

Year 9 Science Knowledge Booklet

Term 6

Name:	Class:						
Homework 1 Due: 14 th June	Homework 2 Due: 28 th June						
Homework 3 Due: 12 th July							



Science Homework 1



Read all of this knowledge organiser. The work covered will be in the first knowledge quiz of the term.

Big questions: What is electricity?

What are electric circuits and how do we draw them? What is electric current and how do we measure it? What is potential difference and how is it measured? What do we mean by electrical resistance? RP15 What factors affect the resistance of a wire? What are the rules that help us analyse series and parallel circuits? What happens to the resistance if we arrange resistors in combination? What is Ohms law and what does it tell us? What does the potential difference - current graph look like for a bulb. What affects the resistance of a thermistor? How can we use resistors to switch a circuit on and off? What is alternating current? Why do plugs have three wires? How do we calculate the power transferred by an appliance? How does resistance affect the power transferred? Why are transformers needed in the national Grid?

Key vocabulary

Electric current	The flow of electric charge around a circuit. Electric current carries energy
	transferred from the cells. Measured in amps, A.
Series circuit	A single loop of a circuit with the components following one after
	another. The current is the same all around the loop.
Voltmeter	A meter to measure potential difference. Voltmeters are connected in
	parallel with the component they are measuring in their own loop.
Light dependent resistor	A device whose resistance goes down when the amount of light goes up.
	They are useful in light sensing circuits such as automatic street lights.
Potential difference	The energy per coulomb transferred between two points in a circuit.
	Measured in volts, V
Parallel circuit	A circuit with more than one loop. The current from the cells divides at
	the junction.
Variable resistor	A resistor whose value can be changed (varied). They can control the
	current in a circuit to make it bigger or smaller.
Alternating current	Electric current that rapidly changes direction. Mains electricity is 50Hz ac
	 it changes direction 50 times a second.
Resistance	How much a component in a circuit slows down the current. It is found by
	dividing the potential difference by the current. Measured in ohms, Ω
Ammeter	A meter to measure electric current. Ammeters are connected in series in
	the loop they are measuring.
Thermistor	A device whose resistance goes down when the temperature goes up.
	They are useful in temperature sensing circuits like thermostats.
National grid	The network of overhead cables and transformers that connects power
	stations and our homes to provide us with electricity.

What are electric circuits and how do we draw them?

Electric circuits transfer energy.

- Energy is transferred from a power supply or battery to a device like a bulb, a heater or motor.
- Energy is transferred by the electric current.
- The current must flow from the power supply to the device and then back to the power supply. This is called an electrical circuit.

Symbols are used to represent the components in an electrical circuit.



Circuits are drawn neatly with a ruler and pencil.



Series circuits

A circuit with only one loop for the current is called a series circuit.



Parallel circuits

A circuit with more than one loop for the current is called a parallel circuit. Each loop must include a cell or power source.



What is electric current and how do we measure it?

- Electric current is a flow of charged particles called electrons.
- Electric current flows around complete loops of a circuit.
- The symbol for electric current is I.
- The amount of current depends on the potential difference of the battery and the resistance of components in the circuit. (V=IR)
- Electric current is not used up by circuit components.
- The amount of current is the same at all points in the loop.
- The current leaving the battery is the same as the current returning.

An ammeter is a meter that measures the electric current.

- The unit for electric current is ampere. This is usually shortened to amp or A.
- An ammeter must be connected in the loop whose current it is measuring. We say it is connected 'in series'.



What is potential difference and how is it measured?

The potential difference across a component measures the energy transferred per coulomb of charge that passes through it.

- The p.d across the battery is the energy transferred from the battery to the current for every coulomb of charge that passes through it.
- The p.d across a component is the energy transferred from the current to the component for every coulomb of charge that passes through it.

Energy is conserved so all of the energy transferred to the charge by the battery must be transferred out of the circuit by its components.

The p.d across the battery = The total p.d across the components

A voltmeter is a meter that measures the potential difference or voltage, between two points in an electric circuit.

- The unit for potential difference is **volt**, **V**.
- A voltmeter must be connected in its own loop across the component it is measuring. We say it is connected 'in parallel'.



What do we mean by electrical resistance?

Electric current is a flow of charged particles called electrons.

When they move electrons collide with atoms or ions inside the metal wires. This slows them down and is called electrical resistance.



The amount of resistance a piece of material has can be measured. It is measured in **Ohms,** Ω .

- Every electrical component has some resistance.
- Components designed to have a fixed amount of resistance are useful and are called resistors.
- The more resistance the components in a circuit have the smaller the current becomes.
- A variable resistor has resistance that can be changed.
- Increasing the resistance of the variable resistor decreases the current in the circuit.

The relationship between potential difference, current and resistance is given by:

Potential difference = current X resistance

 $V = I \times R$

- V = potential difference, V
- I = current in amps, A
- R = resistance, Ω

What factors affect the resistance of a wire?

The resistance of a wire depends on its length, how thick it is, its temperature and what it is made of. We can investigate exactly how resistance changes with length using an ammeter and voltmeter to find the resistance for different lengths of wire.



What happens to the resistance if we arrange resistors in combination?

When resistors are in series:

- The total resistance is more.
- The resistances add together.
- The total resistance is given by:





 $1/R_{total} = 1/R_1 + 1/R_2$

So the total resistance for this pair of resistors would be **400** Ω .

When resistors are in parallel the circuit has less resistance:

• The total resistance is:



What are the rules that help us analyse series and parallel circuits?

- In a series circuit the current is the same at all points in the loop.
- In a **series circuit** the potential difference across the components adds up to the potential difference across the battery.
- Resistors in **series circuits** add up.
- In a **parallel circuit** the total potential difference is the same across both loops.
- In a **parallel circuit** the current divides at the junction.
- When resistors are in **parallel** the circuit has less resistance:

What is Ohms law and what does it tell us?

A graph can show how the current (I) changes when the potential difference (V) is increased across a particular device.



If the graph is a straight line through the origin we can say:

The potential difference is directly proportional to the current.

This result is known as **Ohm's law.** Components that obey Ohm's law are called ohmic conductors.

What does the potential difference - current graph look like for a bulb?

All electric currents make wires hotter. This heat increases their resistance.

- Electrons are pushed through wires by a potential difference.
- Electrons collide with metal ions making them vibrate more.
- This makes the wire hotter and makes it harder for the electrons to move increasing the resistance.

The I-V characteristics of a resistor, bulb and diode look like this.



What affects the resistance of a thermistor?

Thermistors, and LDRs are components whose resistance is not constant. They are used as sensors in control circuits.



How can we use resistors to switch a circuit on and off?

Potential divider circuits

- When two resistors are in series the potential difference of the battery is shared between them.
- If the resistances are different then the bigger resistor takes a bigger share of the potential difference.
- In a control circuit one of the resistors is a sensor like an LDR or a thermistor.
- As the resistance of the sensor changes it takes a takes a bigger or smaller share of the potential difference.
- The changing potential difference across a resistor can be used to switch another circuit on or off. Examples are:
- Street lights use LDRs to turn on in the dark and go off in the morning.
- Thermostats use thermistors to switch heaters on when it gets cold and off again when it gets warmer.

What is alternating current?

- Energy is transferred to our homes by electric current. We call this mains electricity.
- Power stations and renewable energy resources generate electric current.
- Electric current is carried all over the country by a network of cables called the national grid.
- Mains electricity has a higher potential difference, UK mains = 230V
- Mains electricity uses alternating current, UK mains = 50Hz ac.

Mains sockets provide alternating current, ac.

- The potential difference is constantly changing from positive to negative.
- The current constantly changes direction.



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Science Homework 2

Try to answer all of these key knowledge questions. Then check your answers using the answer page. These are some of the questions that will be in the knowledge quizzes and the end of term tests.

Key knowledge question	Your answer
How is resistance defined?	
If resistance in a circuit increases	
what happens to the current?	
In a circuit, potential difference is	
12volts; resistance is 6 ohms, what	
is the current?	
Voltage is the unit of?	
What formula links potential	
difference, current and resistance?	
What is current?	
What is the potential difference of a	
UK plug socket?	
What is the unit of current?	
What is the unit of potential	
difference?	
What is the unit of resistance?	
What meter is used to measure	
potential difference?	

Why do plugs have three wires?

Devices are connected to the mains with a three pin plug. The three pins connect to three wires; live, neutral and earth.

- The live wire carries the 230V ac potential difference from the mains.
- The neutral wire completes the circuit and carries current back to the supply.
- The earth wire is for safety and stops an appliance from becoming live if there is a fault.

For easy identification the three wires are colour coded:

- The live wire is coloured brown.
- The neutral wire is coloured blue.
- The earth wire is coloured green and yellow.

The earth wire connects to the metal parts of an appliance.

- If the appliance becomes live then there is a potential difference of 230V between the metal parts and the earth wire.
- Electric current will flow through the earth wire and not through you.
- The large current will blow the fuse and turn off the appliance to make it safe.

How do we calculate the power transferred by an appliance?

The power of a device

The power of a device is the Energy that it transfers per second. A more powerful device is brighter, louder, faster or hotter than a less powerful one.

Power is measure in watts, W or kilowatts, kW.

The energy transferred by a device is given by:

Energy = power X time E = P x t

Why are transformers needed in the national Grid?

Power is delivered from power stations to our homes by the National Grid.

The National Grid is the network of cables, pylons and transformers that distribute electricity around the country.

Transformers step-up (increase) and step-down (decrease) the potential difference so that power is not lost in the transmission cables. This makes transmission **more efficient**.



How to get the most out of your knowledge organiser:

- To get the most use out of the knowledge organisers you should be learning sections and then selftesting.
- There are several different things you can do
 - Look, cover, write, check, correct
 - Read through the organisers
 - Mind maps
 - Key spellings
 - Make a glossary
 - Missing out key words
 - Questions/answers answers/questions
 - Flash cards
 - Revision clock learning
 - Mnemonics

Science Learning Tools and wider study:

The Oak Academy – Online Science lessons BBC Bitesize <u>You tube channels:</u> Fuse school Ted talks Free science lessons Primrose Kitten <u>Shows on Netfilx</u> Our planet Tiny creatures A life on our planet

Some useful equations					
power = energy transferred/time					
power = work done/time					
efficiency = useful output energy transfer/total input energy transfer					
efficiency = useful power output/total power input					
charge flow = current × time	Q = 1 t				
potential difference = current × resistance	V = I R				
power = potential difference × current	P = V I				
power = (current) ² × resistance	$P = I^2 R$				
energy transferred = power × time $E = P$					

This is an example of the sort of question you might be asked about electricity.

The diagram below shows the inside of a plug.



(a) The plug is **not** wired correctly.

What should be done to connect the wires in the plug correctly?

The correctly wired plug and cable connects a washing machine to the mains electricity supply.

(b) Give the potential difference and frequency of the mains electricity supply in the UK.

The potential difference is _____ V

The frequency is _____ Hz

(c) The washing machine is switched on.

What is the potential difference between the neutral wire and the earth wire?

Potential difference = _____ V

(1)

(2)

(1)

Science Homework 2 Answers



These are some of the questions that will be in the knowledge quizzes and the end of term tests.

Key knowledge question	Your answer
How is resistance defined?	The opposition to the flow of current
If resistance in a circuit increases what happens to the current?	It decreases
In a circuit, potential difference is 12volts; resistance is 6 ohms, what is the current?	2 Amps
Voltage is the unit of?	Potential difference
What formula links potential difference, current and resistance?	V = IR, potential difference = current x resistance
What is current?	The rate of flow of charge
What is the potential difference of a UK plug socket?	220 – 240 volts
What is the unit of current?	Amps (A)
What is the unit of potential difference?	Volts (v)
What is the unit of resistance?	Ohms (Ω)
What meter is used to measure potential difference?	A voltmeter

Science Homework 3

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Try to answer all of these key knowledge questions. Then check your answers using the last page. These are some of the questions that will be in the knowledge quizzes and the end of term tests.

Key knowledge question	Your answer
Define a compound.	
What does the mass number of an atom represent?	
What are the charges of protons, neutrons and electrons?	
What is the plum pudding model of the atom?	
What are the properties of the elements in group 0?	
State the function of arteries and describe their adaptations	
State the function of veins and describe their adaptations	
Where is the enzyme amylase made and what does is do?	
Where is the enzyme lipase made and what does is do?	
What is the purpose of digestion?	
What are the products of digestion used for?	

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The Periodic Table of Elements

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* The Lanthanides (atomic numbers 58 – 71) and the Actinides (atomic numbers 90 – 103) have been omitted.

Relative atomic masses for Cu and CI have not been rounded to the nearest whole number.

Insert for GCSE Chemistry (8462), Combined Science: Trifogy (8464), and Combined Science: Synergy (8465) papers v1

Science Homework 3 Answers



These are some of the questions that will be in the knowledge quizzes and the end of term tests.

Key knowledge question	Your answer						
Define a compound.	Compounds contain two or more elements chemically combined (bonded) in a fixed ratio						
What does the mass number of an atom represent?	The number of protons and neutrons						
What are the charges of protons, neutrons and electrons?	Protons have a positive charge, neutrons have a neutral charge, electrons have a negative charge						
What is the plum pudding model of the atom?	The plum pudding model of the atom is a ball of positive charge with negative electrons embedded in it.						
What are the properties of the elements in group 0?	They are unreactive, do not easily form molecules and have low boiling points.						
State the function of arteries and describe their adaptations	Arteries, carry blood away from the heart, thick elastic and muscular walls to withstand high pressure						
State the function of veins and describe their adaptations	Veins, carry blood towards the heart, contain valves to prevent back flow						
Where is the enzyme amylase made and what does is do?	Made in the salivary glands, pancreas and small intestine -> Amylase digests (breaks down) starch into sugar (glucose)						
Where is the enzyme lipase made and what does is do?	Made in the pancreas and small intestine -> Lipase digests (breaks down) fats into fatty acids and glycerol						
What is the purpose of digestion?	Break down of large insoluble molecules into small soluble molecules so that they can be absorbed into the bloodstream.						
What are the products of digestion used for?	To build new molecules and glucose is used in respiration						