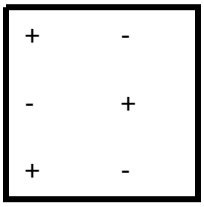
PENANG SANGAM HIGH SCHOOL
YEAR 11 PHYSICS
WEEK 20-21

Strand	Electrostatics
Sub Strand	Charge
Content Learning Outcome	At the end of the lesson students should be able to • demonstrate knowledge of the elementary structure of the atoms.

Neutral object

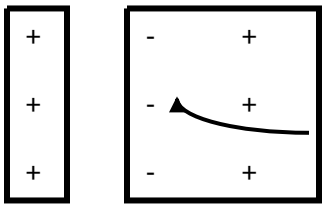
A neutral object has equal number of electrons and protons.



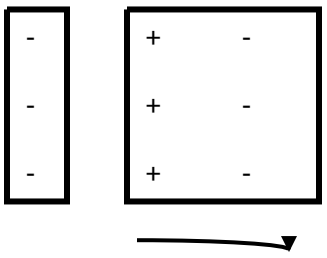
This also means that the object has no net charge.

If a charged rod is brought close to the neutral object than either electrons are attracted to the near side or electrons are repelled to the far side.

Getting a positive rod close to a neutral object



Getting a negative rod close to a neutral object



Electricity

Electricity is the movement of charge. current flows from positive to negative and it flows in a closed circuit.

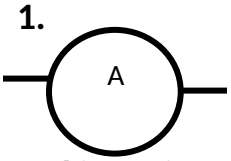
Q = I t

Where Q is the charge, I is the current in amperes,A, and t is the time in seconds

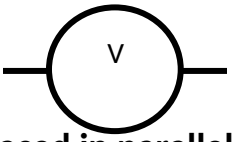
1. **A charge of 12C passes through the filament of a car headlight in 4s. find the size of the current passing**

2. **A current of 0.5A flows for 5 minutes in a conductor. How much charge has passed in the conductor.**

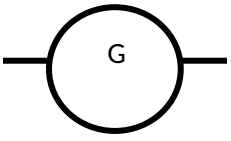
Symbols

1. 

Ammeter – measures the size of current in a circuit. It is placed in series with the component.

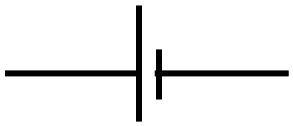
2. 

Voltmeter – measure voltage across a component. It is placed in parallel to the component

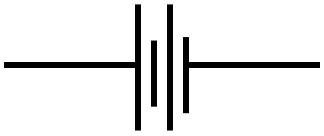
3. 

Galvanometer – indicates the direction of current flow

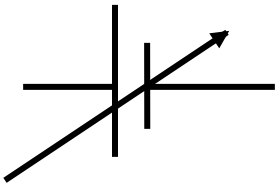
4 Cell



5 battery

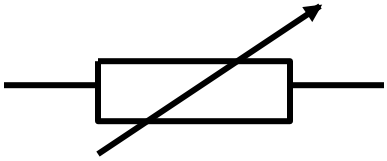


Variable power supply

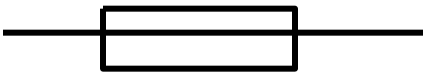


Resistor

variable resistor



Fuse



Fuse is a safety mechanism placed in the switch boards. It is made from a thin wire which will melt when there is an overload of current. This usually happens when there is a short circuit and this causes overloading.

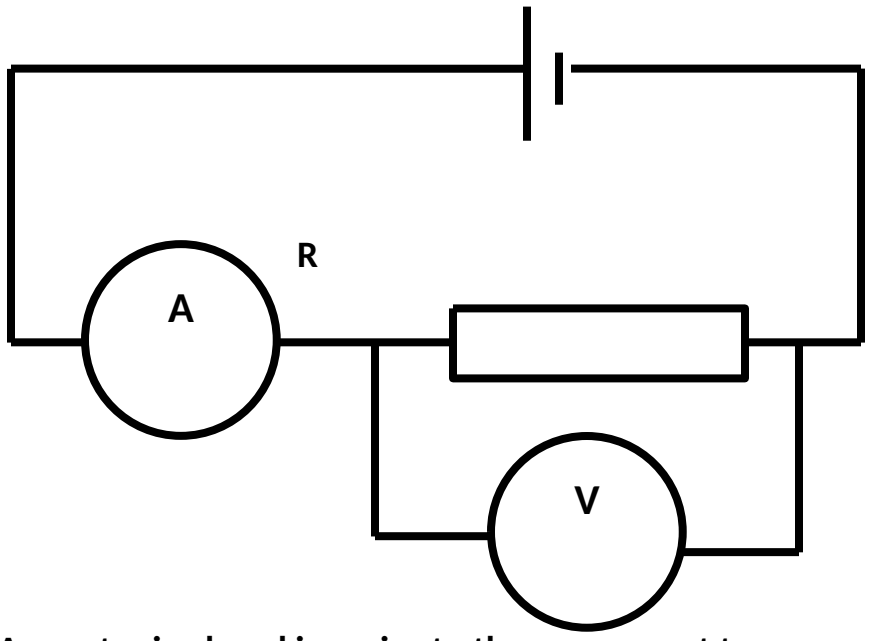
Bulb

1. **Draw a circuit with a voltage supply, and two resistors in series to each other.**

2. **Draw a circuit with a voltage supply and two bulb which are parallel to each other**

3. **Draw a circuit with a voltage supply and three bulbs A, B and C. Bulbs A and C are parallel to each other. This parallel combination is in series to bulb B.**

Correct connection of Ammeter and Voltmeter in a circuit

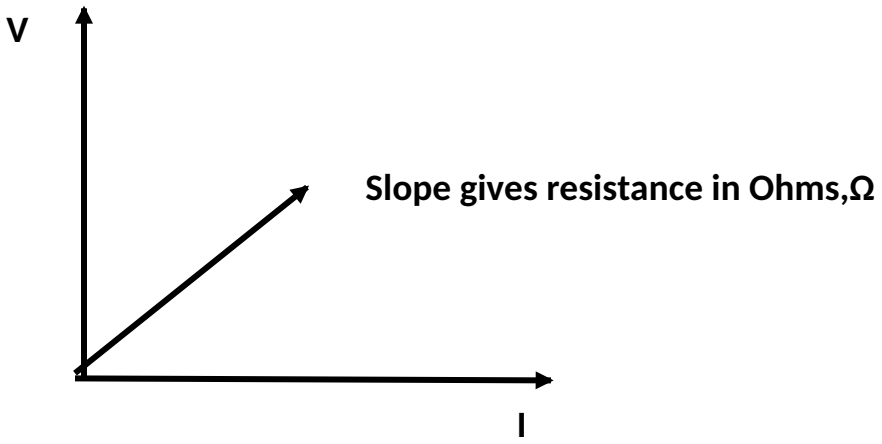


Ammeter is placed in series to the component to measure the current

Voltmeter is placed in parallel to the component to measure voltage.

<u>Ohms law</u> – voltage and current for a conductor is directly proportional

Ohmic conductor is one whose resistance remains the same



Slope gives resistance in Ohms,Ω

$V = I R$

Where V is the voltagein Volts, I is the current in A, and R is the resistance in ohms, Ω

The energy in a resistor is given by E = VI t

The power is given by P = VI

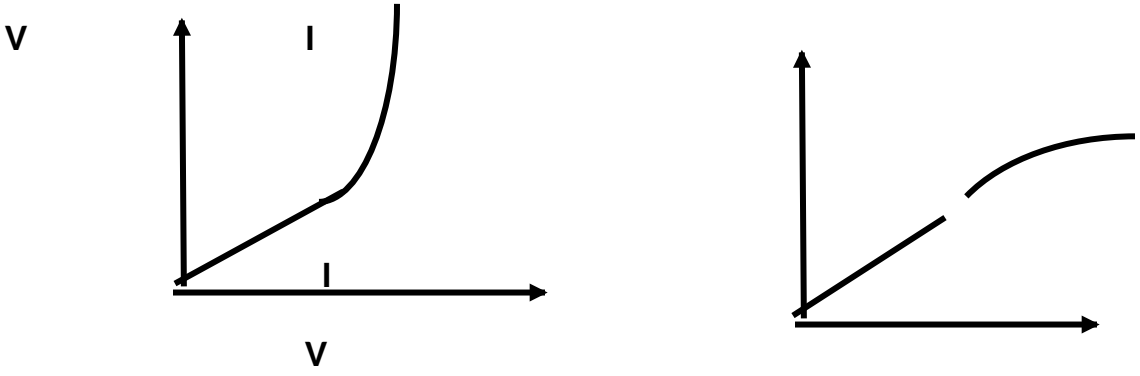
1. **The current in a heater is 5A when it is connected to a 40V supply.**
    a. **Find the heaters resistance**
    b. **Find the energy given out by the heater in 5minutes**

2. **A lamps consumes a power of 60W when connected to a 120V supply.find**
    a. **The current passing through the lamp**
    b. **The resistance of the lamp**

3. **A heater has a resistance of 250 Ω. It is connected to a 120V supply.**
    a. **Find the current it will draw**
    b. **Find the energy given out by this heater in 3minutes**

Non ohmic Conductor

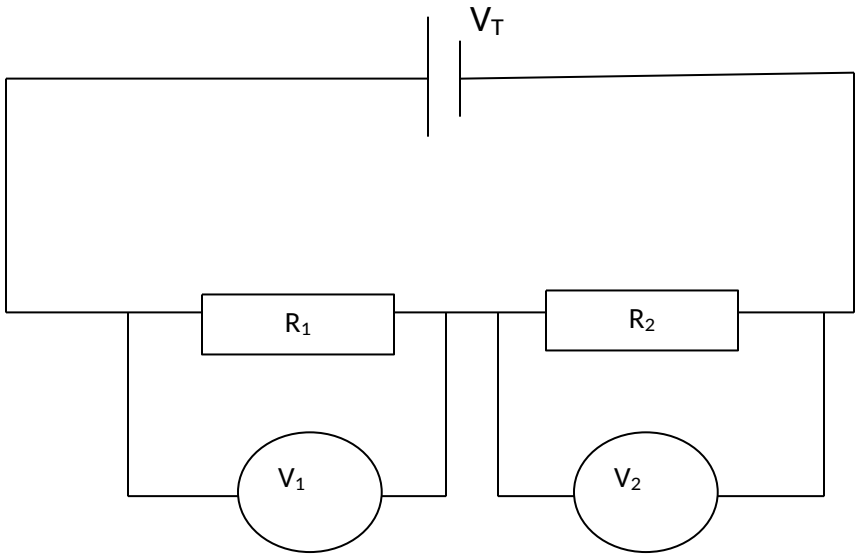
For a non ohmic conductor the resistance increases with an increase in temperature. Eg a bulb.



Power in Watts, W, time must be in seconds. Power decides the brightness in a bulb or lamp. The more the power the more the brightness of the lamp.

1. There are two bulbs one is 6W and the other is 12W. which one will glow brighter.

Resistors in a series circuit



The total resistance is given by the formula

$R_T = R_1 + R_2$

Current flows from positive to negative and it only flows in a closed circuit.

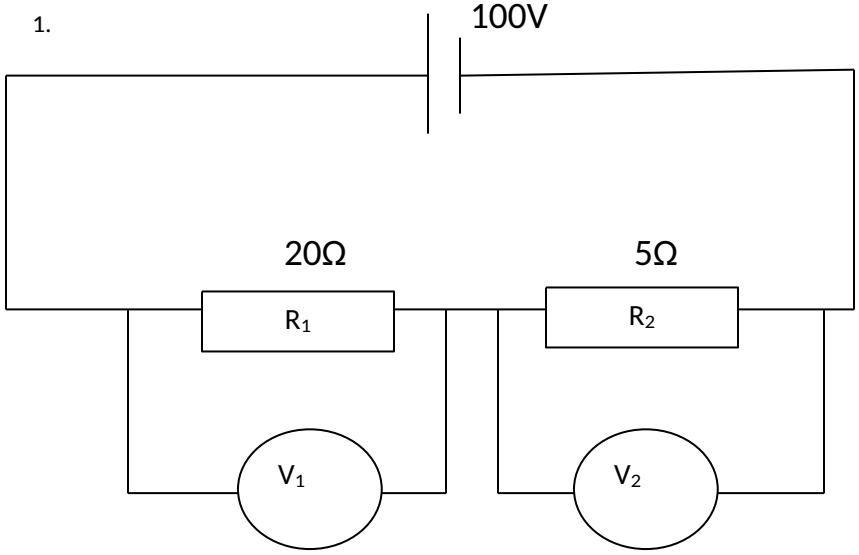
To find the current in the circuit we can use $V = IR$

1. The current remains the same in the series circuit
2. The voltage divides $V_T = V_1 + V_2$

For the following find the total resistance

20Ω 40Ω

1.

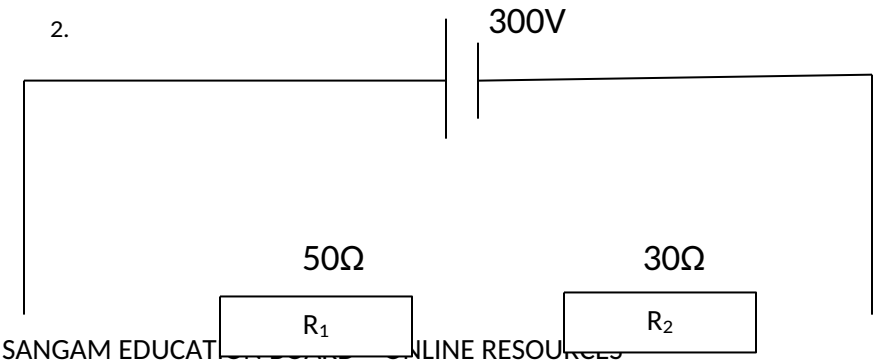


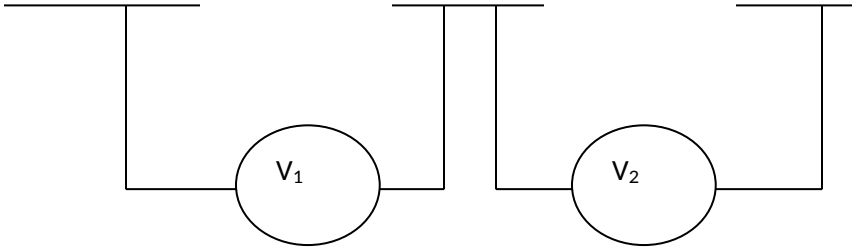
Find

a. The total resistance b. total current in the circuit c. V_1 d.V_2

2

2.



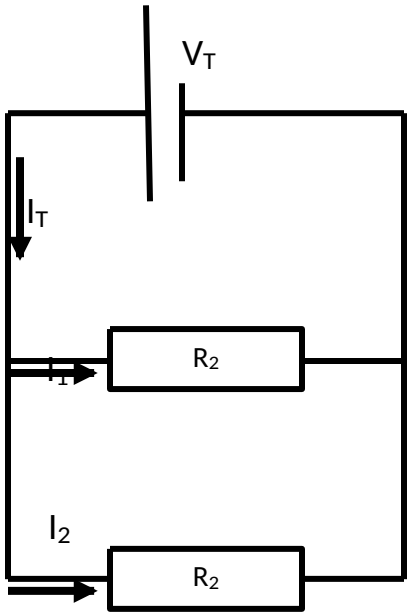


Find

b. The total resistance b. total current in the circuit c. V_1 d.V_2

c.

RESISTORS IN A PARALLEL CIRCUIT



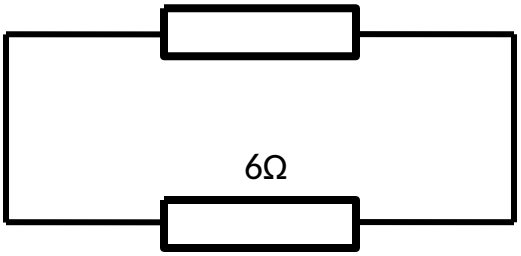
The total resistance is found by

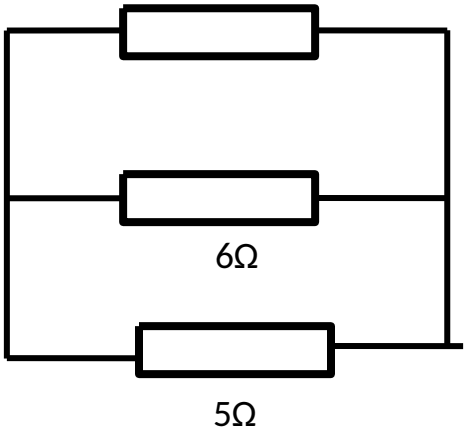
$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2}$$

1. The voltage for parallel components remain the same
2. The current divides $I_T = I_1 + I_2$

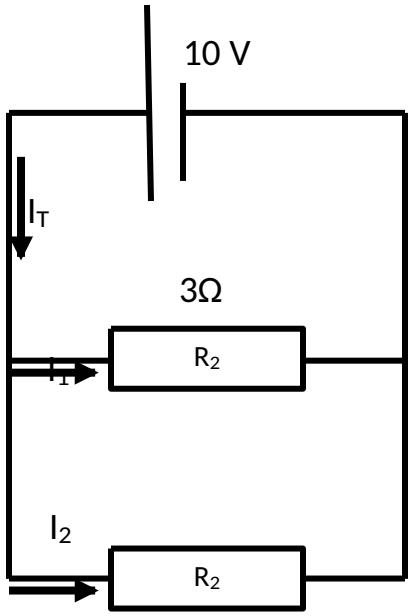
Find the total resistance for the following

3Ω 4Ω





1.



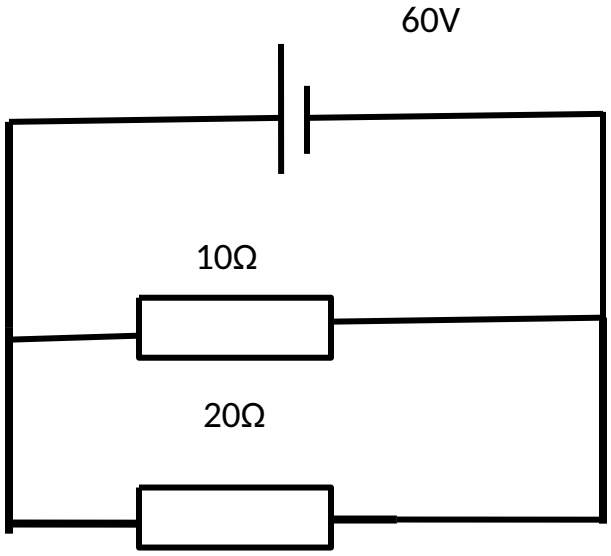
find

a. total resistance

a. Total current flowing in the circuit

b. I_1 d. I_2 6Ω

2.



a. find the total resistance of the circuit.

b. Find the total current in the circuit

Paying for electricity

Cost = power(in kilowatts) x time (in hours) x cost per unit

Take the cost per unit as $0.25. calculate the cost for

1. Running a 2kW heater for 3hours

2. Running a 2.5kW oven for 300minutes.

3. Running a 3200W heater for 4.5 hours

4. Running a 2000W heater for 500minutes

DC AND AC SOURCES

Batteries , fuel cells and solar cells produce DC current.

The power that comes from a power plant is AC.

Power plug

Blue wire – neutral

Green or yellow – earth

Brown – live

Safety devices in the homes

In an electric circuit , fuses and circuit breakers act as safety devices.

A fuse is inserted into a circuit to protect the devise from receiving too much current when a short circuit happens. It is made from a very thin wire and it melts and breaks the circuit when there is more current.

A circuit breaker has the same function as the fuse. If there is excessive current the circuit breaker breaks the line. Circuit breakers are mechanical switches that open when an electrical fault is detected.

A fuse once melted has to be replaced whereas the circuit breaker can be switched back on as part of trouble shooting or when the fault is fixed.