Combined Science - Chemistry - Key Stage 4

Quantitative Chemistry

Review Lesson
Higher

Mrs Begum

Periodic Table of Elements

Key:

relative atomic mass → 1
H ← Atomic symbol
Name → hydrogen
1 ← Atomic (proton number)

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

Calculate the M_r of the following:

1. Ethanoic acid - CH_3COOH
2. Ethane - C_2H_6
3. Magnesium Nitrate - $Mg(NO_3)_2$
4. Aluminium nitrate - $Al(NO_3)_3$
5. Aluminium sulfate - $Al_2(SO_4)_3$

Relative atomic masses (M_r):

- H - 1
- Al - 27
- Mg - 24
- N - 14
- C - 12
- O - 16
- S - 32

Independent practice 2

The relative formula mass (M_r) of a Group 2 sulfate is 142.

Formula X_2SO_4

Relative atomic masses (A_r): S = 32, O = 16

a) Calculate the relative atomic mass (A_r) of the Group 2 metal in the metal carbonate.

b) Name the Group 2 metal.

Independent practice 3

1. What is the percentage of fluorine in tin fluoride (SnF_2)?
2. What is the percentage of magnesium in magnesium carbonate ($MgCO_3$)?
3. What is the percentage of oxygen in aluminium hydroxide $Al(OH)_3$?
4. What percentage of nitrogen in magnesium nitrate $Mg(NO_3)_2$?

Relative atomic masses (A_r):

- H - 1
- Al - 27
- Mg - 24
- N - 14
- C - 12
- O - 16
- Sn - 119
- F - 19

Independent practice 4

How many grams in:

- 5 mol of $CaCO_3$?
- 0.01 mol of $NaHCO_3$?

How many moles are in:

- 303 g of KNO_3?
- 9.80 g of H_2SO_4?

How many:

- atoms are 0.1 mol of carbon?
- molecules are in 0.01 mol of CH_4?
- atoms are in 0.01 mol of CH_4?

Independent practice 5

Balance the following equations:

1. $H_2 + Cl_2 \longrightarrow HCl$
2. $CaO + HCl \longrightarrow CaCl_2 + H_2O$
3. $KCl + F_2 \longrightarrow KF + Cl_2$
4. $ZnO + C \longrightarrow Zn + CO_2$
5. $CuSO_4 + NaOH \longrightarrow Cu(OH)_2 + Na_2SO_4$

Independent practice 6

Iron can be extracted from its ores by heating it with carbon. Some students found that 6.4 g of Fe_2O_3 reacted with 0.72 g of C to produce 4.48 g of Fe and 2.64 g of CO_2. Use the masses to deduce the balanced equation.

Independent practice 7

Convert the volumes below to dm^3:

1. $20\ cm^3$
2. $600\ cm^3$
3. $100\ cm^3$
4. $0.07\ cm^3$
5. $370\ cm^3$

Convert the volumes below to cm^3:

6. $2\ dm^3$
7. $50\ dm^3$
8. $38\ dm^3$
9. $0.8\ dm^3$
10. $6.4\ dm^3$

Independent practice 8

$Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$

80 g of Fe reacted with **100 g** of H_2SO_4. Which reactant is the limiting reactant?

Relative atomic masses (M_r): Fe = 56, H = 1, O = 16, S = 32

Independent practice 1 answers

Calculate the M_r of the following:

1. Ethanoic acid - CH_3COOH. **60**
2. Ethane - C_2H_6. **30**
3. Magnesium Nitrate - $Mg(NO_3)_2$. **148**
4. Aluminium nitrate - $Al(NO_3)_3$. **213**
5. Aluminium sulfate - $Al_2(SO_4)_3$. **342**

Independent practice 2 answers

$X_2SO_4 = 146$

$X + X + 32 + (4 \times 16) = 146$

$X + X + 32 + 64 = 146$

$X + X + 96 = 1146$

$X + X = 146 - 96$

$2X = 46$

$X = 46/2$

$X = 23$

X = Sodium

Independent practice 3 answers

1. What is the percentage of fluorine in tin fluoride (SnF_2)? **38/157 x 100% = 24%**
2. What is the percentage of magnesium in magnesium carbonate ($MgCO_3$)? **24/84 x 100% = 29%**
3. What is the percentage of oxygen in aluminium hydroxide $Al(OH)_3$? **48/73 x 100% = 66%**
4. What percentage of nitrogen in magnesium nitrate $Mg(NO_3)_2$? **28/148 x 100% = 19%**

Relative atomic masses (A_r):

- H - 1
- Al - 27
- Mg - 24
- N - 14
- C - 12
- O - 16
- Sn - 119
- F - 19

Independent practice 4 answers

How many grams in:

- 5 mol of $CaCO_3$? **5 x 100 = 500g**
- 0.01 mol of $NaHCO_3$? **0.01 x 84 = 0.084 g**

How many moles are in:

- 303 g of KNO_3? **303/101 = 3**
- 9.80 g of H_2SO_4? **9.8/ 98 = 0.1**

How many:

- atoms are 0.1 mol of carbon? **$(6.02 \times 10^{23}) \times 0.1 = 6.02 \times 10^{22}$**
- molecules are in 0.01 mol of CH_4? **$(6.02 \times 10^{23}) \times 0.01 = 6.02 \times 10^{21}$**
- atoms are in 0.01 mol of CH_4? **$(6.02 \times 10^{21}) \times 5 = 3.01 \times 10^{22}$**

Independent practice 5 answers

Balance the following equations:

1. $H_2 + Cl_2 \longrightarrow \mathbf{2}HCl$
2. $CaO + \mathbf{2}HCl \longrightarrow CaCl_2 + H_2O$
3. **3.** $\mathbf{2}KCl + F_2 \longrightarrow \mathbf{2}KF + Cl_2$
4. **4.** $\mathbf{2}ZnO + C \longrightarrow \mathbf{2}Zn + CO_2$
5. $CuSO_4 + \mathbf{2}NaOH \longrightarrow Cu(OH)_2 + Na_2SO_4$

Independent practice 6 answers

Convert the volumes below to dm^3:

1. 20 cm^3 **0.02 dm^3**
2. 600 cm^3 **0.6 dm^3**
3. 100 cm^3 **0.1 dm^3**
4. 0.07 cm^3 **0.00007 dm^3**
5. 370 cm^3 **0.37 dm^3**

Convert the volumes below to cm^3:

6. 2 dm^3 **2000 cm^3**
7. 50 dm^3 **50000 cm^3**
8. 38 dm^3 **38000 cm^3**
9. 0.8 dm^3 **800 cm^3**
10. 6.4 dm^3 **6300 cm^3**

Independent practice 7 answer

$$Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$$

	Fe	H_2SO_4	$FeSO_4$	H_2
Work out the M_r	56	98	153	2
Take one mass from the question	80			
Work out scale factor	÷56 x 80	÷56 x 80		
Apply to the other reactant to see how much is needed		140g		

You need 140 g of H_2SO_4 to react with 80 g Fe, but we added 100 g of H_2SO_4, so H_2SO_4 will run out first.

Independent practice 8 answer

$$Fe \quad + \quad H_2SO_4 \quad \rightarrow \quad FeSO_4 \quad + \quad H_2$$

	Fe	H_2SO_4	$FeSO_4$	H_2
Work out the M_r	56	98	153	2
Take one mass from the question				
Work out scale factor	**80**	**÷56 x 80**		
Apply to the other reactant to see how much is needed	**÷56 x 80**	**140 g**		

You need 140 g of H_2SO_4 to react with 80 g Fe, but we added 100 g of H_2SO_4, so $\underline{H_2SO_4}$ will run out first.