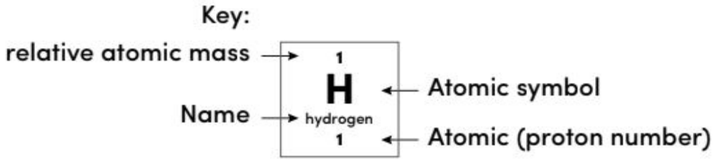
Triple - Chemistry - Key Stage 4

Quantitative Chemistry

Review Lesson
Triple

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.

Independent practice 1

Calcium nitrate can be made by reacting calcium carbonate with nitric acid.

$$CaCO_3 + HNO_3 \longrightarrow Ca(NO_3)_2 + H_2O + CO_2$$

1. What is the maximum theoretical yield that can be made from 500 tonnes of calcium carbonate?
2. What is the percentage yield if the actual yield is 720 tonnes?

Independent practice 2

Ethanol is manufactured in two ways:

Reaction 1: $C_6H_{12}O_6(aq) \longrightarrow 2C_2H_5OH(aq) + 2CO_2(g)$

Reaction 2: $C_2H_4(g) + H_2O(g) \longrightarrow C_2H_5OH(l)$

Calculate the atom economy for both reactions. Show your working out.

Which method should they choose based purely on atom economy?

Independent practice 3

$2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$

A student added 20.0 cm^3 of sodium hydroxide of unknown concentration to a conical flask.

The student carried out a titration to find out the volume of 0.200 mol/dm^3 sulfuric acid needed to neutralise the sodium hydroxide.

The student carried out five titrations. His results are shown in the table.

Concordant results are within 0.10 cm^3 of each other.

Titration	1	2	3	4	5
Volume of 0.100 mol/dm^3 sulfuric acid in cm^3	17.40	18.15	17.05	17.15	17.15

Use the student's concordant results to work out the mean volume of 0.100 mol / dm^3 sulfuric acid added.

Calculate the concentration of the sodium hydroxide.

Give your answer to three significant figures.

Independent practice 4

1. What volume do the following take up at room temp and pressure:
    a. 10 g methane (CH_4)
    b. 1000 g of carbon dioxide (CO_2)

2. Calculate the number of moles in :
    a. 14 dm^3 of nitrogen (N_2)
    b. 2.4 dm^3 of methane (CH_4)

Independent practice 5

The reaction that takes place in a car’s catalytic converter is shown below. What volume of nitrogen oxide (NO) reacts completely with 50 g of carbon monoxide (CO) at rtp?

Independent practice 1 answers

Calcium nitrate can be made by reacting calcium carbonate with nitric acid.

1. What is the maximum theoretical yield that can be made from 500 tonnes of calcium carbonate?
   820 tonnes of $Ca(NO_3)_2$ can be made from 5 tonnes of calcium carbonate

2. What is the percentage yield if the actual yield is 720 tonnes?
   (720 / 820) x 100 = 87.8%

Independent practice 2 answers

Ethanol is manufactured in two ways:

Reaction 1: $C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2$

Reaction 2: $C_2H_4 + H_2O \longrightarrow C_2H_5OH$

Calculate the atom economy for both reactions. Show your working out.

Reaction 1: **(92 / 180) x 100 = 51.1%**

Reaction 2: **(92 / 92) x 100 = 100%**

Which method should they choose based purely on atom economy? **Reaction 2 as it has 100% atom economy.**

Independent practice 2 answers

$$2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$$

Concentration: **?** **0.02 mol/(dm³)**

Volume: **20cm³** **17.12 cm³**

17.12 / 1000 = 0.01712 dm³

Find the number of moles in solution of **known** concentration:

Moles = 0.02 x 0.01712 dm³

= 0.0003424 mol

Moles = Concentration x volume (dm³)

Ratio: **2 : 1**

Use the ratio to find the number of moles in the solution of **unknown** concentration:

0.0006848 : 0.0003424

$$2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$$

20 cm^3

0.0006848	**:**	**0.0003424**

Calculate the concentration of the **unknown** solution:

Concentration = moles / volume (dm^3)
(mol/dm^3)

Volume NaOH in dm^3 = **20** / 1000 = 0.02 dm^3

Concentration NaOH = 0.0006848 / 0.02 = **0.034 mol/dm^3**

Independent practice 4 answers

1. What volume do the following take up at room temp and pressure:
    a. 10 g methane (CH_4) **10/16 = 0.625. Volume of gas = 0.625 x 24 dm^3 = 15 dm^3**
    b. 1000 g of carbon dioxide (CO_2) **100/44 = 22.73. Volume of gas = 22.73 x 24 dm^3 = 545.5 dm^3**
2. Calculate the number of moles in:
    a. 14 dm^3 of nitrogen (N_2) **14 dm^3 / 24 dm^3 = 0.58 moles**
    b. 2.4 dm^3 of methane (CH_4) **2.4 dm^3 / 24 dm^3 = 0.1 moles**

Independent practice 5 answers

The reaction that takes place in a car's catalytic converter is shown below. What volume of nitrogen oxide (NO) reacts completely with 50g of carbon monoxide (CO) at rtp?

1. Balanced symbol equation
2. M_r of carbon monoxide
3. Calculate the number of moles of CO burned
4. Look at the ratio to work out the moles of NO
5. Calculate the volume of NO needed

$2CO + 2NO \rightarrow 2CO_2 + N_2$

M_r of CO = 28

50/28 = 1.79 moles

Ratio is 1 : 1 so there are 1.79 moles of NO

Volume = 1.79 x 24 = 42.96 dm^3