Chemistry - Triple Science - Key Stage 4

Processing Titration Results

Mr Campbell

Periodic Table of Elements

Key:

relative atomic mass → 1

Atomic symbol ← H

Name → hydrogen

Atomic (proton number) ← 1

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

Source: Oak

Titration method

1. Fill the ______ with acid.
2. Use a ______ to measure 25cm^3 of alkali into the conical flask.
3. Add an ______ to the alkali.
4. Take the initial reading on the ______
5. Add the acid to the alkali while ______ the conical flask.
6. Stop adding the acid when the indicator changes colour. Record the final reading on the burette - This is your rough titration.
7. Repeat the titration this time adding ______ near the end point.
8. Repeat until ______ results are achieved.

Processing titration results

	1	2	3	4
Final volume (cm^3)	23.45	45.70	22.60	44.70
Initial volume (cm^3)	0.00	23.45	0.00	22.40
Titre (cm^3)				

Processing titration results

	1	2	3	4
Final volume (cm^3)	23.45	45.70	22.60	44.70
Initial volume (cm^3)	0.00	23.45	0.00	22.40
Titre (cm^3)	23.45	22.25	22.60	22.30

Moles, concentration and volume

	A solution had a volume of $25cm^3$ and a concentration of 0.125 mol/dm^3. Calculate the number of moles in this solution.
Values **E**quation **S**ubstitute **R**earrange **A**nswer **U**nits	

÷ 1000

$1\ dm^3 = 1000cm^3$

X 1000

Moles, concentration and volume

	A solution had a volume of 50cm^3 and a concentration of 0.275 mol/dm^3. Calculate the number of moles in this solution.
Values **E**quation **S**ubstitute **R**earrange **A**nswer **U**nits	

÷ 1000

1 dm^3 = 1000cm^3

X 1000

Titration calculation

A student added 25cm^3 of an unknown concentration of sodium hydroxide into a conical flask. They carried out a titration using 0.100 mol/dm^3 of hydrochloric acid. The mean volume of hydrochloric acid needed to exactly neutralise the acid was 26.50cm^3. Calculate the concentration of the sodium hydroxide.

$NaOH + HCl \rightarrow NaCl + H_2O$

Titration calculation

A student added 25cm^3 of 0.150mol/dm^3 of sodium hydroxide into a conical flask. They carried out a titration using an unknown concentration of of citric acid. The results of the titration are shown below. Calculate the concentration of the citric acid.

$$C_6H_8O_7 \quad + \quad 3\ NaOH \quad \longrightarrow \quad C_6H_5O_7Na_3 \quad + \quad 3\ H_2O$$

	Titration 1	Titration 2	Titration 3	Titration 4	Titration 5
Volume of $C_6H_8O_7$ added in cm^3	12.50	11.10	10.20	10.15	10.15

Independent task

A student titrated 25cm^3 of 0.075 mol/dm^3 of sulfuric acid with an unknown concentration of sodium hydroxide. The mean volume of sodium hydroxide added was 17.55cm^3. Calculate the concentration of the sodium hydroxide solution.

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

1. Calculate moles of sulfuric acid using moles = concentration x volume (remember to make sure your volume is in dm^3)
2. Use the ratio from the balanced equation to work out moles of HCl
3. Calculate the concentration of HCl using concentration = moles/volume (remember to make sure your volume is in dm^3)

Independent task answer

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

Moles (NaOH) = concentration x volume

$25cm^3 = 0.025dm^3$

Moles NaOH = 0.075 x 0.025 = 1.875×10^{-5} (0.00001875)

Independent task answer

Ratio of NaOH:HCl   2:1

So moles of HCl = $1.875 \times 10^{-5} / 2 = 9.375 \times 10^{-6}$

Concentration (HCl) = moles/volume

Volume of HCl = $17.55 cm^3$ so $0.01755 dm^3$

Concentration = $9.375 \times 10^{-6} / 0.01755 = 5.3 \times 10^{-4}$ mol/dm^3

Independent task

A student carried out a titration using 25cm^3 of 0.200 mol/dm^3 HCl. NaOH was end to the HCl and the volume needed to neutralise the HCl was recorded. Use the results of the titration to calculate the concentration of NaOH.

$$NaOH + HCl \rightarrow NaCl + H_2O$$

	Titration 1	Titration 2	Titration 3	Titration 4	Titration 5
Volume of NaOH added in cm^3	12.50	11.10	10.20	10.15	10.15

1. Calculate moles of HCl using moles = concentration x volume (remember to make sure your volume is in dm^3)
2. Use the ratio from the balanced equation to work out moles of NaOH
3. Calculate the mean volume of NaOH using the concordant results from the titration.
4. Calculate the concentration of HCl using concentration = moles/volume (remember to make sure your volume is in dm^3)

Independent task answer

1. Moles (HCl) = 0.200 x 0.025 = 5×10^{-3}
2. Ratio HCl:NaOH 1:1 so moles of NaOH = 5×10^{-3}
3. Mean volume of NaOH = $10.15 cm^3$
4. Concentration of NaOH = $5 \times 10^{-3}/0.01015$ = 0.493 mol/dm^{-3}