Year 10 – T5
Science
Home Learning Booklet

Name: _____

Tutor Group: _____

Science Teacher: _____

Activity 1

Glossary task

Current – The rate of flow of charge, measured in amperes (A)

Diode – a non-ohmic conductor that has a much higher resistance in one direction (its reverse direction) than in the other direction (its forward direction)

Electrons – tiny negatively charged particles that move around the nucleus of an atom in shells

Light-depending resistor (LDR) – a resistor whose resistance depends on the intensity of the light incident on it

Light-emitting diode (LED) - a diode that emits light when it conducts

Ohm's law – the current through a resistor at constant temperature is directly proportional to the potential difference across the resistor

Parallel – components connected in a circuit so that the potential difference is the same across each on

potential difference (voltage) – a measure of energy transferred to the component by each coulomb of charge that passes through it. The unit of potential difference is the volt (V)

Resistance – A material's tendency to slow down the flow of charge. Resistance (in ohms, Ω) = potential difference (in volts, V) ÷ current (in amperes, A)

Series - components connected in a circuit in such a way that the same current passes through them

Thermistor – a resistor whose resistance depends on the temperature of the thermistor

Task - Complete the following table with either the missing word or definition

Word	Definition
Current	
	a non-ohmic conductor that has a much higher resistance in one direction (its reverse direction) than in the other direction (its forward direction)
Electrons	
Light-depending resistor (LDR)	
Light-emitting diode (LED)	
	the current through a resistor at constant temperature is directly proportional to the potential difference across the resistor
potential difference (voltage)	
Resistance	
	a resistor whose resistance depends on the temperature of the thermistor

Activity 2 and 3 Information

Calculating voltage, current and resistance – Ohm's Law

Current – The rate of flow of charge.

- Measured using an ammeter

Voltage (potential difference) - the energy transferred per coulomb of charge.

- Measured using a voltmeter

You cannot measure resistance directly. You can calculate resistance of an electrical component by measuring the electric current flowing through it and the potential difference across it.

This equation, called Ohm's Law, shows the relationship between potential difference, current and resistance:

Voltage = current x resistance

- **V = I × R**
- **where:**
- **V is the potential difference in volts, V**
- **I is the current in amperes (amps), A**
- **R is the resistance in ohms, Ω**

This can be re-arranged to

Current = voltage ÷ resistance

I = V/R

AND

Resistance = voltage ÷ current

R = V/I

Activity 2 Task – Answer these questions

1 Define current (1 mark)

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2 Name the equipment used to measure current (1)

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3 Define voltage (1 mark)

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4 Name the equipment used to measure voltage (1 mark)

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5 Can you measure resistance directly? (1 mark)

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6 Describe how you calculate resistance of a component (1 mark)

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.....

7 Potential difference and voltage are the same thing – true/false (1 mark)

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8 Write the equation for calculating voltage (1 mark)

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9 Write the equation for calculating current (1 mark)

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10 Write the equation for calculating resistance (1 mark)

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Activity 3 Task – Answer these questions

You can use a calculator

1 State the equation linking voltage, current and resistance (1 mark)

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2 Calculate voltage if current is 5A and resistance is 7 Ω (1 mark)

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3 Calculate voltage if current is 12A and resistance is 6 Ω (1 mark)

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4 Calculate voltage if current is 9A and resistance is 8Ω (1 mark)

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5 Calculate voltage if current is 40A and resistance is 3Ω (1 mark)

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6 Calculate voltage if current is 60A and resistance is 5Ω (1 mark)

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7 Calculate potential difference if current is 10A and resistance is 2Ω (1 mark)

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8 Calculate current if voltage is 45V and resistance is 9Ω (2 mark) **Hint – equation is different now. You'll have to divide. Check Activity 2 + 3 information**

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9 Calculate resistance if voltage is 200V and current is 4A (2 marks)

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Activity 4 Information

The reactivity series of metals

When metals react with other substances, the metal atoms **lose electrons** to form **positive ions**. **The easier atoms lose or gain electrons, the more reactive they are.**

The reactivity series of metals is a chart showing metals in order of decreasing reactivity. In general, the more reactive a metal is:

- the more vigorous its reactions are
- the more easily it loses electrons in reactions to form positive ions (cations)

The table summarises some reactions of metals in the reactivity series. Hydrogen and carbon are shown for comparison.

Metal	Reaction with cold water	Reaction with dilute acids	Reactivity
Potassium	Violent	Violent	Most reactive
Sodium			
Lithium			
Calcium	Fast	Rapid	
Magnesium	Very slow		
(Carbon)			
Zinc	Usually no reaction	Slow	
Iron	Rusts slowly		
(Hydrogen)			
Copper	No reaction	No reaction	
Gold			Least reactive

Reactions of metals with water

When a metal reacts with water, **a metal hydroxide and hydrogen are formed.** For example, sodium reacts rapidly with cold water:

- Sodium + water → sodium hydroxide + hydrogen
- $2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$

In general, the more reactive the metal, the more rapid the reaction is.

Activity 4 Task – Complete the questions

1 State what happens to metals electrons when they react with substances (1 mark)

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.....

2 State what kind of ions metals form (1 mark)

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3 State what makes a metal more or less reactive (1 mark)

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.....

4 Name the most reactive metal (1 mark)

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5 Name the least reactive metal on the list (1 mark)

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6 Name 5 metals more reactive than carbon (1 mark)

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7 State what is formed when a metal reacts with water (2 marks)

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8 Write the word equation for sodium's reaction with water (2 marks)

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9 Write the symbol equation for sodium's reaction with water (2 marks)

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10 Suggest how reactions with potassium look compared to a reaction with copper (2 marks)

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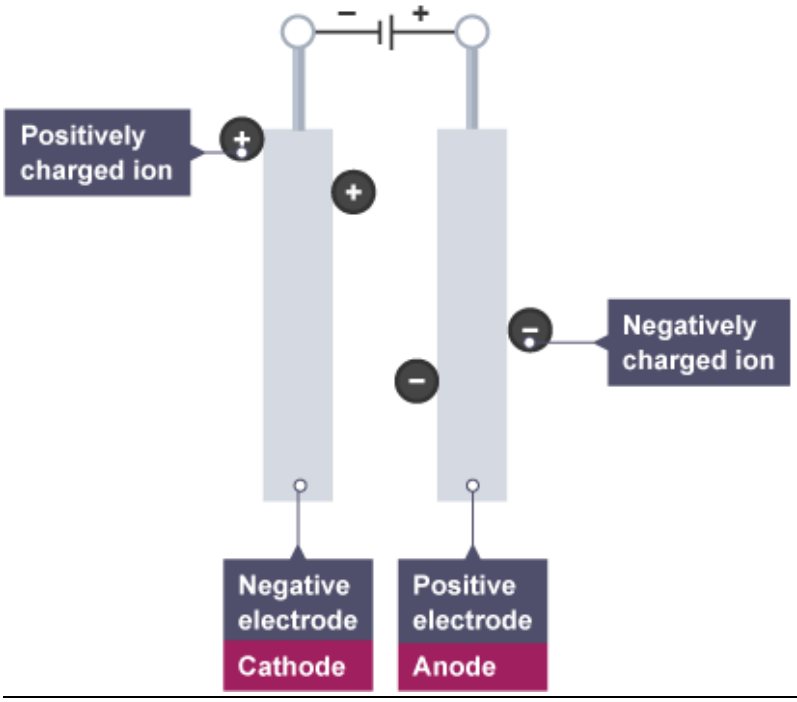
Activity 5 Information

Electrolysis of molten ionic compounds

This is what happens during electrolysis.

- Positively-charged ions move to the **negative electrode (cathode)**. They receive electrons and are **reduced**.
- Negatively-charged ions move to the **positive electrode (anode)**. They lose electrons and are **oxidised**.
- The substance that is broken down is called the **electrolyte.**



Ionic substances contain charged particles called ions. For example, lead(II) bromide ($PbBr_2$) contains positively charged lead ions (Pb^{2+}) and negatively charged bromide ions (Br^-).

Electrolysis is the process by which ionic substances are decomposed (broken down) into simpler substances when an electric current is passed through them.

Electricity is the flow of electrons or ions. For electrolysis to work, the compound must contain ions. Covalent compounds cannot act as electrolytes because they contain neutral atoms.

The **ions must be free to move**, which is possible when an ionic substance is **dissolved in water or it is melted.** For example, if electricity is passed through molten lead(II) bromide, the lead(II) bromide is broken down to form lead and bromine.

Activity 5 Task – Complete the questions

1 State what happens to positively charged ions during electrolysis (2 marks)

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2 State what happens to negatively charged ions during electrolysis (2 marks)

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3 Define the electrolyte (1 mark)

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4 Name the most positive electrode (1 mark)

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5 Name the negative electrode (1 mark)

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6 Define electrolysis (1 mark)

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7 Define electricity (1 mark)

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8 Explain why covalent molecules can't be electrolytes (2 marks)

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9 State two ways you can make ions free to move (2 marks)

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Activity 6 Information

Clinical trials of vaccines and drugs

Clinical trials of vaccines and drugs are carried out to show that they are safe and effective. Tests are randomised, use control groups given placebos, and are carried out double-blind to avoid bias.

All vaccines and drugs are tested using **clinical trials** before being licenced for use. The purpose of clinical trials is to allows drugs to be checked for:

- **safety**
- **effectiveness**
- **dosage**

When designing clinical trials there are **three** main protocols that are used:

- **randomised**
- **placebo-controlled**
- **double-blind**

Protocols for clinical trials

Randomised

All participants in the clinical trial are split into different groups entirely at random. A computer programme may be used. **Randomising the participants reduces possible bias** in the trial, for example by preventing people of the same gender or similar ages together.

Placebo-controlled

A placebo is a 'dummy' treatment with no medical or therapeutic value. A placebo looks like the drug being tested but only contains sugar.

One group of participants will be given the drug and another **control group** will be given the placebo. It is important that participants are not aware of which group they are in. Following the completion of the trial, results will be compared.

Double-blind

In a double-blind trial, neither the participants nor the researchers are aware which group has been given the drug and which group has been given the placebo. This also reduces bias when interpreting the results.

Activity 6 Task – Complete the questions

1 State the purpose of clinical trials (3 marks)

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2 Describe what it means for a trial to be randomised (2 marks)

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3 Explain the benefits of randomising a trial (1 mark)

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4 Define placebo (1 mark)

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5 Describe how placebos are used in a trial (2 marks)

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7 Define double-blind (1 mark)

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