What mass (grams) of $Cl_2$ is needed to react with 0.250 moles of iodine?

  0.250 mol $I_2$ x  5 mol $Cl_2$/1 mol $I_2$ x  70.90 g $Cl_2$/1 mol $Cl_2$  =  88.6 g $Cl_2$

3.(20) Balance the following reactions:

    a) $Ca(NO_3)_2 + H_2SO_4 \longrightarrow CaSO_4 + 2\ HNO_3$

        balance $NO_3$ groups first

    b) $NaHCO_3 + HBr \longrightarrow NaBr + CO_2 + H_2O$

        already balanced :-)

    c) $C_{12}H_{22}O_{11} + H_2O \longrightarrow 4\ C_2H_6O + 4\ CO_2$
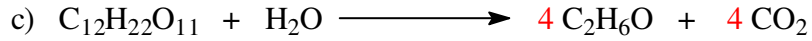
        balance H first on product side with $C_2H_6O$, then C with $CO_2$

    d) $6\ HCl + 2\ Al \longrightarrow 2\ AlCl_3 + 3\ H_2$
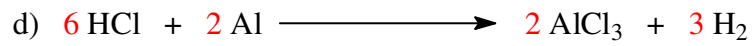
        balance Cl first (3 HCl), then you need 1.5 $H_2$ --
        then double everything to have integers as coefficients