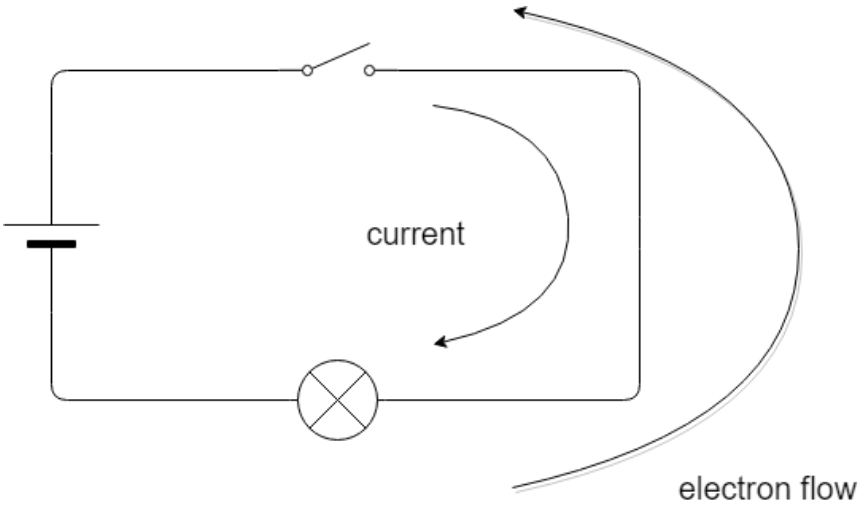
SALTUS
Prepare to meet the world.

IGCSE Physics



Unit 6 – Electricity

Name: .....

Class: ..... Date:.....

Summary

This topic covers the basics of electricity and how it behaves and works. We tend to take electricity for granted and without a doubt it is become almost essential for our modern way of life, to the extent that it would be hard to imagine a world without it. One of the major factors that drove the modernization of the world was the invention of mains electricity and the electric light bulb. Despite the huge importance of electricity in everyday life, it is surprisingly how poorly understood it is!

	Objectives : Students will be assessed on their ability to
Basic Circuits	• explain why a series or parallel circuit is more appropriate for particular applications, including domestic lighting • understand that the current in a series circuit depends on the applied voltage and the number and nature of other components
Charge and Current	• understand that current is the rate of flow of charge • know and use the relationship between charge, current and time : charge = current × time, $Q = I\,t$ • know that electric current in solid metallic conductors is a flow of negatively charged electrons
Voltage	• understand that voltage is the energy transferred per unit charge passed and that the volt is a joule per coulomb • be able to use the equation, $E = Q\,V$
Ohm's Law	• know and use the relationship between voltage, current and resistance: voltage = current × resistance, $V = I\,R$
Series and Parallel Circuits	• Understand why current is conserved at a junction in a circuit • Calculate the current, voltage and resistance of two components in a series circuit • Know that the voltage across two components is the same in a parallel circuit.
Resistance of a Wire	• investigate the relationships between resistance and other key factors for a piece of constantan wire
Changing Resistance	• describe how current varies with voltage in resistors and metal filament lamps and how this can be investigated experimentally • understand that a current in a resistor results in the electrical transfer of energy and an increase in temperature • describe the qualitative effect of changing resistance on the current in a circuit
Semi-conductors	• describe how current varies with voltage in diodes, and how this can be investigated experimentally • describe the qualitative variation of resistance of LDRs with illumination and of thermistors with temperature • know that LEDs can be used to indicate the presence of a current in a circuit

Power	• know and use the relationship power = current × voltage, $P = I\ V$ and apply the relationship to the selection of appropriate fuses
Heating and Energy	• know some of the different ways in which electrical heating is used in a variety of domestic contexts • use the relationship between energy transferred, current, voltage and time: • energy transferred = current × voltage × time, $E = I\ V\ t$
Electrical Safety	• understand the hazards of electricity including frayed cables, long cables, damaged plugs, water around sockets, and pushing metal objects into sockets • understand the uses of insulation, double insulation, earthing, fuses and circuit breakers in a range of domestic appliances
AC/DC	• understand the difference between mains electricity being alternating current (a.c.) and direct current (d.c.) supplied by a cell or battery
Static Electricity	• identify common materials which are electrical conductors or insulators, including metals and plastics • describe experiments to investigate how insulating materials can be charged by friction • explain that positive and negative electrostatic charges are produced on materials by the loss and gain of electrons • understand that there are forces of attraction between unlike charges and forces of repulsion between like charges
Uses and Dangers of Static Electricity	• explain electrostatic phenomena in terms of the movement of electrons • explain the potential dangers of electrostatic charges, e.g. when fuelling aircraft and tankers • explain some uses of electrostatic charges, e.g. in photocopiers and inkjet printers

Important information

The idea behind this booklet is to keep all your notes and revision material for this topic in one ordered place – and avoid 'lost' notes and papers etc. It is expected that you make additional notes and aide memoires wherever you can, as would be the case at college. The booklets will be collected on a roughly weekly basis and certain aspects will be graded. The quality of the overall notes will also be assessed at appropriate intervals. Of course, if students wish to do more than this, they are encouraged to do so – and this will obviously be reflected in the grade achieved.

There are other resources available online via my website, www.islandphysics.com. Any additional resources that students may discover, can be emailed to me so that they can be included on the site.

PW – Update: August 2021

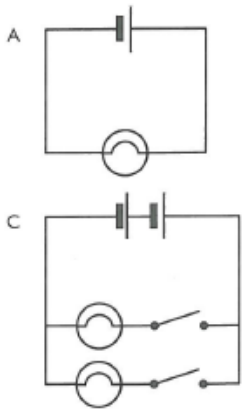
1 – Basic Circuits

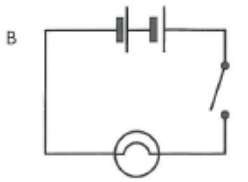
Objectives:

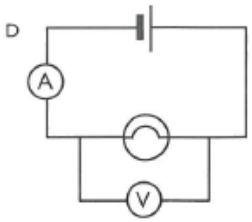
- explain why a series or parallel circuit is more appropriate for particular applications, including domestic lighting
- understand that the current in a series circuit depends on the applied voltage and the number and nature of other components

CW 6.1 - Basic Circuit Diagrams

1. Describe the following simple circuits in words (4)





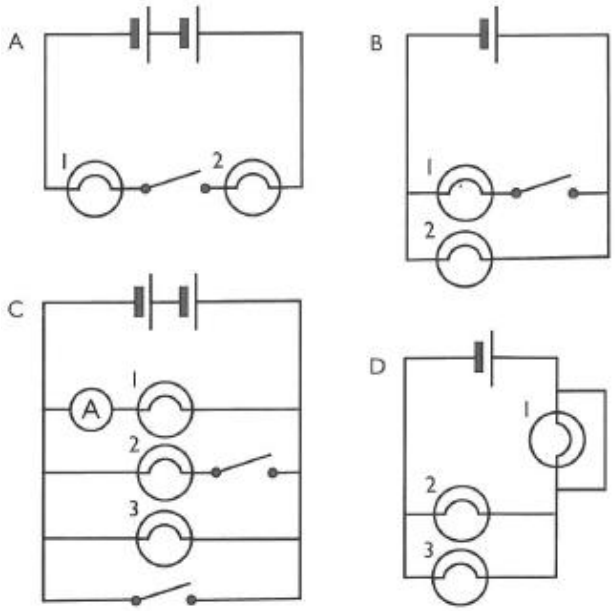


2. Draw simple circuit diagrams for the following:

a) two bulbs in a series circuit with two cells (2)
b) a bulb with one cell and a variable resistor (2)
c) an ammeter in series with a resistor and a cell, with a voltmeter in parallel across the resistor (2)

d) two bulbs in parallel with a single cell, with an open switch in the main loop of the circuit (2)

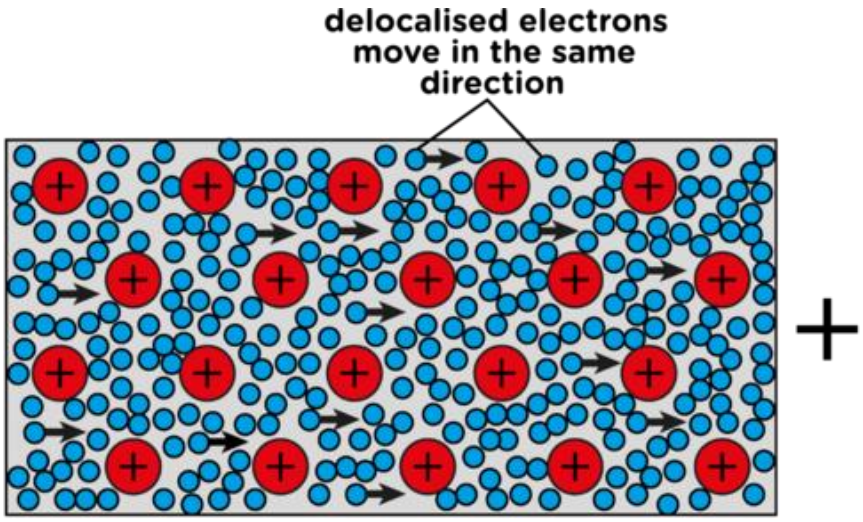
3. Circle the bulb(s), if any, that would light up in the circuits below (1):



2 – Charge and Current

Objectives:

- understand that current is the rate of flow of charge
- know and use the relationship between charge, current and time : charge = current × time, $Q = I\,t$
- know that electric current in solid metallic conductors is a flow of negatively charged electrons

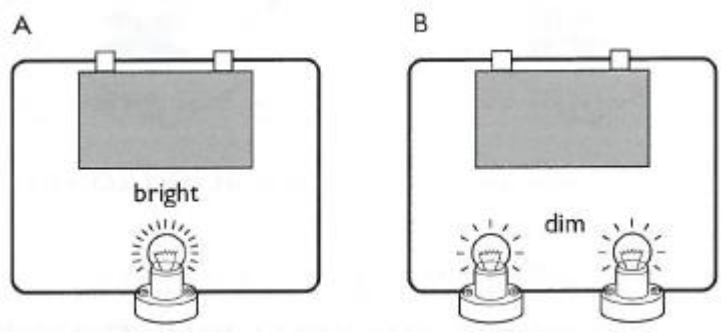


CW 6.2 - What Else is Involved?

1. Electrons need an energy output from some kind of 'electron pump' to make them flow around a circuit. Link the following 'electron pumps' to the energy source that drives them. (2)

'Electron Pump'	Energy Source
Generator	Sound
Battery	Light
Microphone	Movement
Solar Cell	Chemical

2. Look at the diagrams below. Light bulbs are made with a filament coil of high resistance wire.



a) Explain why the bulb in circuit A gets hot when electricity passes through it. (1)

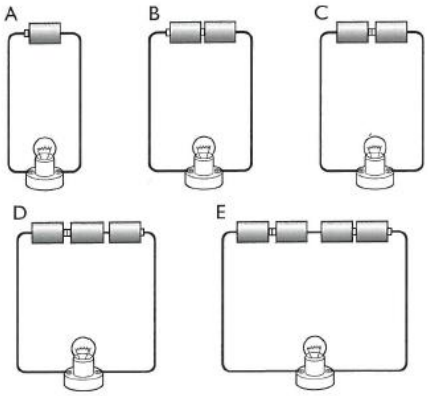
b) The bulbs in circuit B are the same as in circuit A. Is more or less current flowing through circuit B than circuit A? How can you tell? (2)

c) If a third bulb was added into circuit B, would the brightness of the bulbs increase or decrease? Explain your answer.(2)

d) If a second battery was added to circuit A, would the bulb get brighter or dimmer? Explain your answer. (2)

3. A single cell provided a potential difference (voltage) of about 1.5 V. Cells can be stacked up to increase the voltage, but if they are connected the wrong way around they can cancel each other out. (2)

a) What voltage will be provided in each of the circuits A-E?



Circuit	Voltage (V)
A	
B	
C	
D	
E	

b) How many of these cells would there be in a 12 V battery? (1)

3 - Voltage

Objectives:

- understand that voltage is the energy transferred per unit charge passed and that the volt is a joule per coulomb

CW 6.3 - Electric Current

1. An electrical circuit can be compared to a system of water pipes. Choose from the list below to give the electrical equivalent for each part of a water system and explain why they are similar. (4)

wires	charge	current	switch	flow	battery	bulb	resistor

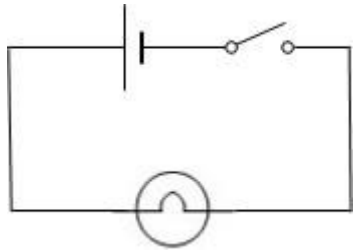
a) The ..... is like a pump because

b) The ..... are like the pipes because

c) The ..... is like the water because

d) The ..... is like a narrow pipe because

2. Ryan and Sam are asked to explain what the battery in the circuit below is doing to make the bulb light up.



Ryan says “The battery supplies charge, and some of it is used in the bulb to make light.”

Sam says “The battery supplies energy amd some of it becomes light in the bulb.”

Who is right? Explain your answer. (2)

4 – Ohm's Law

Objectives:

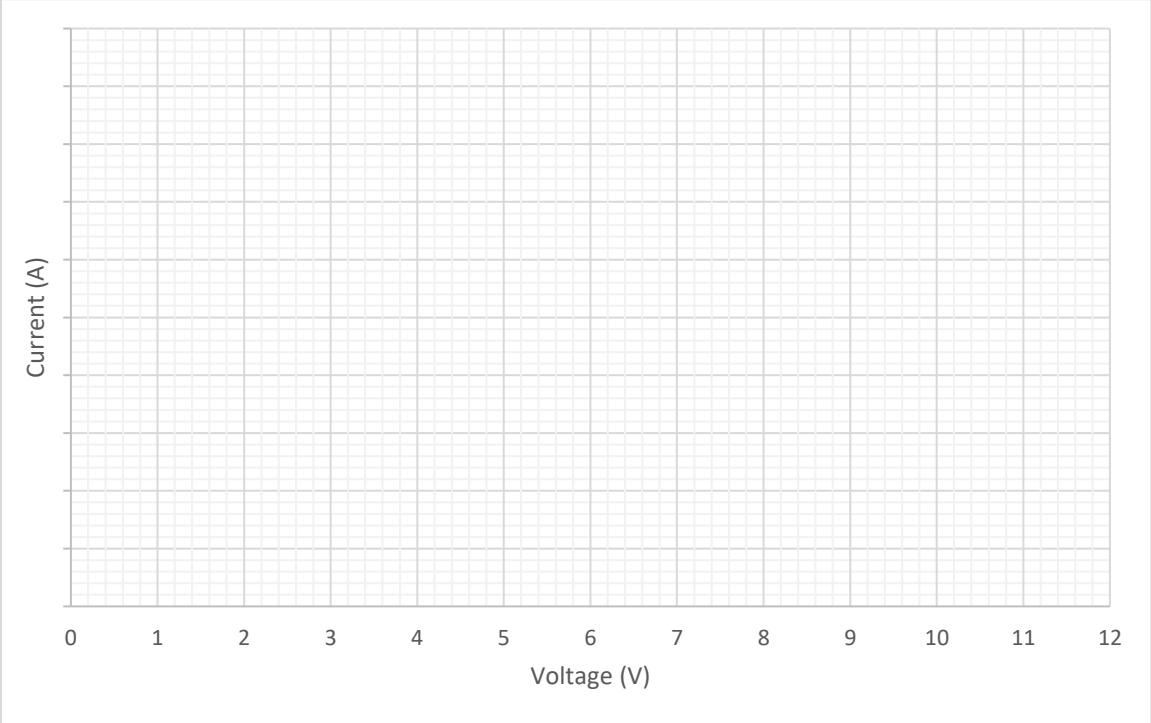
- know and use the relationship between voltage, current and resistance: voltage = current × resistance, $V = I \times R$

In your own words state what is meant by:

Current	
Voltage	
Resistance	

LAB 6.1 – Ohm's Law

RESISTOR		
V (V)	I (A)	R (Ω)
2		
4		
6		
8		
10		
12		



Plot a graph of current against the voltage (4). Explain the results. (2)

CW 6.4 - Measuring Electricity

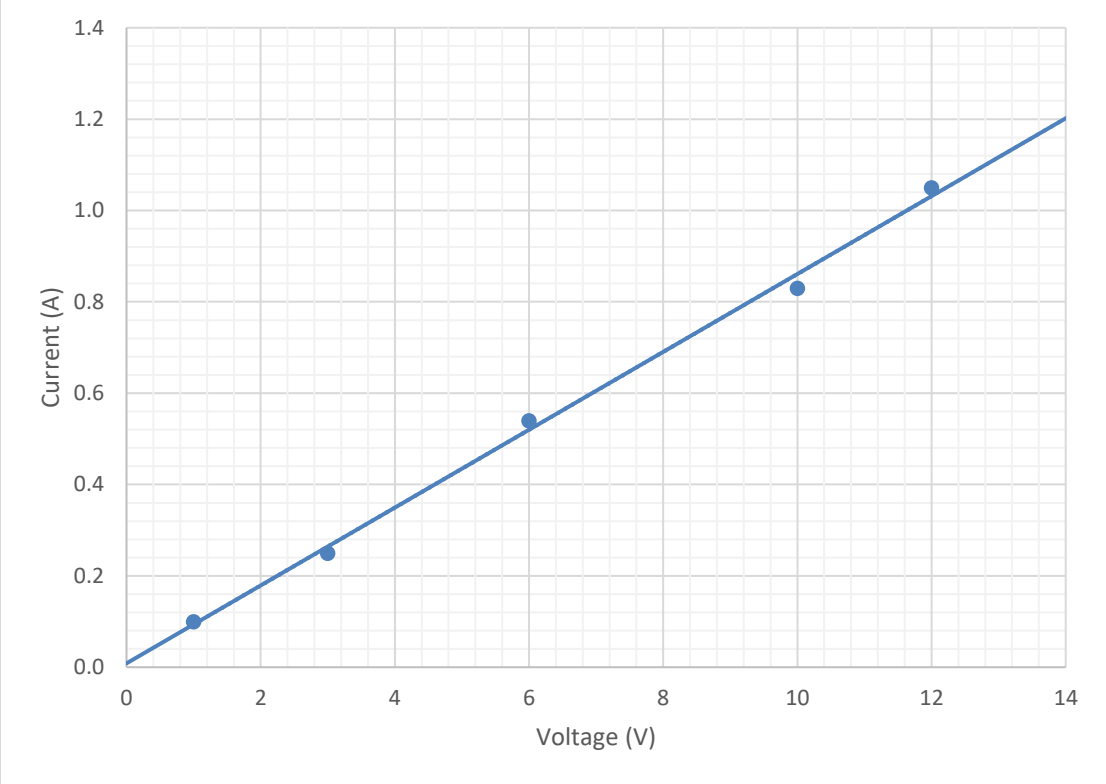
1. In a circuit, what would happen to the size of the current if you:

a) doubled the voltage? (1) .....

b) doubled the resistance? (1) .....

c) multipled the resistance by 10?(1) .....

2. The graph below shows how the current in a circuit varies as the voltage is increased.



a) Describe the relationship between the current and the voltage. (1)

.....

.....

b) What is the current at 6V? ..... (1)

c) What would be the current at 8 V? ..... (1)

d) What current would you expect at 14 V? ..... (1)

e) What voltage gives a current of 1 A? ..... (1)

f) What is the resistance of this circuit? Show your calculations. (3)

.....

.....

.....

3. A teacher has wired a talking toy bear up to a circuit. There are 30 V across it and the current is 6 A.

a) What is the resistance of the bear? (1)

.....

.....

b) The teacher replaces the battery with a 12 V one. What is the current now? (1)

.....

.....

4. A stereo has 120 V across it.

a) What is the resistance of the stereo if there is a current of 5 A? (2)

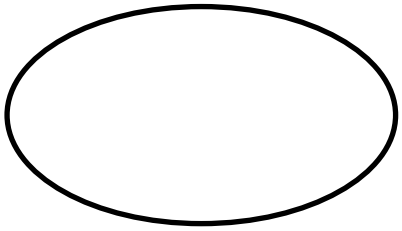
.....

.....

b) If the current through the stereo increases to 8 A (louder), what must the new resistance? (2)

.....

.....



5 – Series and Parallel Circuits

Objectives:

- Understand why current is conserved at a junction in a circuit
- Calculate the current, voltage and resistance of two components in a series circuit
- Know that the voltage across two components is the same in a parallel circuit.

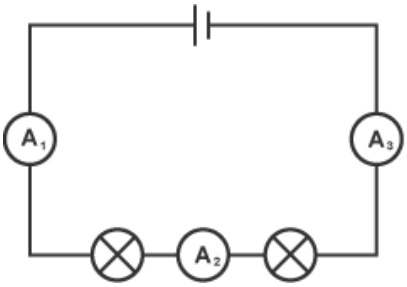
AP Physics Moment

Kirchhoff's Branching Rule: The total current entering any junction must equal the total current leaving that junction. (the direct consequence of the conservation of charge).

Kirchhoff's Loop Rule: The total voltage gained in any given loop of a circuit must equal the voltage dropped across the components in that loop. (the direct consequence of the conservation of energy)

LAB 6.2 - Voltage and Current in Series and Parallel Circuits

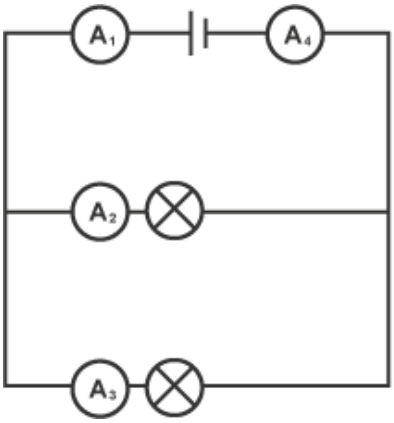
Current in a SERIES circuit



Position	Current (A)
A_1	
A_2	
A_3	

What do these results tell you about the current at different points in a series circuit? (2)

Current in a PARALLEL circuit



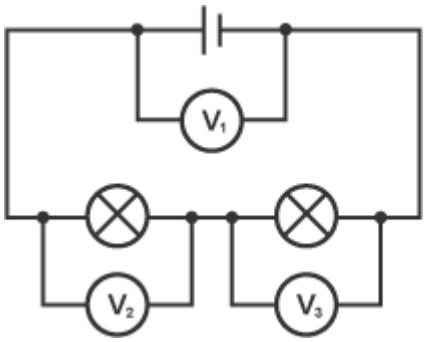
Position	Current (A)
A_1	
A_2	
A_3	
A_4	

What do these results tell you about the current at different points in a parallel circuit? (2)

Important: ammeters must be connected in series – so the current flows through them.

Voltmeters are connected in parallel – to measure the voltage 'across' a component.

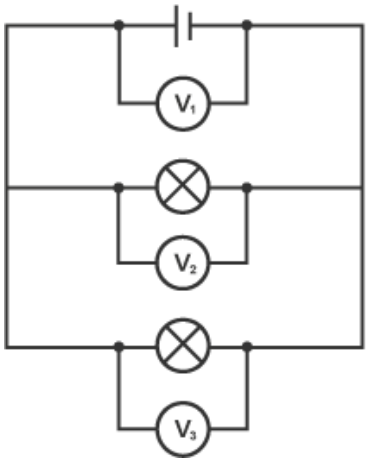
Voltage in a SERIES circuit



Position	Voltage (V)
V_1	
V_2	
V_3	

What do these results tell you about the voltage at different points in a series circuit? (2)

Voltage in a PARALLEL circuit



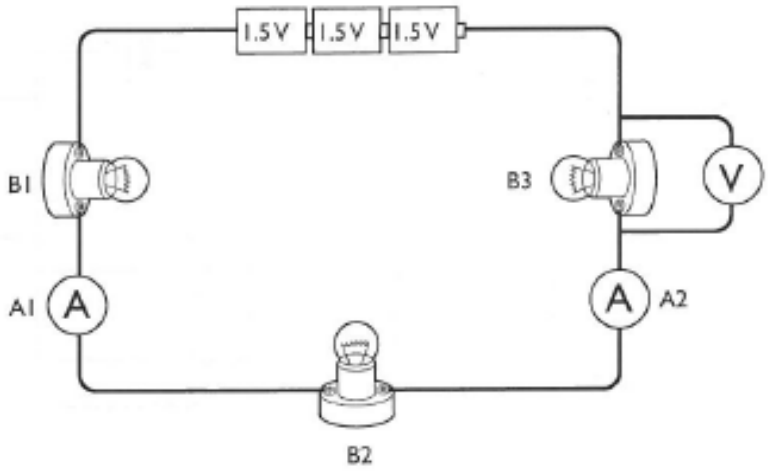
Position	Voltage (V)
V_1	
V_2	
V_3	

What do these results tell you about the voltage at different points in a parallel circuit? (2)

Use these results to explain why the bulbs are brighter in a parallel circuit and dimmer in a series circuit (2)

CW 6.5 - Questions on Series and Parallel Circuits

1. Look at the circuit below:



a) What is the total voltage from the three cells? ..... (1)

b) If ammeter A1 reads 0.5 A, what is the current at A2? ..... (1)

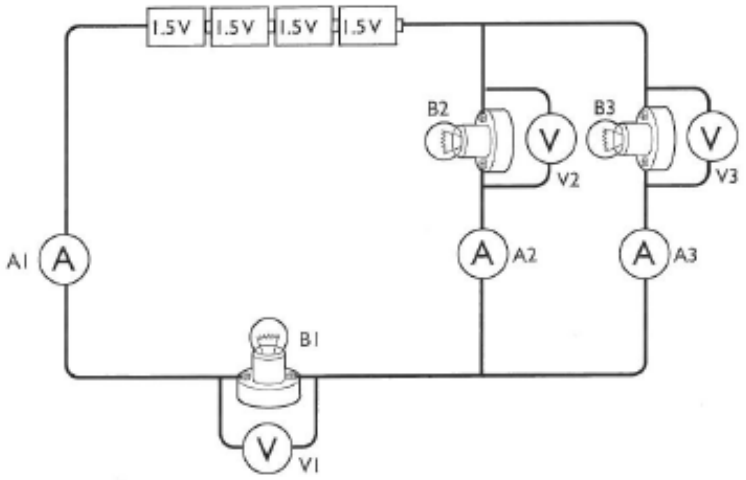
c) The three bulbs are identical and B1 has a resistance of 3 Ω.

What is the total resistance of the three bulbs in the circuit? ..... (1)

d) The voltmeter V reads 1.5 V. What would be the reading be across bulb B1? ..... (1)

e) A current of 0.5 A flows through bulb B3. Calculate its resistance. Show your calculations. (3)

2. In the diagram below, B1, B2 and B3 are identical 4 Ω bulbs.



a) Is this a series or parallel circuit? ..... (1)

b) If A1 reads 1.0 A, what is the current through A2? ..... (1)

c) What is the current through A3? ..... (1)

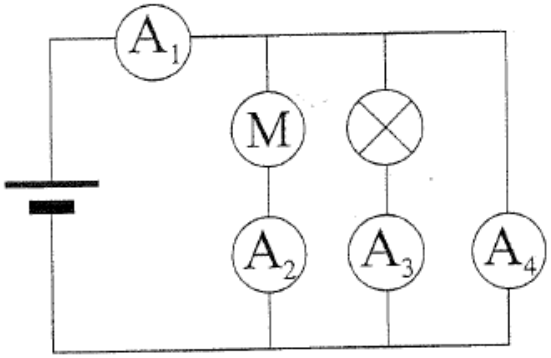
d) What is the total voltage provided by the four cells? ..... (1)

e) Voltmeter V2 reads 2.0 V. What do V3 and V1 read? V3 = ... and V1 = ... (1)

f) Is the combined resistance of bulbs B2 and B3 larger, smaller or equal to that of bulb B1? Explain…

(2)

3. The diagram below shows a parallel circuit with a bulb, motor and four ammeters.



a) Explain what is meant by a parallel circuit. (1)

b) (i) Which ammeter will show how much current is flowing through the whole circuit? (1)

.....

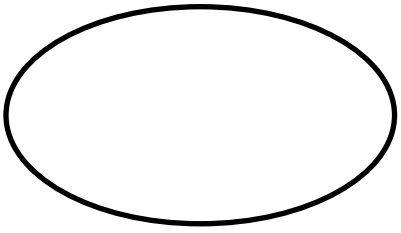
(ii) Which ammeter will show how much current is flowing through the bulb? (1)

.....

c) (i) Which ammeter would have the highest reading? Explain your answer. (2)

(ii) Would you expect ammeters A_2, A_3 and A_4 to read the same? Explain. (2)

(iii) Which of the 3 ammeters would you expect to have the highest reading? Explain your answer. (2)



6 – LAB 6.3 - Investigating the Resistance of a Wire

Objectives:

- investigate the relationships between resistance and other key factors for a piece of wire

Notes:
Any given length of wire has a specific resistance.

Consider the following :

- What are the variables that could affect the resistance of a length of wire?
- How will you measure the resistance?
- How will you ensure that the tests are fair?
- What range of values could you range between with your variables?
- How can you plot the data to best show your results?

The work should be completed on your laptop and presented as a WORD document, with full data tables and graphs included (either by hand or pasted in from EXCEL)
Please save your final version as a .pdf file with your name in the filename.
(e.g. joe_bloggs_resistance_lab.pdf)

Lab Report Format (marks):

- Name, Date, Suitable Title! (1)
- Aim (1)
- Prediction (2)
- Method (2)
- Circuit Diagram (2)
- Data (Results) (2 per table)
- Graphs (4 per graph)
- Conclusion (2)
- Evaluation (2)

Given the scope of this investigation, it is expected that your report will run to quite a few pages.

Space for lab notes:

7 – Changing Resistance

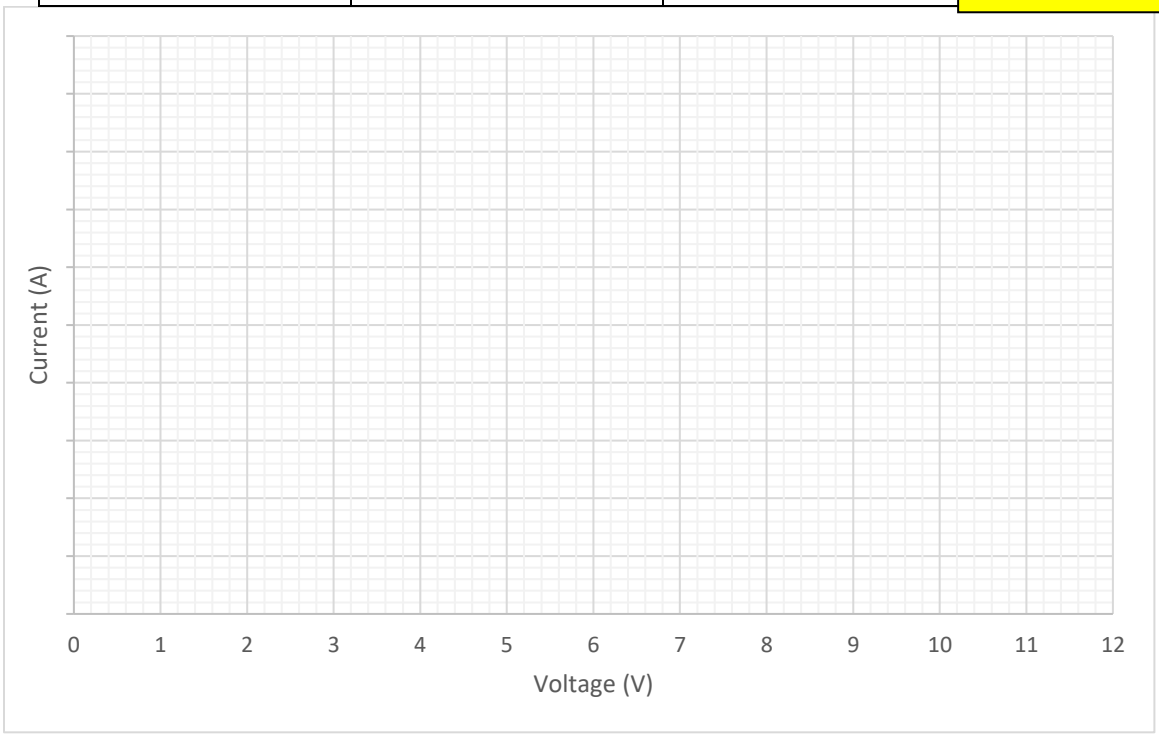
Objectives:

- describe how current varies with voltage in resistors and metal filament lamps and how this can be investigated experimentally
- understand that a current in a resistor results in the electrical transfer of energy and an increase in temperature
- describe the qualitative effect of changing resistance on the current in a circuit

LAB 6.4 – Resistance of a Filament Bulb

FILAMENT LAMP		
V (V)	I (A)	R (Ω)
2		
4		
6		
8		
10		
12		

Compare with page 16



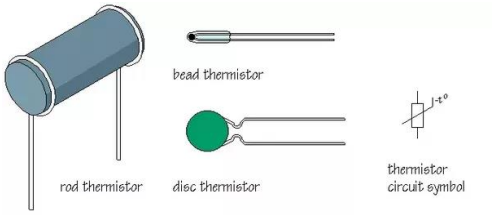
Plot a graph of resistance against the voltage (4). Explain the results. (2)

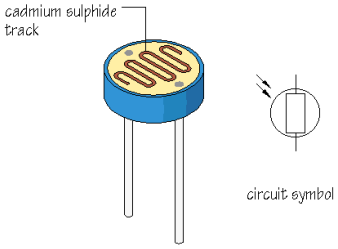
8 – Semi-conductors

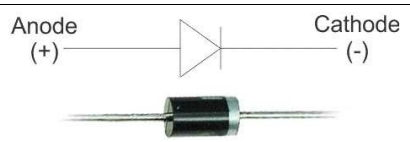
Objectives:

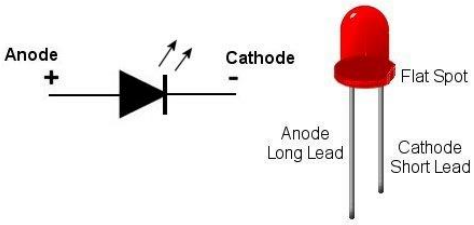
- describe how current varies with voltage in diodes, and how this can be investigated experimentally
- describe the qualitative variation of resistance of LDRs with illumination and of thermistors with temperature
- know that LEDs can be used to indicate the presence of a current in a circuit

Lab Notes:






Anode
(+)
Cathode
(-)


Anode
+
Cathode
-
Flat Spot
Anode
Long Lead
Cathode
Short Lead

LEARN THESE!

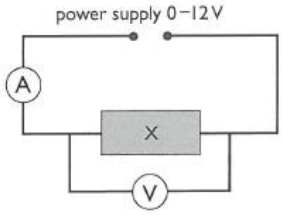
CW 6.6 - Questions on Resistance

1. What is the main characteristic of a diode? (1)

.....

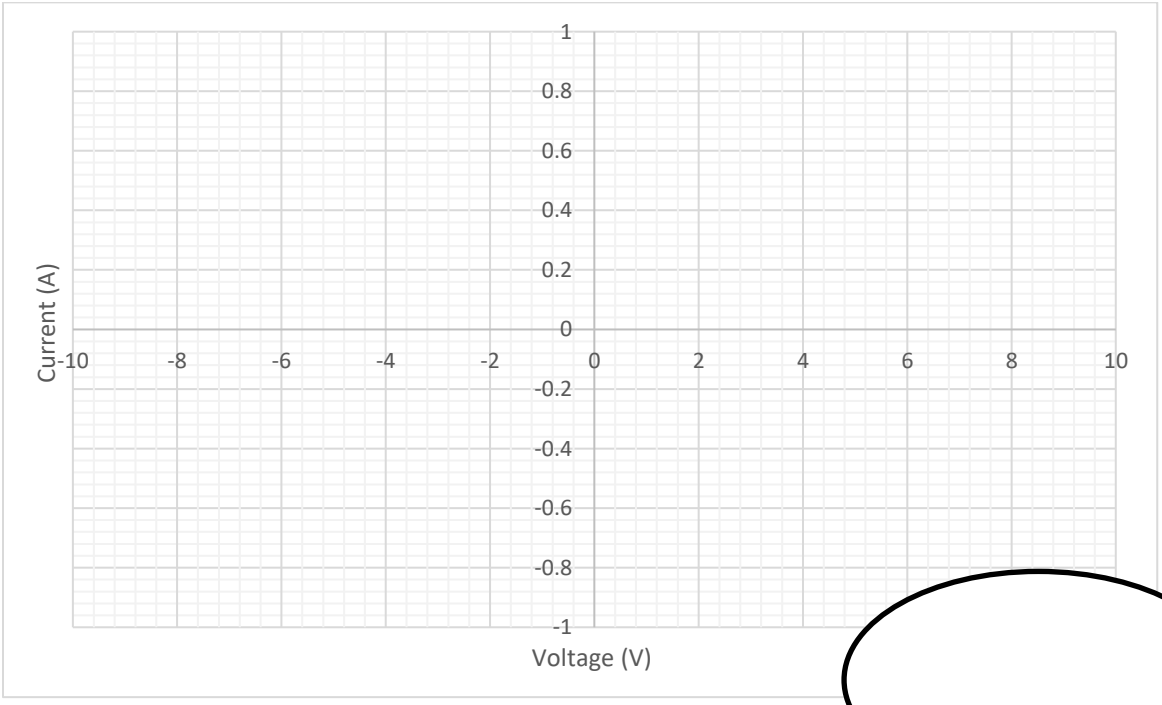
.....

2. A circuit was used to test both a lamp and a diode. Each component was placed in position X. Each component was connected first one way and then reconnected the other way around. The voltage was varied and the current recorded.



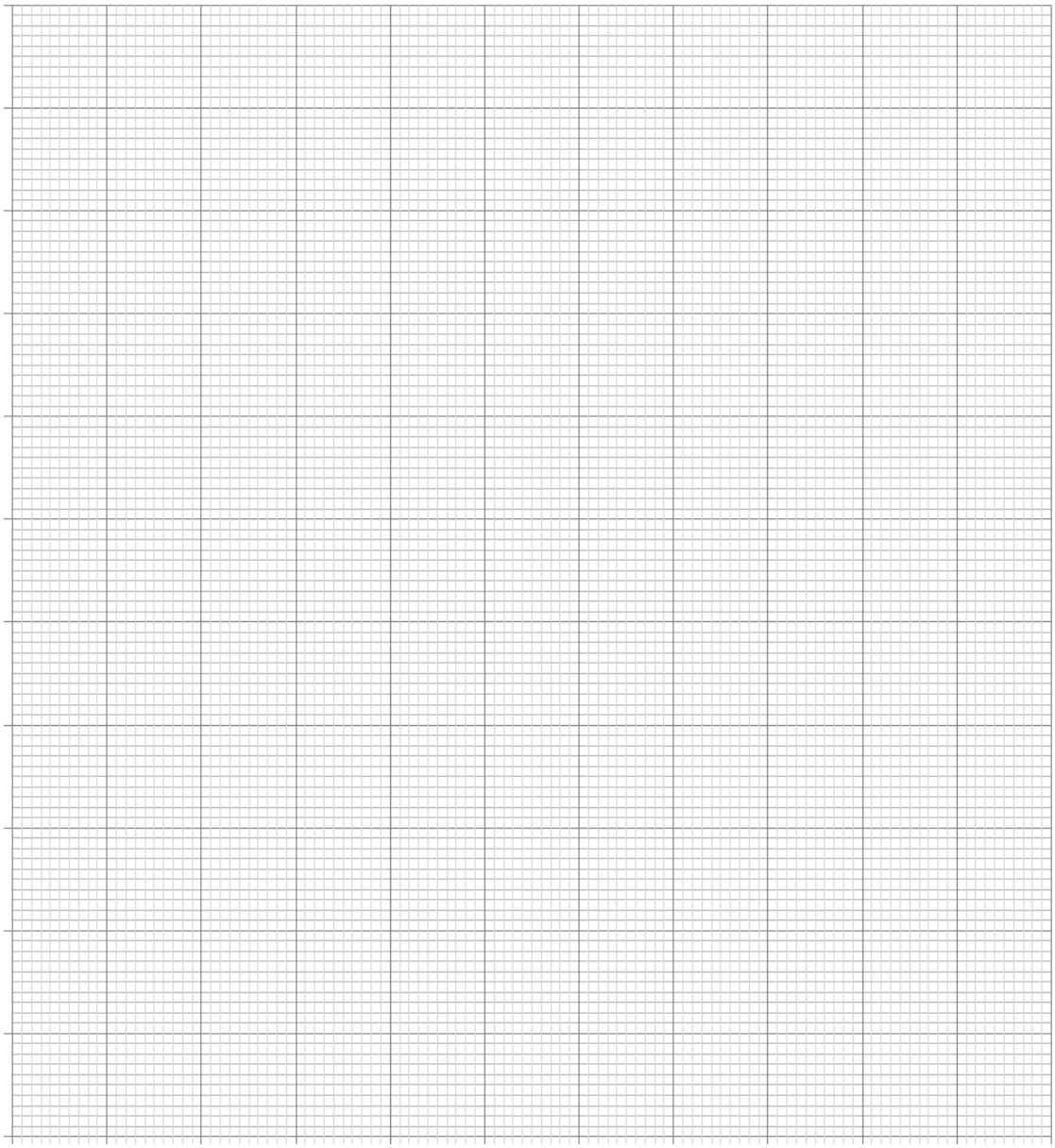
Voltage (V)	Current in component A (A)		Current in component B (A)	
	Normal	Reversed	Normal	Reversed
0	0	0	0	0
2	0.4	-0.4	0.2	0
4	0.7	-0.7	0.4	0
6	0.87	-0.87	0.6	0
8	0.95	-0.95	0.8	0
10	1.0	-1.0	1.0	0

a) Plot the results for the two components below (use the same axes) (2)



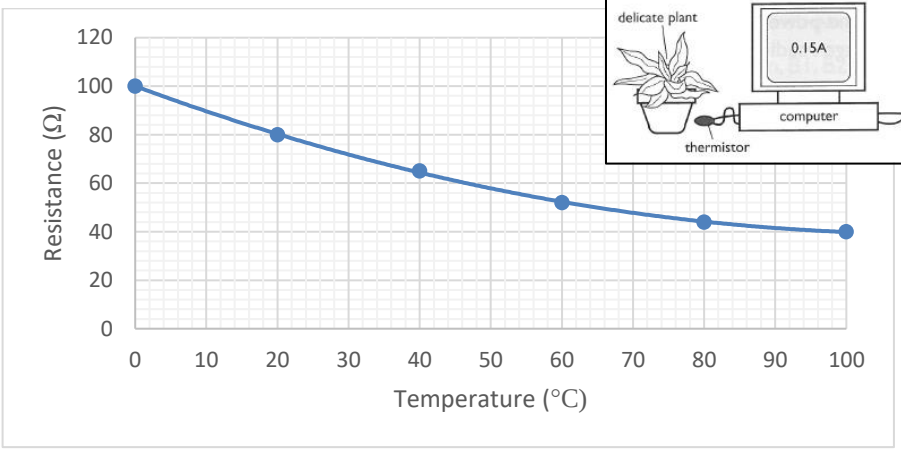
LAB 6.5 - Thermistor

Temperature (˚C)	Resistance (Ω)	Temperature (˚C)	Resistance (Ω)



CW 6.7 - Using Variable Resistance

1. A thermistor's resistance varies with temperature as shown below. This property can be used to control the temperature, for example, in a greenhouse to prevent frost damage for plants.



a) What is the resistance at 75 °C? (1) .....

b) At what temperature is the resistance 85 Ω? (1) .....

c) What current would flow through the thermistor at 0 °C if it was connected to a 12 V battery? (2)

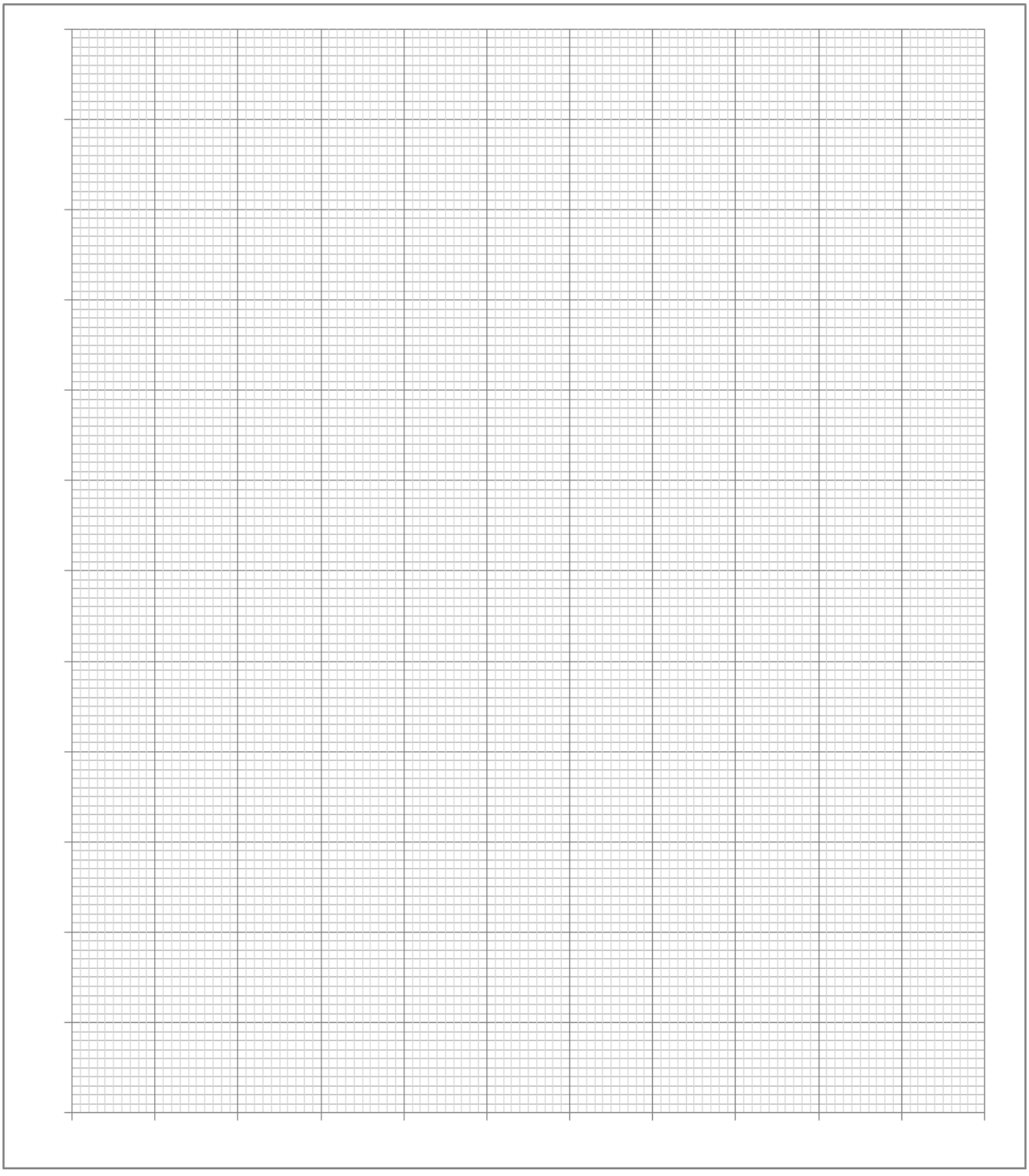
d) How would the computer know when to switch the heater on? (2)

e) If the temperature must not rise above 25 °C, how would the computer know when to switch the heater off? (2)

f) Calculate the current in the thermistor at various temperatures. (2)

Temperature (°C)	0	20	40	60	80	100
Current (A)						

g) Draw a conversion graph of current (y-axis) against temperature (x-axis) (5)



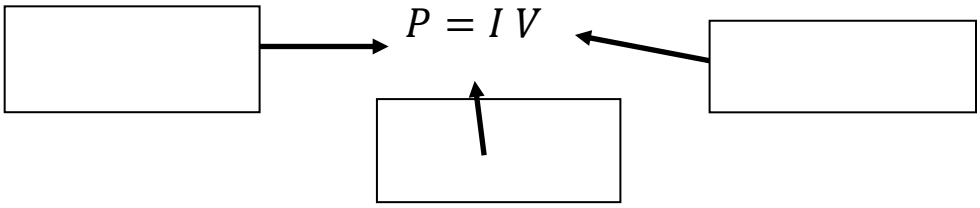
How does this question's data compare with the real thermistor data from our experiment?

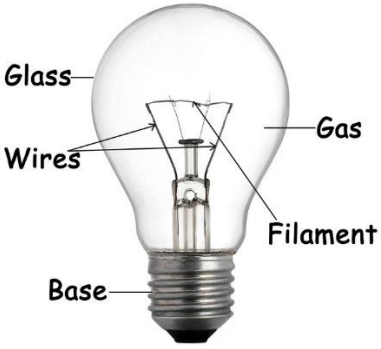
9 – Power

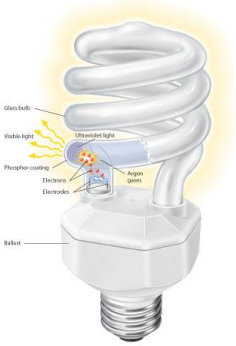
Objectives:

- know and use the relationship power = current × voltage, P = I × V and apply the relationship to the selection of appropriate fuses

Notes:








H.koenig


Eureka

CW 6.8 - Calculating Electrical Power

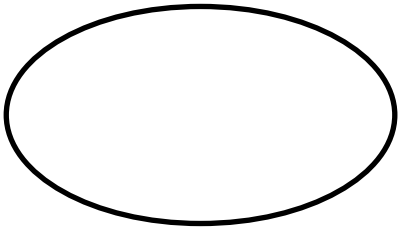
1. Complete the table below using the equation: P = I V (9)

Voltage (V)	Current (A)	Power (W)
230	10	
230	0.25	
12	5	
110		1100
24		12
1.5		6
	5	30
	3	72
	0.1	23

a) Highlight in YELLOW the lines that represent mains electricity. (1)
b) Highlight in RED the line that could represent a circuit from a boat, bike or car. (1)
c) Put an asterisk next to the US circuit. (1)
d) Which circuit could be that for a household bulb? (1)

2. In order to transfer a large amount of power a high/low current is required. (1)
3. A car battery supplies electric current of 0.5 A at a voltage of 12 V. How much energy is drawn from the battery over a 180 second period? (2)

4. A flashlight uses two 1.5 V cells in series. It is switched on for 10 minutes. During this time 360 J of energy is transferred from the cells to the bulb. Calculate the current. (2)

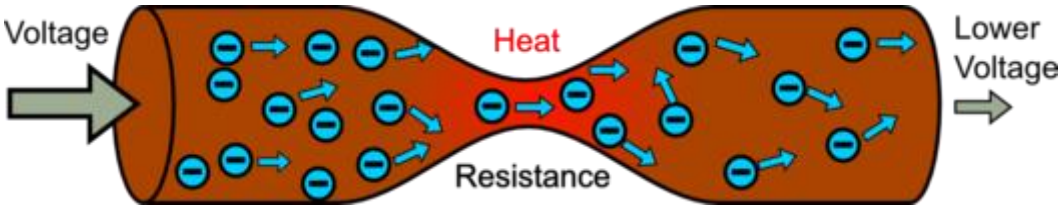


10 – Energy and Cost

Objectives:

- know some of the different ways in which electrical heating is used in a variety of domestic contexts
- use the relationship between energy transferred, current, voltage and time: energy transferred = current × voltage × time, $E = I \times V \times t$

Notes:



CW 6.9 – Energy and Power

1. A battery power lamp takes 6 hours to fully charge when connected to a 400 W power supply. This gives the lamp enough energy to last 6 hours when switched on. A mains powered lamp has a power rating of 1.6 kW.

a) If both lamps are used for 6 hours, calculate the difference in the amount of energy used. (use kWh) (2)

b) The cost of electricity in Bermuda is roughly $0.45 per kWh. Calculate the costs of using the lamps for 6 hours. (2)

2. Estimate the number of light bulbs in your house. Assume that each is 60 W. If they are left on for 5 hours per day, what would be the cost of running them for a year? (2)

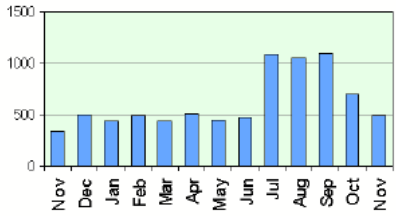
3. If it costs $5 to replace each bulb with a more efficient 10 W LED bulb, how much money would your family save over the year? (Don't forget to include the cost of buying the bulbs!) (2)

BELCO

BERMUDA ELECTRIC LIGHT COMPANY
P.O.BOX HM 1026, HAMILTON HM DX
www.belco.bm
Customer Enquiries:
Phone: (441) 299 2800
E-mail: info@belco.bm

Consumption Comparisons

	KWH	DAYS	KWH/DAY
CURRENT MONTH	492	31	15.87
PREVIOUS MONTH	701	28	25.04
SAME MONTH LAST YEAR	347	34	10.21
ANNUAL ROLLING DAILY AVERAGE			**20.75**



Electricity Usage

METER NUMBER	PREVIOUS METER READING DATE	READING	CURRENT METER READING DATE	READING	CURRENT MONTH CONSUMPTION
55267426	Oct 12 15	61415	Nov 12 15	61907	492

Charges

PREVIOUS BALANCE		$268.31
PAYMENT RECEIVED		$254.90 CR
DISCOUNT GIVEN		$13.41 CR
OUTSTANDING BALANCE		$0.00
BILLING CHARGES:		
FIRST 250 KWHS	$0.1575 per kWh	$39.38
NEXT 250 - 700 KWHS	$0.2400 per kWh	$58.08
TOTAL USAGE CHARGES		$97.46
FACILITIES CHARGE		$33.00
FUEL ADJUSTMENT	$0.1200 per kWh	$59.04
TOTAL BILLING CHARGES		**$189.50**
GROSS TOTAL		$189.50
DISCOUNT DATE AND VALUE	Nov 30	$9.47 CR
NET AMOUNT DUE		**$180.03**

4. Why do you think that the electricity usage varied so much throughout the year? (1)

5. Why does BELCO have a "fuel adjustment" charge? (1)

6. What do you think the "facilties charge" means? (1)

7. Calculate the effective total cost per kwh of electricity in Bermuda. (1)

8. Find out how much the average cost of electricity is in: a) Boston, b) London, c) Toronto. (1)

9. Why is Bermuda more expensive? (1)

11 – Electrical Safety

Objectives:

- understand the hazards of electricity including frayed cables, long cables, damaged plugs, water around sockets, and pushing metal objects into sockets
- understand the uses of insulation, double insulation, earthing, fuses and circuit breakers in a range of domestic appliances

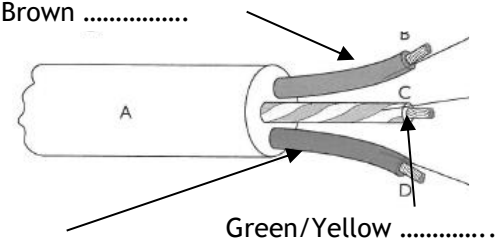
The TWO main dangers from electricity are:

1.

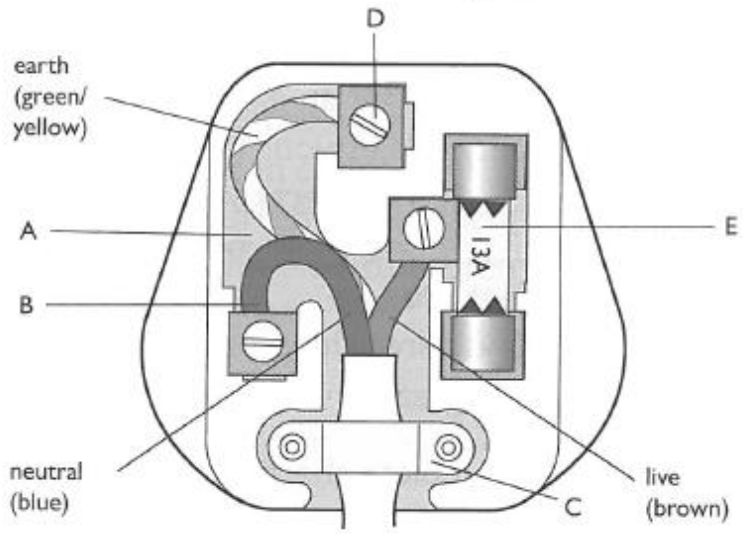
2.

CW 6.10 - Questions on Electrical Safety

1. Label the diagrams below (2)

US/CANADA/BDA	UK
Black ……..	Brown ……..  Green/Yellow …….. Blue ……
White ……	
Geen ……	

2. Label the parts of the UK plug. (3)

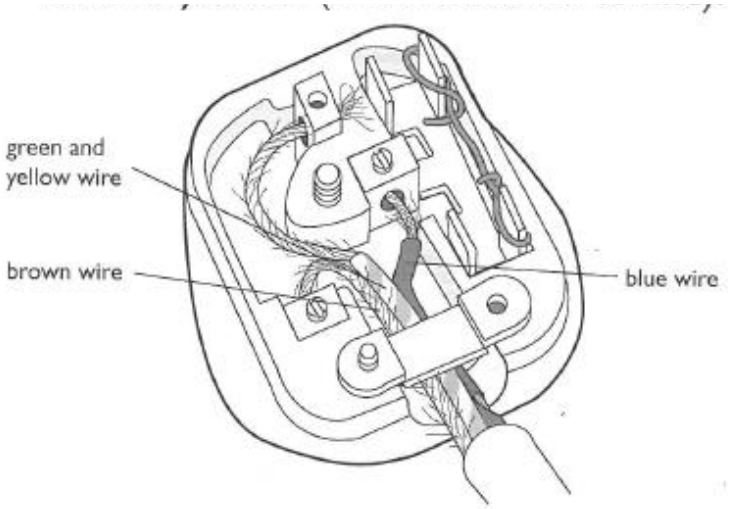


The UK plugs are much larger and more standardised than the US or European versions. They are the only ones to all carry a fuse.

3. What is the purpose of
   a) The fuse? (2)

   b) The earth wire? (2)

4. This plug has been wired up by an idiot. Label as many errors as you can – bonus if you can identify the potential consequence. (5)



WRONG AND VERY DANGEROUS

5. Mr Hooper has two types of hand drills in his workshop. They have the following information stamped on them:

Drill A	Drill B
110 V a.c. 60 Hz	18 V d.c.

a) Which of these drills is the cordless one? (1) .....

b) Explain the three terms on drill A (1)

c) Which drill needs thicker insulation? Explain (2)

d) Which drill requires an earth wire? Explain (2)

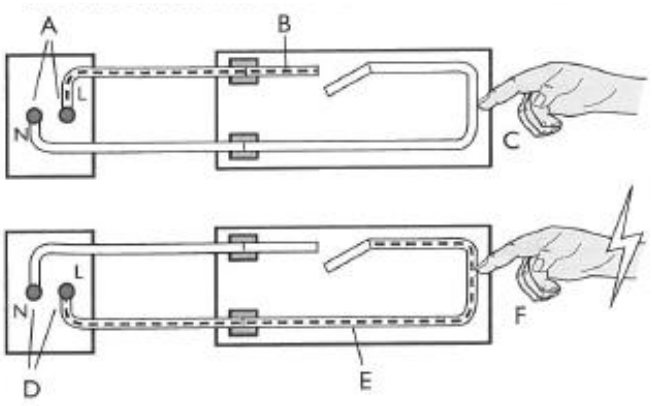
e) Which drill is safer to use in the rain? (1)

f) Saying that, is it a smart idea to use power tools in the rain? (1)

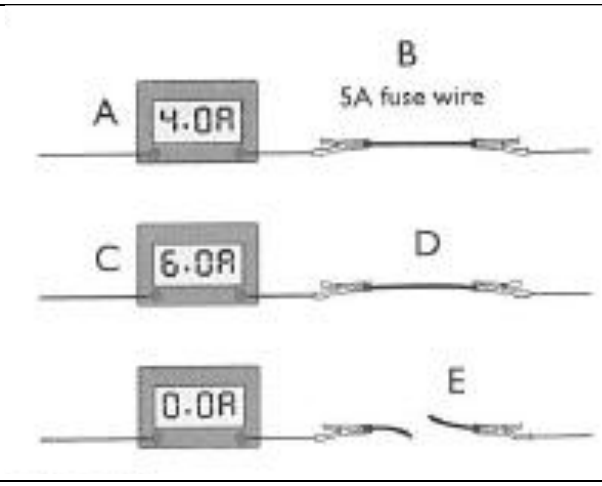
6. In Bermuda and the US, people sometimes break off the earth/ground pin from their plugs.
   a) Explain why they may want to do this? (1)

   b) Explain why this is a very dangerous thing to do. (2)

7. Annotate the following diagram to explain why it is important to not reverse the live and neutral wires in a plug. (2)



8. Fuses are connected in the live part of the circuit. If too great a current passes through them, they "blow". Label the diagram below to show how they work. (2)



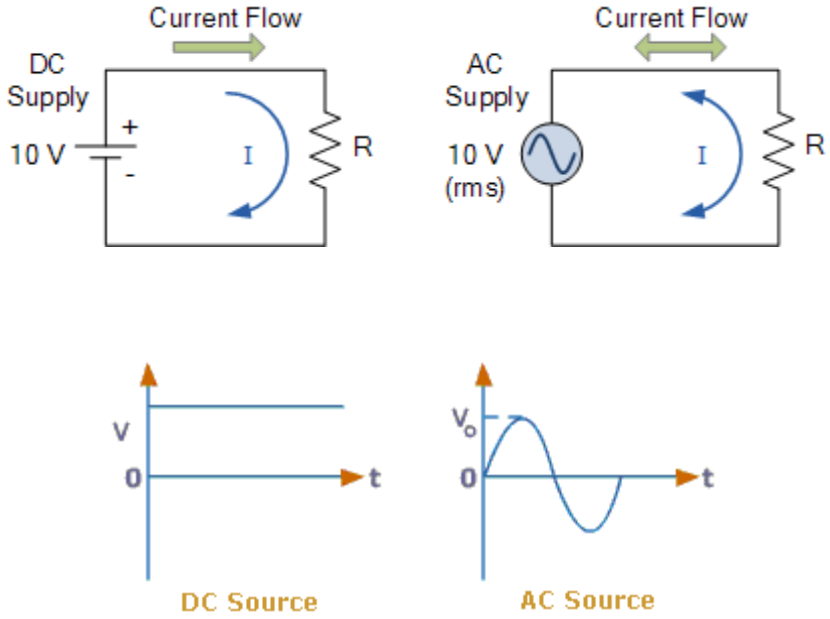
9. Give two advantages of using circuit breakers rather than fuses. (2)

12 – AC/DC

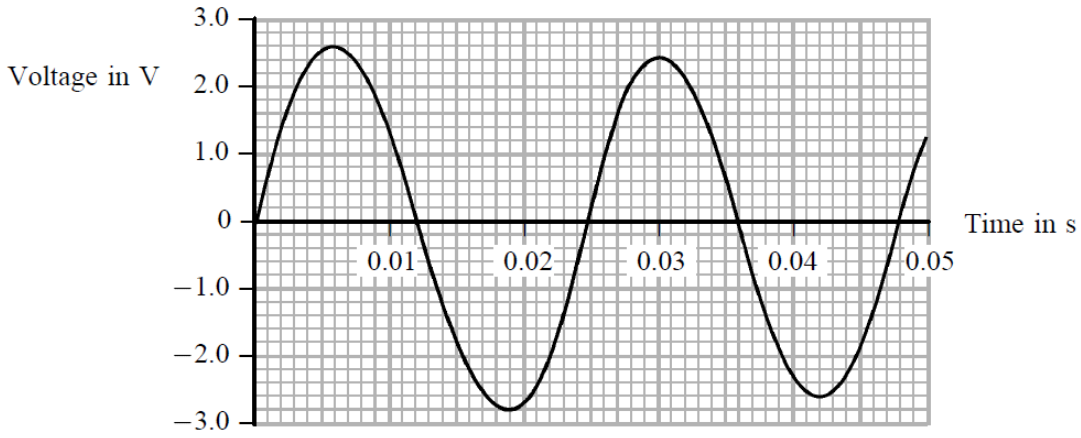
Objectives:

- understand the difference between mains electricity being alternating current (a.c.) and direct current (d.c.) supplied by a cell or battery

Notes:



The diagram shows a trace on an oscilloscope screen, from the output of a bicycle dynamo.



a) What is the peak voltage of the ac electricity?

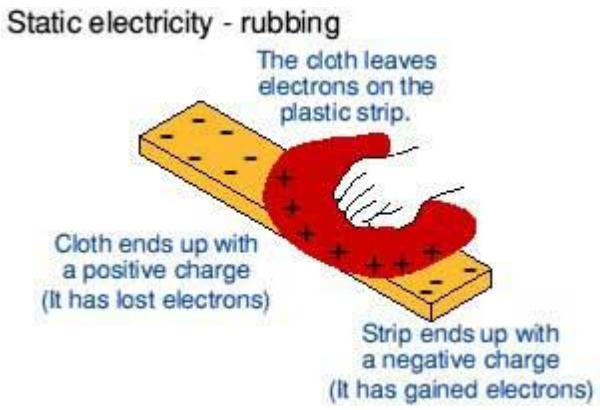
b) What is the time period?

c) Calculate the frequency of this ac supply.

13 – Static Electricity

Objectives:

- identify common materials which are electrical conductors or insulators, including metals and plastics
- describe experiments to investigate how insulating materials can be charged by friction
- explain that positive and negative electrostatic charges are produced on materials by the loss and gain of electrons
- understand that there are forces of attraction between unlike charges and forces of repulsion between like charges



CW 6.11 - Static Electricity

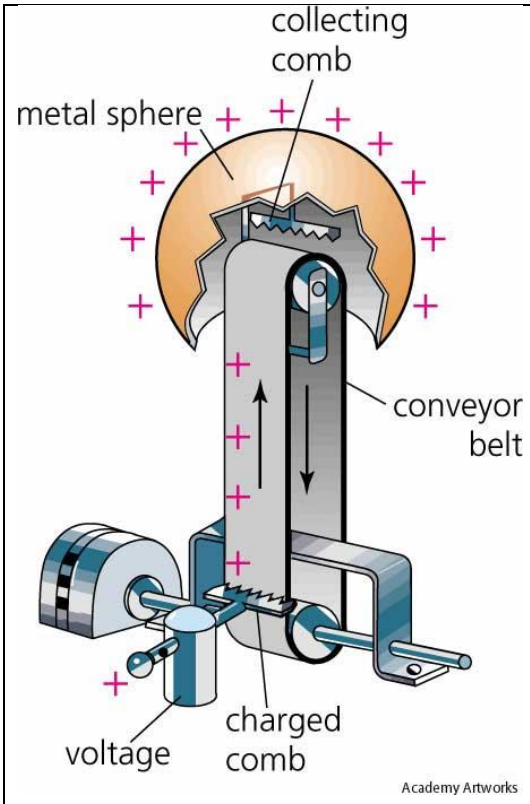
1. A student runs a balloon against a cloth. The balloon gains an electrostatic charge.
   a) Draw a diagram of this experiment. (1)

   b) Explain in terms of movement of electrons how the balloon becomes negatively charged. (2)

   c) If the balloon is brought close to another student's hair, their hair becomes attracted to the balloon. Yet the person is neutral. Explain why the hair is attracted to the balloon (2)

   d) If the balloon has a charge of -1.5 μC. What charge does the cloth have? Explain. (2)

2. A Van de Graaff generator is a machine which is used to generate static electricity. A student writes the following description of how it works:



- The bottom comb is positively charged and attracts electrons away from the rubber belt
- The belt loses electrons and becomes positively charged
- As the positive charge on the belt passes the top comb, electrons are attracted from the dome onto the belt
- The metal dome loses electrons and builds up positive static charge.

a) Why is the belt made from rubber? (1)

b) Why are the electrons attracted from the dome to the belt? (1)

c) Why is the dome made from metal? (1)

14 – Uses and Dangers of Static Electricity

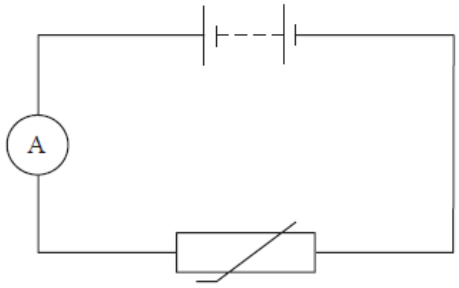
Objectives:

- explain electrostatic phenomena in terms of the movement of electrons
- explain the potential dangers of electrostatic charges, e.g. when fuelling aircraft and tankers
- explain some uses of electrostatic charges, e.g. in photocopiers and inkjet printers

PAST IGCSE QUESTIONS

10 A student investigates how the resistance of a thermistor changes with temperature. He measures a current and a voltage.

The diagram shows part of the circuit that the student uses.



(a) (i) Label the thermistor on the diagram.

(1)

(ii) Add to the diagram to show how a voltmeter should be connected.

(2)

Note the unit

(b) The student varies the temperature of the thermistor and obtains the results below.

Temperature in °C	0	20	40	60	80	100
Current in mA	0.8	2.0	4.2	8.2	15.1	26.6

(i) State the equation linking voltage, current and resistance.

(1)

(ii) The voltage across the thermistor is 12 V.

Calculate the resistance of the thermistor at 20 °C.

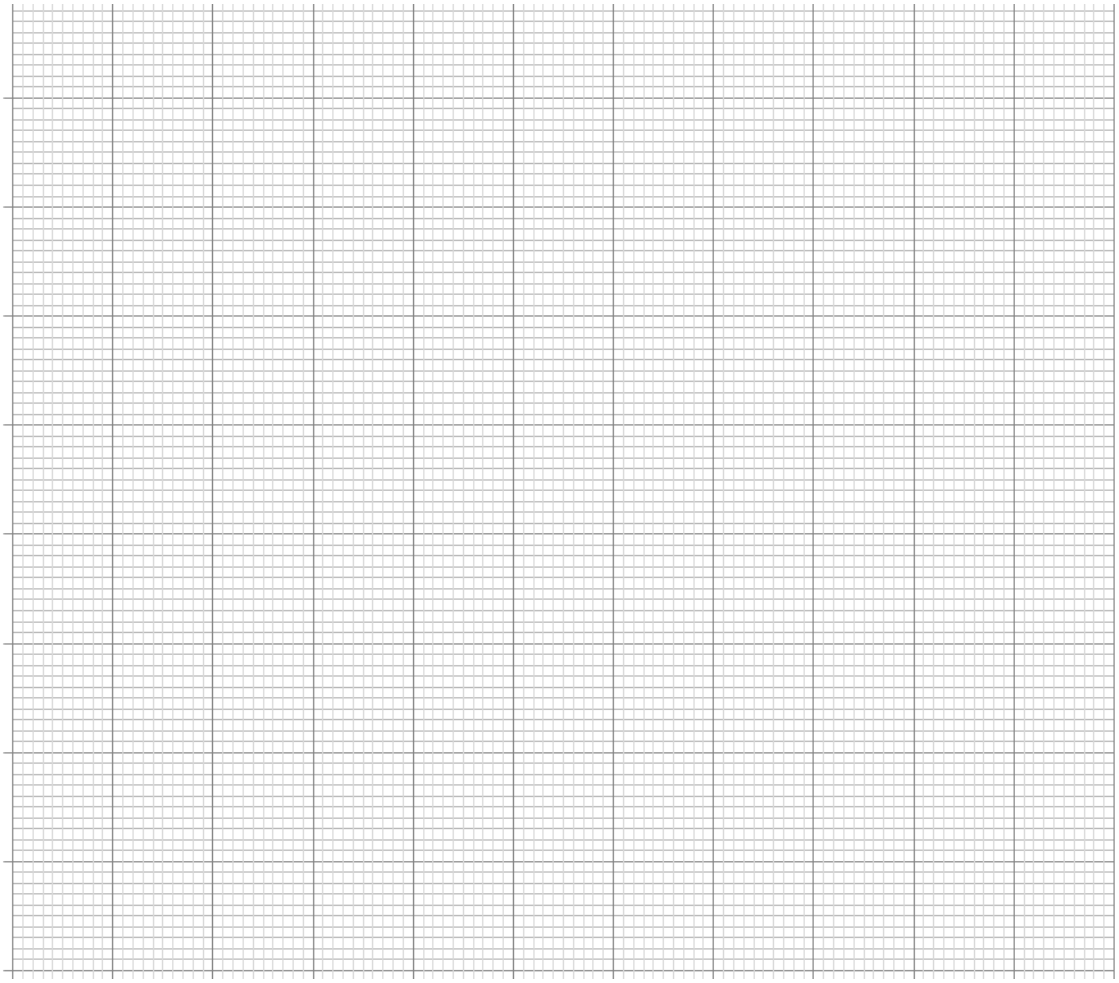
(2)

Resistance = ... Ω

5 marks! Get the axes the right way around and LABEL them….

(iii) Use the results from the table opposite to plot a graph of current against temperature.

(5)



2 marks. Why?

(iv) Use your graph to describe how the current in the thermistor changes as the temperature increases.

(2)

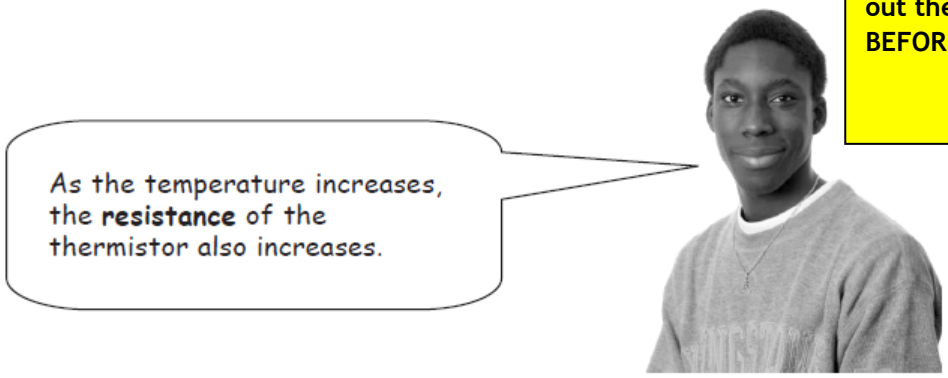
.....

.....

.....

.....

(v) The student concludes:



These students are nearly always wrong - but figure out the answer logically BEFORE you start writing….

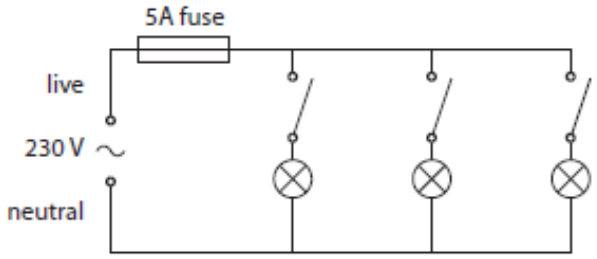
Evaluate this conclusion.

(2)

(Total for Question 10 = 15 marks)

"As the temperature increases the current …… and so the resistance has ……" or use scratch work around the picture to figure it out and then explain it. Eg. *T* leads to *I* ….. and therefore *R* …..

7 The diagram shows the lighting circuit in an office.



Be specific!

(a) (i) State two advantages of connecting lamps in parallel rather than in series.

(2)

1 .....

.....

2 .....

.....

(ii) What is the purpose of the 5 A fuse?

(1)

.....

.....

(iii) Explain how a fuse works.

(3)

.....

.....

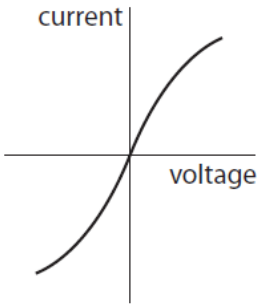
.....

.....

.....

.....

12 The graph shows how current and voltage vary for a filament lamp.



Circuit diagrams should be NEAT! Remember how ammeters and voltmeters are connected.

(a) Draw a circuit diagram to show how you should connect the equipment needed to make the measurements needed to plot the graph.

(4)

(b) The resistance of the filament lamp changes as the voltage is increased.

(i) How can you tell this from the graph?

(1)

.....

.....

(ii) Explain these changes in resistance.

(3)

.....

.....

.....

.....

.....

.....

Note the shape of the graph. How is the resistance changing and why?

(Total for Question 12 = 8 m