


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 more reactive metal can displace a less reactive metal from a compound .
3 Oxidation	Two definitions: Chemicals are oxidised if they gain oxygen in a reaction. Chemicals are oxidised if they lose electrons in a reaction. (HT)
4 Reduction	Two definitions: Chemicals are oxidised if they lose oxygen in a reaction. Chemicals are oxidised if they gain electrons in a reaction. (HT)
5 Acid	A chemical that dissolves in water to produce H⁺ ions .
6 Base	A chemical that reacts with acids and neutralise them. E.g. metal oxides, metal hydroxides, metal carbonate
7 Alkali	A base that dissolves in water . It produces OH⁻ ions in solution.
8 Neutralisation	When a neutral solution is formed from reacting an acid and alkali . General equation: H⁺ + OH⁻ → H₂O
9 pH	A scale to measure acidity/ alkalinity . A decrease of one pH unit causes a 10x increase in H⁺ ions . (HT)
10 Strong acid (HT)	A strong acid is completely ionised in solution. E.g. hydrochloric, nitric and sulfuric acids.
11 Weak acid (HT)	A weak acid is only partially ionised in solution. E.g. ethanoic, citric and carbonic acids.

Section 2: Reactivity		
Element	Reaction	Reactivity
12 Potassium	When potassium is added to water , the metal melts and floats. It moves around very quickly. The metal is also set on fire , with sparks and a lilac flame .	
13 Sodium	When sodium is added to water , it melts to form a ball that moves around on the surface. It fizzes rapidly .	
14 Lithium	When lithium is added to water , it floats. It fizzes steadily and becomes smaller.	
15 Calcium	Fizzes quickly with dilute acid .	
16 Magnesium	Fizzes quickly with dilute acid .	
17 (Carbon)		
18 Zinc	Bubbles slowly with dilute acid .	
19 Iron	Very slow reaction with dilute acid .	
20 (Hydrogen)		
21 Copper	No reaction with dilute acid .	

Section 4: Extracting Metals	
22 Very unreactive metals	Found naturally in the ground. Don't need extracting .
23 Metals less reactive than carbon	Extracted by reduction with carbon .
24 Metals more reactive than carbon	Extracted by electrolysis .

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

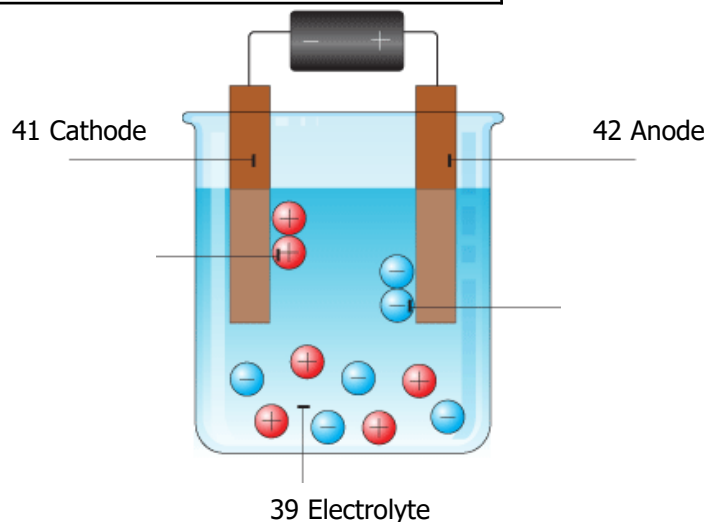
35 Acidic pH 0-6

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

Section 8: What is discharged in electrolysis?

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

Section 9: Aluminium Electrolysis

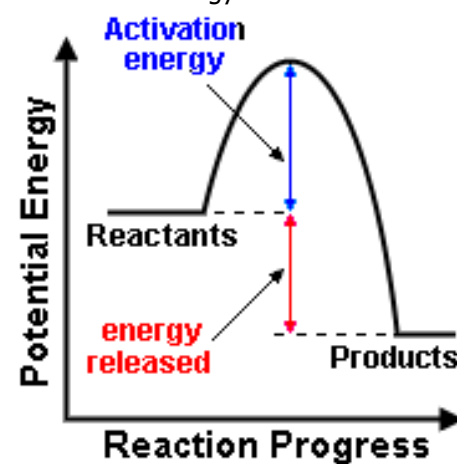
45 Cryolite	Aluminium oxide is dissolved in cryolite to lower its melting point . This saves money on energy costs .
46 Cathode	Positive Al^{3+} ions move to the cathode . Aluminium is produced. $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$
47 Anode	Negative O^{2-} ions move to the anode . Oxygen is made. $2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$ Wears away as the carbon anode reacts with oxygen to form carbon dioxide .

Chemistry 5: Energy Changes

Section 7 Energy Changes Key Terms

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

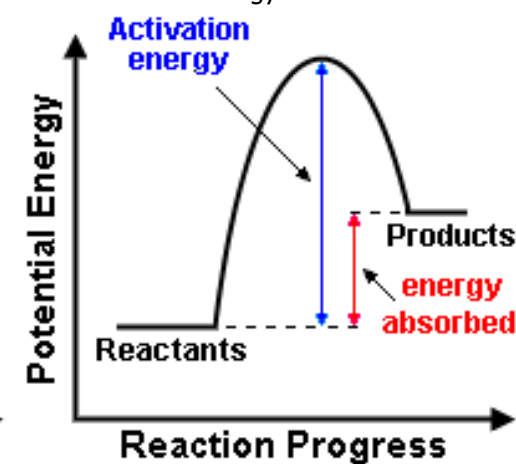
7 Exothermic Energy Profile



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)