AQA Physics GCSE Student Progress

Unit 4.2 - Electricity

4.2.1. Current, Potential Difference and Resistance

4.2.1.1. Standard Circuit Diagram Symbols

a	I can draw and interpret circuit diagrams, using the standard symbols for: cell, battery, lamp, voltmeter, ammeter, resistor, variable resistor, thermistor, LDR, LED, diode, fuse, and switch (open and closed).			

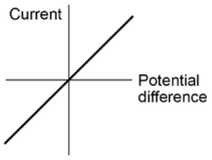
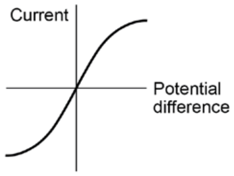
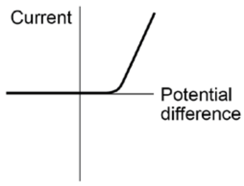
4.2.1.2. Electrical Charge and Current

a	I know that electric current is a flow of electrical charge.			
b	I know that a current has the same value at any point in a single closed loop.			
c	I know that the size of the electric current is the rate of flow of electrical charge.			
d	I can recall and apply the following equation: charge flow = current × time $Q = I t$ charge flow, Q, in coulombs, C current, I, in amperes, A (amp is acceptable for ampere) time, t, in seconds, s			
e	I know that for electrical charge to flow through a closed circuit the circuit must include a source of potential difference.			

4.2.1.3. Current, Resistance and Potential Difference

a	I know that the current (I) through a component depends on both the resistance (R) of the component and the potential difference (V) across the component.			
b	I know that the greater the resistance of the component, the smaller the current for a given potential difference (pd) across the component.			
c	I know that potential difference and voltage are different terms for the same quantity.			
d	I can recall and apply the following equation: potential difference = current × resistance $V = I R$ potential difference, V, in volts, V current, I, in amperes, A (amp is acceptable for ampere) resistance, R, in ohms, Ω			

4.2.1.4. Resistors

a	I can explain that, for some resistors, the value of R remains constant but that in others it can change as the current changes.			
b	I know that the current through an ohmic conductor (at a constant temperature) is directly proportional to the potential difference across the resistor. This means that the resistance remains constant as the current changes.  			
c	I know that the resistance of components such as lamps, diodes, thermistors and LDRs is not constant; it changes with the current through the component. The resistance of a filament lamp increases as the temperature of the filament increases.  			
d	I know that the current through a diode flows in one direction only. The diode has a very high resistance in the reverse direction.  			
e	I know that the resistance of a thermistor decreases as the temperature increases.			
f	I can describe some applications of thermistors in circuits, e.g. a thermostat.			
g	I know that the resistance of an LDR decreases as light intensity increases.			
h	I can describe some applications of LDRs in circuits, e.g. automatically switching lights on when it gets dark.			
i	I can explain the design and use of a circuit to measure the resistance of a component by measuring the current through, and potential difference across, the component.			
j	I can use graphs to explore whether circuit elements are linear or non-linear and relate the curves produced to their function and properties.			

4.2.2. Series and Parallel Circuits

a	I know that there are two ways of joining electrical components, in series and in parallel. Some circuits include both series and parallel parts.			
b	I can describe the difference between series and parallel circuits.			
c	I know that for components connected in series: • there is the same current through each component; • the total potential difference of the power supply is shared between the components; • the total resistance of two components is the sum of the resistance of each component. Rtotal = R1 + R2 resistance, R, in ohms, Ω			
d	I know that for components connected in parallel: • the potential difference across each component is the same; • the total current through the whole circuit is the sum of the currents through the separate components; • the total resistance of two resistors is less than the resistance of the smallest individual resistor.			
e	I can explain qualitatively why adding resistors in series increases the total resistance whilst adding resistors in parallel decreases the total resistance			
f	I can explain the design and use of dc series circuits for measurement and testing purposes.			
g	I can calculate the currents, potential differences and resistances in dc series circuits.			
h	I can use circuit diagrams to construct and check series and parallel circuits that include a variety of common circuit components.			
i	I can solve problems for circuits which include resistors in series using the concept of equivalent resistance.			

4.2.3. Domestic Uses and Safety

4.2.3.1. Direct and Alternating Potential Difference

a	I know that mains electricity is an AC supply.			
b	I know that, in the United Kingdom, the domestic electricity supply has a frequency of 50Hz and is about 230V.			
c	I can explain the difference between direct and alternating potential difference.			

4.2.3.2 Mains Electricity

a	I know that most electrical appliances are connected to the mains using three core cable.			
b	I know that the insulation covering each wire is colour coded for easy identification: • live wire is brown; • neutral wire is blue; • earth wire is green and yellow stripes.			
c	I know that: • the live wire carries the alternating potential difference from the supply; • the neutral wire completes the circuit; • the earth wire is a safety wire to stop the appliance becoming live.			
d	I know that the potential difference between the live wire and earth (0V) is about 230V and that the neutral wire is at, or close to, earth potential (0V).			
e	I know that the earth wire is at 0V, it only carries a current if there is a fault.			
f	I can explain why a live wire may be dangerous even when a switch in the mains circuit is open.			
g	I can explain the dangers of providing any connection between the live wire and earth.			

4.2.4. Energy Transfers

4.2.4.1. Power

a	I can explain how the power transfer in any circuit device is related to the potential difference across it and the current through it, and to the energy changes over time.			
b	I can recall and apply the following equation: power = potential difference × current $P = V I$ power, P, in watts, W potential difference, V, in volts, V current, I, in amperes, A (amp is acceptable for ampere)			
c	I can recall and apply the following equation: power = current^2 × resistance $P = I^2 R$ power, P, in watts, W current, I, in amperes, A (amp is acceptable for ampere) resistance, R, in ohms, Ω			

4.2.4.2. Energy Transfers in Everyday Appliances

a	I know that everyday electrical appliances are designed to bring about energy transfers.			
b	I know that the amount of energy an appliance transfers depends on how long the appliance is switched on for and the power of the appliance.			
c	I can describe how different domestic appliances transfer energy from batteries or ac mains to the kinetic energy of electric motors or the energy of heating devices.			
d	I know that work is done when charge flows in a circuit.			
e	I can recall and apply the following equations to calculate the amount of energy transferred by electrical work: energy transferred = power × time $E = P\,t$ energy transferred = charge flow × potential difference $E = Q\,V$ energy transferred, E, in joules, J; power, P, in watts, W time, t, in seconds, s; charge flow, Q, in coulombs, C potential difference, V, in volts, V			
f	I can explain how the power of a circuit device is related to: • the potential difference across it and the current through it; • the energy transferred over a given time.			
g	I can describe, with examples, the relationship between the power ratings for domestic electrical appliances and the changes in stored energy when they are in use.			

4.2.4.3. The National Grid

a	I know that the National Grid is a system of cables and transformers linking power stations to consumers and that electrical power is transferred from power stations to consumers using the National Grid.			
b	I know that step-up transformers are used to increase the potential difference from the power station to the transmission cables then step-down transformers are used to decrease, to a much lower value, the potential difference for domestic use.			
c	I can explain why the National Grid system is an efficient way to transfer energy.			

4.2.5. Static Electricity (Physics Only)

4.2.5.1. Static Charge (Physics Only)

a	I know that when certain insulating materials are rubbed against each other they become electrically charged; negatively charged electrons are rubbed off one material and on to the other. I can describe the production of static electricity, and sparking, by rubbing surfaces			
b	I know that the material that gains electrons becomes negatively charged and that the material that loses electrons is left with an equal positive charge.			
c	I know that when two electrically charged objects are brought close together they exert a force on each other. Two objects that carry the same type of charge repel. Two objects that carry different types of charge attract.			
d	I know that attraction and repulsion between two charged objects are examples of non-contact force and I can describe the evidence that charged objects exert forces of attraction or repulsion on one another when not in contact			
e	I can explain how the transfer of electrons between objects can explain the phenomena of static electricity.			

4.2.5.2. Electric Fields (Physics Only)

a	I know that a charged object creates an electric field around itself and that the electric field is strongest close to the charged object and that the further away from the charged object, the weaker the field.			
b	I can explain the concept of an electric field.			
c	I know that a second charged object placed in the field experiences a force and that the force gets stronger as the distance between the objects decreases.			
d	I can draw the electric field pattern for an isolated charged sphere.			
e	I can explain how the concept of an electric field helps to explain the noncontact force between charged objects as well as other electrostatic phenomena such as sparking.			