

## ELECTRIC CIRCUITS III

10 JUNE 2014



### Lesson Description

In this lesson we:

- Revise concepts of current, potential difference and resistance.
- Practise solving problems in both series and parallel circuits



### Summary

#### Electricity

**Current** is the rate of flow of charge.

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

**Potential difference** is the work done per unit charge.

$$V = \frac{W}{q}$$

**Resistance slows down** the flow of charge in a circuit.

$$R = \frac{V}{I}$$

#### Series Circuits

- There is only **one path** for current to flow which ensures that the **current is the same** at every point in the circuit.
- The **voltage is divided** across the resistors. The voltage across the battery in the circuit is equal to the sum of voltages across the series resistors:

$$V_{\text{battery}} = V_1 + V_2 + \dots$$

- The **resistance** to the flow of current **increases**. The total resistance,

$$R_S = R_1 + R_2 + \dots$$

#### Parallel Circuits

- There are **more paths** for current to flow which ensures that the **current splits** across the different paths.
- The **voltage** is the **same across** the resistors. The voltage across the battery in the circuit is equal to the voltage across each of the parallel resistors:

$$V_{\text{battery}} = V_1 = V_2 = V_3 \dots$$

- The resistance to the flow of current decreases. The total resistance, is given by:

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_{3p}}$$



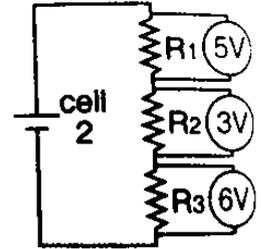
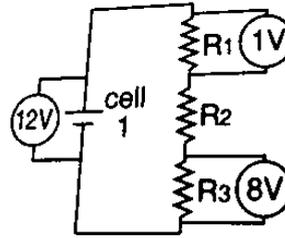
## Test Yourself

### Question 1

(Shutter's Physical Science, Grade 10, 2005)

Consider the following two circuits:

- What is the potential difference across resistor  $R_2$ ?
- What is the potential difference across cell 2?
- Which resistor has the higher resistance  $R_1$  or  $R_3$ ?



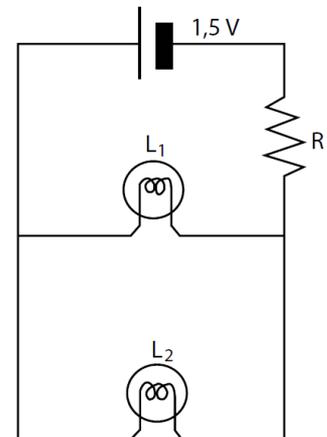
### Question 2

(Study and Master, Physical Science Grade 10, 2003)

Two identical light bulbs  $L_1$  and  $L_2$  are connected in parallel with one another, along with a resistor connected in series to a 1.5 V cell.

Redraw the diagram and include:

- 5 additional cells (total of 6 cells) providing a total emf of 6 V.
- An ammeter which reads the total current.
- A voltmeter which reads the potential difference over both light bulbs.
- A switch which will increase the current when it is closed.



### Question 3

A kettle, connected to a 200 V source and boils water for 1 minute 30 seconds. The current through the kettle is 5 A.

- The resistance of the kettle.
- The energy transferred to heating the water.

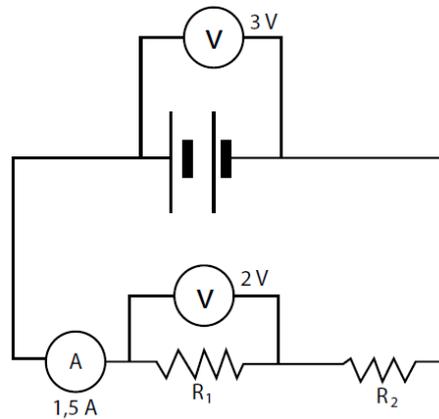


## Improve your Skills

### Question 1

(Study and Master, Physical Science Grade 10, 2003)

A current of 1.5 A flows through the accompanying circuit when a battery with emf 3 V is connected in series.



Calculate:

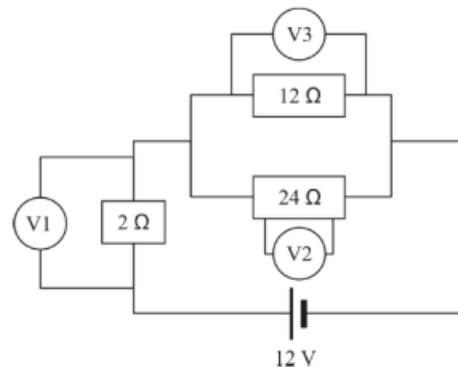
- The amount of charge flowing through the ammeter in 10 seconds.
- The resistance of  $R_1$ .
- The resistance of  $R_2$ .
- The total resistance of the circuit.
- The amount of energy transferred to resistor  $R_2$  in 5 minutes.

### Question 2

Study the accompanying circuit diagram.

Calculate:

- The effective resistance of the parallel connection.
- The total resistance of the circuit.
- The current passing through the  $2\Omega$  resistor.
- The current in the  $12\Omega$  resistor
- The current in the  $24\Omega$  resistor.
- Which of the voltmeters will have the same reading?



## Links

- [www.everythingscience.co.za](http://www.everythingscience.co.za)