Knowledge Revision

AQA Entry Level Certificate in Science

Physics Topic 6 – Electricity and Magnetism

You **need to master** and be able to recall the facts so that you can make progress and complete the external assignments to the best of your ability.

You can use Google or revision guides to help you. You can email me any questions or use Zoom if you'd like some immediate face to face help.

You will need to use Zoom when we complete the assignments.

Email: jdixon@desc.herts.sch.uk

Zoom:

- Download 'Zoom' app
- Sign up for an account
- Select 'Meet & Chat' on the bottom bar
- Select 'Join' (blue + symbol at the top of the screen)
- Enter meeting ID: **960 412 5303**

Name ……

P6.1 Current in a circuit

KEY LEARNING POINTS – Assess as you go!

	R	A	G
Electrical current is a flow of electrical charge.			
Negatively charged particles called electrons carry the electrical charge.			
Current is measured using an ammeter in series in a circuit.			
Voltage is measured using a voltmeter in parallel across the component.			
Some parts of a circuit may have higher resistance and reduce the current.			
Resistance measures how difficult it is for electric current to flow.			
Different components create different resistance in a circuit.			

Essential Questions

1. What is electric current?
2. Some materials, such as metals, are called conductors. Some materials, such as plastics, are called insulators. What is the differnce between conductors and insulators?
3. What is electrical resistance?
4. In the space below draw a circuit diagram to show how you would measure the current and voltage of a bulb in a circuit.

CORE

- ***Name*** three materials that are conductors and three materials that are insulators.

EXTEND

- What makes a current flow?
- How could you increase the current in a circuit?
- ***Explain*** how you would test three wires of increasing thickness for their resistance. You may include a circuit diagram in your answer.

You should be able to give definitions for the following words:

Key word	Definition
Component	
Current	
Resistance	
Voltage	

P6.2 DC and AC current

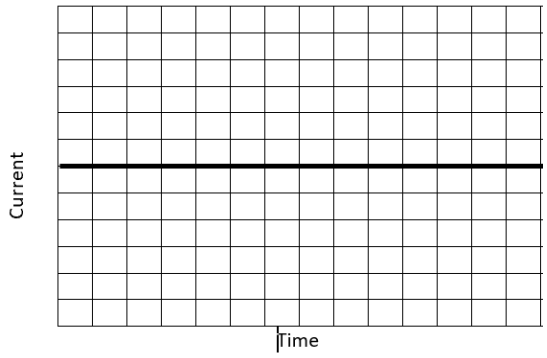
KEY LEARNING POINTS – Assess as you go!

	R	A	G
D.C. stands for direct current; it moves in one direction only.			
D.C. is provided by batteries and cells.			
A.C. stands for alternating current; it changes direction.			
A.C. is the mains electricity in the UK.			
UK mains electricity has a voltage of 230 V and a frequency of 50 Hz.			
A frequency of 50 Hz means the current reverses direction 50 times a second.			

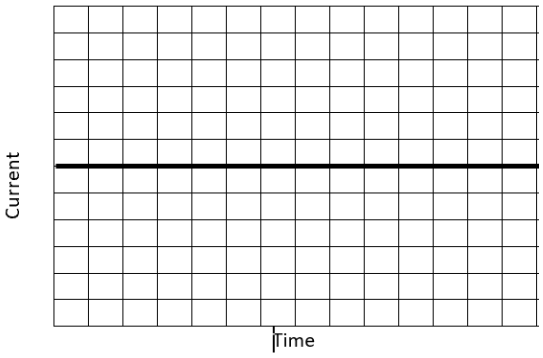
Essential Questions

1. What is the difference between a.c. and d.c.?
2. Complete these two diagrams to show the simple wave pattern from an oscilloscope representing d.c. and a.c:

Direct current



Alternating current



CORE

- What kind of devices supply
    a. A.C.?
    b. D.C.?

EXTEND

- ***State*** two ways that the electricity from a battery is different from the electricity coming through a socket in your home.

You should be able to give definitions for the following words:

Key word	Definition
Alternating current (AC)	
Direct current (DC)	
Battery	
Cell	

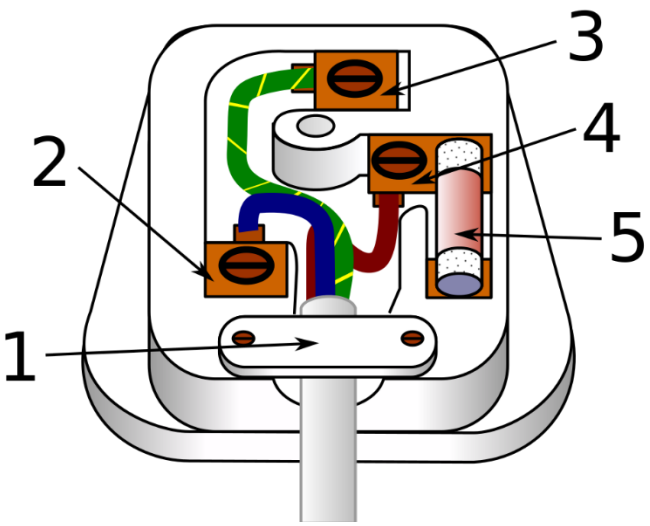
P6.3 Wiring a plug

KEY LEARNING POINTS – Assess as you go!

	R	A	G
A plug is a way to connect the mains electricity to an electrical appliance.			
In the UK plugs use three-core flex. Each wire is covered with a coloured insulation: • Brown = Live • Blue = Neutral • Green and yellow stripes = Earth			
The green and yellow earth wire protects the user from being electrocuted.			
The fuse is a thin piece of wire. It protects the electrical appliance by melting when the current is too high.			
Some appliances are double-insulated and do not need an earth wire. These will have a plastic case instead of a metal case.			

Essential Questions

1. What is a fuse? Where is it found? How does it protect an electrical appliance?
2. ***Label*** the diagram to show the correct wiring of a three-pin plug. ***Annotate*** with information about the job of each wire.



CORE

1. Why must a fuse have the correct rating, i.e. one that is close to but slightly above the current the appliance takes?
2. What is the correct fuse for the following appliances? You can choose from a 3 A, 5 A or 13 A fuse:
    a. A television that takes 1 amp.
    b. A kettle that takes 10 amps.

EXTEND

1. Why do double insulated appliances have a plastic casing rather than a metal casing?
2. Most electrical devices have a power rating that you can find on a label somewhere on the device. You can use this to calculate the current and therefore select the correct fuse:

    Current = Power / Voltage.

    Remember that in the UK the mains voltage is 230 V. Use this equation to work out the current for the following appliances and then the correct fuse.

Device	***Power***	***Current = Power / voltage (show working)***	***Fuse – 3 A, 5 A or 13 A?***
Computer	100 W		
Cooker	3000 W		
Plasma TV	450 W		

You should be able to give definitions for the following words:

Key word	Definition
Appliance	
Earth wire	
Flex	
Fuse	
Insulation	
Live wire	
Neutral wire	

P6.4 Energy transfer in electrical appliances

KEY LEARNING POINTS – Assess as you go!

	R	A	G
Electrical devices transfer energy from one store to another.			
The cost of using an electrical device depends on its power rating, how long you use the appliance for and the cost of a unit of electricity.			

Essential Questions

1. Name three devices that transfer energy electrically and give out heat.
2. Suggest how you could reduce tour home's electricity bill.
3. How many watts are in 1 kilowatt (kW)?

CORE

Complete these sentences:

When an electrical appliance is switched on it transfers _ _ _ _ _ _ . The larger the _ _ _ _ _ of the device the more energy is transferred.

Power is measured in _ _ _ _ _ .

EXTEND

Use this equation: Energy (kWh) = power (W) x time (s)

How much energy is being transferred with these appliances?

a. A 6 W radio listened to for 30 seconds
b. A 200 W TV used for 5 minutes
c. A 2 kW kettle used for 10 minutes

You should be able to give definitions for the following words:

Key word	Definition
Power	

P6.5 Magnets

KEY LEARNING POINTS – Assess as you go!

	R	A	G
The ends of a magnet are called poles – this is where the magnetic force is the strongest.			
N-N and S-S poles repel.			
N-S poles attract.			
Magnetism is a non-contact force.			

Essential Questions

1. Describe a bar magnet.
2. Name three materials a magnet will attract.
3. A magnetic field is the region around a magnet where the magnetic force is felt, and a compass needle would be affected. Complete the diagram below to show the magnetic field lines. Remember to add arrows showing the direction of the magnetic force.

CORE

How could you carry out an experiment to find out which metals are magnetic?

EXTEND

Complete the diagrams to show the magnetic field lines when magnets interact.

You should be able to give definitions for the following words:

Key word	Definition
Attraction	
Poles	
Repulsion	

P6.6 Electromagnets and solenoids

KEY LEARNING POINTS – Assess as you go!

	R	A	G
An electric current flowing through a wire creates a magnetic field around it.			
If the wire is turned into a coil, it is called a solenoid.			
To increase the strength of the magnetic field around the wire, increase the current.			
Electromagnets are temporary magnets made from an iron core and solenoid.			
Electromagnets have many uses including relay switches and in scrapyard cranes.			

Essential Questions

1. What is a solenoid? How does it affect the strength of the magnetic field caused by the current running through the wire?
2. Why is an electromagnet called a temporary magnet?
3. How are electromagnets used in scrapyard cranes?

CORE

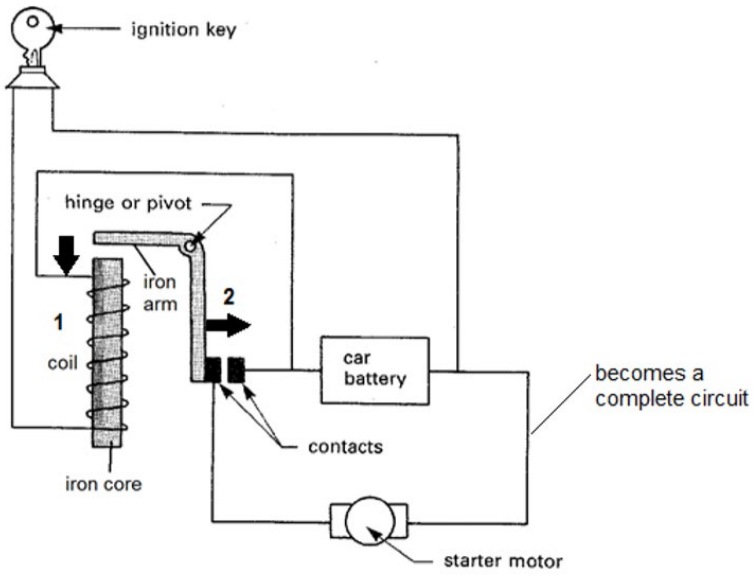
Describe how to compare the strength of two electromagnets you make in the school lab.

You can use insulated wire, an iron rod / nail, a power pack and paper clips.

EXTEND

A relay switch is a way of controlling a circuit using an electromagnet such as found in some vehicle ignition systems.

Look at the diagram below and ***describe*** how the relay switch works.



(AQA Teachers Guide)

You should be able to give definitions for the following words:

Key word	Definition
Current	
Magnetic field	
Solenoid	
Electromagnet	
Relay	

P6.7 Longitudinal and transverse waves

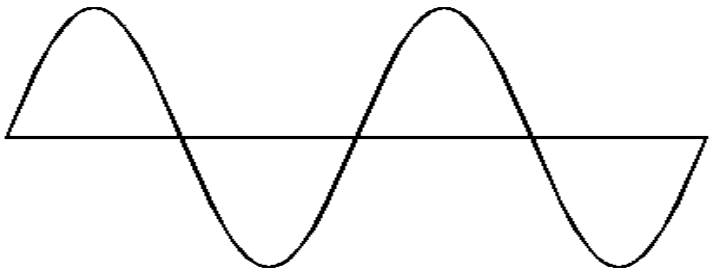
KEY LEARNING POINTS – Assess as you go!

	R	A	G
Waves transfer energy.			
Waves are transverse or longitudinal. Transverse waves include water waves.			
In a transverse wave the wave moves perpendicular (at right angles) to the direction of the energy transfer.			
In a longitudinal wave the waves moves in the same direction as the energy transfer.			
Longitudinal waves have areas of compression (wave pushed together) and rarefaction (wave stretching out).			
Sound waves have to travel through something, e.g. air or water. Sounds waves are longitudinal waves.			

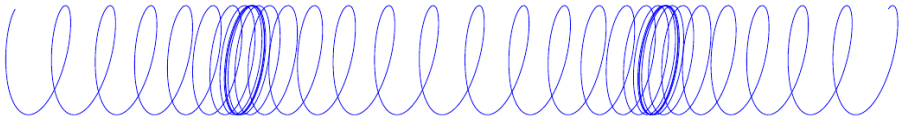
Essential Questions

1. Give two examples of:
    a. Transverse waves
    b. Longitudinal waves

2. This is a transverse wave. Label:
    a. The direction the wave is moving
    b. The direction of energy transfer
    c. One wavelength



3. This is a longitudinal wave. Label:
    a. The direction of energy transfer
    b. An area of compression
    c. An area of rarefaction



CORE

Describe how you can use a slinky spring to demonstrate the movement of a transverse wave and a longitudinal wave.

EXTEND

Sound waves can travel through solids and liquids but not through space. ***Explain*** why.

You should be able to give definitions for the following words:

Key word	Definition
Compression	
Longitudinal	
Oscillation	
Perpendicular	
Rarefaction	
Transverse	

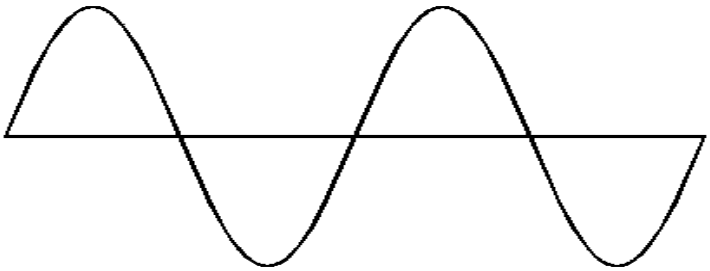
P6.8 Wave properties

KEY LEARNING POINTS – Assess as you go!

	R	A	G
Waves have properties. These include wavelength, frequency and amplitude.			
Wave speed (m/s) = Frequency (Hz) x Wavelength (m)			
Wave frequency is the number of waves that pass a point in one second.			
Amplitude is the height of a wave from the resting position.			
Wavelength is the distance between the same point on two consecutive waves.			

Essential Questions

1. Label the following on this transverse wave:
   - Wavelength
   - Amplitude
   - Crest
   - Trough



2. Sounds waves are longitudinal waves. Their frequency and amplitude changes the sound. ***Draw*** simple waveforms (like the diagram above) to represent a high pitched loud sound next to a low pitched quiet sound.

CORE

Describe the properties of an ocean wave that a surfer would be challenged by.

EXTEND

Use the wave speed equation to calculate the following. You MUST show your working out.

a. The speed of sound from a guitar note that has a frequency of 440 Hz and a wavelength of 0.75 m.
b. The speed of a water wave with a frequency of 0.1 Hz and wavelength of 5.5 m.
c. A wave travelling along a slinky spring with a frequency of 2 Hz and a wavelength of 10 cm.

You should be able to give definitions for the following words:

Key word	Definition
Amplitude	
Frequency	
Wavelength	

P6.9 Electromagnetic waves

KEY LEARNING POINTS – Assess as you go!

	R	A	G
From the longest to shortest wavelength the order of waves in the electromagnetic spectrum is radio waves, microwaves, infrared, visible light, ultraviolet, x-rays and gamma rays.			
All waves in the electromagnetic spectrum are transverse waves that travel in straight lines at the speed of light, approximately 300 000 km / sec through air and the vacuum of space.			
When these waves move from air to a liquid they slow down.			

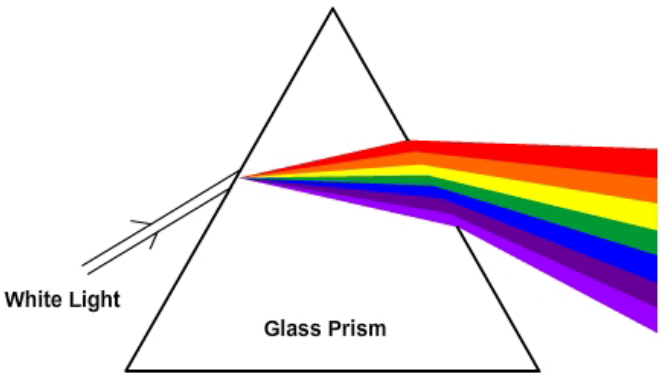
Essential Questions

1. Complete this diagram by filling in the name of the waves in each box.

Increasing wavelength →

← Increasing frequency

2. Visible light can also be split into its own spectrum. Name the colours in order from the longest wavelength.



CORE

Write a mnemonic to remember the order of the waves in the electromagnetic spectrum.

EXTEND

Ultraviolet, x-rays and gamma rays can cause damage to humans. ***Suggest*** why they are more dangerous to life than radio waves.

You should be able to give definitions for the following words:

Key word	Definition
Electromagnetic waves	
Gamma rays	
Infrared	
Microwave	
Radio	
Spectrum	
Ultraviolet	
Vacuum	
Visible light	
X-rays	

P6.10 Uses of the electromagnetic spectrum

KEY LEARNING POINTS – Assess as you go!

Electromagnetic waves have the following uses:	R	A	G
Gamma rays – sterilise surgical equipment, cancer treatment			
X-rays – medical diagnosis of broken bones			
Ultraviolet – Sun tanning, energy efficient lamps			
Visible light – seeing, fibre optics			
Infrared – cooking, remote controls			
Microwaves – cooking, mobile phone and satellite communication			
Radio waves – radar, radio, tv, mobile phones (including Bluetooth)			

Essential Questions

1. Why does a satellite have to be used to transfer radio signals over long distances?
2. How do microwaves work in a microwave oven to cook food?
3. Which of the electromagnetic waves can be used to send signals?
4. Which of the electromagnetic waves is used to detect fake banknotes?

CORE

Based on your scientific knowledge ***suggest*** how to safely suntan.

EXTEND

- ***Explain*** why x-rays are used to take images of suspected broken bones?
- ***Explain*** the risks and uses of gamma rays.

You should be able to give definitions for the following words:

Key words	Definition
Optical fibre	
Radar	
Reflection	
Satellite	