Task Help
BTEC Chemistry

hydrogen
1

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	helium 2
6.9 **Li** lithium 3	9.0 **Be** beryllium 4											10.8 **B** boron 5	12.0 **C** carbon 6	14.0 **N** nitrogen 7	16.0 **O** oxygen 8	19.0 **F** fluorine 9	20.2 **Ne** neon 10
23.0 **Na** sodium 11	24.3 **Mg** magnesium 12											27.0 **Al** aluminium 13	28.1 **Si** silicon 14	31.0 **P** phosphorus 15	32.1 **S** sulfur 16	35.5 **Cl** chlorine 17	39.9 **Ar** argon 18
39.1 **K** potassium 19	40.1 **Ca** calcium 20	45.0 **Sc** scandium 21	47.9 **Ti** titanium 22	50.9 **V** vanadium 23	52.0 **Cr** chromium 24	54.9 **Mn** manganese 25	55.8 **Fe** iron 26	58.9 **Co** cobalt 27	58.7 **Ni** nickel 28	63.5 **Cu** copper 29	65.4 **Zn** zinc 30	69.7 **Ga** gallium 31	72.6 **Ge** germanium 32	74.9 **As** arsenic 33	79.0 **Se** selenium 34	79.9 **Br** bromine 35	83.8 **Kr** krypton 36
85.5 **Rb** rubidium 37	87.6 **Sr** strontium 38	88.9 **Y** yttrium 39	91.2 **Zr** zirconium 40	92.9 **Nb** niobium 41	95.9 **Mo** molybdenum 42	[98] **Tc** technetium 43	101.1 **Ru** ruthenium 44	102.9 **Rh** rhodium 45	106.4 **Pd** palladium 46	107.9 **Ag** silver 47	112.4 **Cd** cadmium 48	114.8 **In** indium 49	118.7 **Sn** tin 50	121.8 **Sb** antimony 51	127.6 **Te** tellurium 52	126.9 **I** iodine 53	131.3 **Xe** xenon 54
132.9 **Cs** caesium 55	137.3 **Ba** barium 56	138.9 **La*** lanthanum 57	178.5 **Hf** hafnium 72	180.9 **Ta** tantalum 73	183.8 **W** tungsten 74	186.2 **Re** rhenium 75	190.2 **Os** osmium 76	192.2 **Ir** iridium 77	195.1 **Pt** platinum 78	197.0 **Au** gold 79	200.6 **Hg** mercury 80	204.4 **Tl** thallium 81	207.2 **Pb** lead 82	209.0 **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	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111							

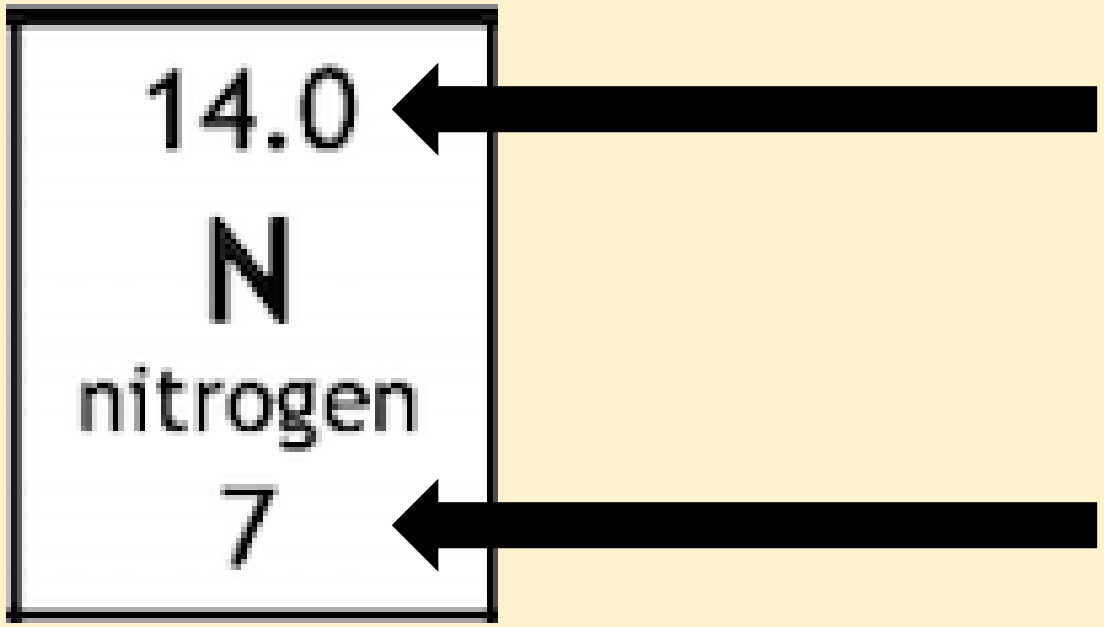
Elements with atomic numbers 112-116 have been reported but not fully authenticated

* Lanthanide series

* Actinide series

140 **Ce** cerium 58	141 **Pr** praseodymium 59	144 **Nd** neodymium 60	[147] **Pm** promethium 61	150 **Sm** samarium 62	152 **Eu** europium 63	157 **Gd** gadolinium 64	159 **Tb** terbium 65	163 **Dy** dysprosium 66	165 **Ho** holmium 67	167 **Er** erbium 68	169 **Tm** thulium 69	173 **Yb** ytterbium 70	175 **Lu** lutetium 71
232 **Th** thorium 90	[231] **Pa** protactinium 91	238 **U** uranium 92	[237] **Np** neptunium 93	[242] **Pu** plutonium 94	[243] **Am** americium 95	[247] **Cm** curium 96	[245] **Bk** berkelium 97	[251] **Cf** californium 98	[254] **Es** einsteinium 99	[253] **Fm** fermium 100	[256] **Md** mendelevium 101	[254] **No** nobelium 102	[257] **Lr** lawrencium 103

Task (Relative atomic mass)



Relative atomic mass of nitrogen is 14 g mol^{-1}

Atomic number of nitrogen is 14

Task (Relative molecular mass)

Nitrogen exists as a diatomic molecule (N_2)

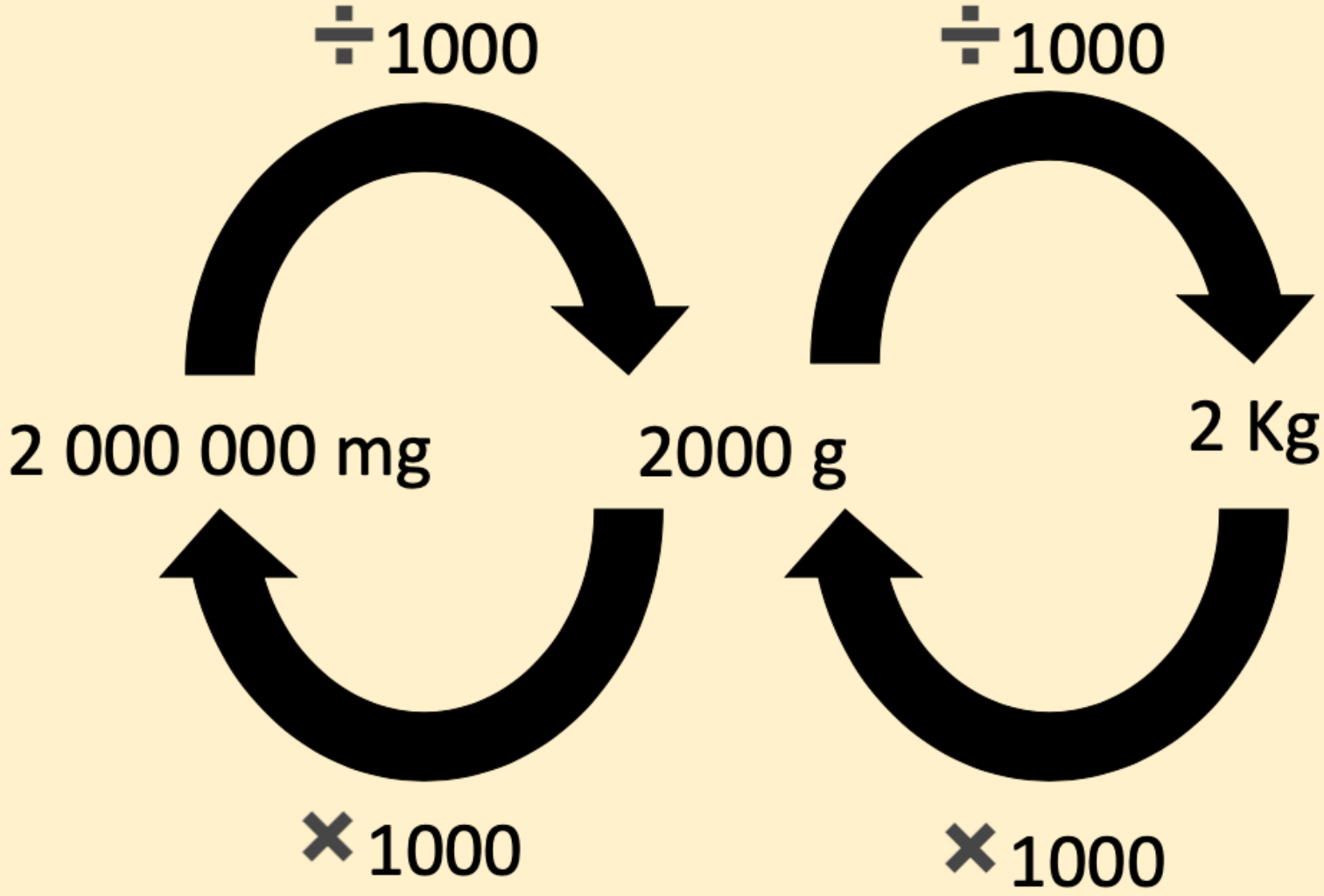
One atom of nitrogen has an A_r of 14 g mol^{-1}

Two atoms of nitrogen have an M_r of 28 g mol^{-1} (14 x 2)

Molecule	Calculation	Relative molecular mass / g mol^{-1}
N_2	14 x 2	28

Task 3(Mass / M_r / Moles)

Unit Conversions



The mass must be in grams (g)

Task continued

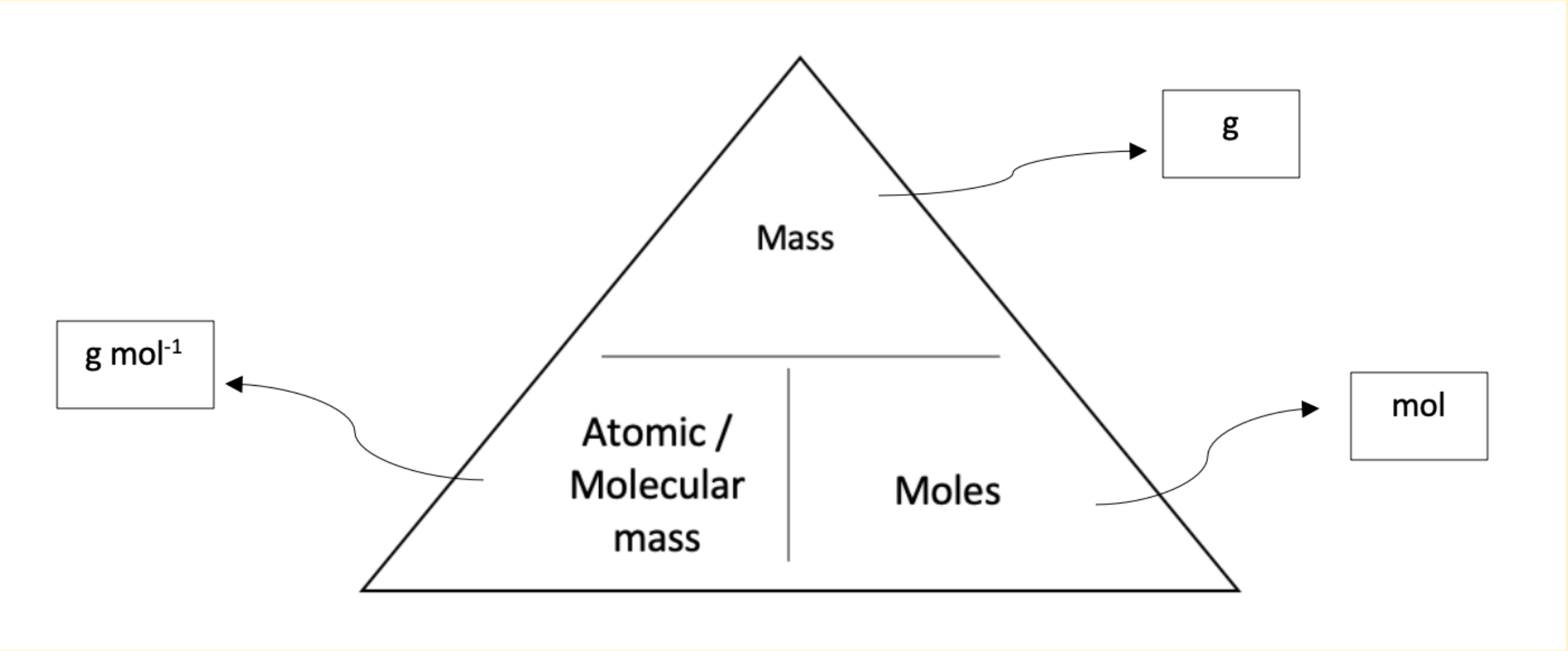
$$\text{Mass} = M_r \times \text{Moles}$$

1. Calculate the mass of 0.25 moles of calcium (Ca)

$$0.25 \text{ mol} \times 40.1 \text{ g mol}^{-1} = 10.025 \text{ g}$$

You will need to rearrange the equation to answer some of the questions. Use the triangle to help.

Task continued



Example where the units need to be converted

Task continued

2. Calculate the number of moles of 54 mg of Nitrogen (N_2)

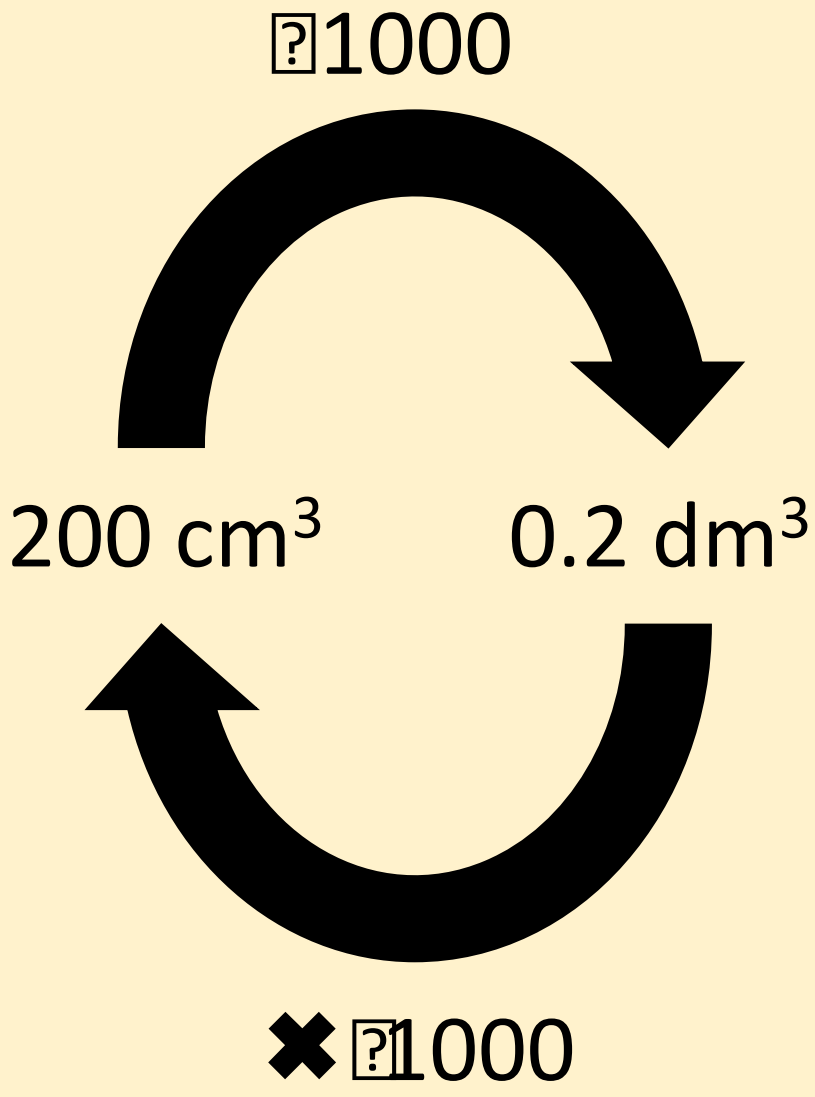
$$\text{Moles} = \frac{\text{Mass}}{M_r}$$

*The mass is not in grams – you need to convert to get it into grams

$$\frac{54\ \text{mg}}{1000} = 0.054\ \text{g} \qquad \frac{0.054\ \text{g}}{28\ \text{g mol}^{-1}} = 0.0019\ \text{mol}$$

Task (Moles / Concentration / Volume)

cm^3 is the equivalent of a millilitre (mL). If the volume is given in cm^3 you need to convert to dm^3.



Unit Conversions

The volume must be in dm^3 which is the equivalent of a litre (L).

Task continued

Moles = Concentration x Volume

1. A sodium hydroxide solution has a volume of 0.25 dm^3 and a concentration of 0.5 mol dm^{-3}. Calculate the moles of sodium hydroxide.

0.5 mol dm^{-3} x 0.25 dm^3 = 0.125 mol

Example where the units need to be converted

Task continued

2. A sodium hydroxide solution has a volume of 100 cm^3 and a concentration of 0.2 mol dm^{-3}. Calculate the moles of sodium hydroxide.

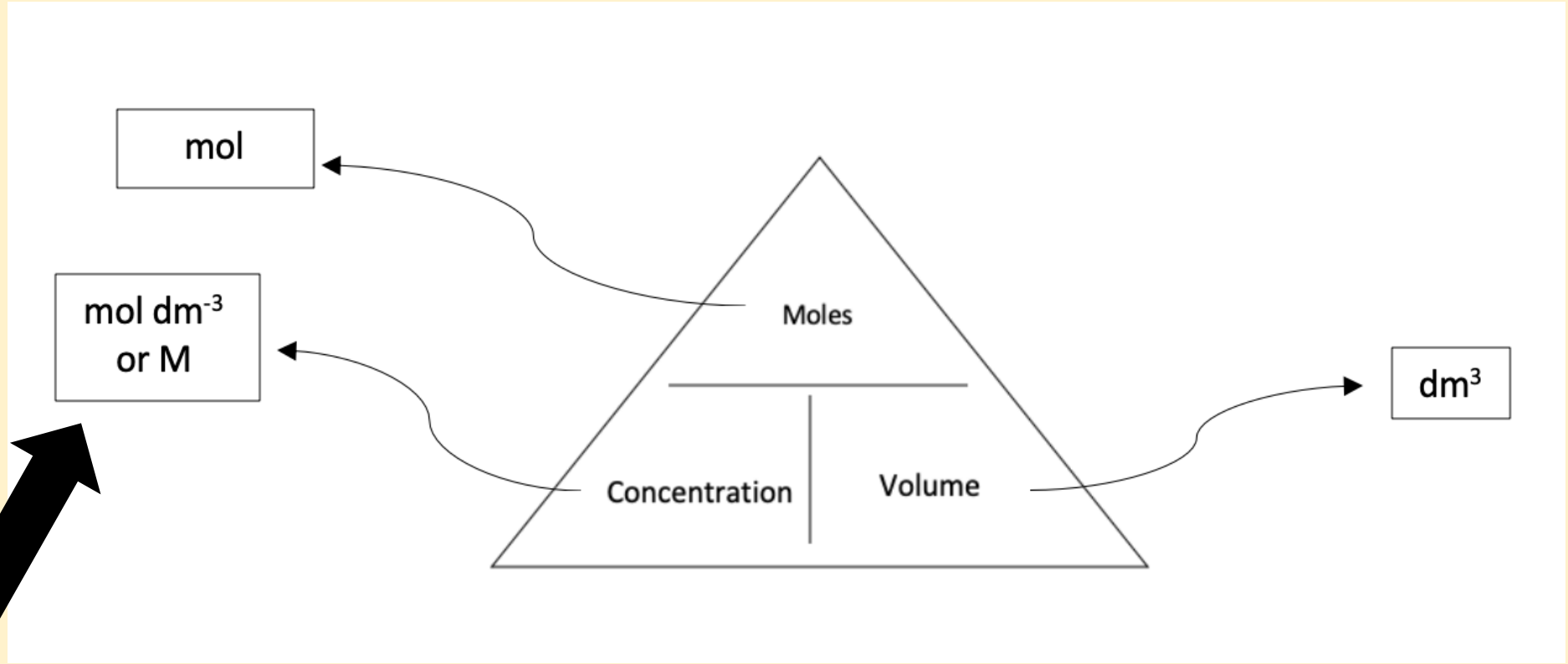
*The volume is not in dm^3. This needs to be converted.

$$\frac{100\ cm^3}{1000} = 0.1\ dm^3$$

$$0.2\ mol\ dm^{-3}\ x\ 0.1\ dm^3 = 0.02\ mol$$

You will need to rearrange the equation to answer some of the questions. Use the triangle to help.

Task continued



mol dm^{-3} and M (molarity) are the same thing

Task continued

3. A solution of hydrochloric acid contains 0.75 moles in 1.5 dm^3. Calculate the concentration of the solution in mol dm^{-3}.

$$\text{Concentration} = \frac{\text{Moles}}{\text{Volume}}$$

$$\frac{0.75 \text{ mol}}{1.5 \text{ dm}^3} = 0.5 \text{ mol dm}^{-3}$$

Example where the units need to be converted

Task continued

4. A solution of sodium hydroxide contains 0.25 mole in 500 cm^3.
Calculate the concentration of the solution in mol dm^{-3}.

*The volume is not in dm^3. This needs to be converted

$$\frac{500\ \text{cm}^3}{1000} = 0.5\ \text{dm}^3$$

$$\frac{0.25\ \text{mol}}{0.5\ \text{dm}^3} = 0.5\ \text{mol dm}^{-3}$$

Task (Using two equations simultaneously)

$$\text{Moles} = \frac{\text{Mass}}{\text{M}_\text{r}}$$

Moles = Concentration x Volume

You will need to calculate the moles first

Task continued

1. A sodium hydroxide (NaOH) solution has a volume of 250 cm^3 and a concentration of 0.1 mol dm^{-3}. Calculate the mass of sodium hydroxide needed in g.

*The volume is in cm^3. This needs to be converted.

$$\frac{250\ \text{cm}^3}{1000} = 0.25\ \text{dm}^3$$

$$0.25\ \text{dm}^3 \times 0.1\ \text{mol dm}^3 = 0.025\ \text{mol}$$

$$0.025\ \text{mol} \times 40\ \text{g mol}^{-1} = 1\ \text{g}$$

Task (Research task)

Research is very important in Science and makes up quite a bit of the BTEC Coursework.

Base your research on the questions that I have provided. This does need to be in quite a bit of detail.

You can present your research how ever you like.

Task (Titration calculations)

You will need to use this equation

Moles = Concentration x Volume

1. 25 cm^3 of 1 M NaOH is needed to titrate 14 cm^3 of a solution of hydrochloric acid. Calculate the concentration of the acid.

$$NaOH\ (aq) + HCl\ (aq) \longrightarrow NaCl\ (aq) + H_2O\ (l)$$

Task continued

Steps

1. Convert the volume of NaOH

$$\frac{25\ \mathrm{cm}^3}{1000} = 0.025\ \mathrm{dm}^3$$

2. Calculate the moles of NaOH

$$0.025\ \mathrm{dm}^3 \times 1\ \mathrm{M} = \ 0.025\ \mathrm{mol\ of\ NaOH}$$

Task continued

3. Look at the ratio of NaOH to HCl (You need to look at the numbers in front). If there is no big number in front. It is 1.

1:1 ratio of NaOH to HCl

Therefore there are 0.025 moles of HCl

*If the ratio is different you will need to multiply or divide the number moles

Task continued

4. Convert the volume of HCl

$$\frac{14\ \text{cm}^3}{1000} = 0.014\ \text{dm}^3$$

5. Calculate the concentration of HCl

$$\frac{0.025\ \text{mol}}{0.014\ \text{dm}^3} = 1.79\ \text{mol}\ \text{dm}^{-3}$$