Name:

Electricity and Electronics

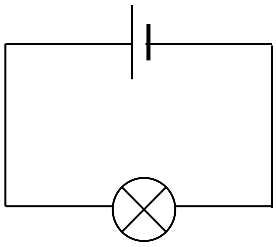
Block 3

Power and Particles

I can state the Function, Application and symbol of the Fuse			
I can state that electrical power is a measure of the energy transferred by an appliance every second or the energy provided by a source per second.			
I can used the word dissipated as it relates to power.			
I am able to use ***E = Pt*** to solve calculations relating to Power, Energy and time.			
I know the effect of potential difference (voltage) and resistance on the current in and power developed across components in a circuit.			
I can use appropriate relationships to solve problems involving power, potential difference (voltage), current and resistance in electrical circuits. $P = IV \quad P = I^2R \quad P = \frac{V^2}{R}$			
I know that I would use a 3A fuse for most appliances rated up to 720W and a 13A fuse for appliances rated over 720W.			
I could select the appropriate fuse rating given the power rating of an electrical appliance			
I can explain the difference between ac and dc			
I can compare the traces of a.c with d.c when viewed on an oscilloscope or data logging software.			
I know that a charged particle experiences a force in an electric field			
I can describe the effect of electric fields on a charged particle			
I know the path a charged particle takes between two oppositely charged parallel plate			
I know the path a charged particle takes near a single point charge			
I know the path a charged particle takes between two oppositely charged points			
I know the path a charged particle takes between two like charged points			

Electrical Energy

When an electric current flows through a lamp, energy changes occur.



As the particles flow through the supply, they gain electrical potential energy. This energy is transformed into heat energy and light energy in the filament of the bulb.

Electrical energy is transformed into **heat energy in any resistive circuit.**

Power, Energy and Time

Many circuit components transform electrical energy into other forms of energy for some useful purpose. Some examples are:

- **Motor – electrical energy to ________ energy**
- **LED – electrical energy to ________ energy**
- **Buzzer – electrical energy to ________ energy.**

A component's ability to transform electrical energy into another form is known as its power. Power is measured in units called watts (W). Components that convert the same amount of energy in a shorter time are said to be more powerful.

Definition: **Power is a measure of the energy transferred each second.**

Equation:

Power (W)   Energy (J)

$$P = \frac{E}{t}$$

Time(s)

Examples:

1. How much Energy is required to power a 100W lamp for 30 seconds?

2. How much electrical energy is converted into heat and light energy when a 60W bulb is turned on for 5 minutes?

Power, Voltage, Current and Resistance:

$$P = VI \qquad P = I^2R \qquad P = \frac{V^2}{R}$$

Symbol	Name	Unit	Unit Symbol
P	Power	watts	W
I	Current	amperes	A
R	Resistance	ohms	Ω
V	Potential Difference	volts	V

Worked Examples

1. A small torch lamp is rated as '2.5 V, 0.2 A'. What is the power of this lamp?

$P = I V$

$P = 0.2 \times 2.5$

$P = 0.5$ W

2. A current of 280 mA flows in a lamp filament of resistance 16.5 Ω. Calculate the power of the lamp.

$P = I^2 R$

$P = (280 \text{ x } 10^{-3})^2 \times 16.5$

$P = 1.29$ W

3. A 50 Ω resistor has a p.d. of 100 V across it. What is the power of the resistor.

$$P = \frac{V^2}{R}$$

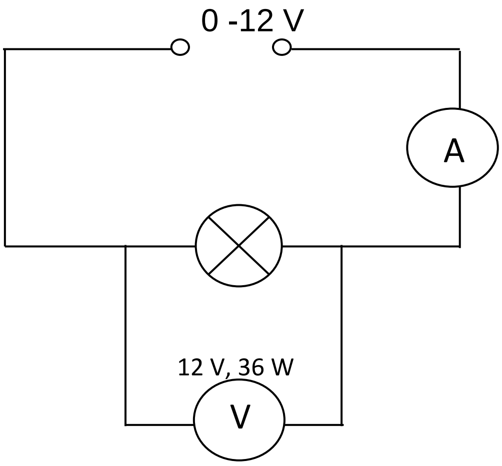
$$P = \frac{100^2}{50}$$

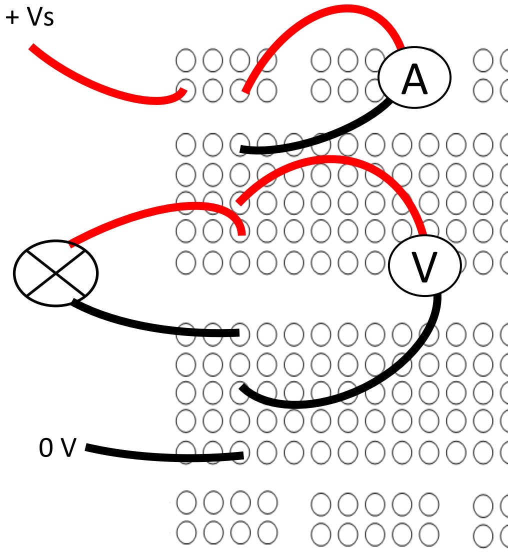
$$P = 200$$

Practical: **Power, Current and Voltage**

AIM To determine the relationship between the power of a lamp, the potential difference (voltage) across it and the current flowing through it.

APPARATUS:





METHOD

- Set up the apparatus as shown above using the 12 V, 36 W lamp (have it checked by your teacher).
- Adjust the power pack so that the p.d. across the lamp is as close to 1 V as possible.
- Measure the p.d. across the lamp and the current flowing through it.
- Repeat above for different values of voltage.

RESULTS

p.d. across lamp (V)	current flowing through lamp (A)	Power (W) [V × I]	Description of Brightness
1			
2			
3			
4			
5			
6			

Fuses

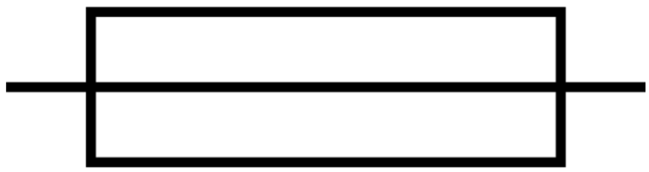
A fuse is a protective device used in a circuit.

If 2 high a current flow through a fuse, the metal wire will melt, breaking the circuit.

The value of fuse required depends on the power rating of appliance.

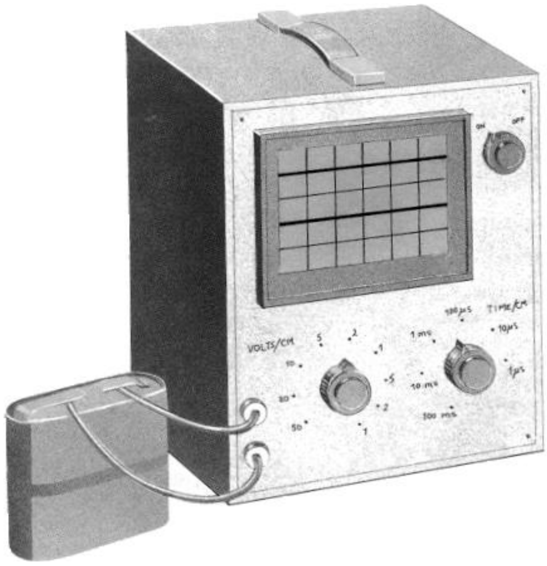
3 A fuse **up to** 720 W

13 A fuse **above** 720 W

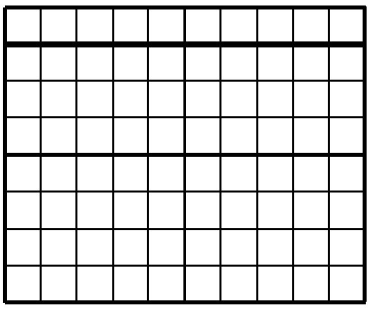


Alternating and Direct Current

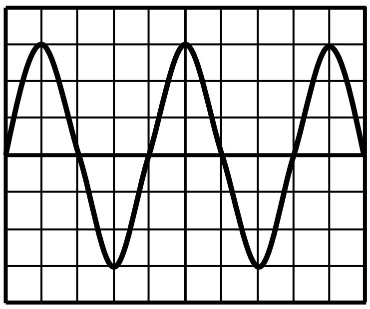
The electrical energy needed to operate electrical circuits usually comes from cells, batteries or the mains supply. The voltage supplied by each of these sources can be displayed on a **cathode ray oscilloscope** (C.R.O.).



Below are examples of types of **analogue** current when displayed on an oscilloscope:



Constant d.c. waveform

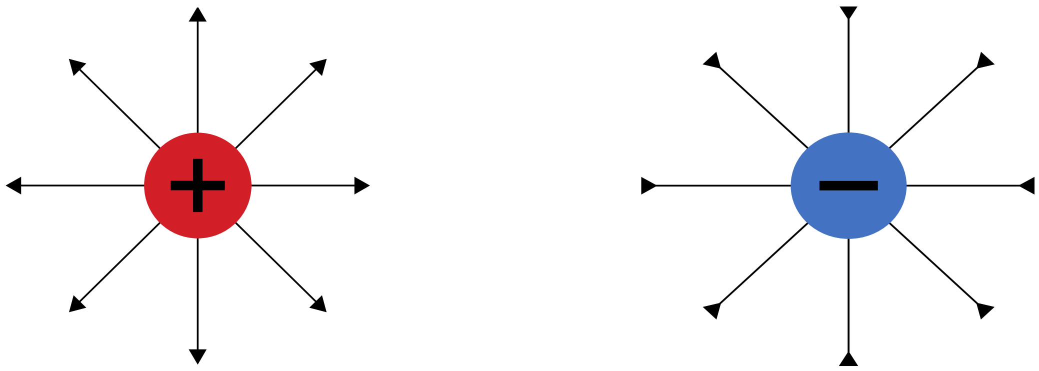


sinusoidal a.c. waveform

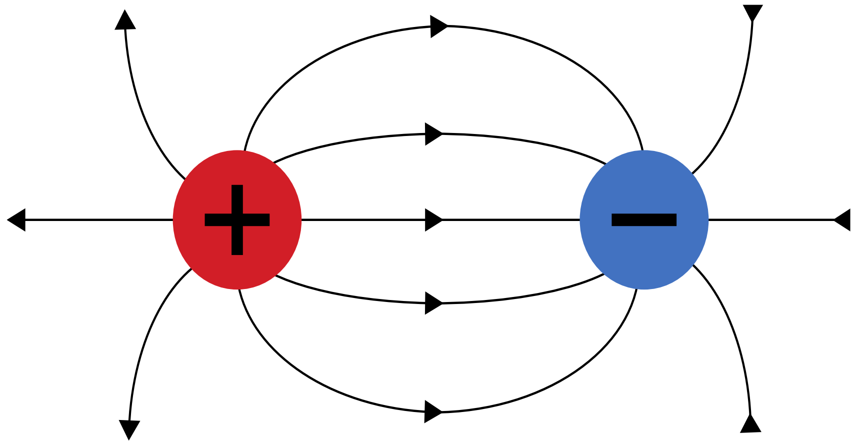
	Name	Description	Example
AC	Alternating Current	Particles constantly changing direction	Mains Electricity (230 V and 50Hz)
DC	Direct Current	Particles go in one direction	Cells and Batteries

Fields

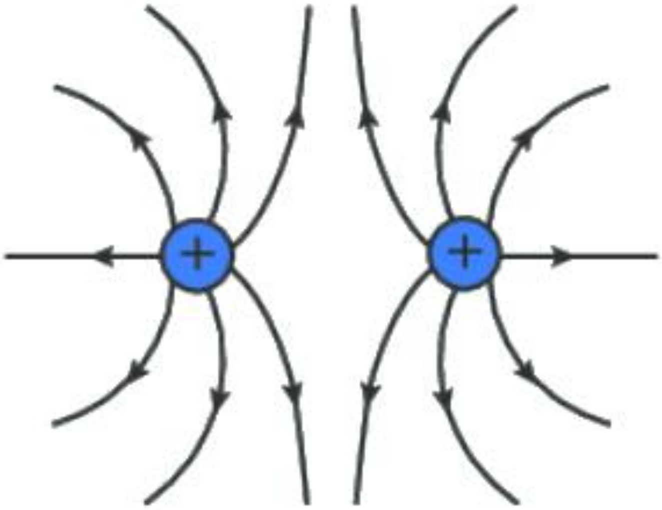
___________ Point charge



___________ Point charges



____________ Point charges



Parallel Plates: