How to ..... Stoichiometry

Remember steps:
1) balance
2) given/unknown
3) molar mass → mass of 1 mole from P.Table
4) mole ratio → coefficients are important, here's where they come into play.

3 sig figs

1) If 60.0g of propane (C_3H_8) is burned in a stove, carbon dioxide (CO_2) and water (H_2O) are produced as shown in the balanced equation below:

12.01+2(16.00)

3(12.01)+8(1.01)

$$C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O$$

forget about compounds that aren't part of the problem

What mass of CO_2 will be released into the environment?

2. given/unknown:	60.0g			xg		
1. balance:	C_3H_8	+	$5O_2$	→	$3CO_2$	+ $4H_2O$
3. molar mass	44.11g				44.01g	
4. mole ratio	1	:			3	

• x start with what you have, move to what you need

$$60.0\,g\,C_3H_8 \times \frac{1\,mol\,C_3H_8}{44.11\,g\,C_3H_8} \times \frac{3\,mol\,CO_2}{1\,mol\,C_3H_8} \times \frac{44.01\,g\,CO_2}{1\,mol\,CO_2} = 179.5919$$

stop when you have the units you are looking for

$$\boxed{180\,g\,CO_2}$$

need oxygen: combustion reaction!

2 sig figs

2) Burning ethane (C_2H_6) in air containig oxygen (O_2) produces carbon dioxide (CO_2) and water (H_2O). You are to produce 32 moles of CO_2. What mass of oxygen is required?

2. given/unknown
1. balance
3. molar mass
4. mole ratio

$$2\,C_2H_6 + 7\,O_2 \longrightarrow 4\,CO_2 + 6\,H_2O$$

	C_2H_6	O_2		CO_2	H_2O
		x g		32 mol	
molar mass		32.00 g		44.01 g	
mole ratio		7	:	4	

no need for grams this time since you start with moles, go right to mole ratio.

$$32 \text{ mol } CO_2 \times \frac{7 \text{ mol } O_2}{4 \text{ mol } CO_2} \times \frac{32.00 \text{ g } O_2}{1 \text{ mol } O_2} = 1792 \text{ g}$$

$$\boxed{1800 \text{ g } O_2}$$

3 sig figs

3) Sodium iodide (NaI) reacts with a solution of lead nitrate ($Pb(NO_3)_2$) to form a lead iodide precipitate (PbI_2) and a solution of sodium nitrate ($NaNO_3$). When a scientist adds 37.5g of NaI to enough $Pb(NO_3)_2$ solution, all of the NaI reacts. What is the mass of the PbI_2 formed?

The equation representing the reaction is:

2. given/unknown
1. balance
3. molar mass
4. mole ratio

$$2\,NaI + Pb(NO_3)_2 \longrightarrow PbI_2 + 2\,NaNO_3$$

	NaI	$Pb(NO_3)_2$		PbI_2	$NaNO_3$
	37.5 g			x g	
molar mass	149.89 g			461 g	
mole ratio	2		:	1	

$$37.5 \text{ g NaI} \times \frac{1 \text{ mol NaI}}{149.89 \text{ g NaI}} \times \frac{1 \text{ mol } PbI_2}{2 \text{ mol NaI}} \times \frac{461 \text{ g } PbI_2}{1 \text{ mol } PbI_2} = 57.667$$

$$\boxed{57.7 \text{ g}}$$

4) The following equation describes the oxidation of iron:

$$Fe_{(s)} + O_{2(g)} \longrightarrow Fe_2O_{3(s)}$$

3 sig figs

How many molecules of Fe_2O_3 are formed by the complete oxidation of 112g of Fe?

2. given/unknown
1. balance
3. molar mass
4. mole ratio

112g				x molecules
4 Fe	+	$3O_2$	→	2 Fe_2O_3
55.85g				159.7g
4		:		2

no need to go to grams, we can compare moles with molecules

$$112\,g\,Fe \times \frac{1\,mol\,Fe}{55.85\,g\,Fe} \times \frac{2\,mol\,Fe_2O_3}{4\,mol\,Fe} \times \frac{6.02\times10^{23}\,molecules\,Fe_2O_3}{1\,mol\,Fe_2O_3} =$$

6.036×10^{23} molecules

$\boxed{6.04\times10^{23}\text{ molecules}}$

1 sig fig

5) Use the following balanced equation to determine what mass of nitric acid (HNO_3) is necessary to obtain 6 moles of water.

2. given/unk
1. balance
3. molar mass
4. mole ratio

	x g			6 mol
$3Ag_{(S)}$ +	$4HNO_{3(aq)}$	→	$3AgNO_{3(aq)}$ + $NO(g)$ +	$2H_2O$
	63.02g			18.02g
	4		:	2

$$6\,mol\,H_2O \times \frac{4\,mol\,HNO_3}{2\,mol\,H_2O} \times \frac{63.02\,g\,HNO_3}{1\,mol\,HNO_3} = 756.24\,g$$

$\boxed{800g}$