

## Topic 2 Electricity Extended writing questions

Name: \_\_\_\_\_

Class: \_\_\_\_\_

Date: \_\_\_\_\_

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Time: **25 minutes**

Marks: **25 marks**

Comments:

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**Q1.**Electrical circuits have resistance.

(a) Draw a ring around the correct answer to complete the sentence.

When the resistance of a circuit increases, the current in the circuit

- decreases.
- increases.
- stays the same.

(1)

(b) Use the correct answer from the box to complete each sentence.

- |                 |        |        |
|-----------------|--------|--------|
| a filament bulb | an LED | an LDR |
|-----------------|--------|--------|

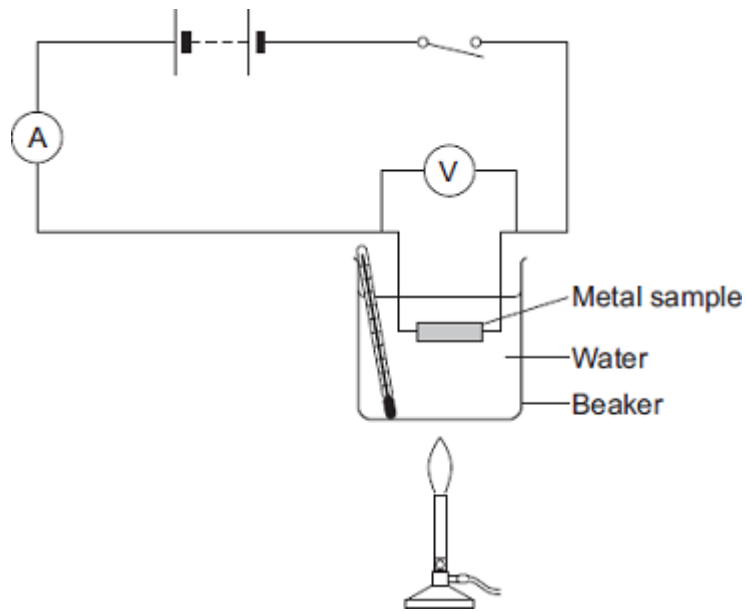
An electrical component which has a resistance that increases as the temperature increases is .....

An electrical component which emits light only when a current flows through it in the forward direction is .....

(2)

(c) When some metals are heated the resistance of the metal changes.

The equipment for investigating how the resistance of a metal changes when it is heated is shown in the diagram.



*In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Describe an investigation a student could do to find how the resistance of a metal sample varies with temperature. The student uses the equipment shown.

Include in your answer:

- how the student should use the equipment
- the measurements the student should make
- how the student should use these measurements to determine the resistance
- how to make sure the results are valid.

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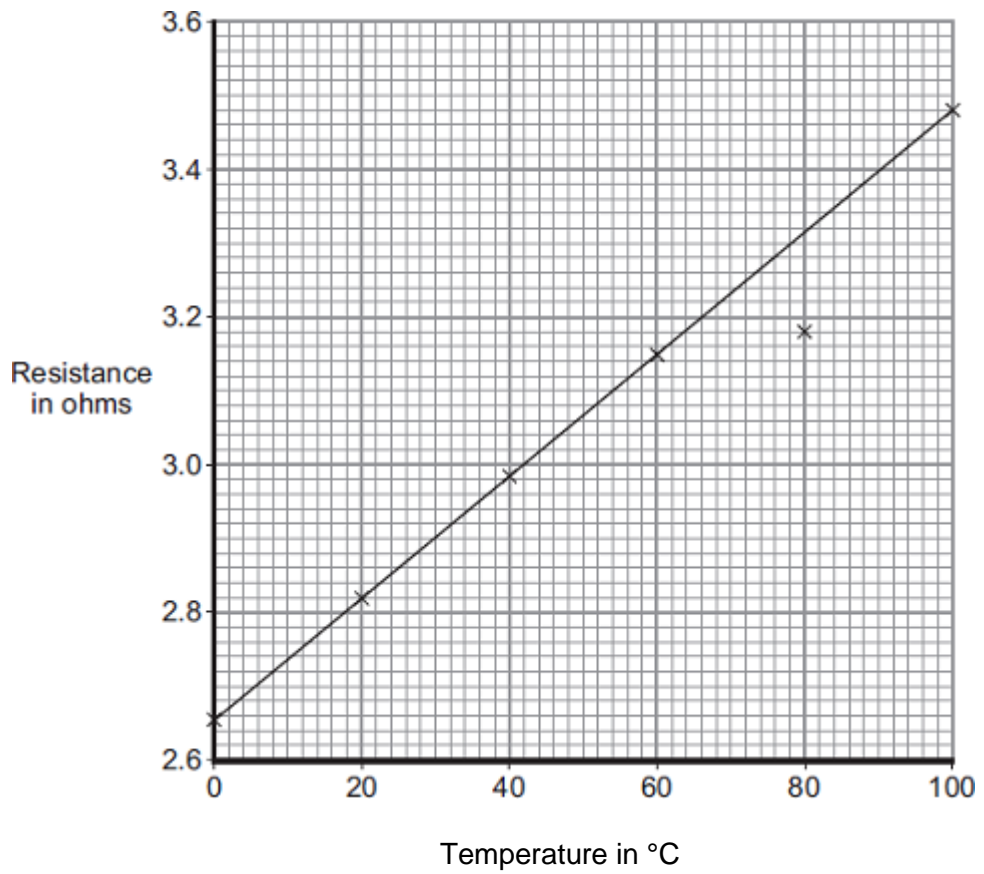
(6)

(d) The table shows some data for samples of four metals **P**, **Q**, **R** and **S**.

The metal samples all had the same cross-sectional area and were the same length.

<b>Metal sample</b>	<b>Resistance at 0°C in ohms</b>	<b>Resistance at 100°C in ohms</b>
<b>P</b>	4.05	5.67
<b>Q</b>	2.65	3.48
<b>R</b>	6.0	9.17
<b>S</b>	1.70	2.23

A graph of the results for one of the metal samples is shown.



(i) Which metal sample, **P**, **Q**, **R** or **S**, has the data shown in the graph?

(1)

(ii) One of the results is anomalous. Circle this result on the graph.

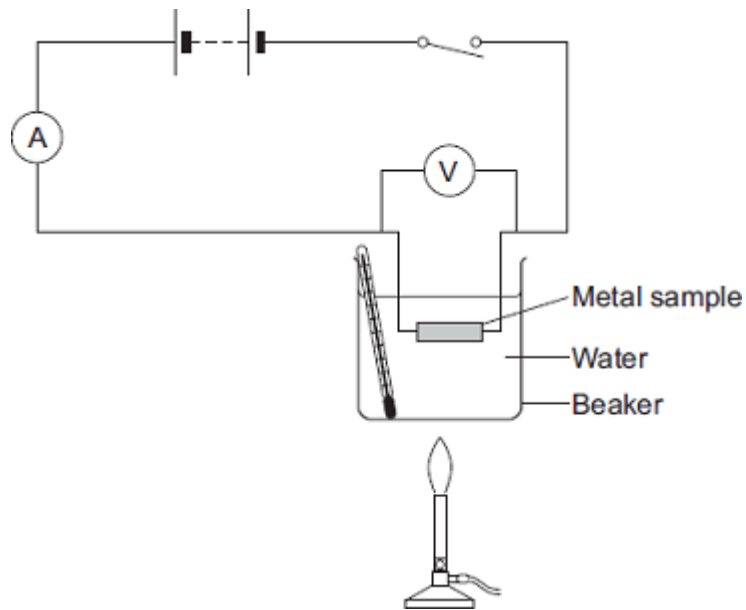
(1)

(iii) Suggest a reason for the anomalous result.

.....  
 .....

(1)

(iv) The same equipment used in the investigation could be used as a thermometer known as a 'resistance thermometer.'

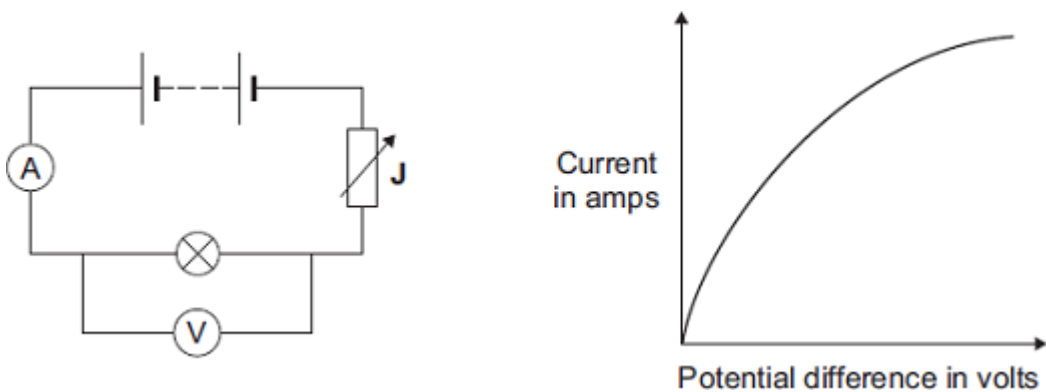


Suggest **two** disadvantages of using this equipment as a thermometer compared to a liquid-in-glass thermometer.

- 1 .....
- .....
- 2 .....
- .....

(2)  
(Total 14 marks)

**Q2.(a)** The diagram shows the circuit used to obtain the data needed to plot the current–potential difference graph for a filament bulb.



(i) Why is the component labelled 'J' included in the circuit?

.....  
.....

(1)

(ii) The resistance of the bulb increases as the potential difference across the bulb increases. Why?

.....  
.....

(1)

(iii) The bulb is at full brightness when the potential difference across the bulb is 12 V.  
The current through the bulb is then 3 A.

Calculate the power of the bulb when it is at full brightness and give the unit.

.....  
.....  
.....

Power = .....

(3)

(b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The table gives data about two types of light bulb people may use in their homes.

Type of light bulb	Energy efficiency	Cost of one light bulb	Average lifetime in hours
Halogen	10%	£1.95	2 000
Light Emitting Diode (LED)	32%	£11.70	36 000

Both types of light bulb produce the same amount of light.

Evaluate, in terms of cost and energy efficiency, the use of the two types of light bulb.

To gain full marks you must compare both types of light bulb and conclude which light bulb would be the best to use.

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(6)  
(Total 11 marks)



M1.(a) decreases

1

(b) a filament bulb  
*allow bulb*

1

an LED

1

(c) Marks awarded for this answer will be determined by the Quality of Communication (QoC) as well as the standard of the scientific response.

**0 marks**

No relevant content.

**Level 1 (1–2 marks)**

There is a basic description of the method. This is incomplete and would not lead to any useful results.

**Level 2 (3–4 marks)**

There is a description of the method which is almost complete with a few minor omissions and would lead to some results.

**Level 3 (5–6 marks)**

There is a detailed description of the method which would lead to valid results. To gain full marks an answer including graph, or another appropriate representation of results, must be given.

**examples of the physics points made in the response:**

- read V and I
- read temperature
- apply heat  
*allow hot water to cool*
- read V and I at least one other temperature
- determine R from  $V / I$
- range of temperatures above 50 °C

extra detail:

- use thermometer to read temperature at regular intervals of temperature
- remove source of heat and stir before taking readings
- details of attaining 0 °C or 100 °C
- last reading taken while boiling
- graph of R against T
- at least 3 different temperatures

(d) (i) Q

1

(ii) (80, 3.18)

1

(iii) any **one** from:

- measurement of V too small
- measurement of I too big
- incorrect calculation of R
- thermometer misread

*allow misread meter*

*ignore any references to an error that is systematic*

1

(iv) any **two** from:

- not portable

*allow requires a lot of equipment allow takes time to set up*

- needs an electrical supply
- cannot be read directly

*accept it is more difficult to read compared to liquid-in-glass*

2

[14]

**M2.(a)** (i) to obtain a range of p.d. values

*accept increase / decrease current / p.d. / voltage / resistance*

*accept to change / control the current / p.d. / voltage / resistance*

*to provide resistance is insufficient*

*a variable resistor is insufficient*

*do **not** accept electricity for current*

1

(ii) temperature of the bulb increases

*accept bulb gets hot(ter)*  
*accept answers correctly*  
*expressed in terms of collisions between (free) electrons and ions / atoms*  
*bulb gets brighter is insufficient*

1

(iii) 36

*allow 1 mark for correct substitution, ie  $12 \times 3$  provided no subsequent step shown*

2

watt(s) / W

*accept joules per second / J/s*  
*do **not** accept w*

1

- (b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the [Marking guidance](#), and apply a 'best-fit' approach to the marking.

**0 marks**No relevant content.

**Level 1 (1-2 marks)**There is a basic comparison of either a cost aspect or an energy efficiency aspect.

**Level 2 (3-4 marks)**There is a clear comparison of either the cost aspect or energy efficiency aspect **OR** a basic comparison of both cost and energy efficiency aspects.

**Level 3 (5-6 marks)**There is a detailed comparison of both the cost aspect and the energy efficiency aspect.

For full marks the comparisons made should support a conclusion as to which type of bulb is preferable.

**Examples of the points made in the response:**

**cost**

- halogen are cheaper to buy  
*simply giving cost figures is insufficient*
- 6 halogen lamps cost the same as one LED
- LEDs last longer
- need to buy 18 / more halogen lamps to last the same time as one LED
- 18 halogens cost £35.10
- costs more to run a halogen than LED
- LED has lower maintenance cost (where many used, eg large departmental store lighting)

**energy efficiency**

- LED works using a smaller current
- LED wastes less energy
- LEDs are more efficient
- LED is 22% more energy efficient
- LED produces less heat
- LED requires smaller input (power) for same output (power)