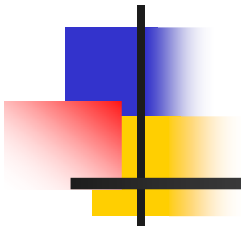


Unit 2 – Using Electricity

2.2 – Alternating and Direct Current

Electric Current

Success Criteria

By the end of the lesson, you should be able to:

- Δ describe an electric current using the words: electrons, positive and negative.
- Δ name the device used to measure electrical current
- Δ name the unit of electrical current.

Can you remember the **name** given to the tiny invisible **particles** that make up an **electric current**?

electrons

What **type of charge** does an **electron** have?

negative

What is the other **type of charge** then?

positive

What happens when **two positive charges** are **near each other**?

repel

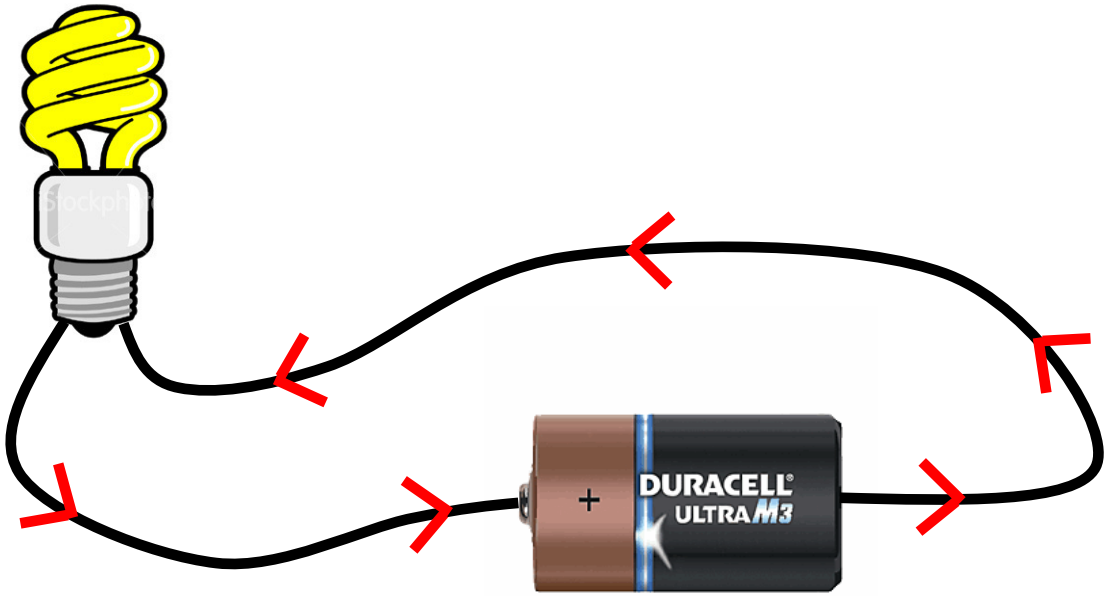
So what about **two negative charges**?

repel

So what happens when **one positive** and **one negative** are close?

attract

Consider the circuit shown.



In what direction do the electrons travel around the circuit?

negative to positive

Electrons in Circuits - Animation

Negative charges called electrons move around circuits.

They always flow from negative to positive.

This flow of electrons is called an electric current.

The size of the current flowing in the circuit is measured using an ammeter.

The unit of electrical current is amps.

current	current	positive
ammeter	electrons	electrons
negative	amps	

Type of Current

Success Criteria

By the end of the lesson, you should be able to:

- Δ **name** a **source** of **a.c.** and **d.c.**electricity.
- Δ **explain in terms of current** the meaning of the terms **a.c. and d.c**
- Δ **state** the **frequency** of the **mains supply**.

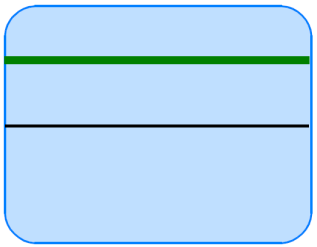
TEACHER DEMONSTRATION

DC and AC on an Oscilloscope

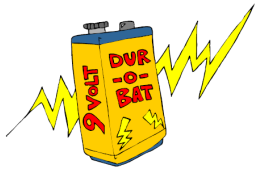
Direct Current (d.c.)

A **direct current flows** around the circuit in only **one direction**.

A **battery** connected to an **oscilloscope** gives a **constant** value for **current**.



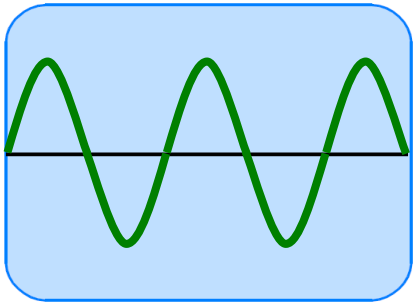
A **battery** is a **source of direct current** (d.c.).



Alternating Current (a.c.)

An **alternating current** in a circuit travels **backwards and forwards**.

The **mains supply** connected to an oscilloscope gives an **alternating** value for **current**.



The **frequency** of the **mains supply** is **50 Hz**.

*** This means 50 waves are produced in one second ***

The **mains supply** is a **source of alternating current** (a.c.).

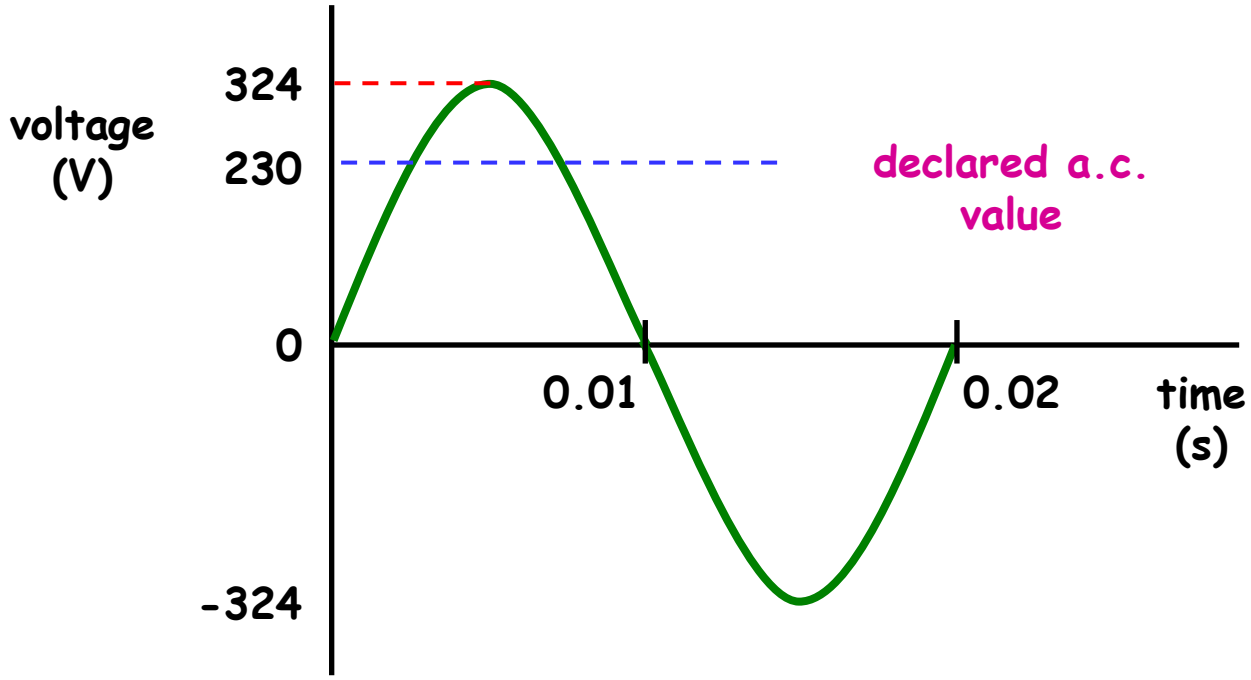
The Mains Supply

Success Criteria

By the end of the lesson, you should be able to:

- Δ **state** the declared value of **mains voltage** in the UK.
- Δ **describe** how the **declared mains voltage** compares with the **peak mains voltage**.

The **mains supply** is a source of **alternating voltage supply**.



Mains voltage is quoted as 230 V.

Mains frequency is 50 Hz.

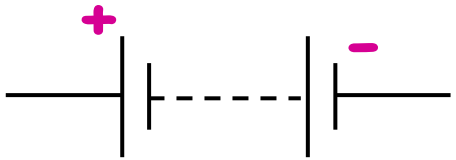
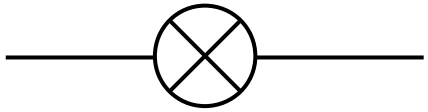
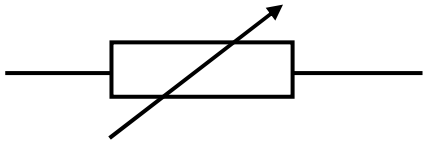
The **declared value** of mains voltage is **less than** the **peak voltage**.

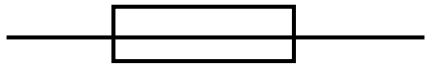
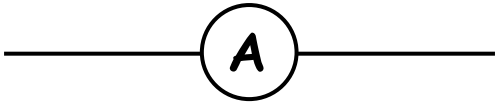
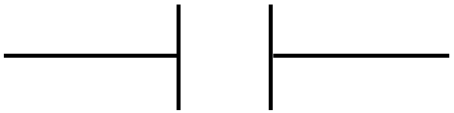
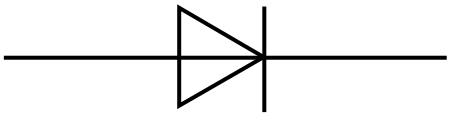
Circuit Symbols

Success Criteria

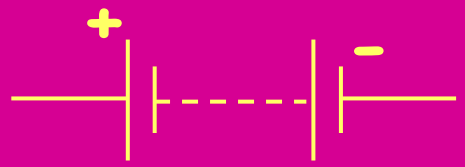
By the end of the lesson, you should be able to:

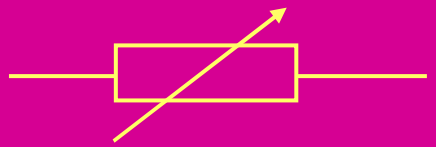
- draw and identify the circuit symbols for a:
  - battery
  - power supply
  - lamp
  - switch
  - resistor
  - variable resistor
  - capacitor
  - diode
  - fuse
  - ammeter
  - voltmeter
  - ohmmeter

Circuit Symbol	Name
	battery
	power supply
	switch
	lamp
	resistor
	variable resistor

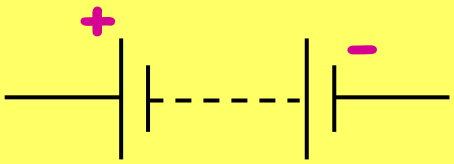
Circuit Symbol	Name
	fuse
	ammeter
	voltmeter
	ohmmeter
	capacitor
	diode

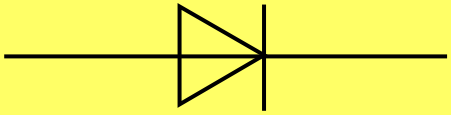
Circuit Symbols Quiz



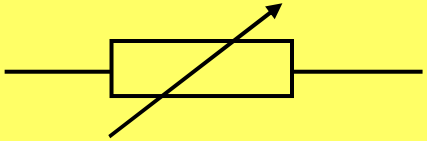


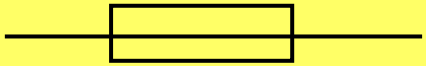
1.Catch the battery!



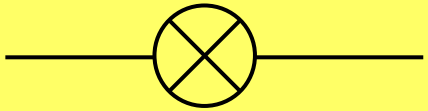


2.Catch the fuse!

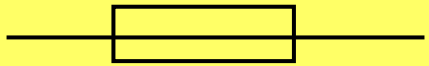


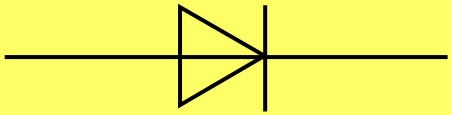


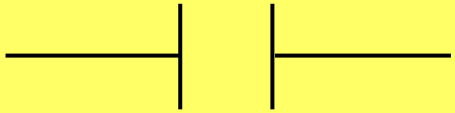
3.For turning lights on and off!



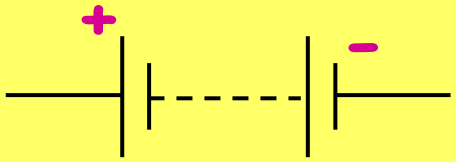
4.Used in a plug to protect the flex!

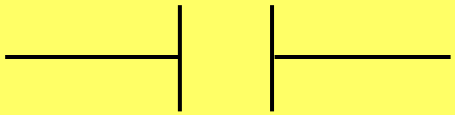




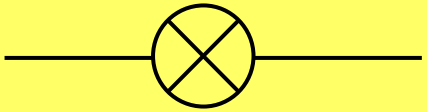


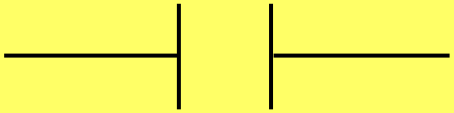
5.Measures the size of current in circuits!

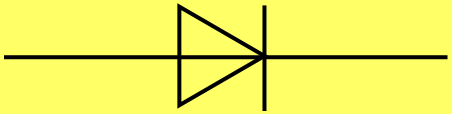




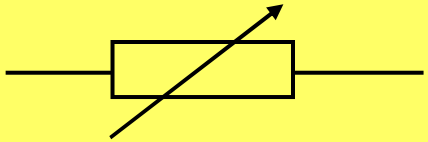
6.Changes electrical energy to light!

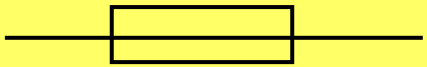




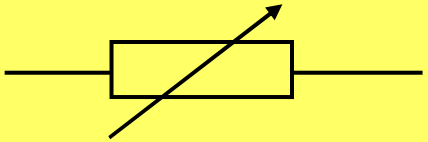


7.Measures resistance of resistors!

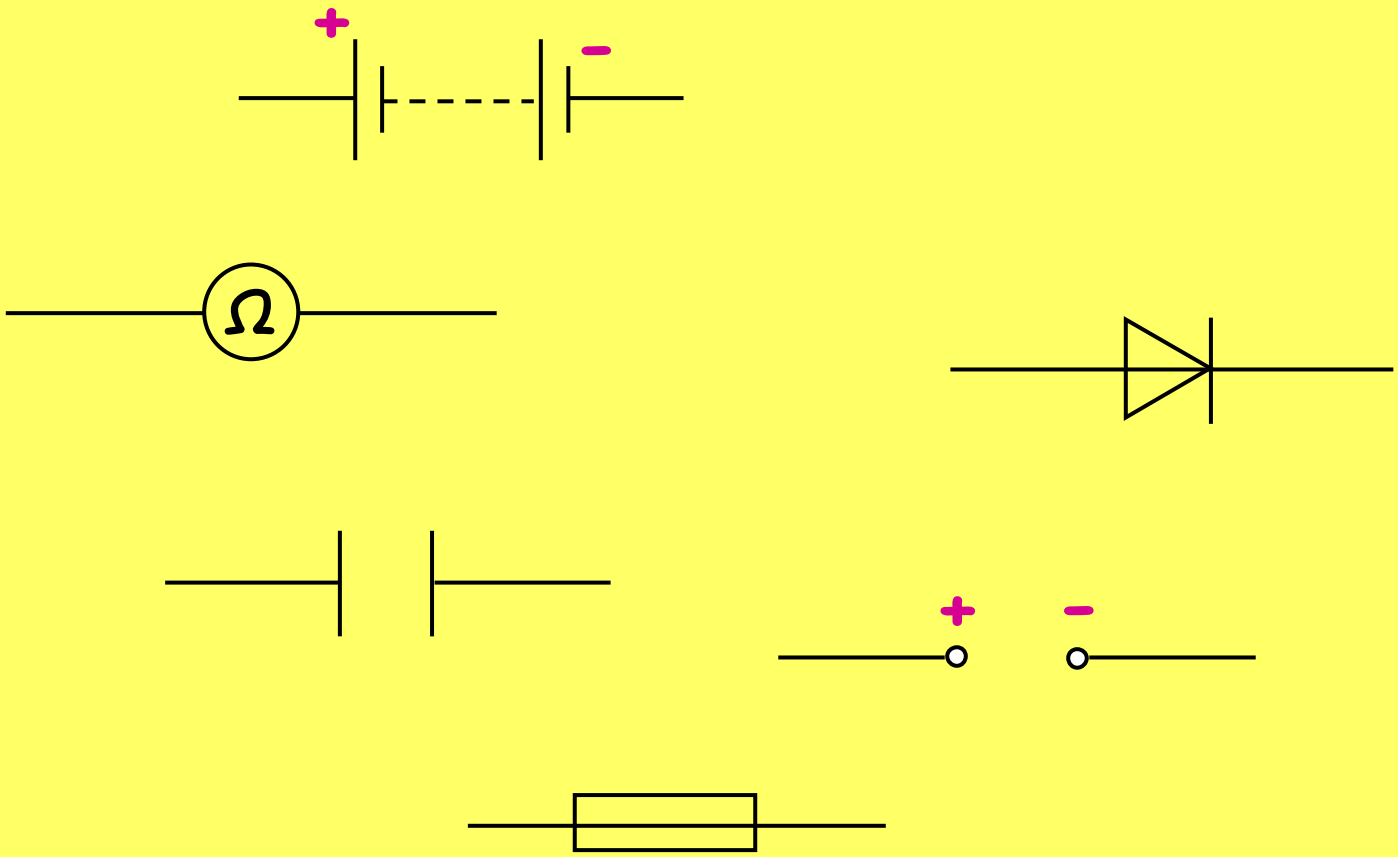




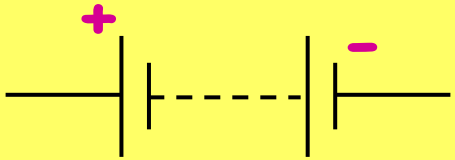
8. Increases or decreases current in a circuit!

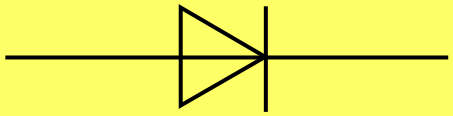


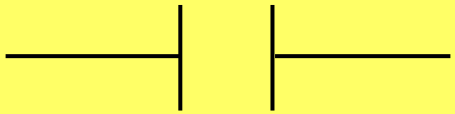
9.Changes chemical to electrical energy!



10. Stores electrical charge!







Conductors and Insulators

Success Criteria

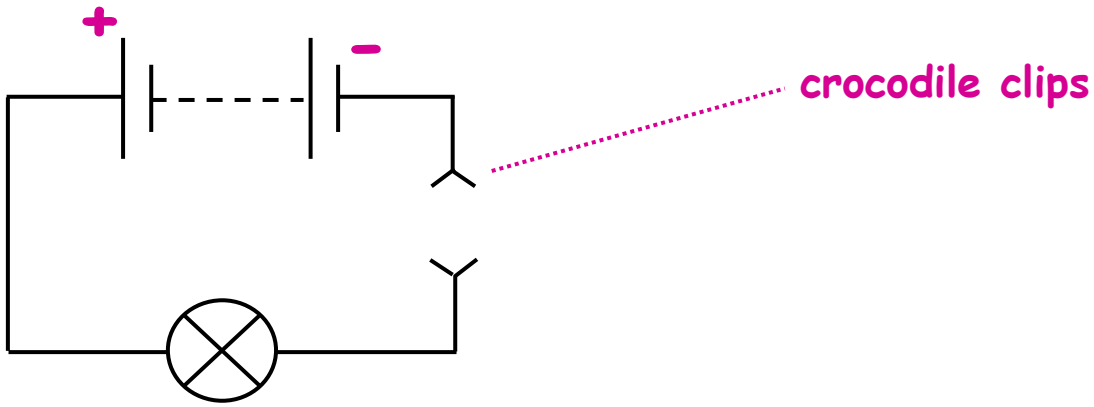
By the end of the lesson, you should be able to:

- Δ **describe** what a **conductor** and **insulator** of electricity is.
- Δ **state** in what **type of materials** where **electrons** are **free to move**.
- Δ **describe** the **electric current** in terms of the **movement of charges** around a circuit.

Aim

To test whether materials allow electricity to pass through them.

Circuit Diagram



EXPERIMENT

Conductors and Insulators

Results

Material	Conductor/Insulator

Conclusion

In a conductor, electrons are free to move.

This allows electrons to flow through conductors.

In an insulator, electrons are fixed so unable to move.

This means electricity does not flow through insulators.

Charge, Current and Time

Success Criteria

By the end of the lesson, you should be able to:

- ◊ *carry out calculations using the relationship:* $Q = I\,t$
- Δ use correctly the **units**:
  - ➢ **amperes**
  - ➢ **volts**
- ◊ *use correctly the **units***
  - ➢ ***coulombs***
- ◊ *describe what the word **voltage** means.*

Electric Current

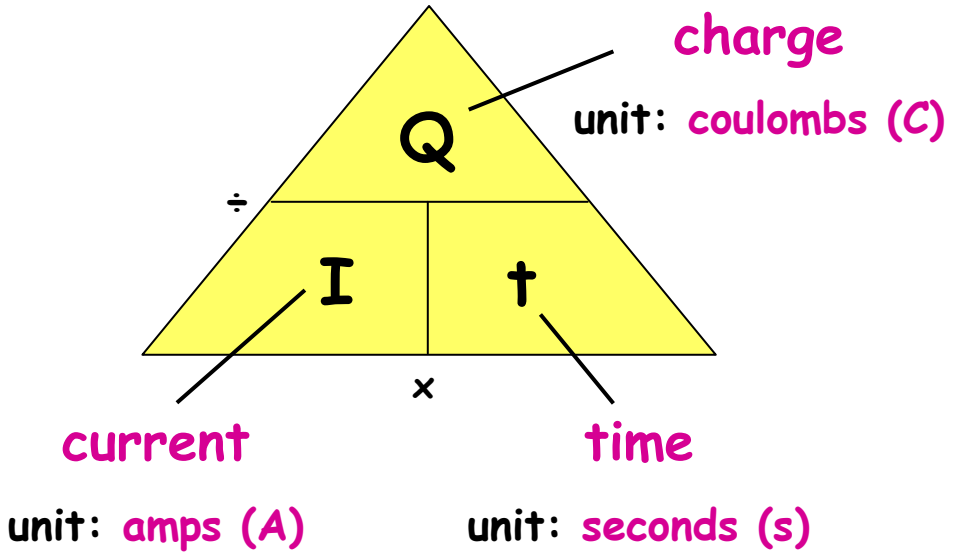
An **electric current** is a movement of **negative charges** called **electrons**.

The amount of **charge** flowing, depends on:

- the **size of current**
- and **length of time** current is flowing for.

Relationship

$$Q = I\,t$$



Voltage

Supply voltage is the energy given to each coulomb of charge in the circuit.

A 1.5 V battery gives 1.5 J of energy to each coulomb of charge.

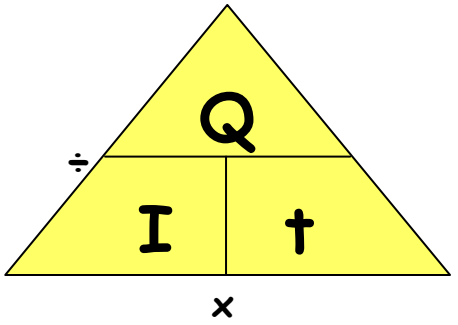
A 9 V battery gives 9 J of energy to each coulomb of charge.

The mains voltage gives 230 J of energy to each coulomb of charge.

Example 1

A current of 5 A flows in a kettle for 2 minutes.

Calculate the amount of charge in the kettle.



$I = 5\ A$

$t = 2\ \text{minutes}$
$= 2 \times 60\ s$
$= 120\ s$

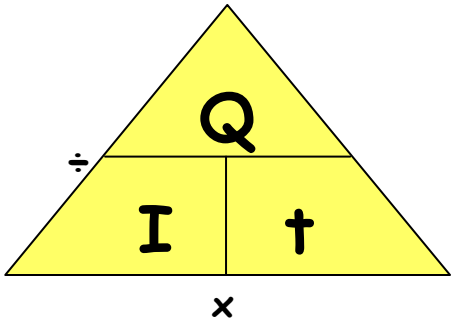
$Q = ?$

$Q = I\,t$
$= 5 \times 120$
$Q = 600\ C$

Example 2

A charge of 1 kC flows through a circuit in 80 s.

Calculate the current in the circuit.



$$Q = 1\,kC$$
$$= 1\times10^{3}\,C$$

** kilo means a thousand **

$$t = 80\,s$$

$$I = ?$$

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

$$= \frac{1\times10^{3}}{80}$$

$$I = 12.5\,A$$

Questions

m = milli ($x10^{-3}$)	k = kilo ($x10^{3}$)
μ = micro ($x10^{-6}$)	M = mega ($x10^{6}$)

	charge	current	time
1.		4 A	25 s
2.		0.5 A	20 s
3.	0.5 kC	10 A	
4.	1.2 kC		5 min
5.	200 C		400 s
6.	2 kC	40 A	
7.	5 C	20 A	
8.	16 C		80 s