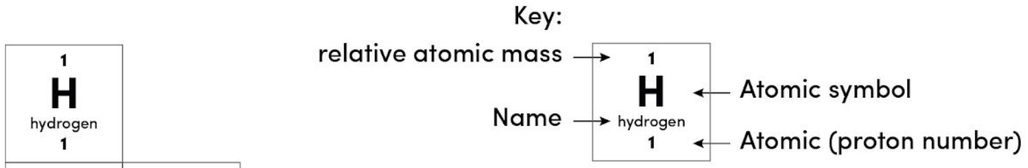
Combined Science - Chemistry - Key Stage 4

Electrolysis Review

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

Knowledge quiz

1. What is electrolysis?
2. What is the charge on the cathode?
3. Why does the ionic compound being electrolysed need to be molten or dissolved?
4. Why does aluminium need to be extracted from aluminium oxide using electrolysis?
5. Why is cryolite used during the electrolysis of aluminium oxide?
6. Why does the anode need periodically replacing during the electrolysis of aluminium oxide?
7. What is the name of the positive electrode in electrolysis?
8. What would form at the anode and cathode during the electrolysis of **molten** sodium chloride?
9. During the electrolysis of sodium chloride **solution** hydrogen forms at the anode, explain why.
10. What will form at the anode during the electrolysis of of copper sulfate solution?

Knowledge quiz - Answers

1. What is electrolysis? The breaking down of ionic compounds using electricity
2. What is the charge on the cathode? Negative
3. Why does the ionic compound being electrolysed need to be molten or dissolved? So the ions are free to move

1. Why does aluminium need to be extracted from aluminium oxide using electrolysis? Aluminium is more reactive than carbon, so carbon can not remove the oxygen from aluminium oxide.

1. Why is cryolite used during the electrolysis of aluminium oxide? Cryolite lowers the melting point of the aluminium oxide, reducing energy costs.

Knowledge quiz - Answers

6. Why does the anode need periodically replacing during the electrolysis of aluminium oxide? Oxygen produced at the anode reacts with the carbon anode forming carbon dioxide, this wears away the anode.
7. What is the name of the positive electrode in electrolysis? Anode
8. What would form at the anode and cathode during the electrolysis of **molten** sodium chloride? Anode = chlorine Cathode = Sodium
9. During the electrolysis of sodium chloride **solution** hydrogen forms at the anode, explain why. Sodium is more reactive than hydrogen.
10. What will form at the anode during the electrolysis of of copper sulfate solution? Oxygen

	Extraction of iron from iron oxide	Extraction of aluminium from aluminium oxide
Obtaining the ore	Mined from earth's crust	Mined from earth's crust
Method of extraction	Heating with carbon	Electrolysis
Cost of extraction per tonne (£)	500	1500
Energy needs of extraction per tonne (KJ)	750	1000
Solid waste produced per tonne of metal extracted (tonnes)	800	200

Compare the extraction of iron and aluminium from their ore.

- Similarities
- Differences
- Use comparative language
- Use data to illustrate

Similarities

- Both ores are mined from the earth's crust

Differences

- Iron is extracted from its ore by heating with carbon whereas electrolysis is used for aluminium
- It costs **more** to extracted aluminium from its ore, three times more or £1000 per tonne more.
- The energy needs are **higher** to extract aluminium from its ore, 1.5 times more or 375 KJ per tonne more
- **More** solid waste is produced during the extraction of iron, 4 times more or 600 tonnes more.

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Evaluate the two methods of extraction of metals from their ore. Use data from the table and your own knowledge.

- Positives and Negatives
- Overall opinion
- Add value to the information do not just repeat it!

Iron/heating with carbon

Positives

- The energy needs and costs are lower, x1.5 and x3 lower, so it is cheaper

Negatives

- The ore is mined from the earth’s crust this will destroy habitats and create noise/dust pollution.
- A larger amount, x 4, of solid waste is produced which will need to be disposed of and take up space in landfill, which affects habitats

Aluminium/Electrolysis

Positives

- Produces less solid waste so less waste going to landfill

Negatives

- Aluminium needs electrolysis for extraction due to being more reactive than carbon.
- The energy needs and costs are much higher due to the electricity needed for electrolysis.
- The ore is mined from the earth’s crust this will destroy habitats and created noise/dust pollution.

Overall opinion - Heating with carbon is the best option for extracting a metal from its ore as it is cheaper and has lower energy needs, however, this method can only be used if the metal is less reactive than carbon.