3055 BA SANGAM COLLEGE

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Worksheet 24

School: Ba Sangam College **Year/Level**: 11

Subject: Physics

Strand	Current Electricity
Sub Strand	Current, Voltage and Resistance
Content Learning Outcome	Apply knowledge and develop skills in the concept of current electricity

CURRENT ELECTRICITY

- Current electricity is about moving charged particles. If you allow the charge that builds up in static electricity to flow, you get a current.

Current

- Current is the rate of flow of charge; it is the amount of charge flowing per second through a conductor. The equation for calculating current is:

$$I = \frac{Q}{t}$$

Where:

I = current (amps, A)

Q = charge flowing past a point in the circuit (coulombs, C)

t = time taken for the charge to flow past the point (seconds, s)

Note:

So a current of 1 amp is 1 coulomb of charge flowing past a point every second.

Examples

A charge of 12 C passes through the filament of a car headlamp bulb in 4 s. What is the current?

Current = Charge/time ➡ $I = \frac{Q}{t}$

$= \frac{12}{4} = 3$ A

2. A current of 0.5 A flows for 20 s through a small electric motor. How much charge has passed?

Charge = Current x time = Q = $I \times t$= 0.5 x 20 = 10C

3. A current of 200 mA flows for 2 minutes. How much charge has passed?

Charge, = 0.200 x 120 ➡ Q = $I \times t$ =24 C

(current in amps, time in seconds, milli = $\times 10^{-3}$)

Voltage

Voltage is “the potential difference between two points in a conductor to move the electrons from one place to another”. In the other way, “the magnitude of applied electro - motive force for the flow of electric current (electron movement)”.

The unit is Volts, V

Resistance

Resistance is “the passive element which restricts the flow of electric current”. The effect of resistor is resistance. The unit of resistance is Ohms.

OHM’S LAW

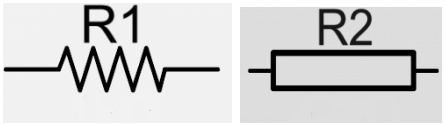
The electric current flowing through a conductor is directly proportional to the potential difference across the two ends of the conductor when physical conditions such as temperature, mechanical strain, etc.

remain the same.
You can write this in an equation as:

$$V = IR$$

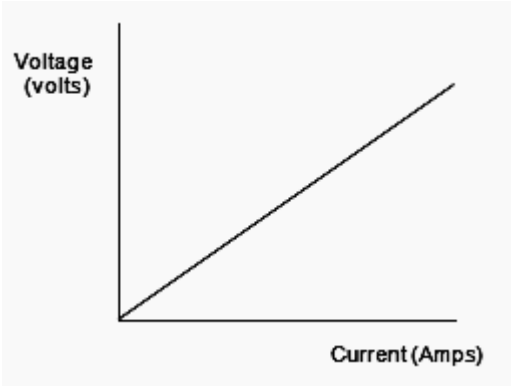
Where:
R = resistance of the wire (ohms,Ω)
V = voltage (volt, V)
I = current (amps)

Resistance is measured in units called Ohms (Ω). The resistance of a piece of wire is 1 ohm if a current of 1 A flows through it when a voltage of 1 V is applied between its ends.



Old Symbol **New Symbol**

If you plot a graph of current against the voltage applied, you should get a result like the one shown in the diagram below.



Note: From the formula V= IR, slope of V Vs R gives resistance.

Factors Affecting The Resistance Of A Wire

There are four factors that affect the resistance of a wire.

- **Resistance is directly proportional to length.** If you take a wire of different lengths and give each a particular potential difference across its ends. The longer the wire the less volts each centimeter of it will get meaning current decreases with increased length and resistance increases.
- **Resistance is inversely proportional to cross-sectional-area.** The bigger the cross sectional area of the wire means the resistance decreases.
- **Resistance depends on the material the wire is made of.** The more tightly an atom holds on to its outermost electrons the harder it will be to make a current flow. Different metals have different resistances.
- **Resistance is directly proportional to temperature.** The hotter wire has a larger resistance because of increased vibration of the atomic lattice. When a material gets hotter the atoms in the lattice vibrate more. This makes it difficult for the electrons to move without interaction with an atom and increases resistance.

EXAMPLE

A 6 V battery is connected to a small electromagnet and a current of 1.5 A flows through it. What is the resistance of the electromagnet?

$$R = \frac{V}{I} = \frac{6}{1.5} = 4\ \Omega$$

ACTIVITY (9 MARKS)

1. What current will flow through a circuit with a resistance of 400 Ω if it is connected to a 2 V battery?

2. A current of 0.5 mA flows through a resistor of 100 kΩ . What voltage is needed to do this?

3. Year 1102 Physics students performed an experiment to determine the resistance of a resistor. The voltage and current values across the resistor were

measured as follows:

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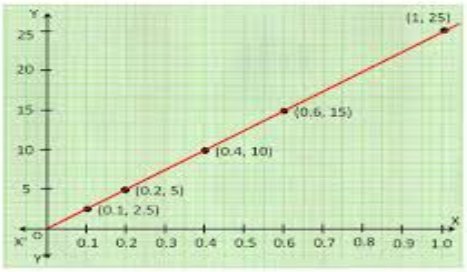
I (Amperes)	0.1	0.2	0.4	0.6	1
V (Volts)	2.5	5	10	15	25



If the above graph is a graph of Voltage vs Current, determine the resistance of the resistor used.

THE END