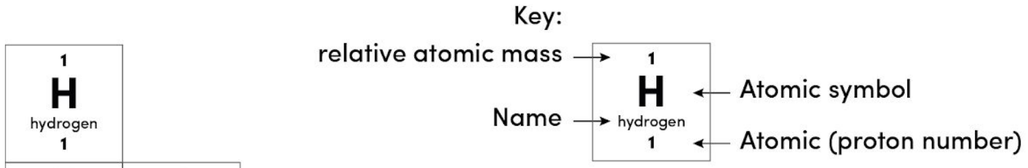
Combined Science - Chemistry - Key Stage 4

Developing an Electrolysis Hypothesis

Mr Campbell

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

Source: Oak

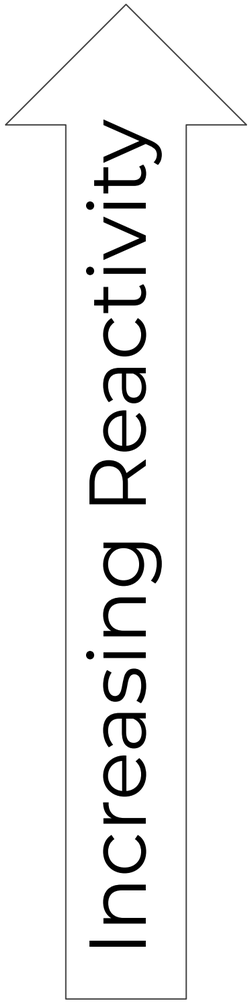
Electrolysis of solutions

At the anode
If the non-metal ions is a halide ion (group 7) chloride Cl^-, Br^-, I^-.
Then the halogen will form chlorine Cl_2, Br_2 or I_2.

If the non-metal ion is not a halide ion then oxygen, O_2, forms.

At the cathode
If the metal is more reactive than hydrogen then hydrogen forms.

If the metal is less reactive than hydrogen (copper, silver, gold, platinum) then the metal forms.



Potassium
Sodium
Calcium
Magnesium
Aluminium
Zinc
Iron
Tin
Lead
Hydrogen
Copper
Silver
Gold
Platinum

Electrolysis of solutions

Solution	Product at anode	Product at cathode
Copper chloride		
Copper sulfate		
Sodium chloride		
Sodium sulfate		

Electrolysis of solutions answers

Solution	Product at anode	Product at cathode
Copper chloride	chlorine	copper
Copper sulfate	oxygen	copper
Sodium chloride	chlorine	hydrogen
Sodium sulfate	oxygen	hydrogen

Independent task

Identify the products made at the anode and cathode during the electrolysis of the following solutions.

1. Silver chloride
2. Potassium bromide
3. Sodium sulfate
4. Copper nitrate

Independent task

Complete the sentences describing the tests for the gases below.

1. Hydrogen, a _____ splint gives a .....
2. Oxygen, a _____ splint will .....
3. Chlorine, damp blue _____ paper will turn _____ then _____

Independent task answers

Identify the products made at the anode and cathode during the electrolysis of the following solutions.

1. Silver chloride anode = chlorine cathode = silver
2. Potassium bromide anode = bromine cathode = hydrogen
3. Sodium sulfate anode = oxygen cathode = hydrogen
4. Copper nitrate anode = oxygen cathode = copper

Independent task answers

Complete the sentences describing the tests for the gases below.

1. Hydrogen, a lit splint gives a squeaky pop.
2. Oxygen, a glowing splint will relight.
3. Chlorine, damp blue Litmus paper will turn red then bleaches or white.

Independent task

Hypothesis - The greater the concentration of of copper sulfate electrolysed, the greater the mass of copper produced at the cathode.

Plan an investigation to test this hypothesis that would produce valid results.

Identify
The independent variable
The dependent variable
Control variables

Identify your range and intervals for the independent variable.

Give a brief descriptions of the method (remember repeats).

Independent task answers

Independent variable	Concentration of copper sulfate solution
Dependent variable	Mass of copper produced
Control variables	• Volume of solution • The voltage of the power supply • The temperature of the solution • The time electrolysis is run for

Identify your range and intervals for the independent variable.

0.5 to 2 mol/dm^3 going up in 0.5's

Give a brief description of how to carry out the experiment.

- Set up electrolysis equipment (you could use a diagram for this)
- Measure 50cm^3 of 0.5 mol/dm^3 copper sulfate solution
- Record the mass of the cathode
- Turn on the power supply at 2V for 5 minutes
- Record the mass of the cathode, the calculate the increase in mass
- Repeat 3 times
- Repeat for concentrations of 1, 1.5 and 2 mol/dm^3