

## Chemistry 4: Chemical Changes

### Section 1: Key Terms

1 Metal oxide	Metals react with oxides to produce metal oxides. This is an oxidation reaction.
2 Displacement reaction	A <b>more reactive metal</b> can <b>displace</b> a <b>less reactive metal</b> from a <b>compound</b> .
3 Oxidation	Two definitions: Chemicals are oxidised if they <b>gain oxygen</b> in a reaction. Chemicals are oxidised if they <b>lose electrons</b> in a reaction. (HT)
4 Reduction	Two definitions: Chemicals are oxidised if they <b>lose oxygen</b> in a reaction. Chemicals are oxidised if they <b>gain electrons</b> in a reaction. (HT)
5 Acid	A chemical that <b>dissolves in water</b> to produce <b>H<sup>+</sup> ions</b> .
6 Base	A chemical that <b>reacts with acids</b> and <b>neutralise</b> them. E.g. <b>metal oxides, metal hydroxides, metal carbonate</b>
7 Alkali	A <b>base</b> that <b>dissolves in water</b> . It produces <b>OH<sup>-</sup> ions</b> in solution.
8 Neutralisation	When a <b>neutral solution</b> is formed from reacting an <b>acid</b> and <b>alkali</b> . General equation: <b>H<sup>+</sup> + OH<sup>-</sup> → H<sub>2</sub>O</b>
9 pH	A scale to <b>measure acidity/ alkalinity</b> . A <b>decrease of one pH</b> unit causes a <b>10x increase in H<sup>+</sup> ions</b> . (HT)
10 Strong acid (HT)	A strong acid is <b>completely ionised</b> in solution. E.g. <b>hydrochloric, nitric</b> and <b>sulfuric</b> acids.
11 Weak acid (HT)	A weak acid is <b>only partially ionised</b> in solution. E.g. <b>ethanoic, citric</b> and <b>carbonic</b> acids.

### Section 2: Reactivity

Element	Reaction	Reactivity
12 Potassium	When potassium is added to <b>water</b> , the metal <b>melts</b> and floats. It moves around very quickly. The metal is also <b>set on fire</b> , with sparks and a <b>lilac flame</b> .	↑
13 Sodium	When sodium is added to <b>water</b> , it <b>melts</b> to form a ball that moves around on the surface. It <b>fizzes rapidly</b> .	
14 Lithium	When lithium is added to <b>water</b> , it floats. It <b>fizzes steadily</b> and becomes smaller.	
15 Calcium	<b>Fizzes quickly</b> with dilute <b>acid</b> .	
16 Magnesium	<b>Fizzes quickly</b> with dilute <b>acid</b> .	
17 (Carbon)		
18 Zinc	<b>Bubbles slowly</b> with dilute <b>acid</b> .	
19 Iron	<b>Very slow reaction</b> with dilute <b>acid</b> .	
20 (Hydrogen)		
21 Copper	<b>No reaction</b> with dilute <b>acid</b> .	

### Section 4: Extracting Metals

22 Very unreactive metals	Found <b>naturally</b> in the ground. <b>Don't need extracting</b> .
23 Metals less reactive than carbon	Extracted by <b>reduction with carbon</b> .
24 Metals more reactive than carbon	Extracted by <b>electrolysis</b> .

### Section 5: Reactions of Acids

25 With metal	Acid + Metal → Salt + Hydrogen
26 With alkali	Acid + Metal Hydroxide → Salt + Water (Neutralisation reaction)
27 With metal oxide	Acid + Metal Oxide → Salt + Water (Neutralisation reaction)
28 With carbonate	Acid + Metal Carbonate → Salt + Water + Carbon Dioxide (Neutralisation reaction)

### Section 6: Making a Soluble Salt

29	<b>Add solid</b> metal, metal carbonate, metal oxide or metal hydroxide <b>to an acid</b> .
30	Add solid <b>until no more reacts</b> .
31	<b>Filter</b> off excess solid.
32	<b>Evaporate</b> to remove some of the water.
33	Leave to <b>crystallise</b> .
34	Remove all water in a <b>desiccator/ oven</b> .

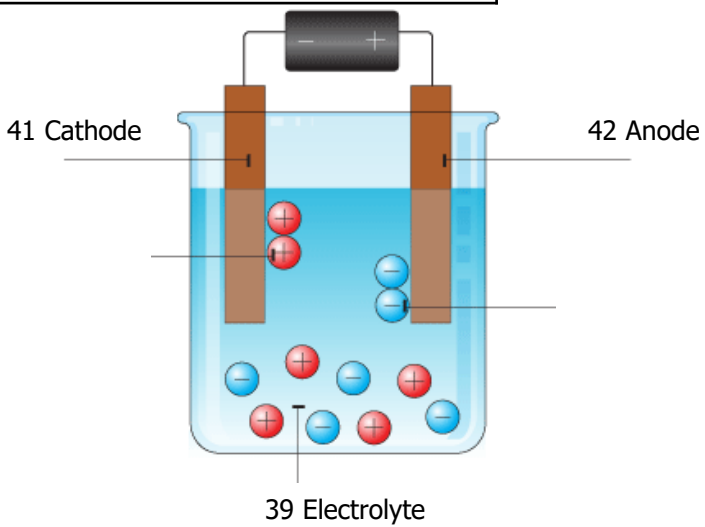
35 Acidic pH 0-6

36 Neutral pH 7

37 Neutral pH 8-14



### Chemistry 4: Chemical Changes



- Positive
- Anode
- Negative
- Is
- Cathode

### Section 7 Electrolysis key terms

38 Electrolysis	The process of <b>splitting an ionic compound</b> by passing <b>electricity</b> through it.
39 Electrolyte	An <b>ionic compound</b> that is <b>molten</b> (melted) or <b>dissolved in water</b> . The <b>ions</b> are <b>free to move</b> .
40 Electrode	An <b>electrical conductor</b> that is placed in the <b>electrolyte</b> and connected to the <b>power supply</b> .
41 Cathode	The <b>electrode</b> attached to the <b>negative</b> terminal of the <b>power supply</b> .
42 Anode	The <b>electrode</b> attached to the <b>positive</b> terminal of the <b>power supply</b> .

### Section 8: What is discharged in electrolysis?

Electrolyte	Cathode	Anode
43 Molten Compound	Metal	Non-metal
44 Dissolved compound (aqueous solution)	The <b>metal</b> if the metal is <b>less reactive than hydrogen</b> . <b>Hydrogen</b> is produced if the <b>metal is more reactive than hydrogen</b> .	<b>Oxygen</b> is produced <b>unless the solution contains halide ions</b> (chloride, bromide, iodide) when the <b>halogen</b> (chlorine, bromine, iodine) is produced.

### Section 9: Aluminium Electrolysis

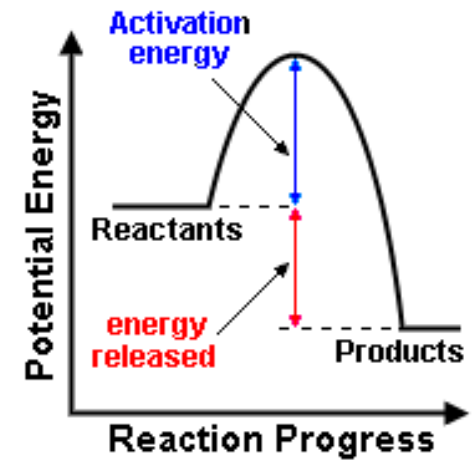
45 Cryolite	<b>Aluminium oxide</b> is <b>dissolved in cryolite</b> to <b>lower its melting point</b> . This <b>saves money on energy costs</b> .
46 Cathode	Positive <b>Al<sup>3+</sup> ions</b> move to the <b>cathode</b> . Aluminium is produced. <b>Al<sup>3+</sup> + 3e<sup>-</sup> → Al</b>
47 Anode	Negative <b>O<sup>2-</sup> ions</b> move to the <b>anode</b> . Oxygen is made. <b>2O<sup>2-</sup> → O<sub>2</sub> + 4e<sup>-</sup></b> <b>Wears away</b> as the <b>carbon anode reacts with oxygen to form carbon dioxide</b> .

### Chemistry 5: Energy Changes

#### Section 7 Energy Changes Key Terms

1 Conservation of energy	Energy is <b>not created or destroyed</b> , only <b>transferred from one store to another</b>
2 Exothermic	A reaction that <b>transfers energy to the surroundings</b> so the <b>temperature of the surroundings increases</b> , e.g. <b>combustion</b> and <b>neutralisation</b> reactions. Used in <b>self-heating cans</b> and <b>hand warmers</b> .
3 Endothermic	A reaction that <b>takes in energy from the surroundings</b> so the <b>temperature of the surroundings decreases</b> , e.g. <b>thermal decomposition</b> . Used in <b>sports injury packs</b> .
4 Activation energy	The <b>energy needed</b> for <b>particles to successfully react</b> .
5 Breaking bonds	<b>Energy is needed</b> to break bonds.
6 Forming bonds	<b>Energy is released</b> when bonds are formed.

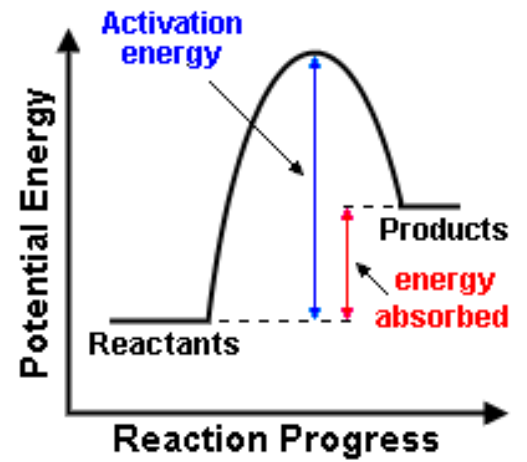
7 Exothermic Energy Profile



Exothermic reaction

9 Energy released from forming bonds is **greater than** the energy needed to break bonds. (HT)

8 Endothermic Energy Profile



Endothermic reaction

10 Energy released from forming bonds is **less than** the energy needed to break bonds. (HT)