AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



EXAM QUESTION PACK

4.2.1 CURRENT, POTENTIAL DIFFERENCE AND RESISTANCE (PACK 4)

SCORE	PERCENTAGE
/129	%

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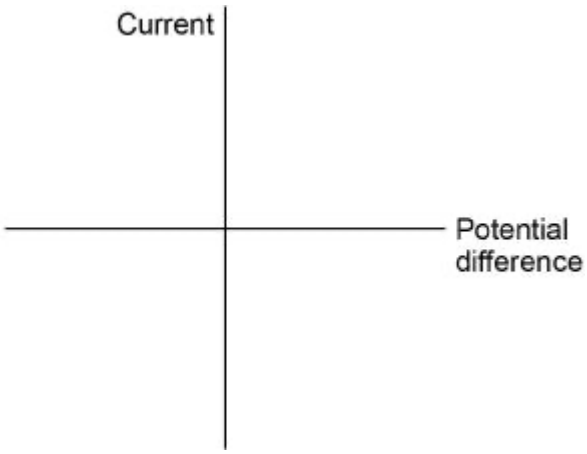
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Q1.

A student built a circuit using filament lamps.

(a) Sketch a current potential difference graph for a filament lamp on **Figure 1**

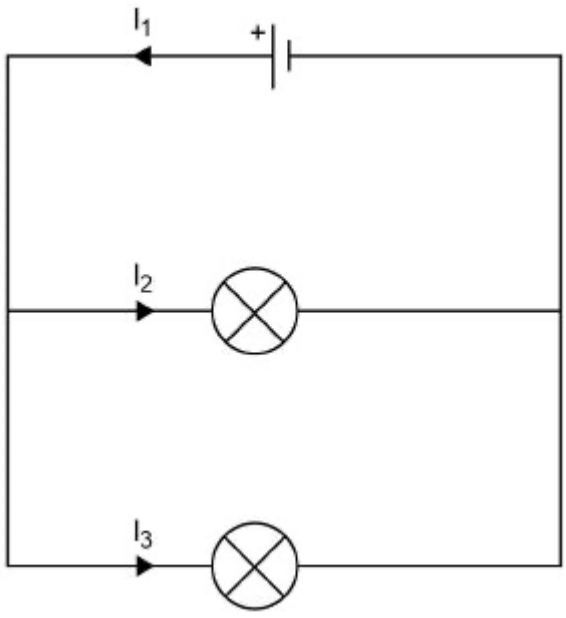
Figure 1



(2)

Figure 2 shows the circuit with two identical filament lamps.

Figure 2



(b) Compare the currents I_1, I_2 and I_3

_____

_____

_____

(2)

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(c) Calculate the charge that flows through the cell in 1 minute.

Each filament lamp has a power of 3 W and a resistance of 12 Ω

Write any equations that you use.

Give the unit.

Charge = _____

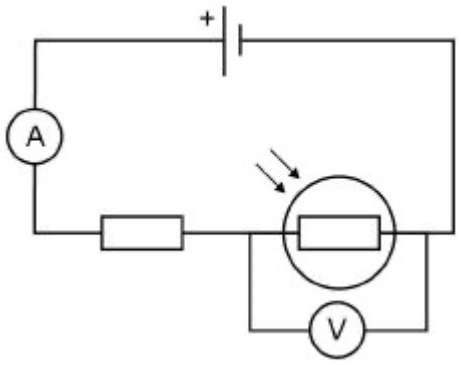
Unit = _____

(6)

(d) The student builds a different circuit.

Figure 3 shows the circuit.

Figure 3



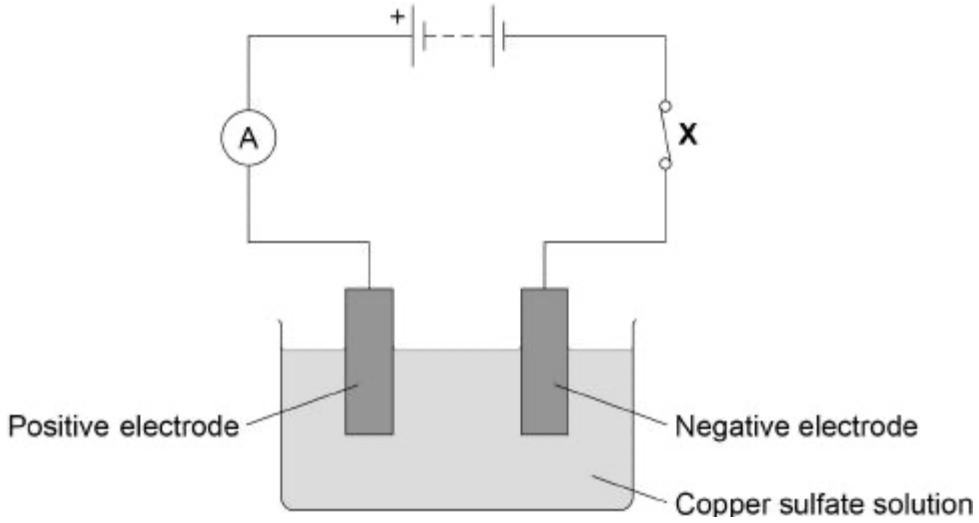
Explain how the readings on both meters change when the environmental conditions change.

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(6)
(Total 16 marks)

Q2.

The diagram below shows the apparatus used to pass a current through copper sulfate solution.



(a) What is the name of component **X** in the diagram above?

Tick **one** box.

- Ammeter ☐
- Battery ☐
- Fuse ☐
- Switch ☐

(1)

(b) What is the name of the process happening in the diagram above?

Tick **one** box.

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Combustion ☐

Crystallisation ☐

Distillation ☐

Electrolysis ☐

(1)

A student investigated how the concentration of copper sulfate solution affects the mass of copper deposited on the negative electrode.

(c) What are the independent and dependent variables in this investigation?

Draw **one** line from each type of variable to the correct description.

Type of variable	**Description**
Independent variable	Concentration of copper sulfate solution
	Distance between electrodes
Dependent variable	Mass of copper deposited
	Time circuit is switched on for

(2)

The table below shows the student's results.

Concentration of copper sulfate solution in g/dm^3	**Mass of copper deposited in grams**
30	0.04
60	0.08
90	0.12
120	0.07
150	0.20

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(d) The result for the concentration of 120 g/dm^3 is anomalous.

What may have caused the anomalous result?

Tick **one** box.

Some copper fell off the electrode ☐

The circuit was switched on for too much time ☐

The concentration of the solution was too high ☐

(1)

(e) Predict the expected mass of copper deposited for the concentration of 120 g/dm^3

Use the table above.

Mass of copper = _____ g

(1)

(f) During the investigation copper ions move to the negative electrode.

Choose the answer from the box.

a negative charge	**a positive charge**	**no charge**

Copper ions move to the negative electrode because copper ions have

_____ .

(1)

(g) Solid copper sulfate does **not** conduct electricity.

What is the reason for this?

Tick **one** box.

The charge on the ions is too high ☐

The ions are too big ☐

The ions are too small ☐

The ions cannot move ☐

(1)

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(h) In a different investigation, a student passed a current of 0.6 A through copper sulfate solution for 300 s

Calculate the charge flow through the solution.

Use the equation:

charge flow = current × time

_____

_____

_____

charge flow = _____ coulombs

(2)

(Total 10 marks)

Q3.

A light dependent resistor (LDR) is connected in a circuit.

(a) Draw the circuit symbol for an LDR.

(1)

(b) A student investigated the relationship between current and potential difference for an LDR.

How should the student have connected the ammeter and voltmeter in the circuit?

Tick **one** box.

Ammeter	Voltmeter	
in parallel with LDR	in parallel with LDR	☐
in parallel with LDR	in series with LDR	☐
in series with LDR	in parallel with LDR	☐

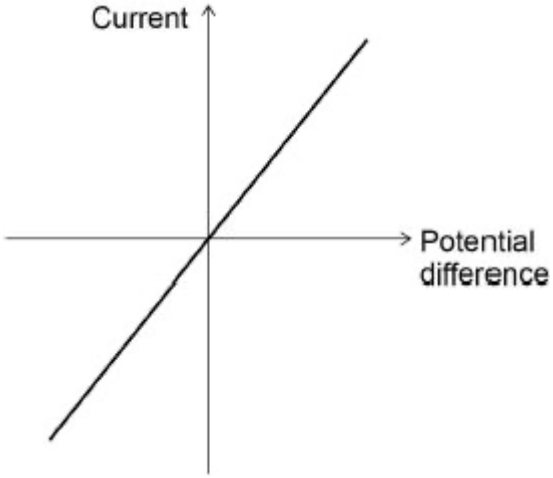
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in series with LDR in series with LDR ☐

(1)

The diagram below shows a sketch graph of the student's results.

The LDR was in a constant bright light.



(c) The student concluded that the current in the LDR is inversely proportional to the potential difference across the LDR.

Explain why the student's conclusion is incorrect.

_____

_____

_____

_____

(2)

(d) The student repeated the investigation with the LDR in constant dark conditions.

Sketch on the diagram above the graph for the LDR in constant dark conditions.

(2)

The LDR was placed near a light source.

The following results were recorded:

potential difference = 5.50 V

current = 12.5 mA

(e) Write down the equation that links current, potential difference and resistance.

_____

(1)

(f) Calculate the resistance of the LDR.

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Resistance = _____ Ω

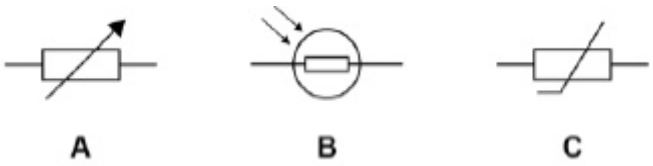
(4)

(Total 11 marks)

Q4.

Figure 1 shows the circuit symbol for three different components.

Figure 1



(a) Which component is a variable resistor?

Tick **one** box.

A ☐ **B** ☐ **C** ☐

(1)

(b) Which component is a thermistor?

Tick **one** box.

A ☐ **B** ☐ **C** ☐

(1)

(c) In which component will the resistance decrease when the temperature increases?

Tick **one** box.

A ☐ **B** ☐ **C** ☐

(1)

(d) In which component will the resistance decrease when the light intensity increases?

Tick **one** box.

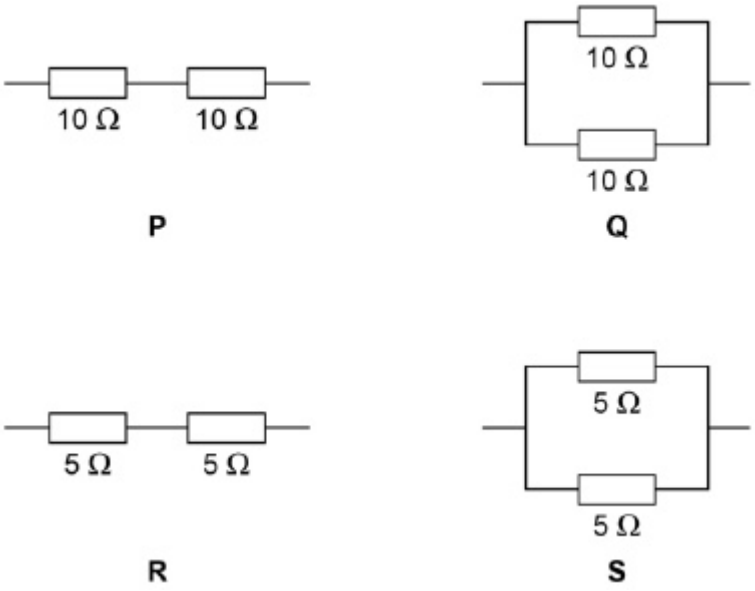
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A ☐ B ☐ C ☐

(1)

Figure 2 shows four different arrangements of resistors.

Figure 2



(e) Two of the arrangements are in series and two are in parallel.

Describe the difference between a series and a parallel arrangement.

_____

_____

_____

_____

(2)

(f) Which arrangement has a resistance of 10 Ω?

Tick **one** box.

P ☐ **Q** ☐ **R** ☐ **S** ☐

(1)

(g) Which arrangement has the highest resistance?

Tick **one** box.

P ☐ **Q** ☐ **R** ☐ **S** ☐

(1)

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(h) A student connects a resistor to a cell for 60 seconds.

The current through the resistor is 0.97 A

Calculate the charge flow.

Use the equation:

charge flow = current × time

Give your answer to 2 significant figures.

Charge flow = _____ C

(3)

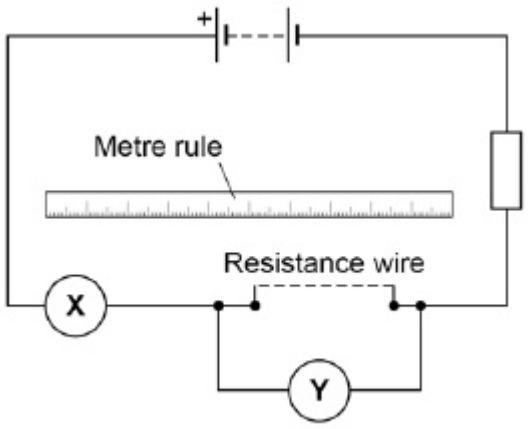
(Total 11 marks)

Q5.

A student investigated how length affects resistance of a wire.

Figure 1 shows the circuit the student used.

Figure 1



(a) The student took measurements using the meters **X** and **Y**.

Name meters **X** and **Y**.

Meter **X** _____

Meter **Y** _____

(2)

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The table shows the results.

	Resistance in Ω			
Length in m	**Test 1**	**Test 2**	**Test 3**	**Mean**
0.100	0.66	0.67	0.74	0.69
0.200	1.36	1.40	1.34	1.37
0.300	2.02	2.02	2.03	2.02
0.400	2.77	2.72	2.68	2.72
0.500	3.37	3.35	3.40	3.37
0.600	4.03	4.02	3.96	4.00

(b) For which length of wire are the readings of resistance the most precise?

Give the reason for your answer.

Length = _____ m

Reason _____

_____

(2)

(c) Why did the student do three tests and calculate a mean?

_____

_____

(1)

(d) Write the equation that links current, potential difference, and resistance.

_____

(1)

(e) The potential difference across a piece of wire is 2.1 V

The current in the wire is 0.30 A

Calculate the resistance of the wire.

Write any equation that you use.

_____

_____

_____

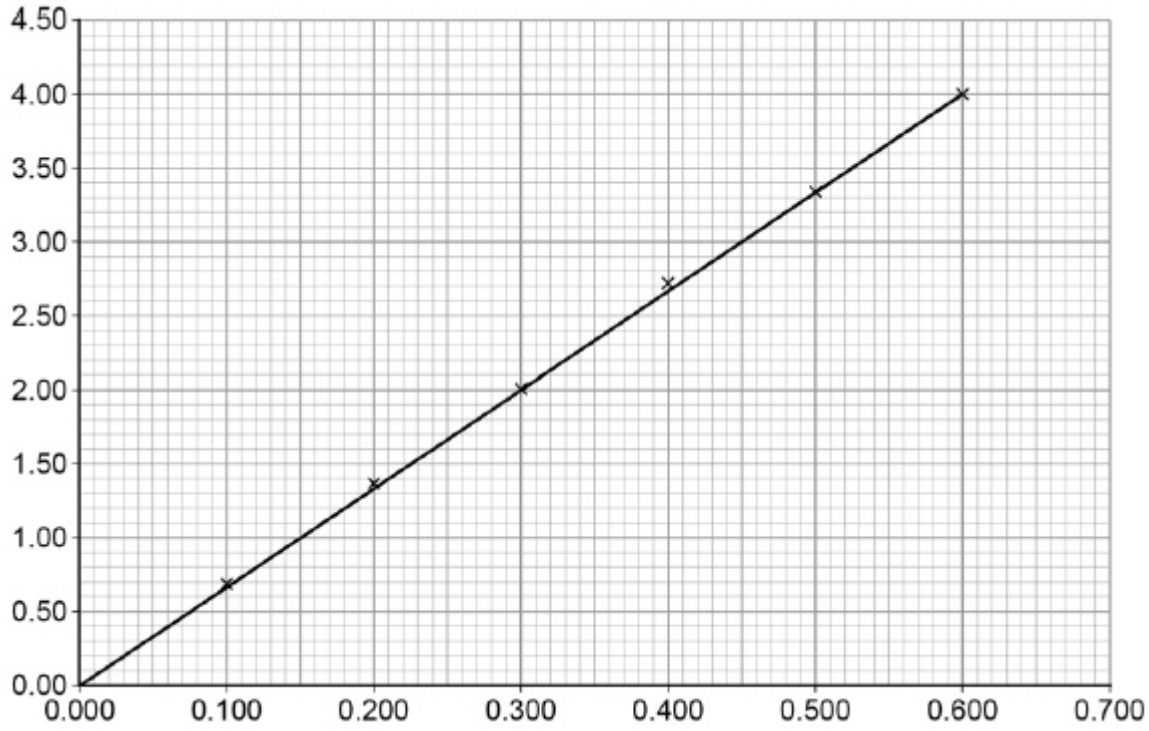
Resistance = _____ Ω

(3)

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Figure 2 shows a graph of the results.

Figure 2



(f) What is the label for each axis of the graph?

x-axis _____

y-axis _____

(2)

(g) What conclusion can be made from the graph in **Figure 2**?

_____

_____

(1)

(Total 12 marks)

Q6.

Some electrical appliances use electricity from the mains supply and some use electricity from a battery.

(a) Explain the differences between the current supplied by the mains supply and the current supplied by a battery.

_____

_____

_____

_____

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(2)

(b) Which set of units correctly links current, potential difference and power?

Tick **one** box.

one watt = one volt × one amp ☐

$$\text{one watt} = \frac{\text{one amp}}{\text{one volt}}$$ ☐

$$\text{one watt} = \frac{\text{one volt}}{\text{one amp}}$$ ☐

(1)

Electrical appliances can be connected to the mains supply using three-core cables.

The cables contain the mains wires.

(c) What are the colours of the insulation around the wires?

Tick **one** box.

Earth	**Live**	**Neutral**	**Tick one box**
Blue	Brown	Green and yellow	
Blue	Green and yellow	Brown	
Brown	Blue	Green and yellow	
Brown	Green and yellow	Blue	
Green and yellow	Blue	Brown	
Green and yellow	Brown	Blue	

(1)

(d) Touching the live wire of an appliance is dangerous when the appliance is connected to the mains electricity supply.

Explain why.

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_____

_____

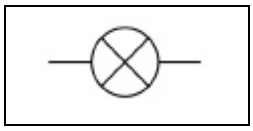
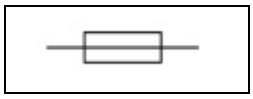
(4)

(Total 8 marks)

Q7.

Components can be connected in electrical circuits in different ways.

(a) Draw **one** line from each circuit symbol to the name of the component it represents.

Circuit symbol	**Name of component**
	cell
	diode
	fuse
	lamp
	variable resistor

(2)

(b) Complete the sentence.

Choose the answer from the box.

charge	**energy**	**potential difference**	**resistance**

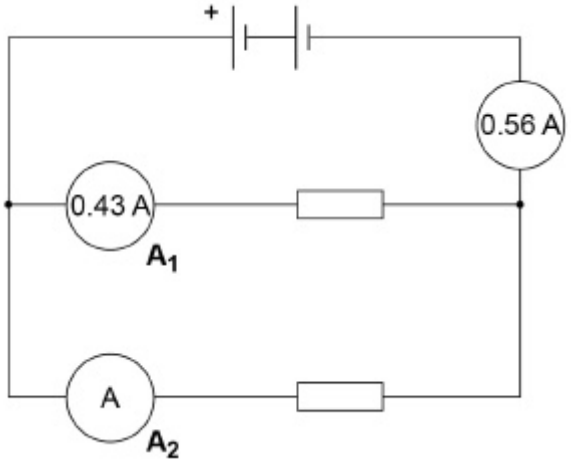
Electric current is the rate of flow of _____.

(1)

Figure 1 shows a parallel circuit.

Figure 1

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(c) Calculate the current measured by ammeter $\mathbf{A_2}$.

Current = _____ A

(1)

(d) The circuit is connected for 300 s

The total current in the circuit stays at 0.56 A

Calculate the total charge flow.

Use the equation:

charge flow = current × time

_____

_____

_____

_____

Charge flow = _____ C

(2)

(e) The potential difference supplied by the battery is 4.5 V

Calculate the total energy transferred in 300 s

Use the equation:

energy transferred = charge flow × potential difference

Use your answer to part (d).

_____

_____

_____

_____

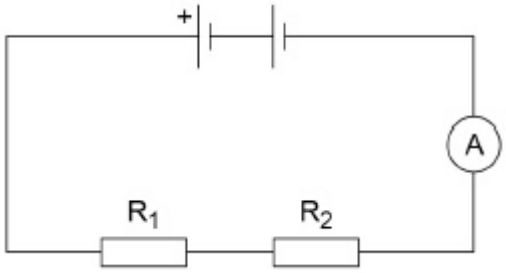
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Energy transferred = _____ J

(2)

(f) **Figure 2** shows a series circuit.

Figure 2



Resistor **R_2** breaks.

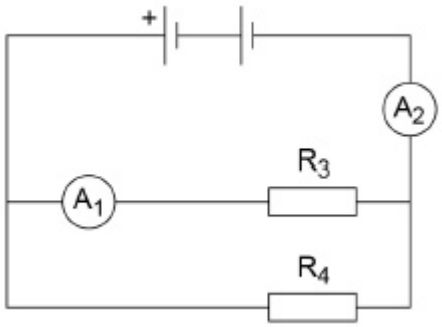
What happens to the reading on the ammeter?

_____

(1)

(g) **Figure 3** shows a parallel circuit.

Figure 3



Resistor **R_3** breaks.

What happens to the readings on the ammeter?

Ammeter **A_1** _____

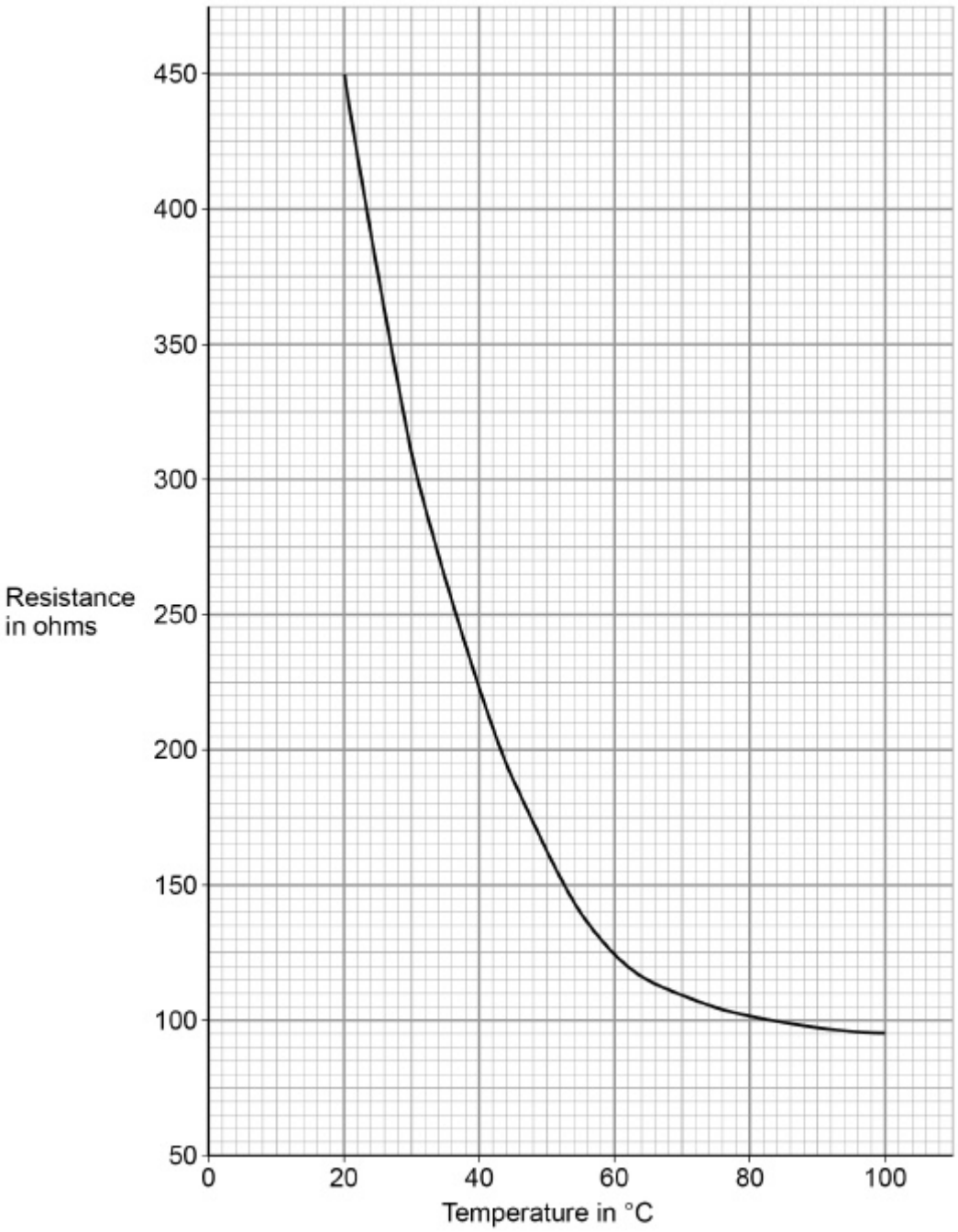
Ammeter **A_2** _____

(2)

Figure 4 shows how the resistance of a component varies with temperature.

Figure 4

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(h) What is the name of the component?

Tick **one** box.

LED ☐

LDR ☐

Resistor ☐

Thermistor ☐

(1)

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(i) What is the resistance of the component at a temperature of 50 °C?

Resistance = _____ Ω

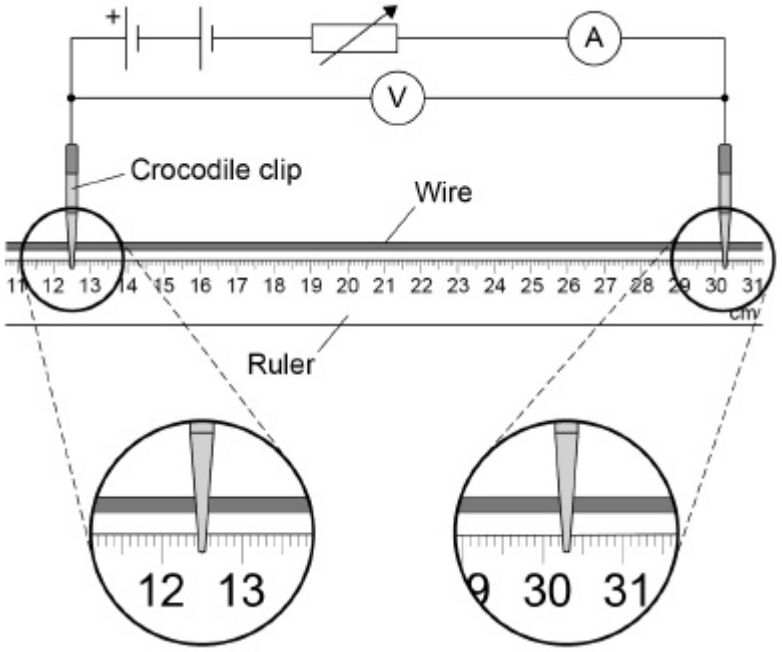
(1)

(Total 13 marks)

Q8.

A student investigates how the length of a piece of wire affects its resistance.

The diagram shows the apparatus used.



(a) What is the length of wire between the two crocodile clips shown in the diagram?

Length = _____ cm

(1)

(b) Write the equation which links current, potential difference and resistance.

_____

(1)

(c) For the experiment shown in the diagram, the student recorded:

- a potential difference of 3.22 V
- a current of 2.18 A

Calculate the resistance of the length of wire between the crocodile clips.

Give your answer to 3 significant figures.

_____

_____

_____

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Resistance = _____ Ω

(4)

(d) The student used constantan wire.

The resistance of constantan only changes a small amount when its temperature changes.

Suggest why using constantan is an advantage in this experiment.

(2)

The table shows the student's results.

Length in cm	Resistance in Ω
20.0	1.67
30.0	2.49
40.0	3.31
50.0	5.26
60.0	4.98
70.0	5.78
80.0	6.65

(e) One of the results in the table is anomalous.

For what length of wire is the resistance anomalous?

Length = _____ cm

(1)

(f) What could have caused the anomalous result?

Tick **one** box.

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The ammeter gave a reading that was too low.	☐
The wire was shorter than the measured value.	☐
The temperature of the wire decreased.	☐
The voltmeter gave a reading that was too low.	☐

(1)

(Total 10 marks)

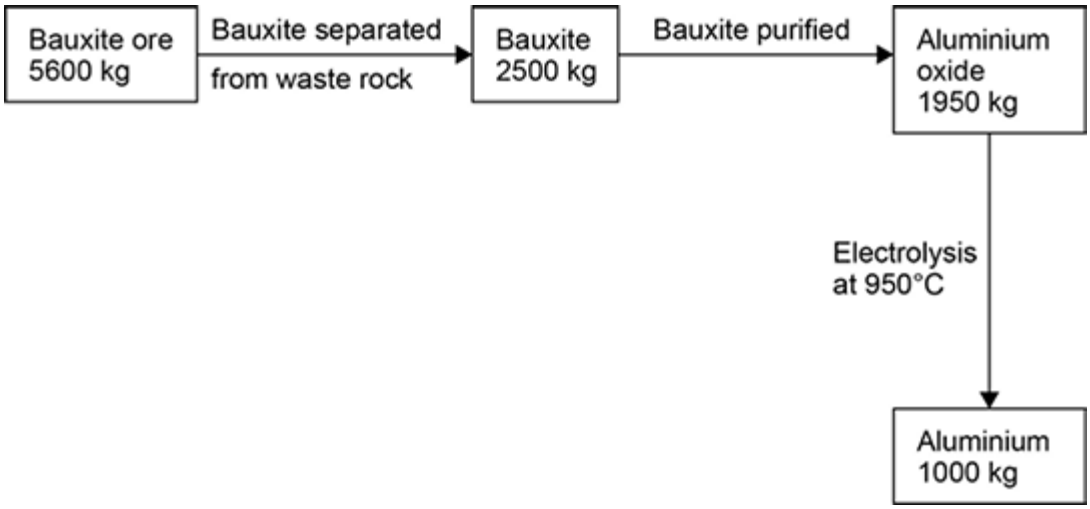
Q9.

Aluminium is produced from an ore called bauxite.

Bauxite contains aluminium oxide.

Look at **Figure 1**.

Figure 1



(a) Calculate the percentage of bauxite that is converted into aluminium oxide.

_____

_____

Percentage = _____

(2)

(b) Show by calculation that the mass of aluminium produced is less than that expected from 1 950 kg aluminium oxide (Al_2O_3).

You should state the difference in the mass of aluminium expected and the mass of aluminium produced to three significant figures.

Relative atomic masses (A_r): O = 16; Al = 27

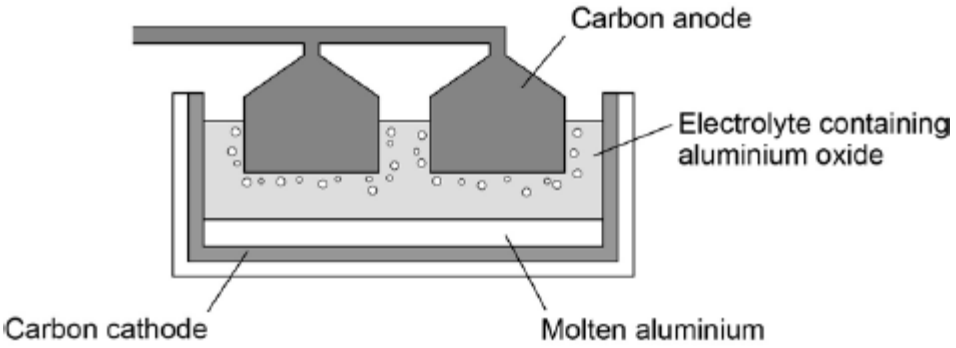
_____

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(3)

(c) **Figure 2** shows an electrolysis cell used to extract aluminium.

Figure 2



Why does the carbon anode used in the electrolysis cell need to be continually replaced?

(3)

(d) In an electrolysis cell the current is 1.5×10^5 A, at a potential difference of 4V.

Calculate the energy transferred by the electrolysis cell in 24 hours.

Energy transferred = _____ J

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(5)

(e) The half equation at the cathode is:

$Al^{3+} + 3\,e^- \longrightarrow Al$

Calculate the number of moles of electrons needed to produce 1 000 kg of aluminium.

Give your answer to three significant figures.

Relative atomic mass (A_r): Al = 27

_____

_____

_____

_____

Answer = _____ moles

(3)

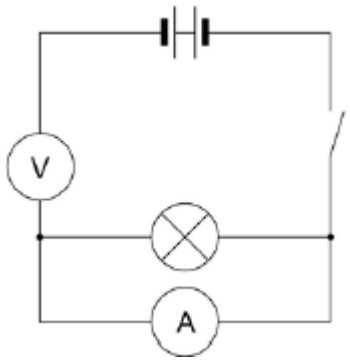
(Total 16 marks)

Q10.

A student used electrical circuits to investigate the relationship between resistance, potential difference and current.

Figure 1 shows how the student connects the first circuit he set up.

Figure 1



(a) The circuit does not work.

Draw the correct circuit.

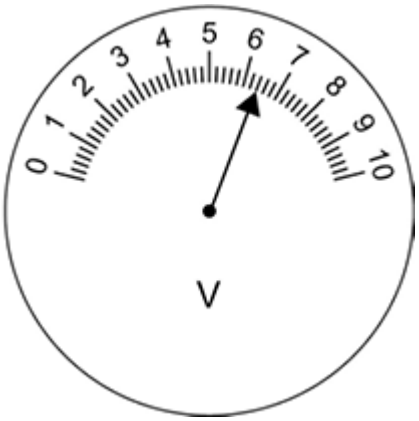
(2)

(b) The student then sets up the circuit correctly.

Look at **Figure 2**.

Figure 2

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What is the reading on the voltmeter?

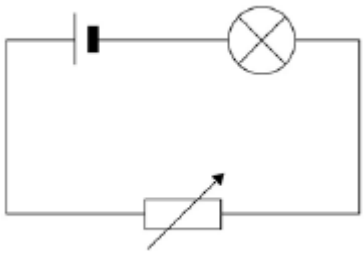
_____

(1)

(c) The student then set up a circuit to investigate how resistance affects the brightness of a lamp.

Figure 3 shows the circuit he set up.

Figure 3



The student increases the resistance of the variable resistor.

What effect does this have on the brightness of the lamp?

Explain your answer.

_____

_____

_____

_____

(2)

(d) Write down the equation that links current, potential difference and resistance.

_____

(1)

(e) When the potential difference across the lamp is 3.3 V the current is 0.15 A.

Calculate the resistance of the lamp in the student's experiment.

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Resistance = _____ Ω

(3)

(Total 9 marks)

Q11.

A student is investigating some electrical components.

(a) Describe how the student could set up a circuit to find the resistance of a lamp.

You should include a circuit diagram in your answer.

(4)

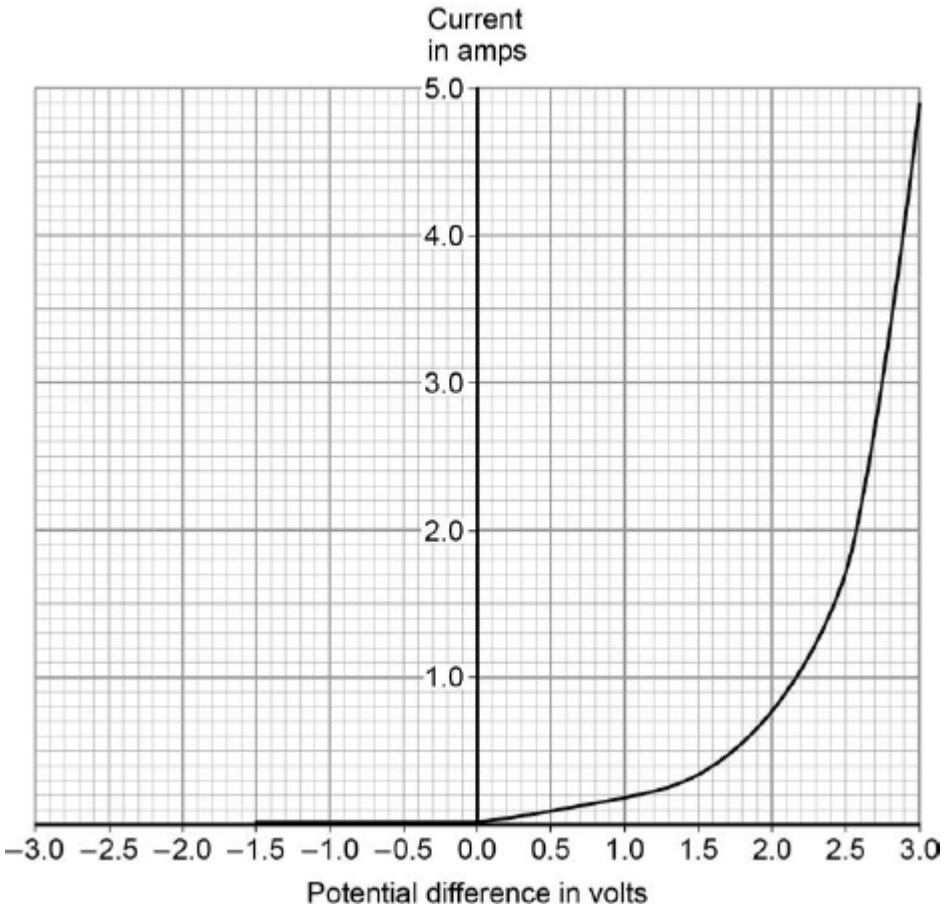
(b) The student is given an electrical component in a sealed box.

She has to find out what the electrical component is by experiment.

The student records the current and the potential difference for the component.

Her results are shown in the figure below.

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Explain how the student could know that the electrical component in the sealed box is **not** an ohmic conductor.

(2)

(c) What is the electrical component in the sealed box?

Explain your answer.

Component _____

Explanation _____

(3)

(d) Use the graph to determine the resistance of the component at 2.3 V.

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Resistance = _____ Ω

(4)

(Total 13 marks)

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