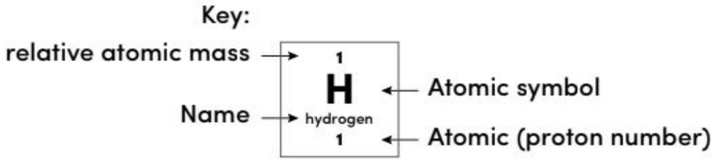
Combined Science - Chemistry - Key Stage 4

Quantitative Chemistry

Limiting Reactants - Higher

Mrs. Begum

Periodic Table of Elements



1 H hydrogen 1																	4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[97] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[267] Rf rutherfordium 104	[270] Db dubnium 105	[269] Sg seaborgium 106	[270] Bh bohrium 107	[270] Hs hassium 108	[278] Mt meitnerium 109	[281] Ds darmstadtium 110	[281] Rg roentgenium 87	[285] Cn copernicium 112	[286] Nh nihonium 113	[289] Fl flerovium 114	[289] Mc moscovium 115	[293] Lv livermorium 116	[293] Ts tennessine 117	[294] Og organesson 118

* The lanthanides (atomic numbers 58 - 71) and the Actinides (atomic numbers 90 - 103) have been omitted.

Relative atomic masses for **Cu** and **Cl** have not been rounded to the nearest whole number.

Warm up

1. Calculate the relative formula mass of $NaHCO_3$ (sodium hydrogen carbonate).
2. Deduce the charge on the carbonate ion in $CaCO_3$.
3. Calculate the number of moles in 2 g of $NaHCO_3$.
4. Calculate the number of moles in 50 cm^3 of a 1 M solution.
5. The symbol equation below shows the reaction between $NaHCO_3$ and ethanoic acid (vinegar), complete the equation:

$$NaHCO_3 + C_2H_3OOH \longrightarrow NaC_2H_3O_2 + \_\_\_\_\_ + \_\_\_\_\_$$

Independent practice

1. **$2Mg + O_2 \longrightarrow 2MgO$**

   What is the limiting reactant when 900 g of magnesium is reacted with 800 g of oxygen?

1. **$4Na + O_2 \longrightarrow 2Na_2O$**

   If 40 kg of sodium was reacted with 20 kg of oxygen. What is the limiting reactant?

1. **$2Fe + 3Cl_2 \longrightarrow 2FeCl_3$**

   In a reaction, 0.896 g of iron was added to 0.8 g chlorine. What is the limiting reactant?

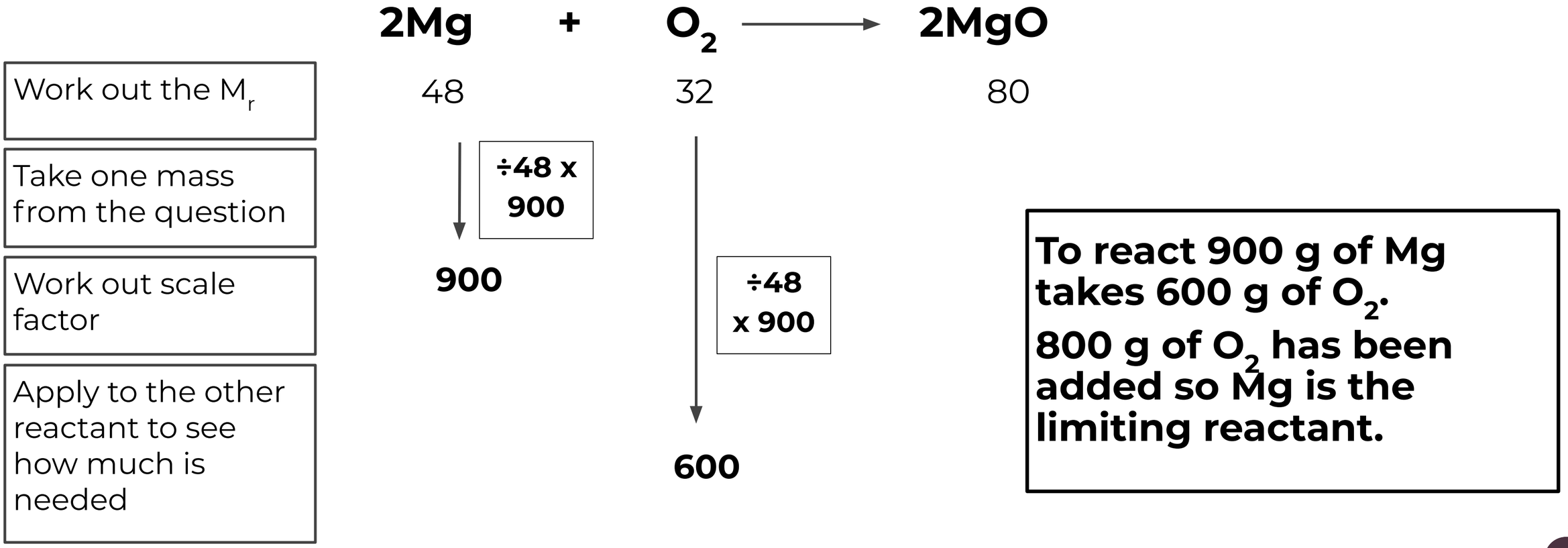
Warm up

1. Calculate the relative formula mass of $NaHCO_3$ (sodium hydrogen carbonate).
   23 + 1 + 12 + (16 x 3) = 84
2. Deduce the charge on the carbonate ion in $CaCO_3$. **HCO_3^-**
3. Calculate the number of moles in 2 g of $NaHCO_3$. **2 / 84 = 0.024 mol**
4. Calculate the number of moles in 50 cm^3 of a 1 M solution. **1 x (50 / 1000) = 0.05 mol**
5. The symbol equation below shows the reaction between $NaHCO_3$ and ethanoic acid (vinegar), complete the equation:

$$NaHCO_3 + C_2H_3OOH \longrightarrow NaC_2H_3O_2 + \mathbf{CO_2} + \mathbf{H_2O}$$

Independent practice review

1. What is the limiting reactant when 900 g of magnesium is reacted with 800 g of oxygen?



Independent practice review

2. If 40 g of sodium was reacted with 20 g of oxygen. What is the limiting reactant?

Work out the M_r
Take one mass from the question
Work out scale factor
Apply to the other reactant to see how much is needed

$4Na$ + O_2 → $2Na_2O$

92 32 124

÷92
x 40

40

÷92
x 40

13.9

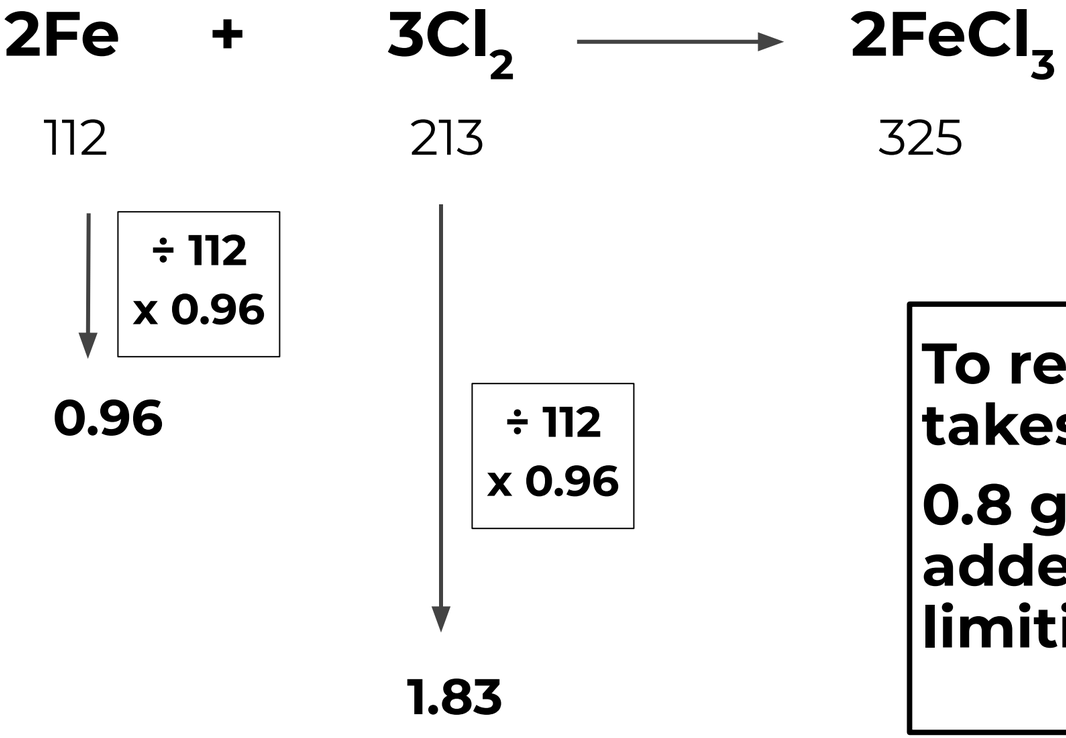
To react 40 g of Na needs 13.9 g of O_2.

20 g of O_2 has been added, so Na is the limiting reactant.

Independent practice review

3. In a reaction, 0.96 g of iron was added to 0.8 g chlorine. What is the limiting reactant?

Work out the M_r
Take one mass from the question
Work out scale factor
Apply to the other reactant to see how much is needed



To react 0.96 g of Fe takes 1.83 g of Cl_2.

0.8 g of Cl_2 has been added so Cl_2 is the limiting reactant.