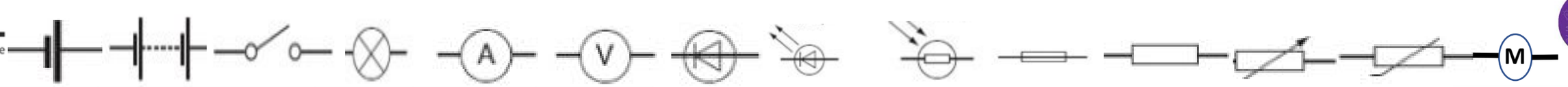
EDEXCEL TOPIC 10 ELECTRCITY AND CIRCUITS

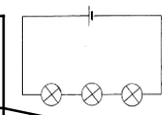


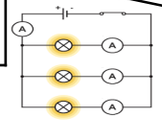
Cell	Battery	Switch	Lamp	Ammeter	Volt meter	Diode	LED	LDR	Fuse	Resistor	Variable resistor	Thermistor	Motor
Store of chemical energy	*Two or more cells in series*	*Breaks circuit, turning current off*	*Lights when current flows*	*Measures current*	*Measures potential difference*	*Current flows one way*	*Emits light when current flows*	*Resistance low in bright light*	*Melts when current is too high*	*Affects the size of current flowing*	*Allows current to be varied*	*Resistance low at high temp*	*Converts electrical energy into mechanical energy*

Electric Circuits

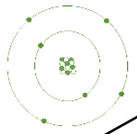
Ammeter	*Set up in series with components*	Measures current in amps in the component
Volt meter	*Set up parallel to components*	Measures p.d.in volts across the component

Series	*A circuit with one loop*
Parallel	*A circuit with two or more loops*





Atom structure



Particle	*Charge*	*Size*	*Found*
Proton	*+*	*1*	*In the nucleus*
Neutron	*None*	*1*	
Electron	*-*	*Tiny*	*Orbits the nucleus*

Current, Potential difference, Charge and Energy.

Potential difference	*The energy transferred by a component for every per unit of charge passed*	1 volt = 1 joule per coulomb (1V = 1J/C)

E = Q X V

Energy transferred = Charge moved X potential difference

Q = I X t

Charge = Current X time

Current is conserved at a junction in a circuit.

Current in metals is the flow of electrons.

Current only flows when the circuit is closed and there is a p.d. across a component.

Current	*Flow of electrical charge*	Ampere (A)
Potential difference (p.d.)	*How much electrical work is done by a cell*	Volt (V)
Charge	*Amount of electricity travelling in a circuit*	Coulomb (C)

Energy transferred	*Joules (J)*
Charge	*Coulombs (C)*
Potential difference	*Volts (V)*
Current	*Amps (A)*
Time	*Seconds (s)*
Resistance	*Ohms (Ω)*

Resistance

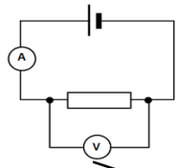
Series circuit	Ammeter reading are the same.	Volt meter readings are shared.	Total resistance increases as you add resistors in series.
Parallel circuit	Ammeters readings are shared between branches.	Volt meter readings are the same.	Total resistance decreases as you add resistors in parallel.

V = I X R

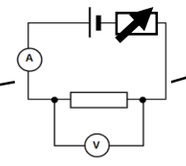
Potential difference = Current X Resistance

Resistance Ohms (Ω)	*A measurement of how much current flow is reduced*
The higher the resistance, the more difficult it is for current to flow.	
Increasing resistance, reduces current.	
Increasing voltage, increases current.	

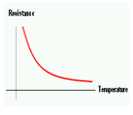
Core Practical	
Relationship between p.d., current and resistance of a lamp and resistor	*To test series and parallel circuits using resistors and lamps*
Circuit set up like standard test circuit.	



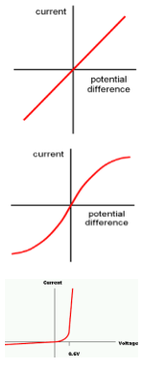
Standard test circuit	*Used to investigate relationship between current, p.d. and resistance of components*	Insert variable resistor, in series, to change current and measure current and p.d.



Thermistor	LDR
Resistance varies with temperature	*Resistance varies with light intensity*
Resistance decreases as temperature increases.	Resistance decreases as light increases.



Fixed resistor	*At a constant temperature, current is directly proportional to the p.d. across the resistor.*
Filament lamp	*As current increases, the resistance increases. The temperature increases as current flows.*
Diode	*Current flows when p.d. flows forward. Very high resistance in reverse.*



EDEXCEL TOPIC 10 ELECTRCITY AND CIRCUITS

Electrical safety

3 pin plug			
	Live - Brown	Carries p.d from mains supply.	p.d between live and earth = 230V
	Neutral - Blue	Completes the circuit.	p.d. = OV
	Earth – Green and Yellow stripes	Only carries current if there is a fault.	p.d. = 0V

Safety features			
	Fuse	Thin wire inside the plug connected to live wire.	If current exceeds a certain value, the wire melts breaking the circuit.
	Circuit breaker	'Trips' the switch.	Detect change in current and switch off the supply.
	Switch	Connected to the live wire.	When turned off, no current goes through the appliance.
	Earthing	Earth wire joins the metal case.	Earth wire takes current to the ground instead of conducting in the metal.

Electric shock		
	A connection between the live wire and earth	The live wire carries 230V, your body is at 0V so there is a large potential difference across your body and current flows through you.

Power rating		
	Power rating measured in watts	The power rating equals the number of joules transferred every second by the device from mans electrical supply to an energy store.

Power

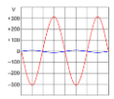
Power		
	Energy transferred per second	Measured in Watts (W).

Power transfer	
Depends on p.d. across and current flowing through device	Current equals how much charge passes per unit time.
Both affect the rate of energy transfer and the rate at which energy is transferred to other energy stores.	p.d. equals how much energy each unit of charge transfers.

Power (W) = current X potential difference — P = I X VI

Power = (current)^2 X resistance — P = I^2 X R

Transferring energy by electricity



Alternating current	Direct current
p.d. switches direction many times a second, current switches direction	***p.d. remains in one direction, current flows the same direction***
Generator.	Cell or battery.

Mains supply
Frequency 50Hz, 230V

Battery operated fan	***Energy from the chemical energy*** store	Electrical energy transferred.	Kinetic energy store of the fan.
		Thermal energy transferred by work done.	Thermal energy store of the wires, motor and surroundings.

Kettle	***Electrical energy from the mains***	Thermal energy transferred by work done.	Thermal energy store of the water.
			Thermal energy store of the kettle and surroundings.

Transferring energy

HIGHER ONLY

Reducing unwanted energy transfer	Use low resistance metals in wire. Thicker wires have lower resistance. Resistance can be decreased by cooling wires so the lattice ions do not vibrate as much.

Energy transfer	***Electrons flow through lattice of vibrating ions, they collide with ions.***	The more collisions, the harder it is for electrons to pass through so higher electrical resistance.

Thermal energy dissipates into surroundings thermal energy store and the temperature rises.

Energy transferred by heating and the resistor becomes warmer.

Current in a resistor	***When current flows circuits warm up***	Energy is transferred as work is done against the resistance.

Advantages	Disadvantages
Used to heat objects	***Efficiency is reduced***
Toasters have a coil of wire with high resistance. Current flows and wire glows red giving off IR radiation. IR radiation transfers energy to bread.	Less energy transferred as useful, more 'wasted' as thermal.
	Too hot, components may melt and circuit stops working.

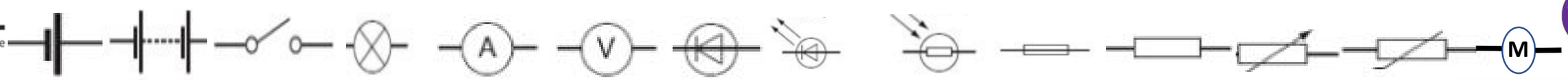
Lamps and heaters work in the same way.

P = E ÷ t

Power = Energy transferred ÷ time

Energy transferred	***Joules (J)***
Potential difference	***Volts (V)***
Power	***Watts (W)9***
Current	***Amps (A)***
Time	***Seconds (s)***
Resistance	***Ohms (Ω)***

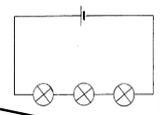
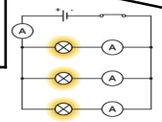
EDEXCEL TOPIC 10 ELECTRCITY AND CIRCUITS



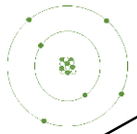
Store of chemical energy	*Two or more cells in series*	*Breaks circuit, turning current off*	*Lights when current flows*	*Measures current*	*Measures potential difference*	*Current flows one way*	*Emits light when current flows*	*Resistance low in bright light*	*Melts when current is too high*	*Affects the size of current flowing*	*Allows current to be varied*	*Resistance low at high temp*	*Converts electrical energy into mechanical energy*

Electric Circuits

	Set up in series with components	Measures current in amps in the component
	Set up parallel to components	Measures p.d.in volts across the component

A circuit with one loop	
A circuit with two or more loops	

Atom structure



	Charge	Size	Found
	+	1	*In the nucleus*
	None	1	
	-	*Tiny*	*Orbits the nucleus*

Current, Potential difference, Charge and Energy.

	The energy transferred by a component for every per unit of charge passed	1 volt = 1 joule per coulomb (1V = 1J/C)

E = Q X V

Energy transferred = Charge moved X potential difference

Q = I X t

Charge = Current X time

Current is conserved at a junction in a circuit.

Current in metals is the flow of electrons.

Current only flows when the circuit is closed and there is a p.d. across a component.

	Flow of electrical charge	Ampere (A)
	How much electrical work is done by a cell	Volt (V)
	Amount of electricity travelling in a circuit	Coulomb (C)

	Joules (J)
	Coulombs (C)
	Volts (V)
	Amps (A)
	Seconds (s)
	Ohms (Ω)

Resistance

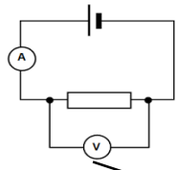
	Ammeter reading are the same.	Volt meter readings are shared.	Total resistance increases as you add resistors in series.
	Ammeters readings are shared between branches.	Volt meter readings are the same.	Total resistance decreases as you add resistors in parallel.

V = I X R

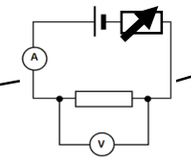
Potential difference = Current X Resistance

	A measurement of how much current flow is reduced
The higher the resistance, the more difficult it is for current to flow.	
Increasing resistance, reduces current.	
Increasing voltage, increases current.	

Core Practical	
Relationship between p.d., current and resistance of a lamp and resistor	*To test series and parallel circuits using resistors and lamps*
Circuit set up like standard test circuit.	

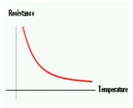


	Used to investigate relationship between current, p.d. and resistance of components

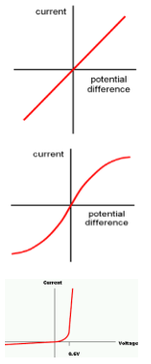


Insert variable resistor, in series, to change current and measure current and p.d.

Resistance varies with temperature	*Resistance varies with light intensity*
Resistance decreases as temperature increases.	Resistance decreases as light increases.



	At a constant temperature, current is directly proportional to the p.d. across the resistor.
	As current increases, the resistance increases. The temperature increases as current flows.
	Current flows when p.d. flows forward. Very high resistance in reverse.



EDEXCEL TOPIC 10 ELECTRCITY AND CIRCUITS

Electrical safety

Live - Brown	Carries p.d from mains supply.	p.d between live and earth = 230V
Neutral - Blue	Completes the circuit.	p.d. = OV
Earth – Green and Yellow stripes	Only carries current if there is a fault.	p.d. = 0V

Fuse	Thin wire inside the plug connected to live wire.	If current exceeds a certain value, the wire melts breaking the circuit.
Circuit breaker	‘Trips’ the switch.	Detect change in current and switch off the supply.
Switch	Connected to the live wire.	When turned off, no current goes through the appliance.
Earthing	Earth wire joins the metal case.	Earth wire takes current to the ground instead of conducting in the metal.

A connection between the live wire and earth	The live wire carries 230V, your body is at 0V so there is a large potential difference across your body and current flows through you.

Power rating measured in watts	The power rating equals the number of joules transferred every second by the device from mans electrical supply to an energy store.

Power

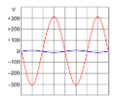
Energy transferred per second	Measured in Watts (W).

Depends on p.d. across and current flowing through device	
Both affect the rate of energy transfer and the rate at which energy is transferred to other energy stores.	Current equals how much charge passes per unit time. p.d. equals how much energy each unit of charge transfers.

Power (W) = current X potential difference — P = I X VI

Power = (current)^2 X resistance — P = I^2 X R

Transferring energy by electricity



p.d. switches direction many times a second, current switches direction	*p.d. remains in one direction, current flows the same direction*
Generator.	Cell or battery.

Frequency 50Hz, 230V

Energy from the chemical energy store	Electrical energy transferred.	→	Kinetic energy store of the fan.
	Thermal energy transferred by work done.		Thermal energy store of the wires, motor and surroundings.
Electrical energy from the mains	Thermal energy transferred by work done.	→	Thermal energy store of the water. Thermal energy store of the kettle and surroundings.

Transferring energy

	When current flows circuits warm up	Energy is transferred as work is done against the resistance.

Energy transferred by heating and the resistor becomes warmer.

Thermal energy dissipates into surroundings thermal energy store and the temperature rises.

Used to heat objects	*Efficiency is reduced*
Toasters have a coil of wire with high resistance. Current flows and wire glows red giving off IR radiation. IR radiation transfers energy to bread.	Less energy transferred as useful, more ‘wasted’ as thermal. Too hot, components may melt and circuit stops working.

Lamps and heaters work in the same way.

HIGHER ONLY

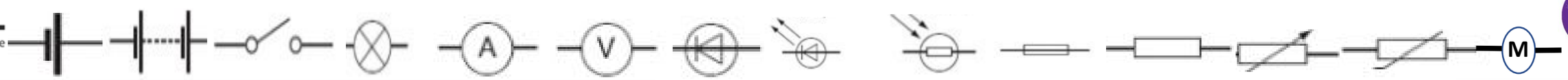
	Use low resistance metals in wire. Thicker wires have lower resistance. Resistance can be decreased by cooling wires so the lattice ions do not vibrate as much.
Electrons flow through lattice of vibrating ions, they collide with ions.	The more collisions, the harder it is for electrons to pass through so higher electrical resistance.

P = E ÷ t

Power = Energy transferred ÷ time

	Joules (J)
	Volts (V)
	Watts (W)9
	Amps (A)
	Seconds (s)
	Ohms (Ω)

EDEXCEL TOPIC 10 ELECTRCITY AND CIRCUITS

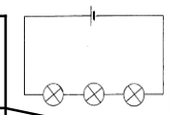


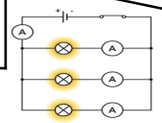
Cell	Battery	Switch	Lamp	Ammeter	Volt meter	Diode	LED	LDR	Fuse	Resistor	Variable resistor	Thermistor	Motor

Electric Circuits

Ammeter		Measures current in amps in the component
Volt meter		Measures p.d.in volts across the component

Series	
Parallel	





Atom structure

Particle			
Proton			
Neutron			
Electron			

Current, Potential difference, Charge and Energy.

Potential difference		1 volt = 1 joule per coulomb (1V = 1J/C)

E = Q X V

Energy transferred = Charge moved X potential difference

Q = I X t

Charge = Current X time

Current is conserved at a junction in a circuit.

Current		Ampere (A)
Potential difference (p.d.)		Volt (V)
Charge		Coulomb (C)

Current in metals is the flow of electrons.

Current only flows when the circuit is closed and there is a p.d. across a component.

Energy transferred	
Charge	
Potential difference	
Current	
Time	
Resistance	

Resistance

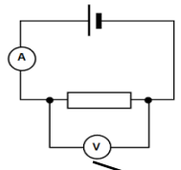
Series circuit	Ammeter reading are the same.	Volt meter readings are shared.	Total resistance increases as you add resistors in series.
Parallel circuit	Ammeters readings are shared between branches.	Volt meter readings are the same.	Total resistance decreases as you add resistors in parallel.

V = I X R

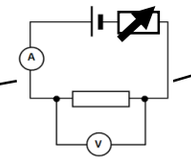
Potential difference = Current X Resistance

Resistance Ohms (Ω)	
The higher the resistance, the more difficult it is for current to flow.	
Increasing resistance, reduces current.	
Increasing voltage, increases current.	

Core Practical	
Circuit set up like standard test circuit.	

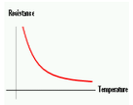


Standard test circuit	

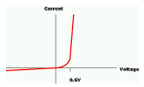


Insert variable resistor, in series, to change current and measure current and p.d.

Thermistor	LDR
Resistance decreases as temperature increases.	Resistance decreases as light increases.



Fixed resistor	
Filament lamp	
Diode	



EDEXCEL TOPIC 10 ELECTRCITY AND CIRCUITS

Electrical safety

3 pin plug		
	Carries p.d from mains supply.	p.d between live and earth = 230V
	Completes the circuit.	p.d. = OV
	Only carries current if there is a fault.	p.d. = 0V

Safety features		
	Thin wire inside the plug connected to live wire.	If current exceeds a certain value, the wire melts breaking the circuit.
	‘Trips’ the switch.	Detect change in current and switch off the supply.
	Connected to the live wire.	When turned off, no current goes through the appliance.
	Earth wire joins the metal case.	Earth wire takes current to the ground instead of conducting in the metal.

Electric shock		
	The live wire carries 230V, your body is at 0V so there is a large potential difference across your body and current flows through you.	

Power rating		
	The power rating equals the number of joules transferred every second by the device from mans electrical supply to an energy store.	

Power

Power		
		Measured in Watts (W).

Power transfer
Both affect the rate of energy transfer and the rate at which energy is transferred to other energy stores.

- Current equals how much charge passes per unit time.
- p.d. equals how much energy each unit of charge transfers.

Power (W) = current X potential difference — P = I X VI

Power = (current)^2 X resistance — P = I^2 X R

Transferring energy

HIGHER ONLY

Reducing unwanted energy transfer	Use low resistance metals in wire. Thicker wires have lower resistance. Resistance can be decreased by cooling wires so the lattice ions do not vibrate as much.

Energy transfer		
		The more collisions, the harder it is for electrons to pass through so higher electrical resistance.

P = E ÷ t

Power = Energy transferred ÷ time

Thermal energy dissipates into surroundings thermal energy store and the temperature rises.

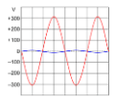
Energy transferred by heating and the resistor becomes warmer.

Current in a resistor		
		Energy is transferred as work is done against the resistance.

Advantages	Disadvantages
Toasters have a coil of wire with high resistance. Current flows and wire glows red giving off IR radiation. IR radiation transfers energy to bread.	Less energy transferred as useful, more ‘wasted’ as thermal.
	Too hot, components may melt and circuit stops working.

Lamps and heaters work in the same way.

Transferring energy by electricity



Alternating current	Direct current
Generator.	Cell or battery.

Mains supply

Battery operated fan		Electrical energy transferred.	Kinetic energy store of the fan.
		Thermal energy transferred by work done.	Thermal energy store of the wires, motor and surroundings.

Kettle		Thermal energy transferred by work done.	Thermal energy store of the water.
			Thermal energy store of the kettle and surroundings.

Energy transferred	
Potential difference	
Power	
Current	
Time	
Resistance	

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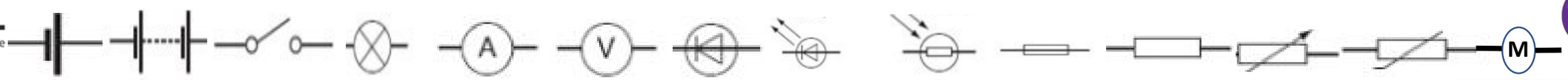
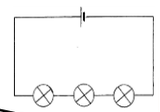
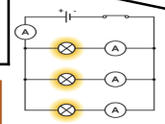


PiXL Science

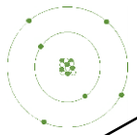
EDEXCEL TOPIC 10 ELECTRCITY AND CIRCUITS

Electric Circuits





Atom structure



Current, Potential difference, Charge and Energy.

E = Q X V

Q = I X t

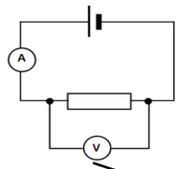
Current is

Current in

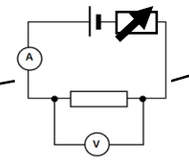
Current only

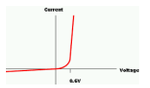
Resistance

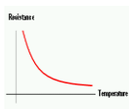
V = I X R



Core Practical







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EDEXCEL TOPIC 10 ELECTRCITY AND CIRCUITS

Electrical safety

Transferring energy

HIGHER ONLY

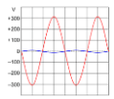
P = E ÷ t

Thermal energy

Energy

Current in a resistor	***When current flows circuits warm up***	Energy is transferred as work is done against the resistance.

Transferring energy by electricity



Power

Current

p.d.

.

P = I X VI

P = I^2 X R

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