3055 BA SANGAM COLLEGE

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Worksheet 24

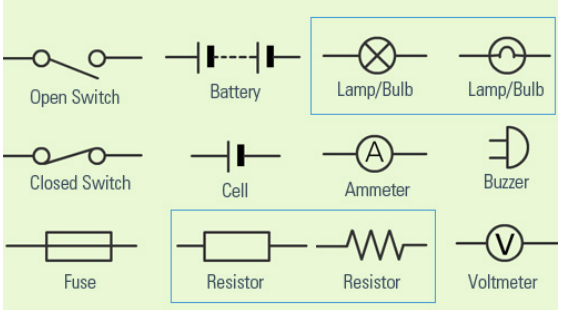
School: Ba Sangam College **Year/Level**: 11

Subject: Physics

Strand	Current Electricity
Sub Strand	Parallel and Series Circuit
Content Learning Outcome	Apply knowledge and develop skills in the concept of current electricity

CIRCUIT DIAGRAMS

Below are some of the most common electrical symbols that you are likely to see when looking at diagrams of electrical circuits.



ELECTRICAL CIRCUITS

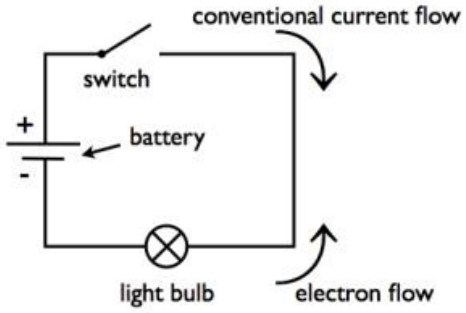
When one or more electrical components are joined together to a cell, it is called a circuit. Electricity will not flow if there are any breaks in this circuit.

Battery

Provides the power needed to operate the circuit (can also be another power source such as solar energy, wind energy, etc.)

Conventional Current (I)

Conventional current is the current whose direction is along the direction of motion of positive charge under the action of electric field and in the direction opposite to that of motion of electrons.



Electron Flow

Electrons flow from negative to positive. The current flows out of the positive side, through the circuit, and into the negative terminal of the source. The movement or flow of electrons in a closed circuit produces electricity.

Circuit Rules

- *As the charged particles flow around a circuit they do not get used up*; it is the energy that the charged particles carry that decreases as they move around the circuit.

- So if you have 12 amps leaving the battery, there will be 12 amps in the circuit and 12 amps returning to the battery.

- *Voltage changes as the charge moves around the circuit*. The potential energy given to the charge is changed into heat energy in the circuit. An electron may leave a battery with 6 V, but will return to the battery with 0 V. This gives a change in potential of 6 V, hence the words 'potential difference'.

CIRCUITS

In this section we deal with the mathematics of more than one resistor in a series or parallel circuit. There are two main types of circuits you need to know about and each has two rules that make calculations simpler:

Series Circuit:

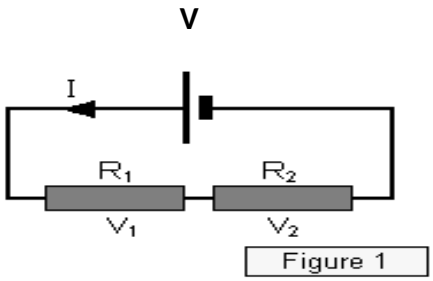


Figure 1

Two resistors in series are shown in Figure 1 above. The current (I) flowing through R_1 and R_2 is same and the potential differences across them are $V_1 = IR_1$ and $V_2 = IR_2$. Since the total potential difference across them is $V = V_1 + V_2$ Therefore $V = IR = IR_1 + IR_2$ where R_T is the effective series resistance of the two resistors. So: $R_T = R_1 + R_2$

Note: In series circuit:

1. Current in each resistor is same ($I = I_1 = I_2$)
2. Voltage gets divided ($V = V_1 + V_2$)

To find the effective resistance we use

$$R_T = R_1 + R_2$$

where R_T is the effective resistance of the two resistors in series.

Example

Find the total resistance for two resistors, R_1 and R_2 connected in series.

$R_1 = 50\ \Omega$, $R_2 = 100\ \Omega$

Solution

$R_T = R_1 + R_2 = 50\ \Omega + 100\ \Omega = 150\ \Omega$

$R_T = 150\ \Omega$

Note:

- the total resistance is larger than either of the individual resistors.
- the current is the same all the way around the circuit.
- the voltage is divided between the components in the circuit.

Parallel circuits:

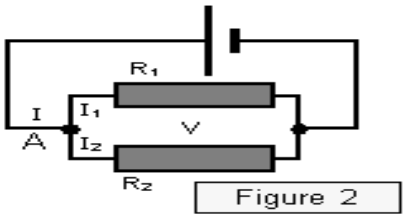


Figure 2

Two resistors in parallel are shown in Figure 2 above.

The potential difference (V) across each of the two resistors is the same, and the current (I) flowing into junction A is equal to the sum of the currents in the two branches therefore: $I = I_1 + I_2$.

Note: In parallel circuit:

1. Current is divided ($I = I_1 + I_2$)
2. Voltage is same ($V = V_1 = V_2$)

To find the effective resistance we use

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$$

where RT is the effective resistance of the two resistors in parallel.

Example

Find the total resistance for two resistors, R_1 and R_2 connected in parallel.

$R_1 = 50\ \Omega$, $R_2 = 100\ \Omega$

Solution

$1/R_T = 1/R_1 + 1/R_2 = 1/50 + 1/100$
$1/R_T = 0.02 + 0.01$
$= 0.03$
So $R_T = 33.3\ \Omega$

ACTIVITY (5 MARKS)

Calculate the resistance of the following combinations: (a) 25 Ω and 50 Ω in series (b) 30 Ω and 60 Ω in parallel

2. Calculate the current flowing through the following when a p.d of 12 V is applied across the ends:
(a) 200 Ω and 1000 Ω in series (b) 200 Ω and 1000 Ω in parallel

THE END