Reacting masses, Y10

The golden rule in these calculations is to **keep track of the moles**!
Remember that a mole is simply a certain number of particles (6.02×10^{23})
The molecular weight is the mass of that number of molecules

Balanced equations

The balanced equation allows us to work out how many of each kind of species (molecule, atom or ion) take part in a chemical reaction.

$$2H_2 + O_2 \rightarrow 2H_2O$$

Each oxygen molecule reacts with two hydrogen molecule to form 2 molecules of water.

Reacting masses

1. First write the equation for the reaction
2. Keep track of the moles! Find the number of moles of one of the substances in the equation for which you know the mass
3. Use the equation to work out the number of moles of the substance you're interested in
4. Now use its molecular mass to work out the mass of it which reacted / was formed

e.g. 68 g of calcium carbonate ($CaCO_3$) is heated strongly, so that it decomposes into calcium oxide (CaO) and carbon dioxide (CO_2). What mass of calcium oxide is left once the carbon dioxide has been given off?

1. $CaCO_3+ \rightarrow CaO + CO_2$
2. We start with 68 g of $CaCO_3$. One mole would weigh $40+12+3\times16 =$ 100g. So we have $\frac{68}{100} = 0.68$ mol $CaCO_3$
3. The equation shows that 1 mol of $CaCO_3$ will produce 1 mol of CaO, so 0.68 mol $CaCO_3$ will produce 0.68 mol CaO
4. The M_r of CaO is 56, so 1 mol of it will have a mass of 56 g. 0.68 mol will have a mass of 0.68 mol $\times$56 g = 38.08 g

ACN, 13–v–2011

Reacting masses question

43 g of copper is heated strongly in a crucible attached to a bunsen burner, causing it to react with oxygen to form copper oxide (CuO). It is heated until its mass stops changing. [A_r: Cu 64, O 16]

1. What mass of copper oxide is formed?
2. Why is the crucible heated until the mass stops changing?

44 g of red lead oxide (Pb_3O_4) is heated strongly and weighed every minute (see below). It is found to give off oxygen gas (lights a glowing splint) and forms a yellow powder (definitely not molten shiny lead!) [A_r: Pb 207, O 16]

t / min	mass / g
0	44.0
1	32.7
2	23.4
3	16.8
4	14.7
5	14.5
6	14.5

1. How many moles of red lead oxide did we start with?
2. Why does the mass of the yellow powder stop changing?
3. How much lead is in the yellow powder?
4. How much oxygen must be in the yellow powder?
5. Can you guess its molecular formular?