AQA GCSE PHYSICS (HIGHER) · 8463

PHYSICS



EXAM QUESTION PACK

4.2.1 CURRENT, POTENTIAL DIFFERENCE AND RESISTANCE (PACK 2)

SCORE	PERCENTAGE
/235	%

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Q1.

(a) The resistance of a 24 W, 12 V filament lamp depends on the current flowing through the lamp. For currents up to 0.8 A, the resistance has a constant value of 2.5 Ω.

(i) Use the equation in the box to calculate the potential difference across the lamp when a current of 0.8 A flows through the lamp.

potential difference = current × resistance

Show clearly how you work out your answer.

_____

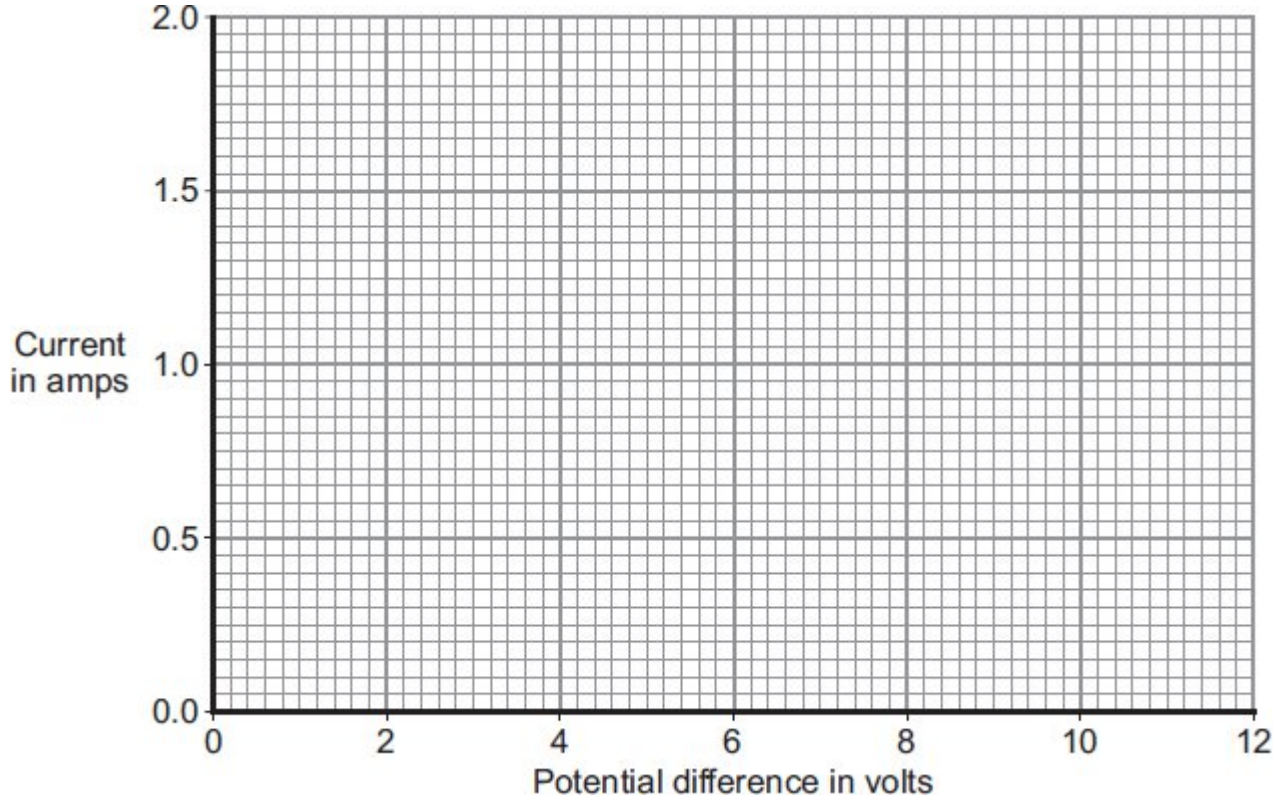
_____

Potential difference = _____ V

(2)

(ii) When the potential difference across the lamp is 12 V, the current through the lamp is 2 A.

On the axes below, draw a current–potential difference graph for the filament lamp over the range of potential difference from 0 to 12 volts.



(2)

(iii) Why does the resistance of the lamp change when the current through the lamp exceeds 0.8 A?

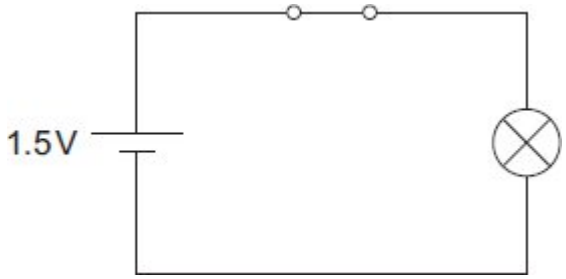
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_____

_____

(1)

(b) The lamp is now included in a circuit. The circuit is switched on for 2 minutes. During this time, 72 coulombs of charge pass through the lamp.



Use the equation in the box to calculate the energy transformed by the lamp while the circuit is switched on.

energy transformed = potential difference × charge

Show clearly how you work out your answer.

_____

_____

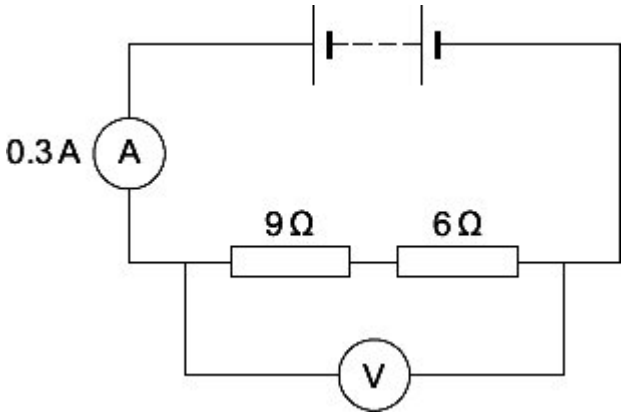
Energy transformed = _____ J

(2)

(Total 7 marks)

Q2.

(a) The diagram shows a simple circuit.



(i) Calculate the total resistance of the two resistors in the circuit.

_____

Total resistance = _____ Ω

(1)

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(ii) Calculate the reading on the voltmeter.

Show clearly how you work out your answer.

_____

_____

Voltmeter reading = _____ V

(2)

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

Replacing one of the resistors with a resistor of higher value will

decrease
not change
increase

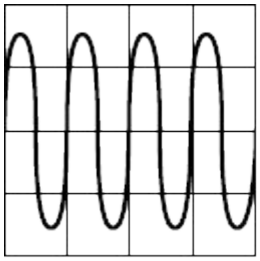
the reading on the ammeter.

(1)

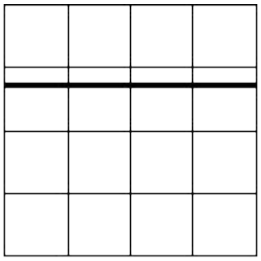
(b) The voltmeter in the circuit is replaced with an oscilloscope.

Which one of the diagrams, **X**, **Y** or **Z**, shows the trace that would be seen on the oscilloscope?

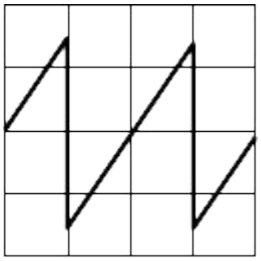
Write your answer, **X**, **Y** or **Z**, in the box.



X



Y



Z

Diagram ☐

Give a reason for your answer.

_____

_____

_____

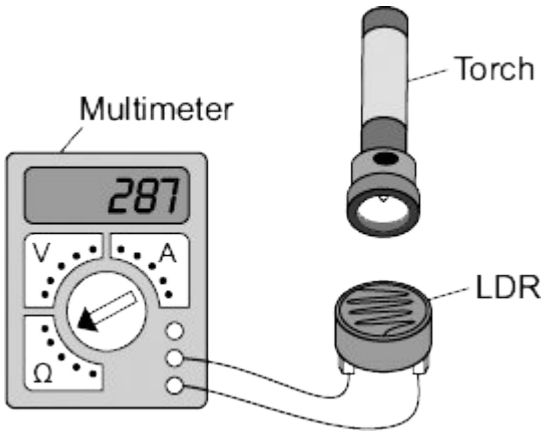
(2)

(Total 6 marks)

Q3.

A student used the apparatus below to find out how the resistance of a light-dependent resistor (LDR) depends on light intensity.

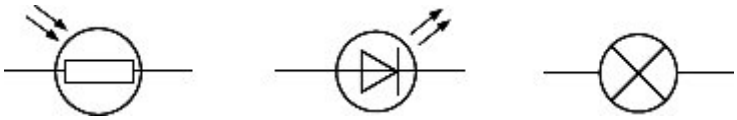
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The resistance of the LDR was measured directly using a multimeter.

(a) (i) Which **one** of the following is the correct circuit symbol for a LDR?

Draw a ring around your answer.



(1)

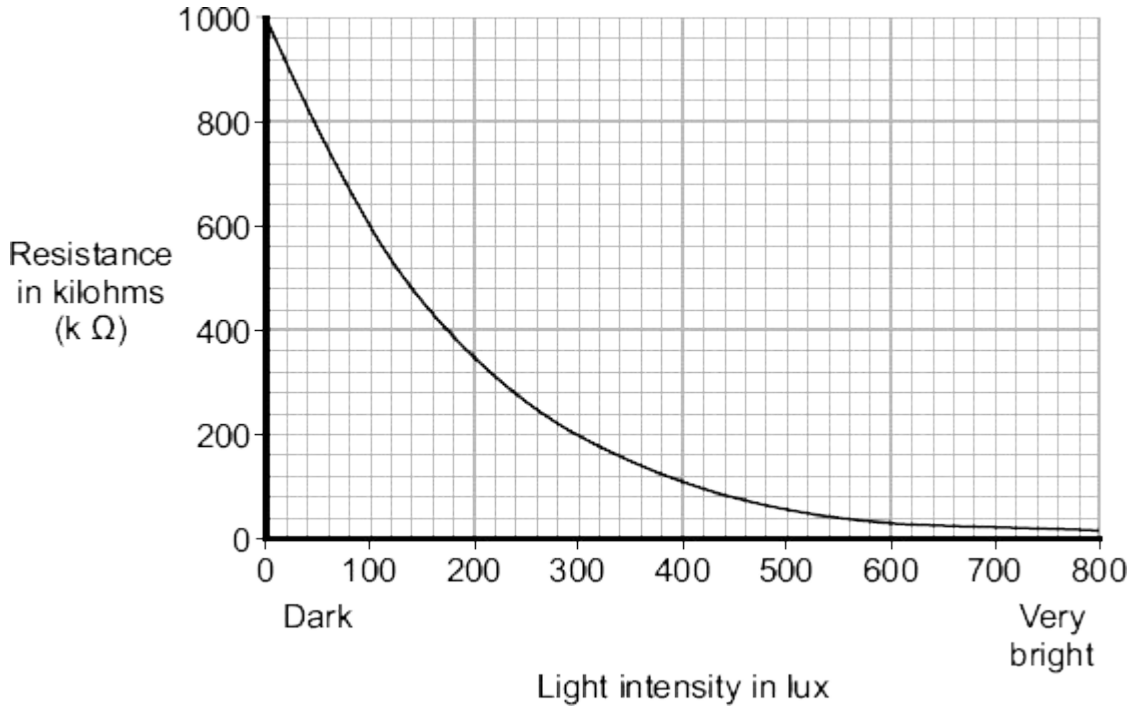
(ii) Name **one** factor that will affect the intensity of the light hitting the LDR.

_____

_____

(1)

(b) The manufacturer of the LDR provides data for the LDR in the form of a graph.



Describe how the resistance of the LDR changes when the light intensity increases from 100 lux to 300 lux.

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_____

_____

_____

(2)

(c) The student only obtained three results. These are given in the table.

Light intensity	Resistance in kilohms
Dark	750
Bright	100
Very bright	1

(i) The student could **not** use the results to draw a line graph.
Why not?

_____

_____

(1)

(ii) Do the student's results agree with the data the manufacturer provided?

Draw a ring around your answer. YES NO

Give a reason for your answer.

_____

_____

_____

(1)

(d) Which **one** of the following circuits probably includes a LDR?

Tick (✓) **one** box.

A circuit that automatically switches outside lights on when it gets dark. ☐

A circuit that automatically switches central heating on and off. ☐

A circuit that automatically turns lights off when no one is in the room. ☐

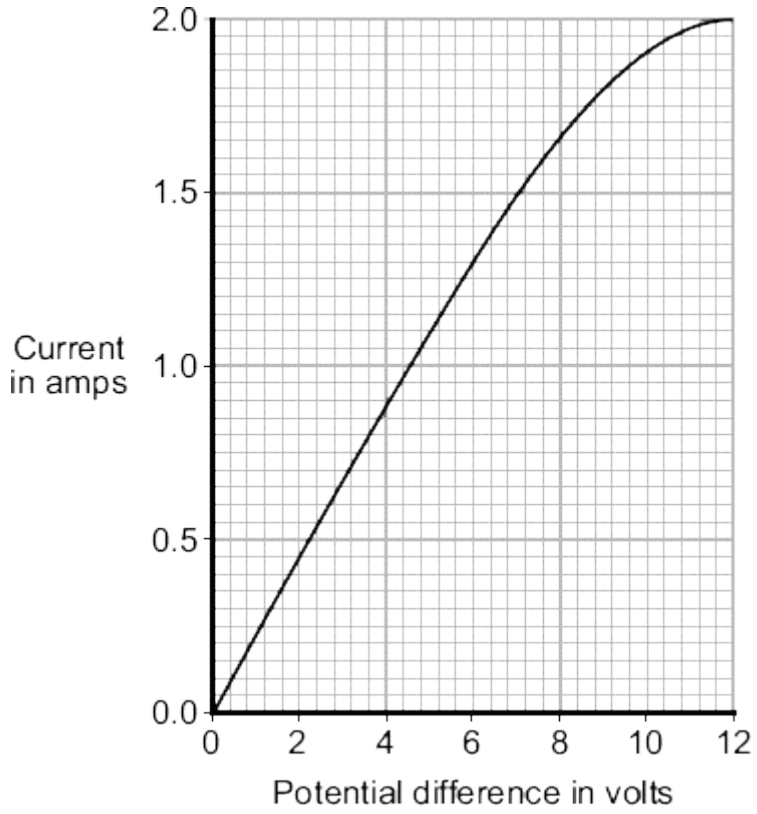
(1)

(Total 7 marks)

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Q4.

The graph shows how the electric current through a 12 V filament bulb varies with the potential difference across the bulb.



(a) What is the meaning of the following terms?

electric current

_____

_____

potential difference

_____

_____

(2)

(b) The resistance of the metal filament inside the bulb increases as the potential difference across the bulb increases.

Explain why.

_____

_____

_____

_____

_____

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_____

_____

_____

(3)

(c) Use data from the graph to calculate the rate at which the filament bulb transfers energy, when the potential difference across the bulb is 6 V.

Show clearly how you work out your answer.

_____

_____

Rate of energy transfer = _____ W

(2)

(Total 7 marks)

Q5.

(a) The picture shows a person using a set of electronic 'Body Fat Scales'. When the person stands on the scales, a small, harmless, electric current passes through the person's body. The scales then calculate the resistance of the person's body and convert the resistance into a *prediction* of body fat content.



(i) The scales contain two 3 V cells joined in series.

Calculate the resistance of a person's body, if when he stands on the scales, a current of 0.12 mA passes through his body.

1000 mA = 1 A

Show clearly how you work out your answer and give the unit.

_____

_____

_____

Resistance = _____

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(3)

(ii) The scales can only produce a *prediction* of body fat content and not an accurate measurement.

Suggest why.

_____

_____

_____

(1)

(iii) It is recommended that the scales are **not** used immediately after a person has drunk a large amount of water.

Suggest why.

_____

_____

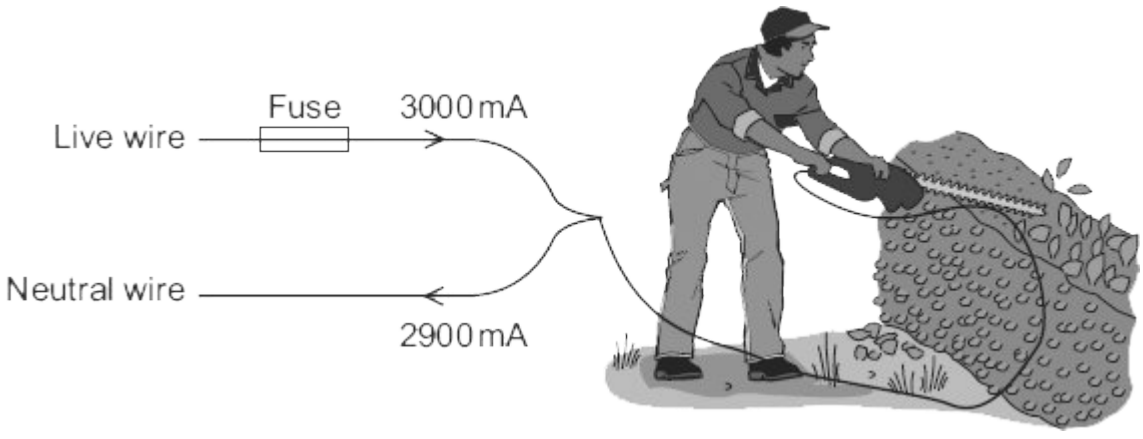
_____

_____

_____

(2)

(b) The diagram shows how someone could get an electric shock from accidentally cutting into an electric cable. If this happens, and a Residual Current Circuit Breaker (RCCB) is being used, the circuit will switch off automatically.



(i) A faulty appliance or circuit can be switched off by a RCCB or a fuse.

Compare the action of a RCCB with the action of a fuse.

_____

_____

_____

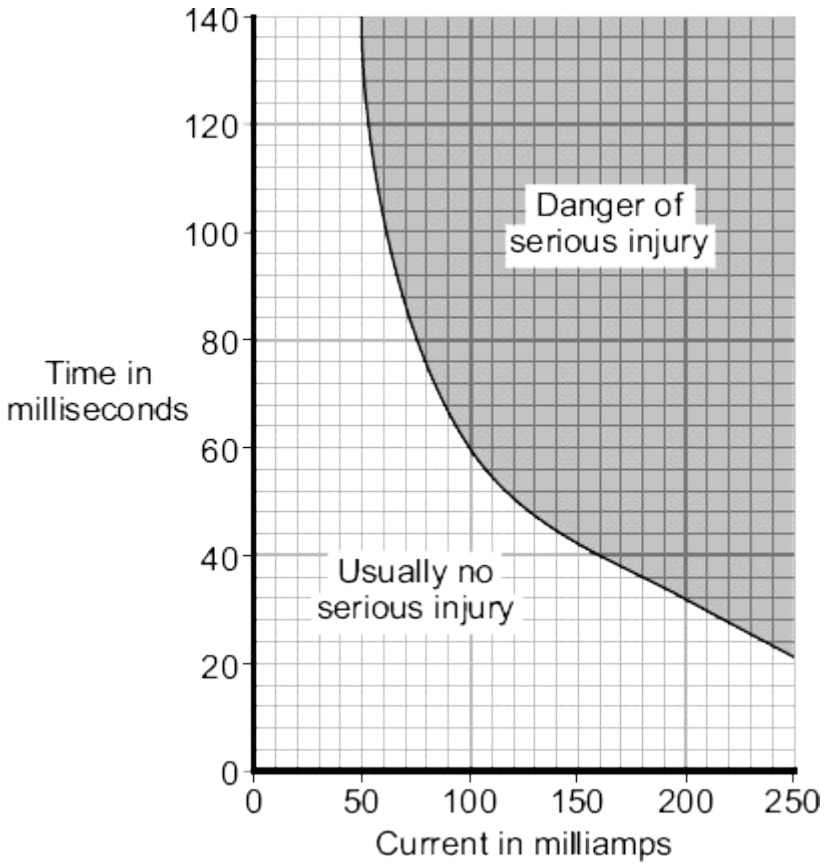
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_____

_____

(2)

(ii) The graph shows how the severity of an electric shock depends on the size of the current and the time that the current flows through the body.



Using the RCCB helps prevent an electric shock seriously injuring the person using the hedge trimmers.

Using information from both the diagram and the graph explain how.

_____

_____

_____

_____

_____

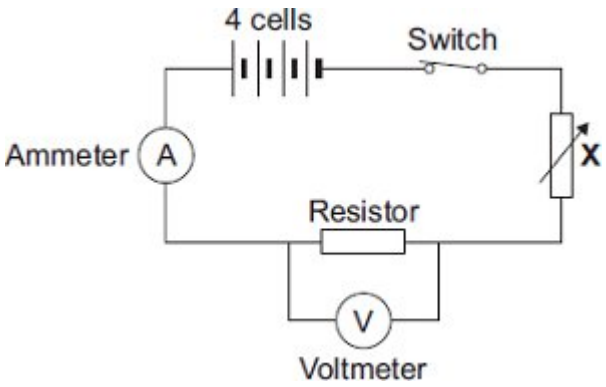
(2)

(Total 10 marks)

Q6.

(a) The diagram shows the circuit that a student used to investigate how the current through a resistor depends on the potential difference across the resistor.

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(i) Each cell provides a potential difference of 1.5 volts.

What is the total potential difference provided by the four cells in the circuit?

_____

Total potential difference = _____ volts

(1)

(ii) The student uses the component labelled **X** to change the potential difference across the resistor.

What is component **X**?

Draw a ring around your answer.

light-dependent resistor **thermistor** **variable resistor**

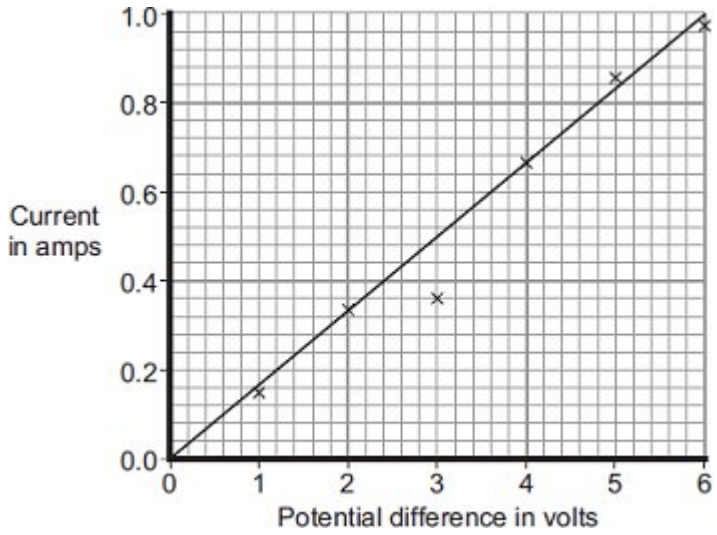
(1)

(iii) Name a component connected in parallel with the resistor.

_____

(1)

(b) The results obtained by the student have been plotted on a graph.



(i) One of the results is anomalous.

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Draw a ring around the anomalous result.

(1)

(ii) Which **one** of the following is the most likely cause of the anomalous result?

Put a tick (✓) in the box next to your answer.

The student misread the ammeter. ☐

The resistance of the resistor changed. ☐

The voltmeter had a zero error. ☐

(1)

(iii) What was the interval between the potential difference values obtained by the student?

_____

_____

(1)

(c) Describe the relationship between the potential difference across the resistor and the current through the resistor.

_____

_____

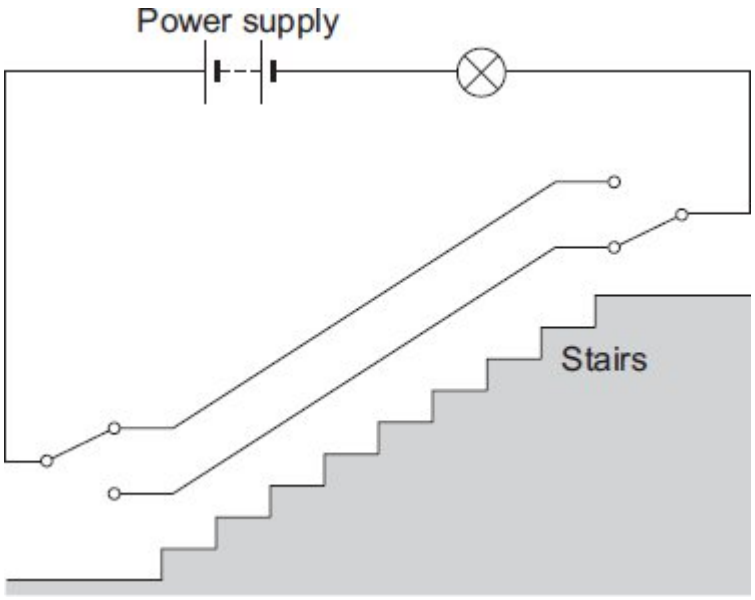
(1)

(Total 7 marks)

Q7.

The diagram shows an electric circuit used in a dolls' house.
The switches are 2-way switches; this means that each switch has a connecting wire that can be in one of two positions.

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(a) (i) With the connecting wire in each switch in the position shown in the diagram, the lamp is off. Why?

_____

_____

(1)

(ii) When switched on, the lamp has a resistance of 18 Ω and draws a current of 0.5 A from the power supply.

Use the equation in the box to calculate the potential difference of the power supply used in the circuit.

potential difference = current × resistance

Show clearly how you work out your answer.

_____

_____

Potential difference = _____ V

(2)

(iii) A second, identical lamp is added to the circuit. The two lamps are joined in series.

Calculate the total resistance of the two lamps.

_____

Total resistance = _____ Ω

(1)

(b) This type of circuit is also used in real houses. One of the switches is at the top of the stairs, and the other switch is at the bottom of the stairs.

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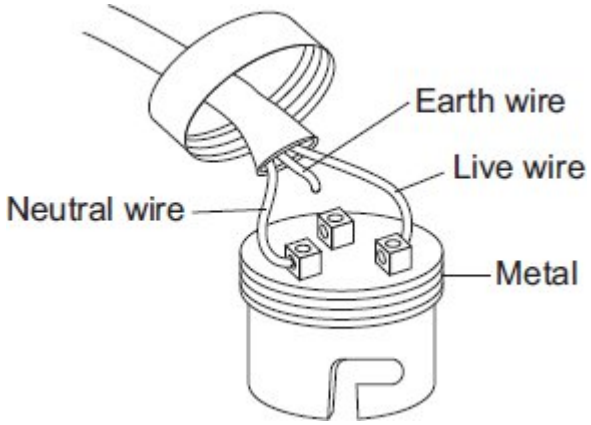
What is the advantage of using this circuit to switch a lamp on or off, rather than using a more simple circuit that has only one switch?

_____

_____

(1)

(c) The diagram shows an old type of metal lamp fitting.



The cable has been connected to the lamp fitting in a way that makes the lamp fitting unsafe.

(i) What is the possible risk to someone touching the lamp fitting while the lamp is switched on?

_____

_____

(1)

(ii) What should be done to make **this** lamp fitting safe to use?

_____

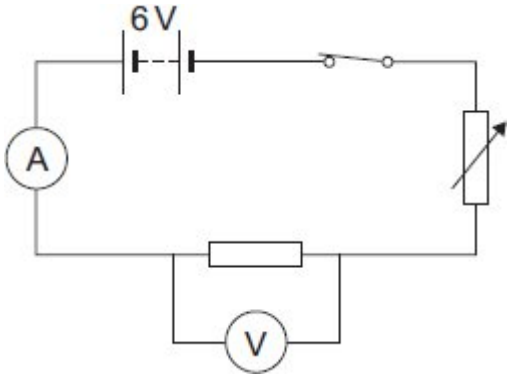
_____

(1)

(Total 7 marks)

Q8.

The diagram shows the circuit set up by a student.



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(a) The student uses the circuit to test the following hypothesis:

'The current through a resistor is directly proportional to the potential difference across the resistor.'

(i) If the hypothesis is correct, what should the student predict will happen to the current through the resistor when the potential difference across the resistor is doubled?

_____

_____

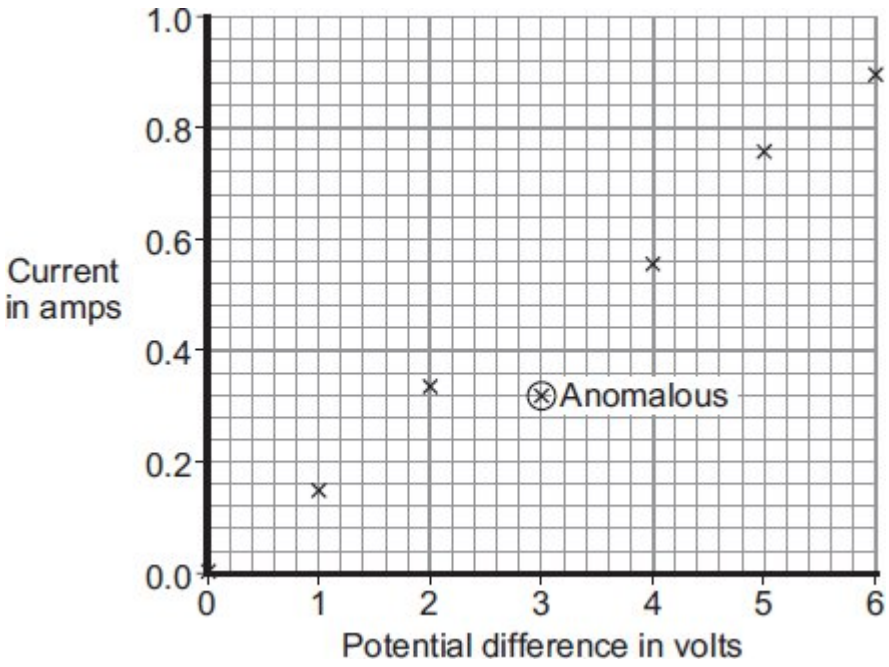
(1)

(ii) Name the component in the circuit used to change the potential difference across the resistor.

_____

(1)

(b) The student used the data obtained to plot the points for a graph of current against potential difference.



(i) Why has the student plotted the points for a line graph and not drawn a bar chart?

_____

_____

(1)

(ii) One of the points has been identified by the student as being anomalous.

What is the most likely cause for this anomalous point?

_____

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_____

(1)

(iii) Draw a line of best fit for these points.

(1)

(iv) Does the data the student obtained support the hypothesis?

Give a reason for your answer.

_____

_____

(1)

(Total 6 marks)

Q9.

The picture shows an electric bicycle. The bicycle is usually powered using a combination of the rider pedalling and an electric motor.



(a) A 36 volt battery powers the electric motor. The battery is made using individual 1.2 volt cells.

(i) Explain how a 36 volt battery can be produced using individual 1.2 volt cells.

To gain full marks, you must include a calculation in your answer.

_____

_____

_____

_____

(2)

(ii) The battery supplies a direct current (d.c.).

What is a *direct current (d.c.)*?

_____

_____

(1)

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(iii) When fully charged, the battery can deliver a current of 5 A for 2 hours. The battery is then fully discharged.

Calculate the maximum charge that the battery stores.

Show clearly how you work out your answer and give the unit.

_____

_____

Charge stored = _____

(3)

(b) When powered only by the electric motor, the bicycle can carry a 90 kg rider at a maximum speed of 6 m/s. Under these conditions, the maximum distance that the bicycle can cover before the battery needs recharging is 32 km.

The bicycle has a mass of 30 kg.

(i) Calculate the maximum kinetic energy of the bicycle **and** rider when the rider is not pedalling.

Show clearly how you work out your answer.

_____

_____

Kinetic energy = _____ J

(2)

(ii) The bicycle can be fitted with panniers (bags) to carry a small amount of luggage.

What effect would fitting panniers and carrying luggage have on the distance the bicycle can cover before the battery needs recharging?

_____

Give a reason for your answer.

_____

_____

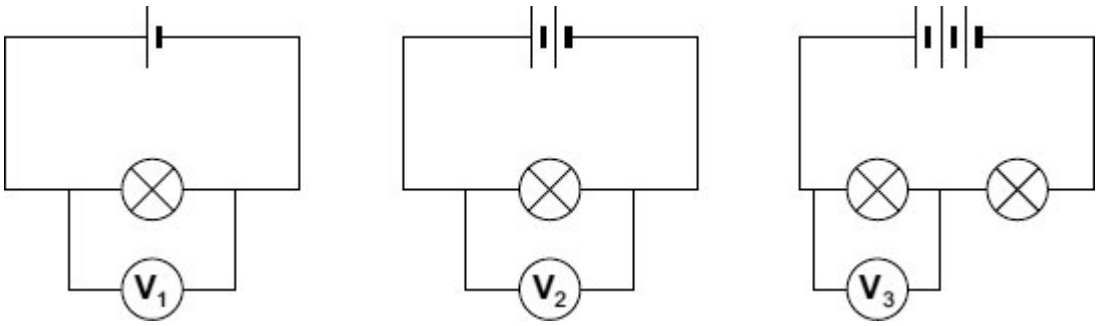
(2)

(Total 10 marks)

Q10.

(a) The lamps in the circuits drawn below are all identical.
Each of the cells has a potential difference of 1.5 volts.

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(i) What is the potential difference across the 3 cells that are joined in series?

_____

Potential difference = _____ V

(1)

(ii) What will be the reading on the voltmeter labelled $\mathbf{V_3}$?

Voltmeter reading $\mathbf{V_3}$ = _____ V

(1)

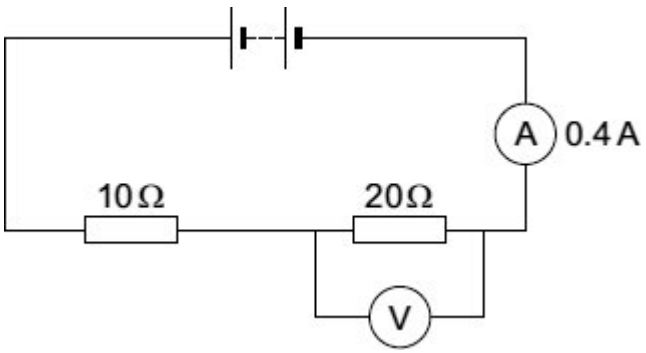
(iii) Which voltmeter, $\mathbf{V_1}$, $\mathbf{V_2}$ or $\mathbf{V_3}$, will give the highest reading?

Draw a ring around your answer.

$\mathbf{V_1}$ $\mathbf{V_2}$ $\mathbf{V_3}$

(1)

(b) The diagram below shows a simple circuit.



(i) Calculate the total resistance of the two resistors in the circuit.

_____

Total resistance = _____ Ω

(1)

(ii) Use the equation in the box to calculate the reading on the voltmeter.

potential difference = current × resistance

Show clearly how you work out your answer.

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_____

_____

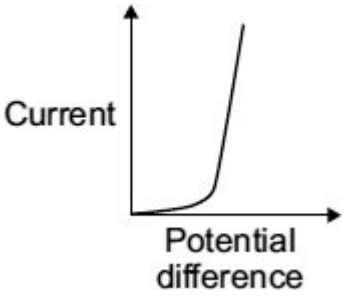
Voltmeter reading = _____ V

(2)

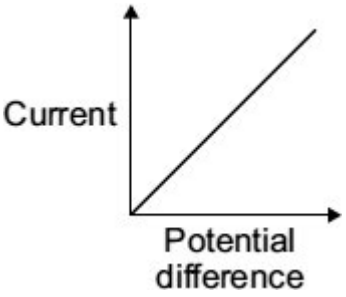
(iii) The current through a resistor at constant temperature changes when the potential difference across the resistor changes.

Which **one** of the graphs, **X**, **Y** or **Z**, shows how the current changes?

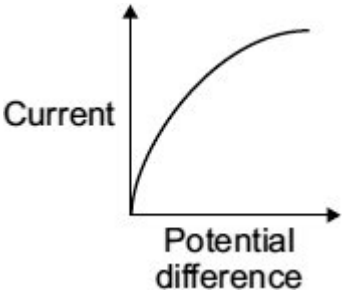
Write your answer, **X**, **Y** or **Z**, in the box.



X



Y



Z

Graph ☐

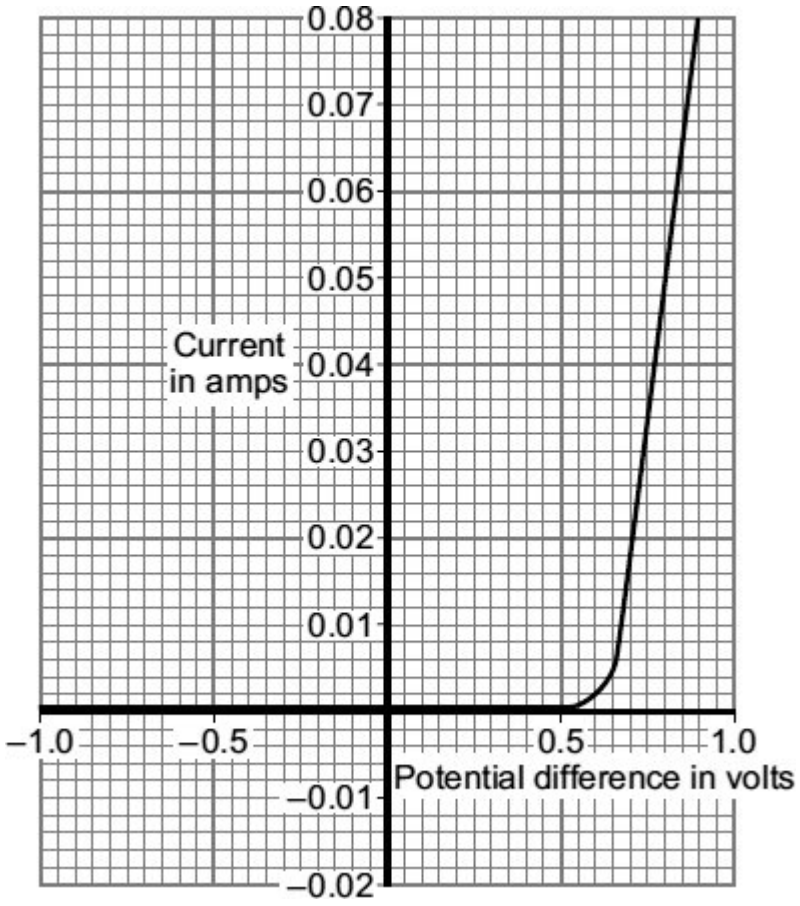
(1)

(Total 7 marks)

Q11.

The current-potential difference graph for one type of electrical component is drawn below.

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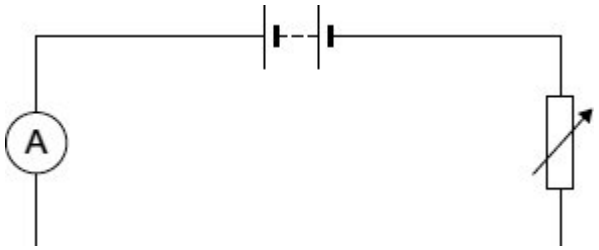


(a) What is the component?

_____

(1)

(b) Complete the diagram to show a circuit that can be used to obtain the data needed to plot the graph. Use the correct circuit symbol for each component that you add to the diagram.



(2)

(c) (i) What is the current through the component when the potential difference across the component is 0.8 volts?

Current _____ amps

(1)

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(ii) Calculate the resistance of the component when the potential difference across it is 0.8 volts.

Show clearly how you work out your answer.

_____

_____

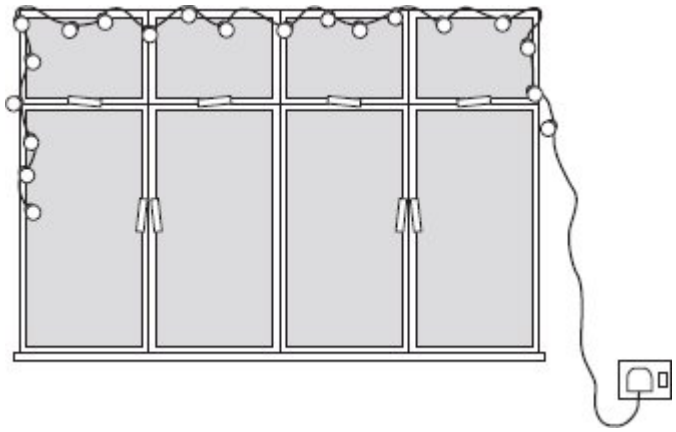
Resistance = _____ Ω

(2)

(Total 6 marks)

Q12.

A set of lights consists of 20 lamps connected in series to the 230 V mains electricity supply.



(a) When the lights are switched on and working correctly, the current through each lamp is 0.25 A.

(i) What is the total current drawn from the mains supply?

_____

(1)

(ii) Calculate the charge passing through **one** of the lamps in 5 minutes.

Show clearly how you work out your answer and give the unit.

_____

_____

_____

_____

Total charge = _____

(3)

(b) One of the lamps in the set is a fuse lamp. This contains a filament which melts if a fault occurs. A short time after the lights are switched on, a fault causes the filament inside the fuse lamp to melt and all the lamps go out.

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The householder cannot find another fuse lamp so connects a piece of aluminium foil across the contacts inside the fuse lamp holder.
When switched on, the nineteen remaining lamps work.
What the householder has done is dangerous.

Explain why.

_____

_____

_____

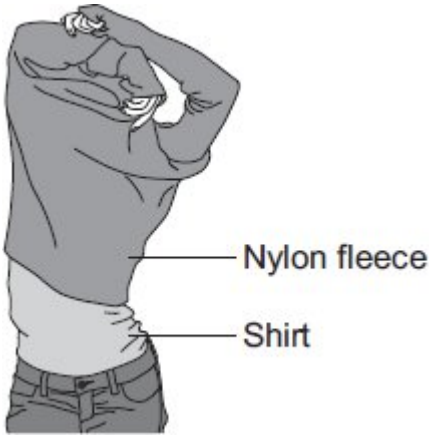
_____

(2)

(Total 6 marks)

Q13.

(a) A student takes off his nylon fleece and feels a small electric shock.
He realises that this happens because his fleece becomes charged.



Explain why the fleece becomes charged.

_____

_____

_____

_____

_____

(2)

(b) Only **two** of the following statements are correct.

Put a tick (✓) in the boxes next to the **two** correct statements.

Positively charged objects repel negatively charged objects. ☐

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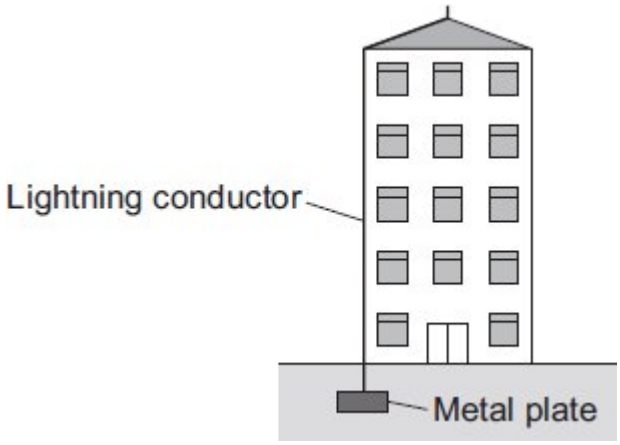
Electrical charges move easily through metals. ☐

Static electricity is safe; it never causes any danger. ☐

An electric current is a flow of electrical charge. ☐

(2)

(c) The diagram shows a lightning conductor attached to the side of a tall building.



If the building is struck by lightning, charge flows to earth through the lightning conductor.

(i) Which of the materials in the list is used to make the lightning conductor?

Draw a ring around your answer.

copper **glass** **plastic**

Give a reason for your answer.

_____

_____

_____

(2)

(ii) Complete the sentence by drawing a ring around the correct line in the box.

The resistance of the lightning conductor is

higher than
the same as

the resistance of the building.

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lower than

(1)

(iii) It is almost impossible to test different designs of lightning conductor in controlled experiments during a lightning storm.

Suggest a reason why.

_____

_____

(1)

(Total 8 marks)

Q14.

Diagram 1 shows a hairdryer.
Diagram 2 shows how the heaters and fan of the hairdryer are connected to a 3-pin plug.
The hairdryer does not have an earth wire.

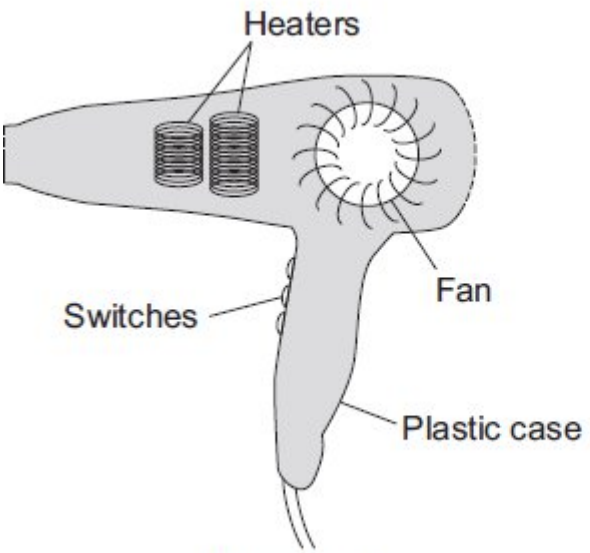


Diagram 1

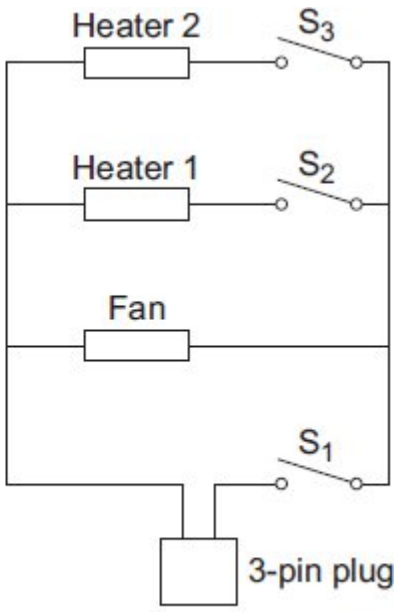


Diagram 2

(a) What colour is the insulation around the wire connected to the live pin inside the plug?

_____

(1)

(b) Why does the hairdryer **not** need an earth wire?

_____

_____

(1)

(c) All the switches are shown in the OFF position.

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(i) Which switch or switches have to be ON to make:

(1) only the fan work; _____

(2) heater 2 work? _____

(2)

(ii) The heaters can only be switched on when the fan is also switched on.

Explain why.

_____

_____

_____

_____

_____

(2)

(d) The table shows the current drawn from the 230 volt mains electricity supply when different parts of the hairdryer are switched on.

	Current in amps
Fan only	1.0
Fan and heater 1	4.4
Fan and both heaters	6.5

Calculate the maximum power of the hairdryer.

Show clearly how you work out your answer and give the unit.

_____

_____

Maximum power = _____

(3)

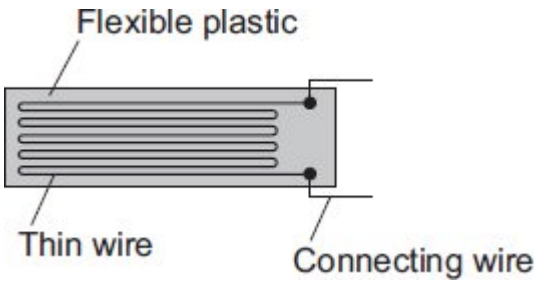
(Total 9 marks)

Q15.

The diagram shows a strain gauge, which is an electrical device used to monitor a changing force.

Applying a force to the gauge causes it to stretch.
This makes the electrical resistance of the wire change.

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(a) (i) Using the correct symbols, **add** to the diagram to show how a battery, an ammeter and a voltmeter can be used to find the resistance of the strain gauge drawn above.

(2)

(ii) When in use, the strain gauge is always connected to a d.c. power supply, such as a battery.

How is a d.c. (direct current) power supply different from an a.c. (alternating current) power supply?

_____

_____

_____

(1)

(b) Before any force is applied, the unstretched gauge, correctly connected to a 3.0 V battery, has a current of 0.040 A flowing through it.

(i) Calculate the resistance of the unstretched gauge.

Show clearly how you work out your answer.

_____

_____

Resistance = _____ Ω

(2)

(ii) Stretching the gauge causes the current flowing through the gauge to decrease.

What happens to the resistance of the gauge when it is stretched?

_____

_____

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(1)

(iii) What form of energy is stored in the gauge when a force is applied and the gauge stretches?

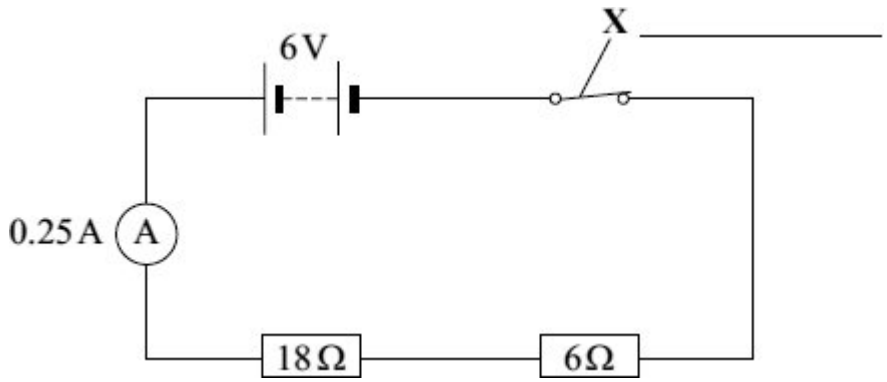
_____

(1)

(Total 7 marks)

Q16.

A circuit diagram is shown below.



(a) Use a word from the box to label component **X**.

fuse	**switch**	**thermistor**

(1)

(b) Calculate the total resistance of the two resistors in the circuit.

_____

Total resistance = _____ Ω

(1)

(c) The reading on the ammeter is 0.25 A.

The current through the 6 Ω resistor will be:

bigger than 0.25 A **equal to 0.25 A** **smaller than 0.25 A**

Draw a ring around your answer

(1)

(d) The 6 V battery is made by correctly joining several 1.5 V cells in series.

Calculate the number of cells needed to make the battery.

_____

Number of cells = _____

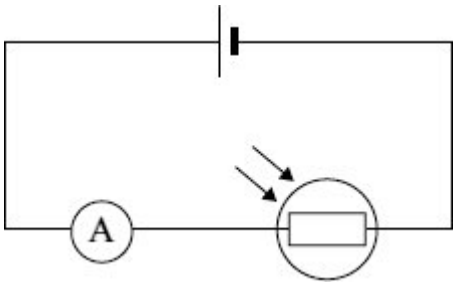
(1)

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(Total 4 marks)

Q17.

The diagram shows a simple circuit.



(a) The circuit includes an LDR.

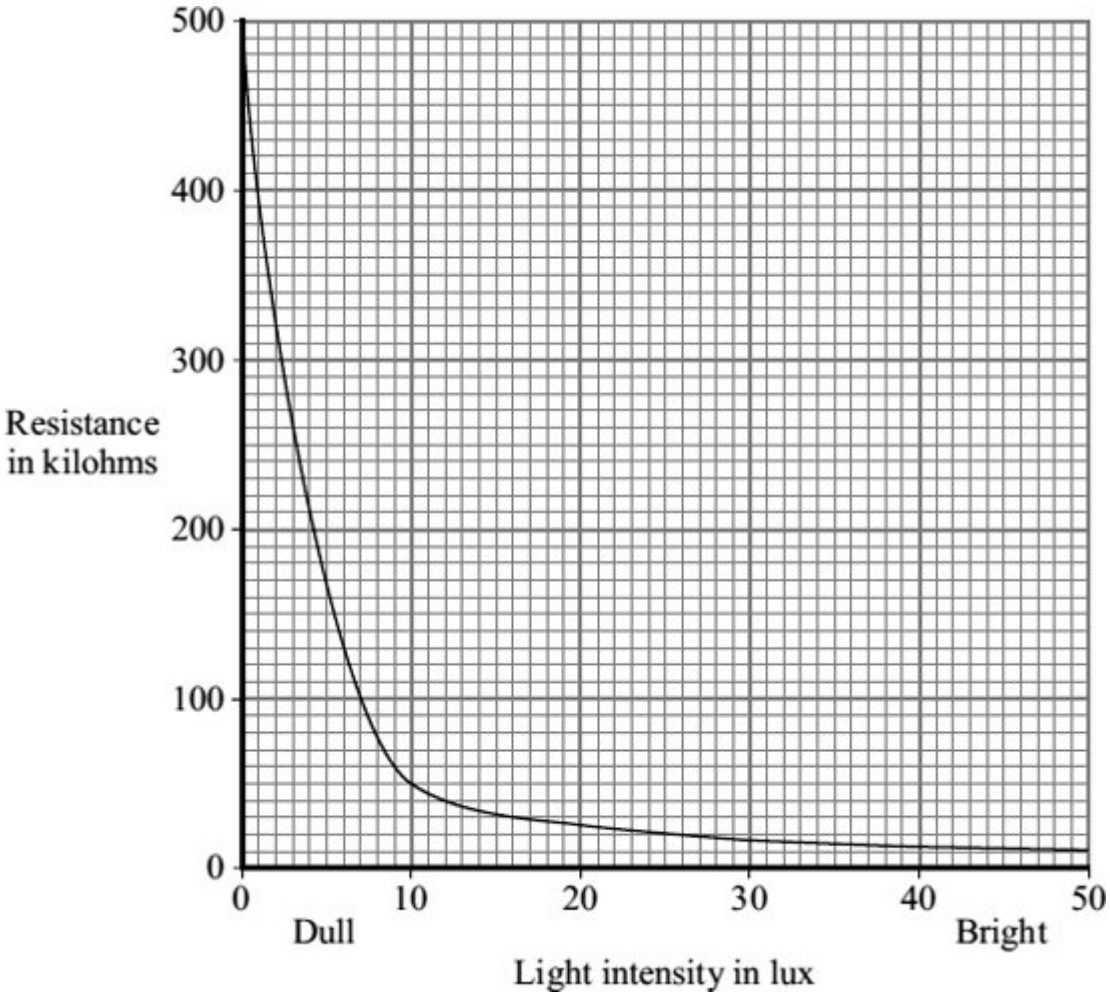
What do the letters LDR stand for?

Draw a ring around your answer.

Light-dependable resistor **light-dependent resistor** **light-direct resistor**

(1)

(b) The graph shows how the resistance of an LDR changes with light intensity.



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Describe in detail how the resistance of the LDR changes as the light intensity increases from 0 to 50 lux.

_____

_____

_____

_____

_____

_____

(3)

(c) (i) Complete the following sentence by drawing a ring around the correct line in the box.

A decrease in the light intensity of light on the LDR will

decrease
not change
increase

the reading on the ammeter.

(1)

(ii) Give a reason for your answer to part (c)(i).

_____

_____

(1)

(d) An LDR can be used to switch a circuit on and off automatically.

In which **one** of the following would an LDR be used?

Put a tick (✓) in the box next to your answer.

a circuit to switch on central heating when it gets cold ☐

a circuit to switch on security lighting when it gets dark ☐

a circuit to switch on a water sprinkler when the soil in a greenhouse is dry ☐

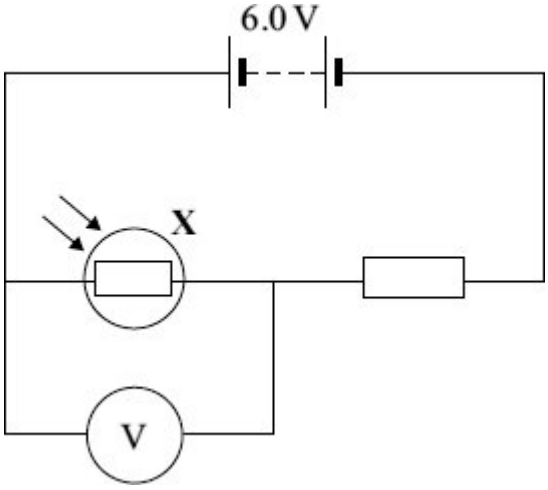
(1)

(Total 7 marks)

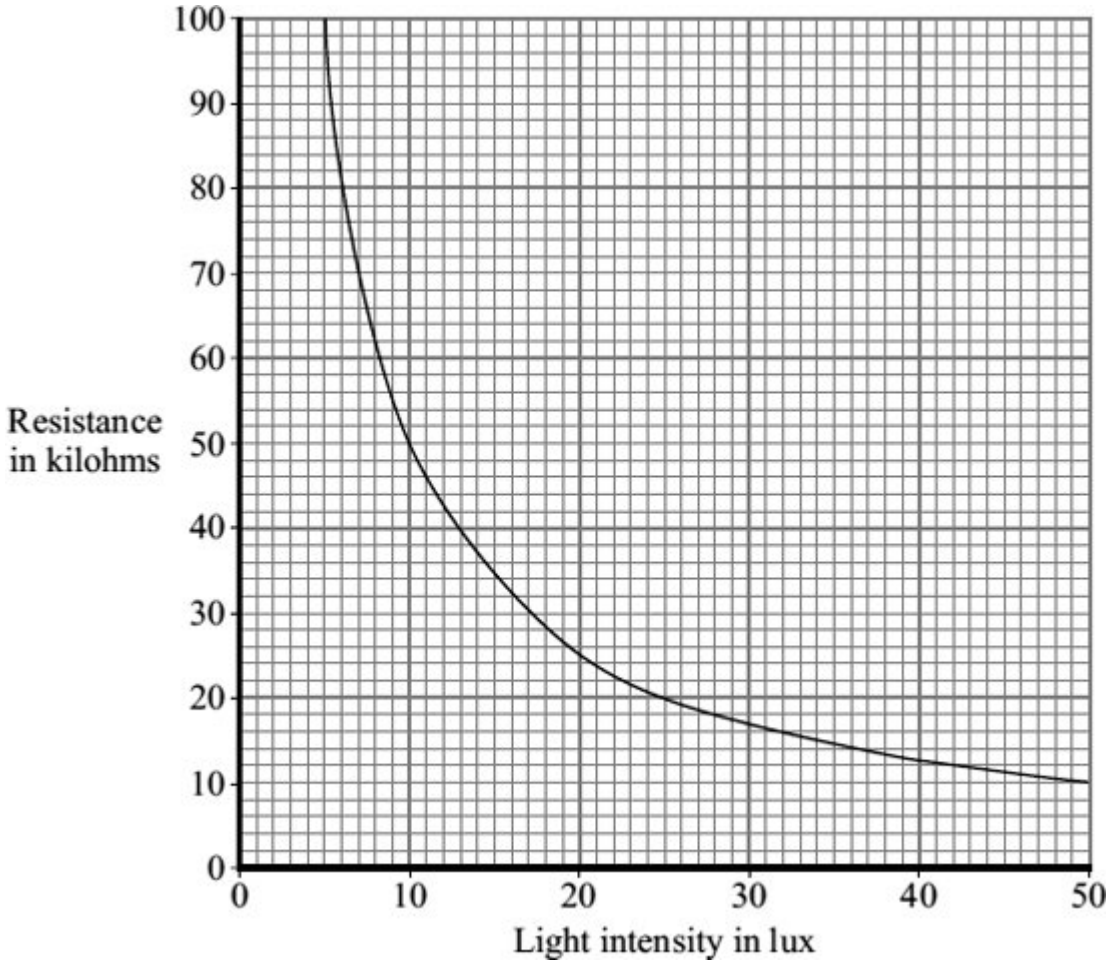
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Q18.

The diagram shows a simple light-sensing circuit.



(a) The graph, supplied by the manufacturer, shows how the resistance of the component labelled **X** varies with light intensity.



(i) What is component **X**?

_____

(1)

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(ii) Use the graph to find the resistance of component **X** when the light intensity is 20 lux.

_____

(1)

(iii) When the light intensity is 20 lux, the current through the circuit is 0.0002 A.

Calculate the reading on the voltmeter when the light intensity is 20 lux.

Show clearly how you work out your answer.

_____

_____

Voltmeter reading =_____ volts

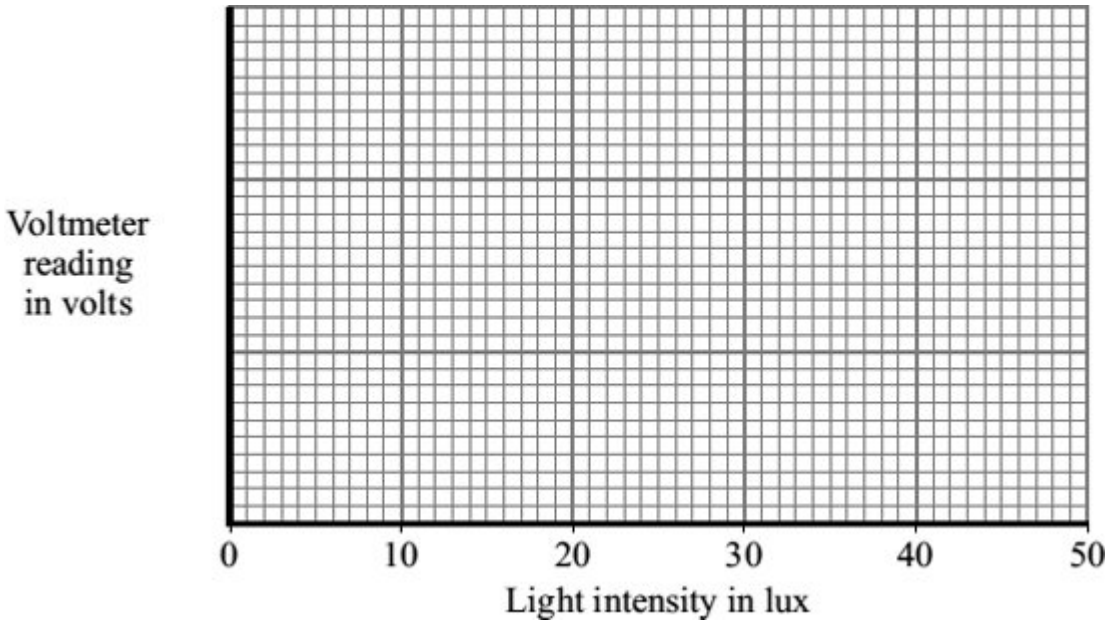
(2)

(b) Use the grid below to show how the voltmeter reading in the light-sensing circuit varies with light intensity.

(i) Add a suitable scale to the *y*-axis (vertical axis).

(1)

(ii) Complete the sketch graph by drawing a line on the grid to show how the voltmeter reading will vary with light intensity.



(2)

(c) The following passage is taken from the technical data supplied for component **X** by the manufacturer.

> For any given light intensity, the resistance of this component can vary by plus or minus 50% of the value shown on the **graph of light intensity and resistance**.

(i) Calculate the maximum resistance that component **X** could have at 20 lux light intensity.

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_____

Maximum resistance =_____ kilohms

(1)

(ii) Explain why this light-sensing circuit would **not** be used to measure values of light intensity.

_____

_____

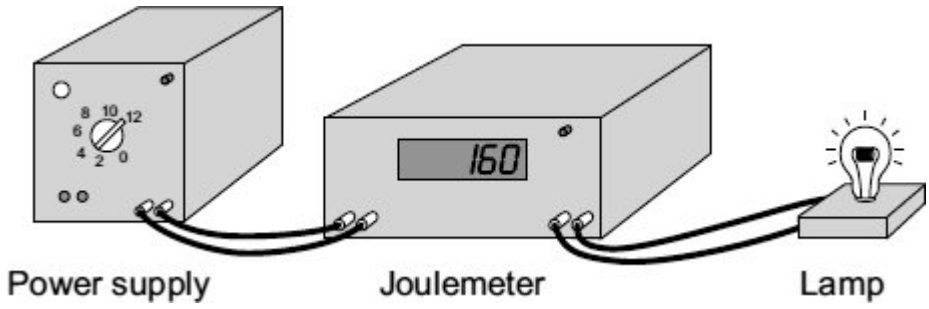
_____

(2)

(Total 10 marks)

Q19.

A student used a joulemeter to measure the energy transformed by a lamp.



The student set the joulemeter to zero, and then switched on the power supply.

After 120 seconds (2 minutes), the reading on the joulemeter had increased to 2880.

(a) In the space below, draw the circuit symbol used to represent a lamp.

(1)

(b) (i) Use the equation in the box to calculate the power of the lamp.

$$\text{power} = \frac{\text{energy transformed}}{\text{time}}$$

Show clearly how you work out your answer.

_____

_____

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Power = _____

(2)

(ii) Which **one** of the following is the unit of power?

Draw a ring around your answer.

joule **newton** **watt**

(1)

(c) Complete the following sentence using one of the phrases from the box.

larger than	the same as	smaller than

If the lamp was left switched on for 10 minutes, the amount of energy transformed would be _____ the amount of energy transformed in 2 minutes.

(1)

(Total 5 marks)

Q20.

Complete each of the following sentences, **A**, **B**, **C**, **D** and **E**, by choosing the correct ending from **K**, **L**, **M**, **N** or **O**.

The first one has been done for you.

A The current through a resistor depends _____ O

B A direct current _____

C In a series circuit, the potential difference _____

D An alternating current _____

E In a parallel circuit, the potential difference _____

K _____ across each component is the same.

L _____ is supplied by a cell or battery.

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M _____ is constantly changing direction.

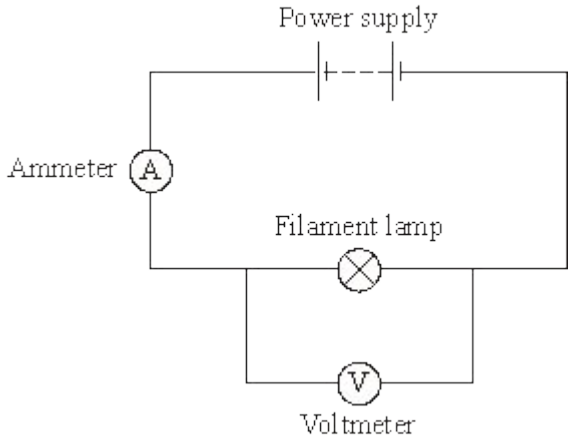
N _____ of the power supply is shared by the components.

O _____ on the potential difference across the resistor.

(Total 3 marks)

Q21.

(a) The diagram shows the circuit used by a student to measure the power of a filament lamp.



Name a component connected in parallel with the filament lamp.

_____

(1)

(b) By adding another component to the circuit, the student is able to obtain a range of ammeter and voltmeter readings.

Ammeter reading in amps	Voltmeter reading in volts
0.10	1.0
0.15	2.0
0.20	4.0
0.25	7.0
0.30	11.0

(i) Which **one** of the following components did the student add to the circuit?

Draw a ring around your answer.

fuse **switch** **variable resistor**

(1)

(ii) What is the range of ammeter readings taken by the student?

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from _____ amps to _____ amps

(1)

(iii) Use the data in the table and the equation in the box to calculate the **maximum** power of the filament lamp.

$$\frac{\text{power}}{(\text{watt, W})} = \frac{\text{current}}{(\text{ampere, A})} \times \frac{\text{potential difference}}{(\text{volt, V})}$$

Show clearly how you work out your answer.

_____

_____

Power = _____ W

(3)

(c) Complete the following sentence by drawing a ring around the correct line in the box.

As the temperature of a filament lamp increases, its resistance

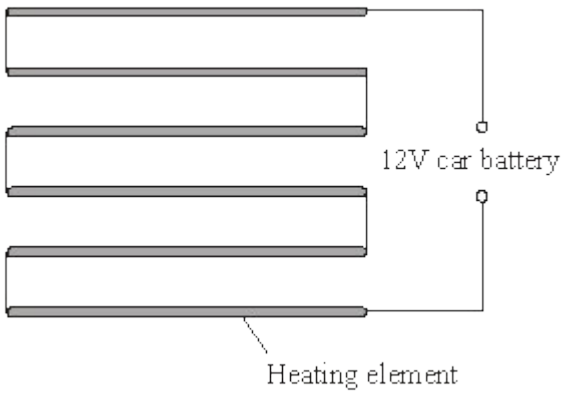
increases
remains constant
decreases

(1)

(Total 7 marks)

Q22.

The diagram shows a simple type of car rear window heater. The six heating elements are exactly the same.



Each heating element has a resistance of 5 Ω. The current passing through each element is 0.4 A.

(i) Calculate the total resistance of the six heating elements.

Show clearly how you work out your answer.

_____

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_____

Total resistance = _____ ohms

(2)

(ii) Why is the current passing through each element the same?

_____

_____

(1)

(iii) What is the total current passing through the whole circuit?

_____

(1)

(iv) How is the 12 volt potential difference of the car battery shared between the six heating elements?

_____

_____

(1)

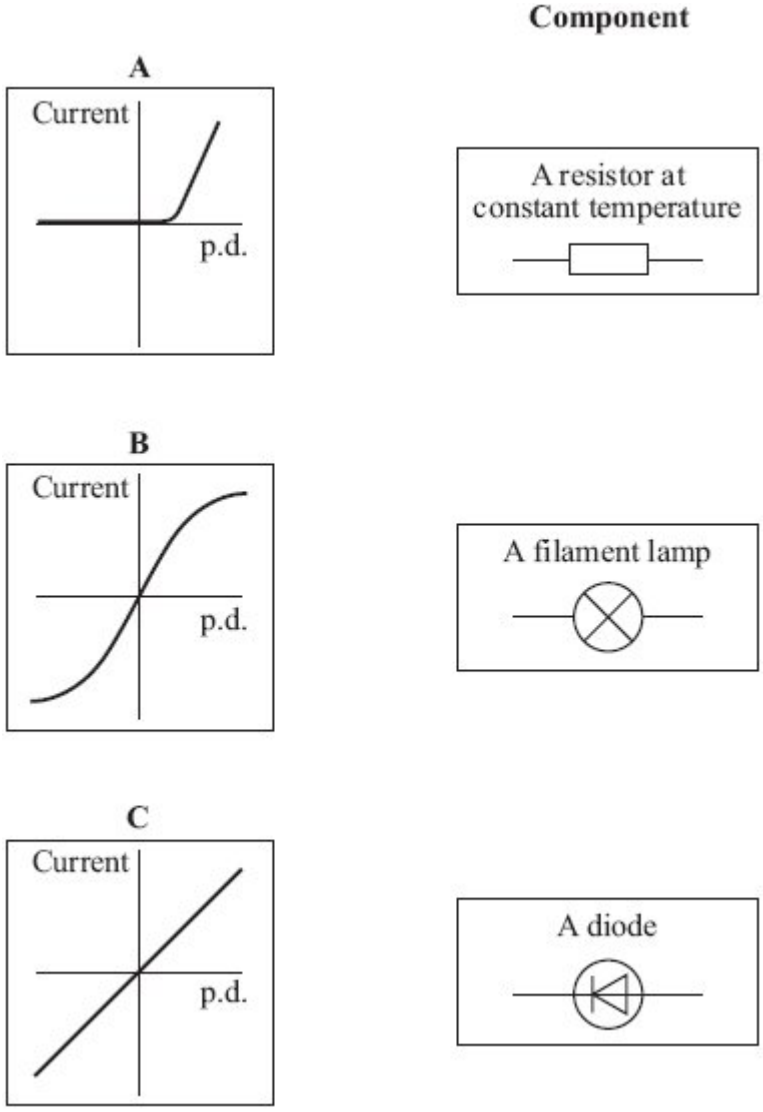
(Total 5 marks)

Q23.

(a) The graphs, **A**, **B** and **C**, show how the current through a component varies with the potential difference (p.d.) across the component.

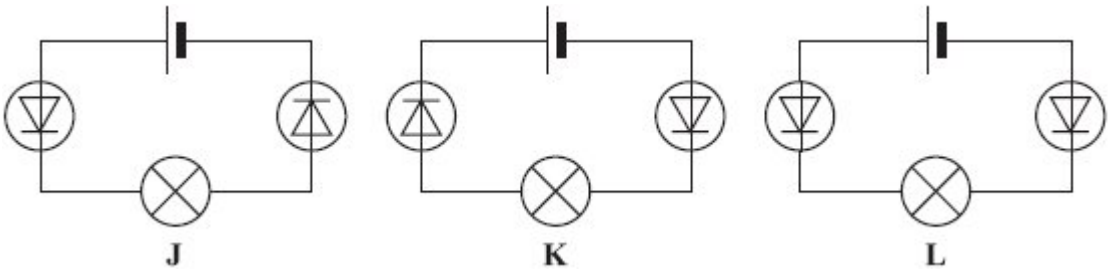
Draw a line to link each graph to the correct component.
Draw only **three** lines.

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(2)

(b) Each of the circuits, **J**, **K** and **L**, include two diodes.



In which **one** of the circuits, **J**, **K** or **L**, would the filament lamp be on?

_____

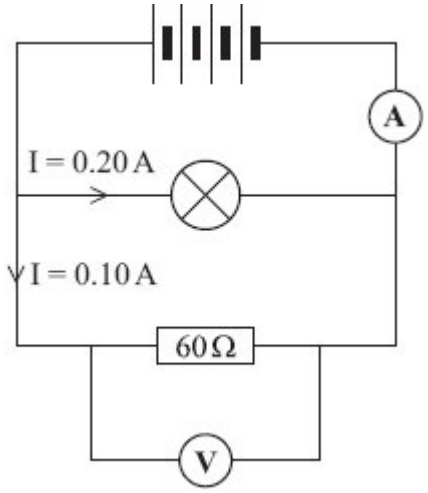
(1)

(Total 3 marks)

Q24.

A circuit was set up as shown in the diagram.

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(a) Each cell provides a potential difference of 1.5 volts.

(i) What is the total potential difference provided by the four cells in the circuit?

_____

Total potential difference = _____ volts

(1)

(ii) What will be the reading on the voltmeter?

_____

(1)

(b) The current through the lamp is 0.20 amps.
The current through the resistor is 0.10 amps.

What is the reading on the ammeter?

_____

Reading on ammeter = _____ amps

(1)

(c) Use a phrase from the box to complete the following sentence.

greater than	**equal to**	**smaller than**

The resistance of the lamp is _____ 60 Ω.

Give a reason for your answer.

_____

_____

(2)

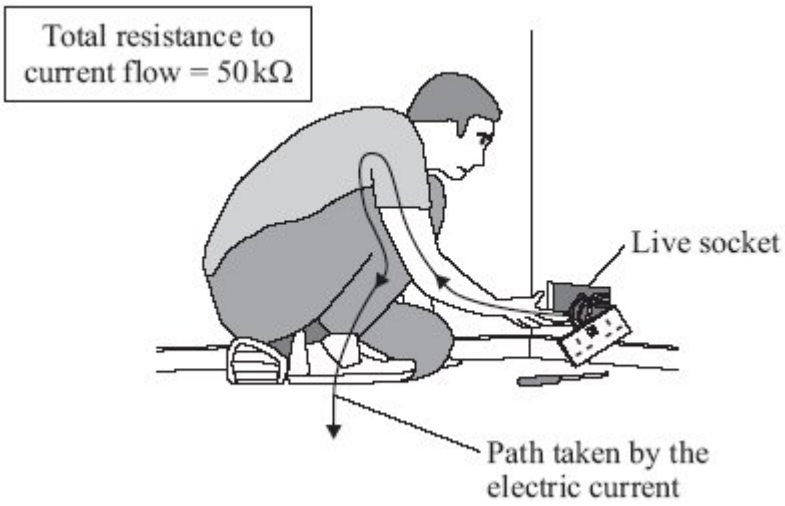
(Total 5 marks)

Q25.

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The diagram shows someone accidentally touching the live wire inside a dismantled 230 volt mains electricity socket.

A current flows through the person giving him an electric shock.



(a) (i) Calculate the current that will flow through the person.

Show clearly how you work out your answer.

_____

_____

Current = _____ A

(2)

(ii) Rubber is a good insulator.

Explain why it is a good idea for electricians to wear rubber soled boots when working.

_____

_____

_____

_____

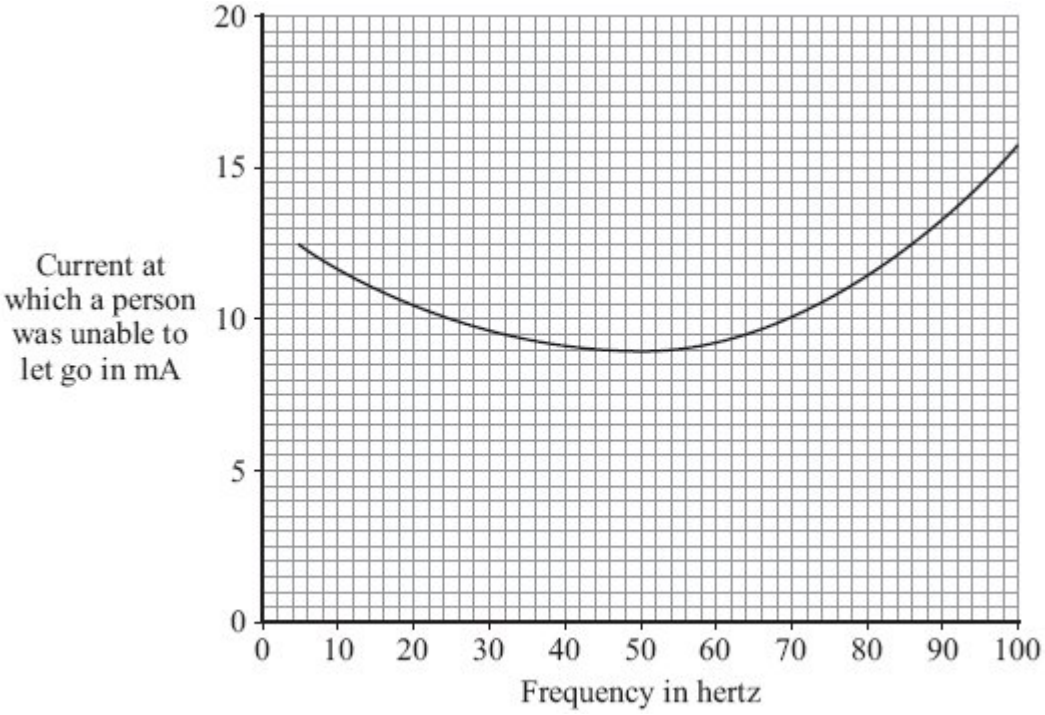
(2)

(b) If the current flowing through a person is too high, the person cannot let go of the electrical source.

Different people were tested to see whether the ability to let go of an electrical source depended on the frequency of the current.

The results of the test are shown in the graph.

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(i) What is the frequency of the mains electricity supply in the UK?

_____

(1)

(ii) From a safety point of view, is the frequency of the UK mains electricity supply suitable?

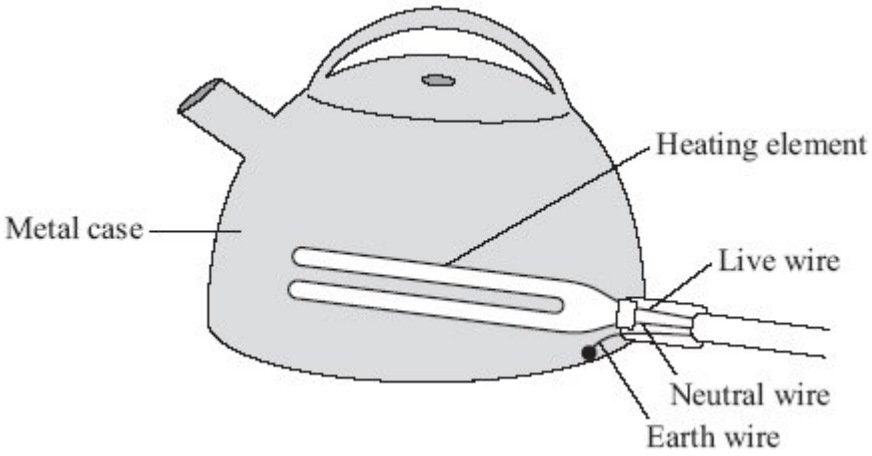
Give a reason for your answer.

_____

_____

(1)

(c) The diagram shows how the electric supply cable is connected to an electric kettle. The earth wire is connected to the metal case of the kettle.



If a fault makes the metal case live, the earth wire and the fuse inside the plug protect anyone using the kettle from an electric shock.

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Explain how.

_____

_____

_____

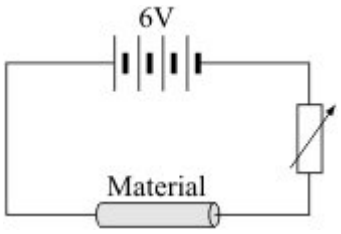
_____

(2)

(Total 8 marks)

Q26.

(a) The diagram shows the circuit used to investigate the resistance of a material. The diagram is incomplete; the ammeter and voltmeter are missing.



(i) Draw the symbols for the ammeter and voltmeter on the diagram in the correct places.

(2)

(ii) How can the current through the material be changed?

_____

_____

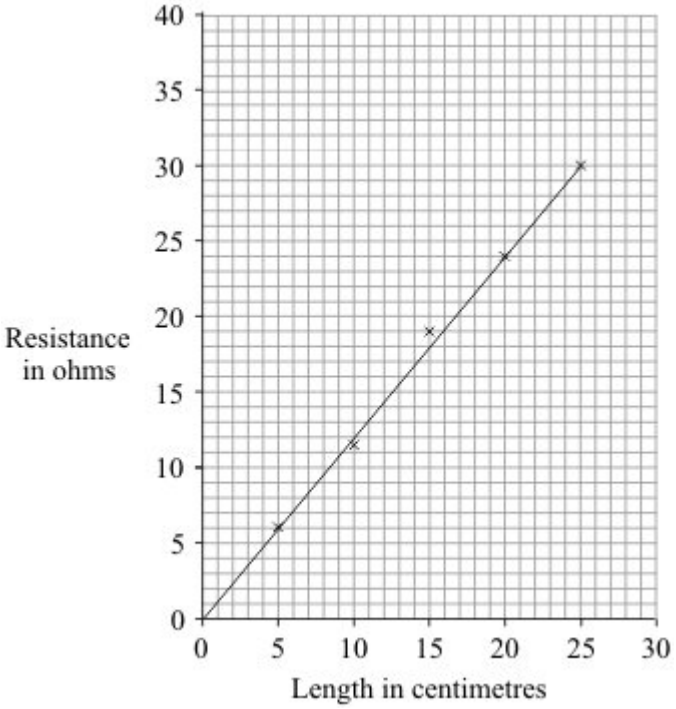
(1)

(b) The material, called conducting putty, is rolled into cylinders of different lengths but with equal thicknesses.

Graph 1 shows how the resistance changes with length.

Graph 1

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(i) Why has the data been shown as a line graph rather than a bar chart?

_____

_____

(1)

(ii) The current through a 30 cm length of conducting putty was 0.15 A.

Use **Graph 1** to find the resistance of a 30 cm length of conducting putty.

Resistance = _____ ohms

(1)

(iii) Use your answer to (b)(ii) to calculate the potential difference across a 30 cm length of conducting putty.

Show clearly how you work out your answer.

_____

_____

_____

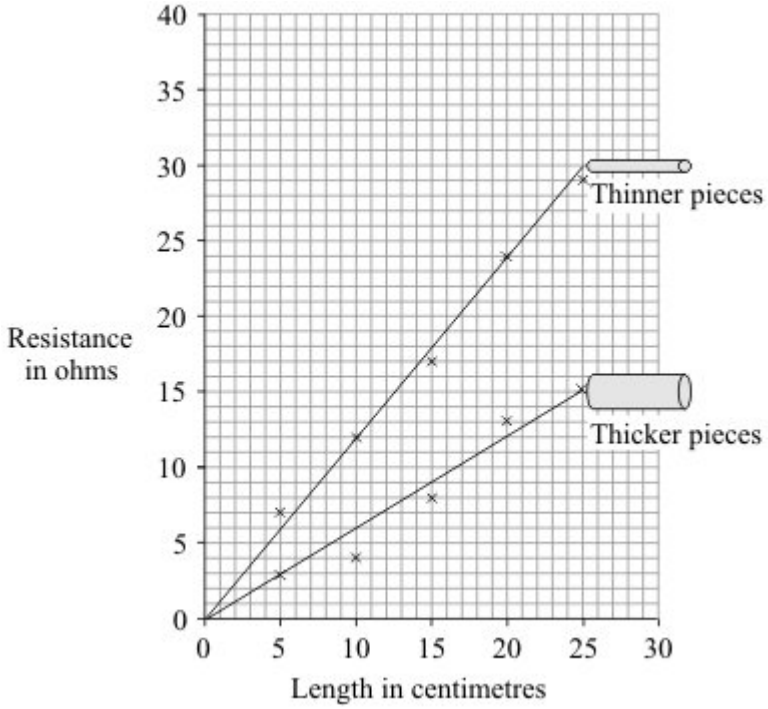
Potential difference = _____ volts

(2)

(c) A second set of data was obtained using thicker pieces of conducting putty. Both sets of results are shown in **Graph 2.**

Graph 2

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(i) What is the relationship between the resistance and the thickness of the conducting putty?

_____

_____

(1)

(ii) Name **one** error that may have reduced the accuracy of the results.

_____

(1)

(iii) How could the reliability of the data have been improved?

_____

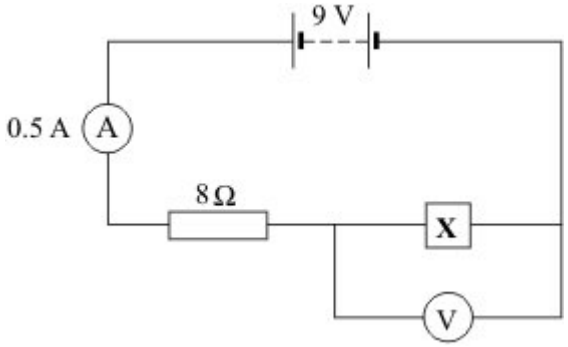
_____

(1)

(Total 10 marks)

Q27.

(a) The circuit diagram drawn below includes a component labelled **X**.



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(i) Calculate the potential difference across the 8 ohm resistor.

Show clearly how you work out your answer.

_____

_____

Potential difference = _____ volts

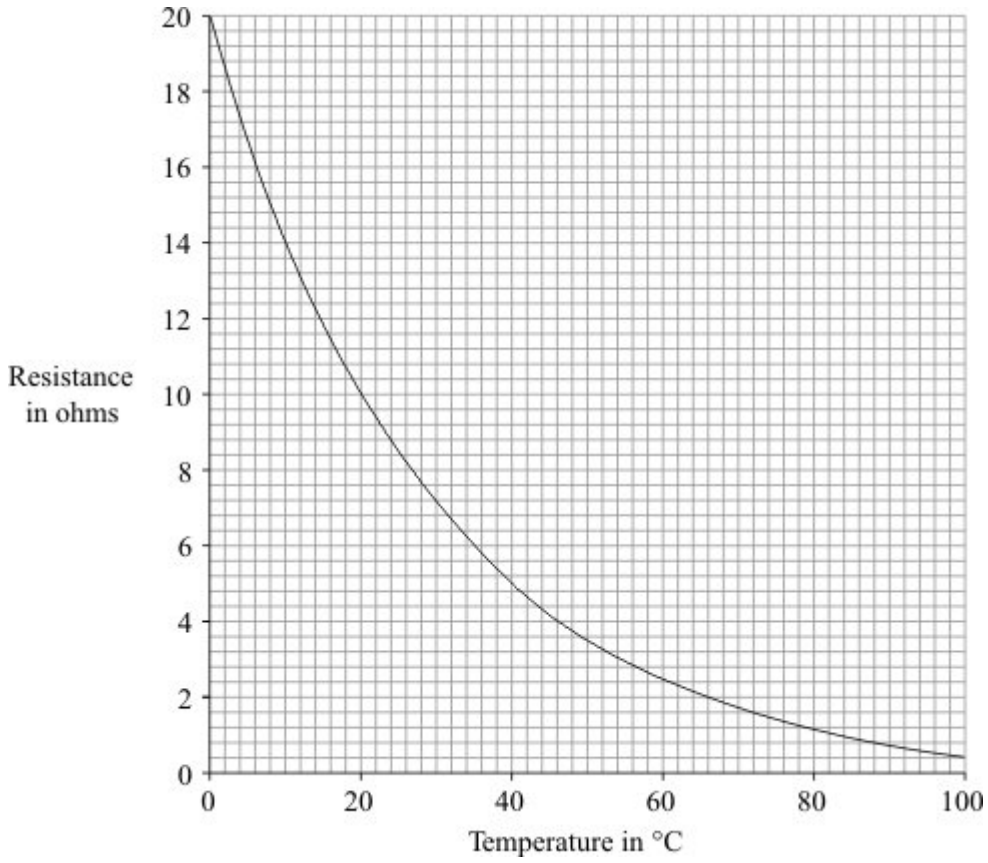
(2)

(ii) What is the potential difference across component **X**?

_____

(1)

(b) The graph shows how the resistance of component **X** changes with temperature.



(i) What is component **X**?

_____

(1)

(ii) Over which range of temperatures does the resistance of component **X** change the most?

Put a tick (✓) next to your choice.

0 °C to 20 °C ☐

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20 °C to 40 °C ☐

40 °C to 60 °C ☐

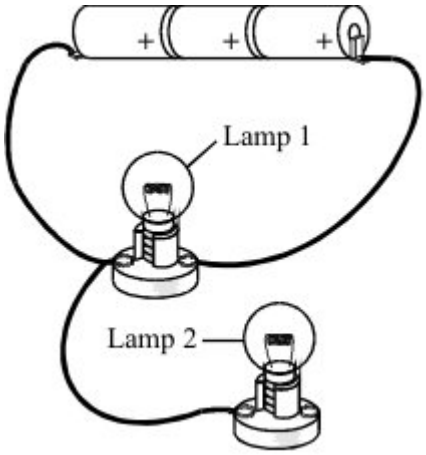
60 °C to 80 °C ☐

80 °C to 100 °C ☐

(1)
(Total 5 marks)

Q28.

The drawing shows three identical cells and two identical lamps joined in a circuit.



(a) Use the correct symbols to draw a circuit diagram for this circuit.

(3)

(b) Each of the cells provides a potential difference (voltage) of 1.5 volts. What is the total potential difference (voltage) provided by all three cells?

_____ volts

(1)

(c) Complete this sentence by crossing out the **two** lines in the box that are wrong.

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The current through lamp 2 will be [smaller than / the same as / bigger than] the current through lamp 1.

(1)

(Total 5 marks)

Q29.

A set of Christmas tree lights is made from twenty identical lamps connected in series.



(a) Each lamp is designed to take a current of 0.25 A. The set plugs directly into the 230 V mains electricity supply.

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

_____

_____

(1)

(ii) Calculate the resistance of **one** of the lamps. Show clearly how you work out your final answer and give the unit.

_____

_____

_____

_____

Resistance = _____

(4)

(iii) What is the total resistance of the set of lights?

_____

_____

Total resistance = _____

(1)

(b) How does the resistance of a filament lamp change as the temperature of the filament changes?

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_____

_____

_____

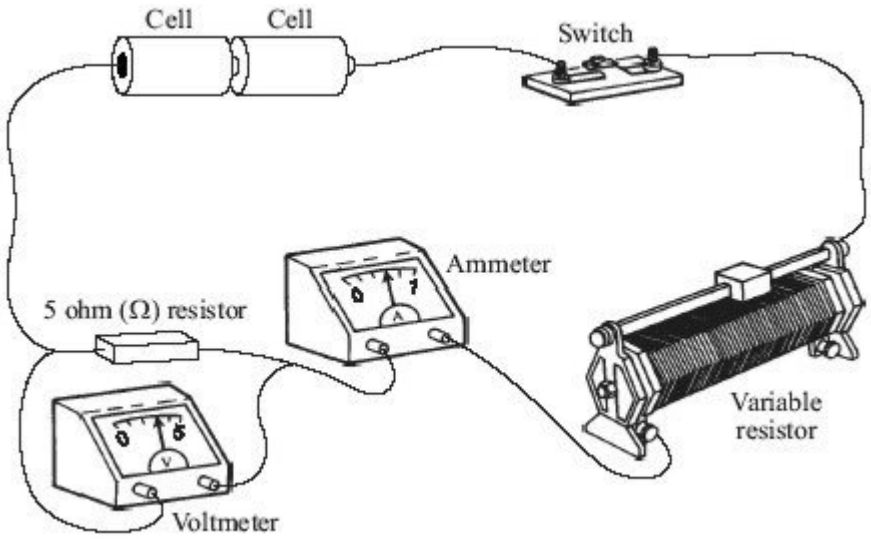
_____

(1)

(Total 7 marks)

Q30.

The drawing shows the circuit used to investigate how the current through a 5 ohm (Ω) resistor changes as the potential difference (voltage) across the resistor changes.



(a) Draw, in the space below, a circuit diagram of this circuit. Use the correct symbols for each part of the circuit.

(2)

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

_____

(1)

(ii) Calculate the potential difference across the 5 ohm (Ω) resistor when the current through the resistor equals 0.4 A. Show clearly how you work out your final answer.

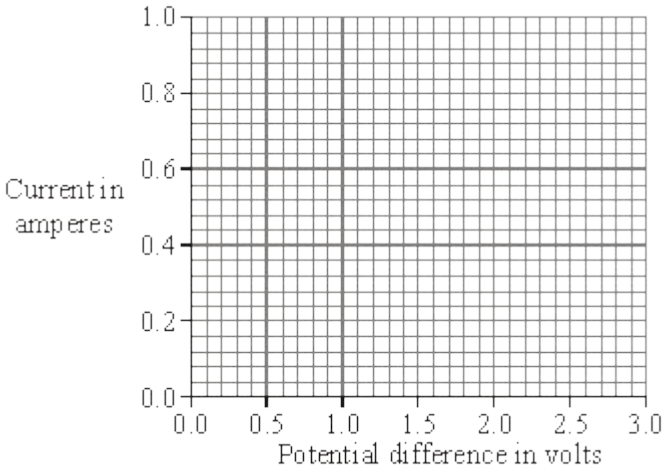
_____

_____

potential difference = _____ volts

(2)

(iii) Complete the graph to show how the current through the resistor changes as the potential difference across the resistor increases from 0 V to 3 V. Assume the resistor stays at a constant temperature.



(2)

(c) The resistor is replaced by a 3 V filament lamp. The resistance of the lamp increases as the potential difference across it increases. Why?

_____

_____

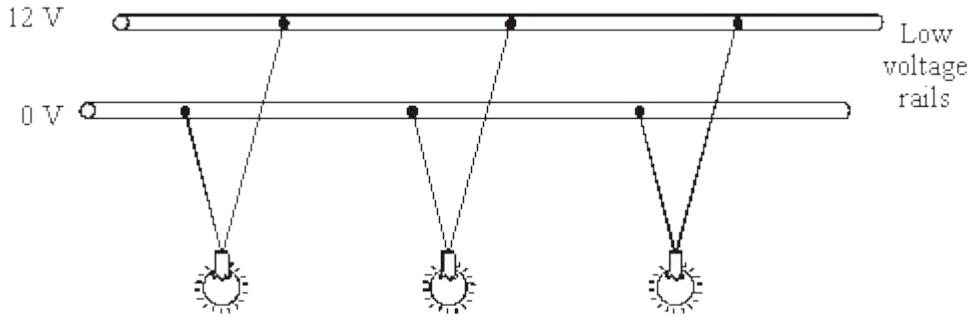
(1)

(Total 8 marks)

Q31.

The diagram shows a 12 volt lighting system. Each lamp has a power of 32 watts.

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(i) Write down the equation that links current, potential difference and power.

_____

(1)

(ii) Calculate the input current to the lighting system. Show clearly how you work out your answer.

_____

_____

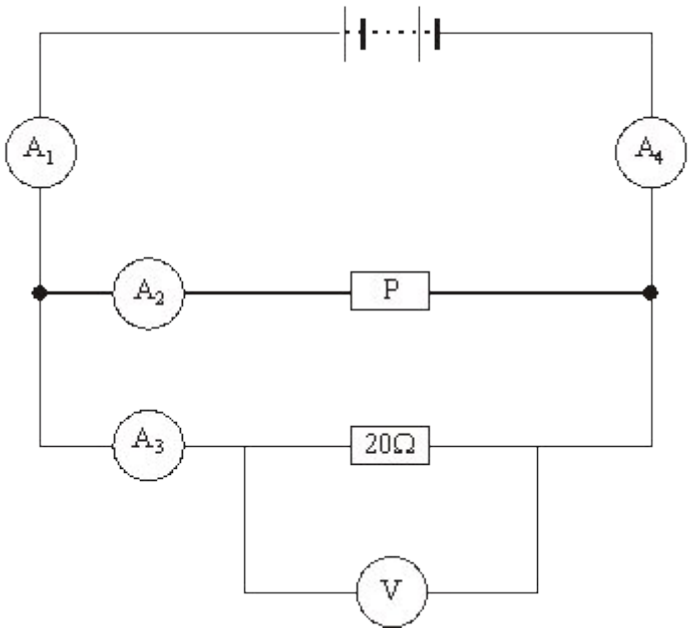
current = _____ A

(2)

(Total 3 marks)

Q32.

The circuit shown has four identical ammeters.



(a) The table gives the current through two of the ammeters.

(i) Complete the table to show the current through the other two ammeters.

Ammeter	Reading on ammeter in amps

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A_1	
A_2	0.2
A_3	0.3
A_4	

(2)

(ii) Which **one** of the following statements is correct. Tick (✓) the box next to your choice.

The resistance of **P** is more than 20 Ω. ☐

The resistance of **P** is equal to 20 Ω. ☐

The resistance of **P** is less than 20 Ω. ☐

Give a reason for your choice.

_____

_____

_____

(2)

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

_____

(1)

(ii) Calculate the reading on the voltmeter. Show clearly how you work out your answer.

_____

_____

Voltmeter reading = _____ volts.

(2)

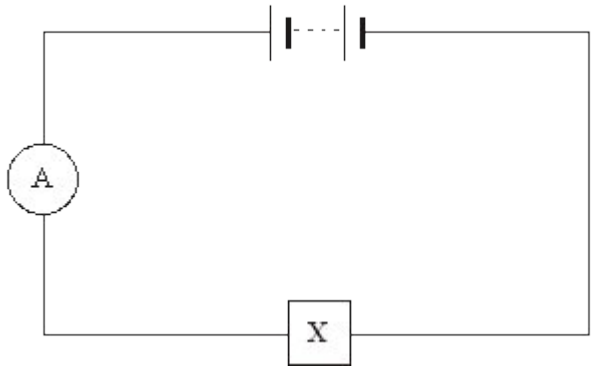
(iii) State the potential difference of the power supply.

_____

(1)

(c) A second circuit contains an unknown component labelled **X**.

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As component **X** is heated, the reading on the ammeter goes up.

What is component **X**?

_____

Give a reason for your answer.

_____

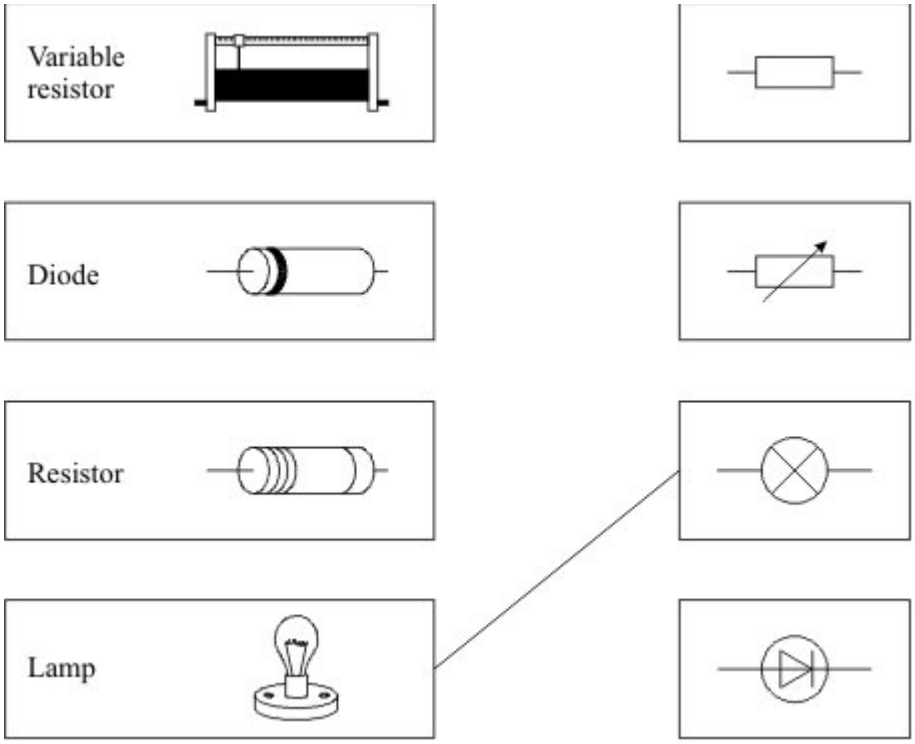
_____

(2)

(Total 10 marks)

Q33.

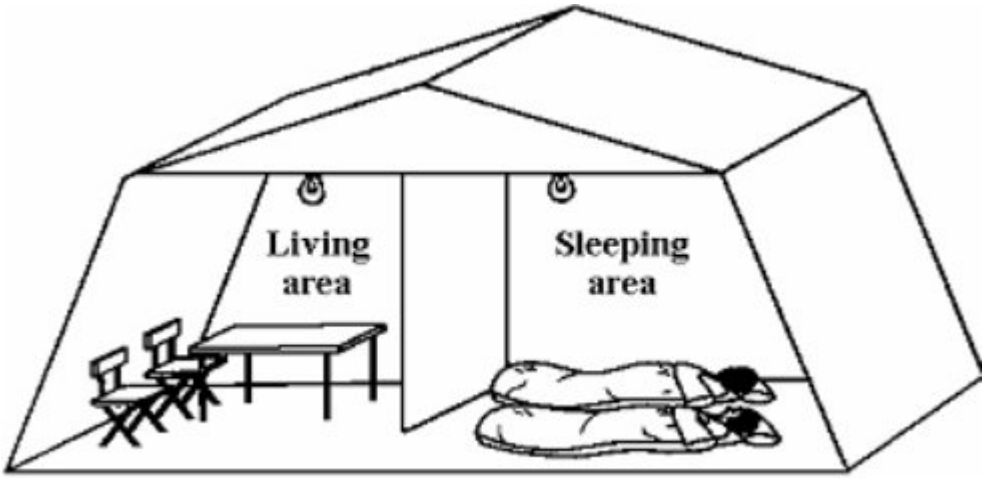
(a) Draw lines to join the picture to the correct circuit symbol. The lamp has been done for you.



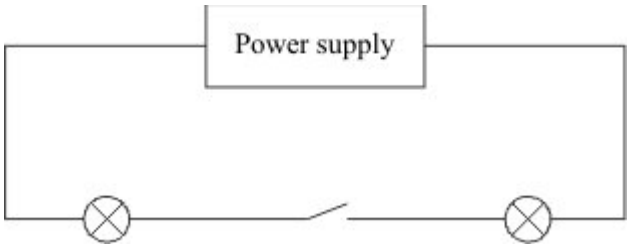
(2)

(b) A family tent is to be fitted with a simple lighting circuit.

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The diagram shows the first circuit used.



(i) Are the lamps connected in series or in parallel?

_____

(1)

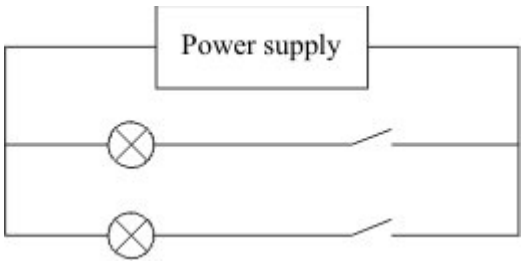
(ii) This is not a good circuit for using in the tent. Why?

_____

_____

(1)

The diagram shows the second circuit used.



(iii) Give **two** reasons why this circuit is better than the first circuit.

1. _____

_____

2. _____

_____

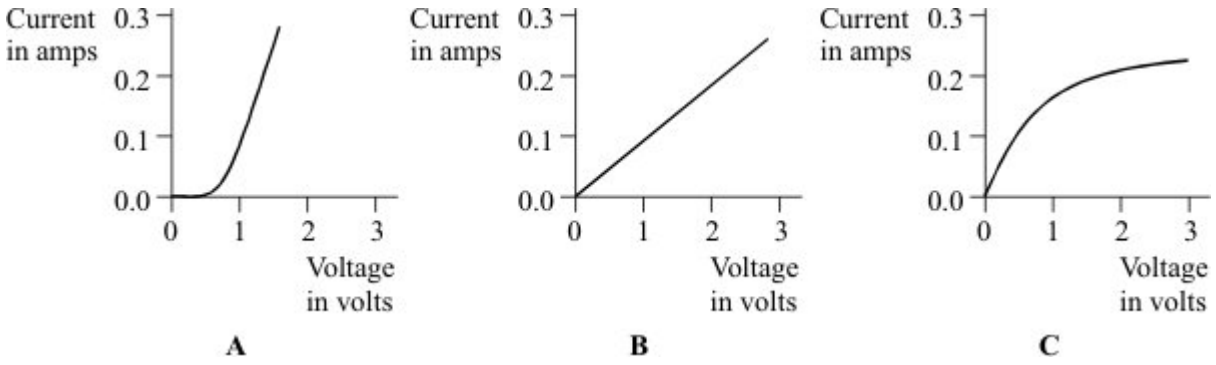
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(2)

(Total 6 marks)

Q34.

(a) The diagram shows the voltage-current graphs for three different electrical components.



Which **one** of the components **A**, **B** or **C** could be a 3 volt filament lamp? Explain the reason for your choice.

_____

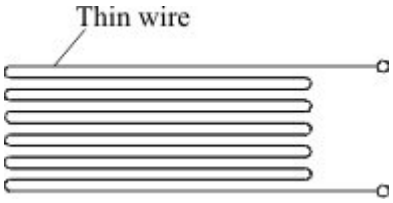
_____

_____

_____

(3)

(b) Using the correct symbols draw a circuit diagram to show how a battery, ammeter and voltmeter can be used to find the resistance of the wire shown.



(3)

(c) When correctly connected to a 9 volt battery the wire has a current of 0.30 amperes flowing through it.

(i) Give the equation that links current, resistance and voltage.

_____

(1)

(ii) Calculate the resistance of the wire. Show clearly how you work out your answer and give the unit.

_____

_____

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Resistance = _____

(3)

(iii) When the wire is heated, the current goes down to 0.26 amperes. State how the resistance of the wire has changed.

_____

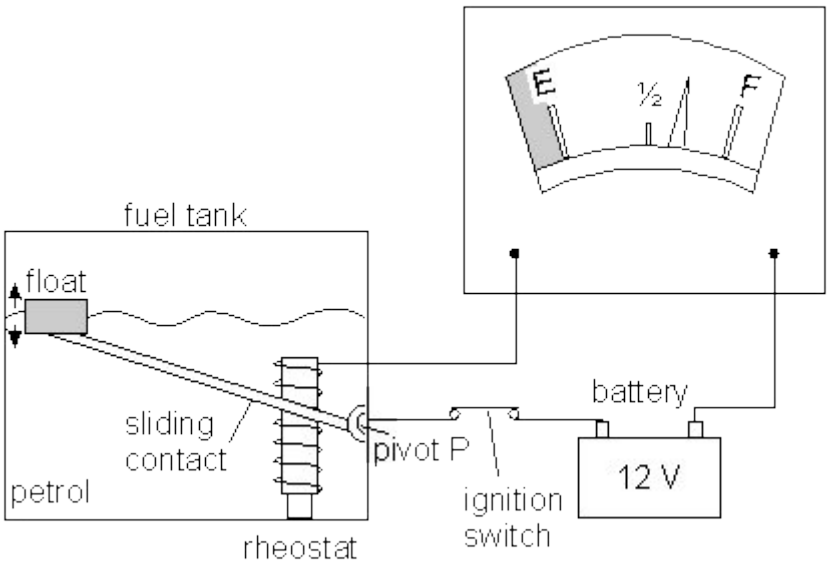
_____

(1)

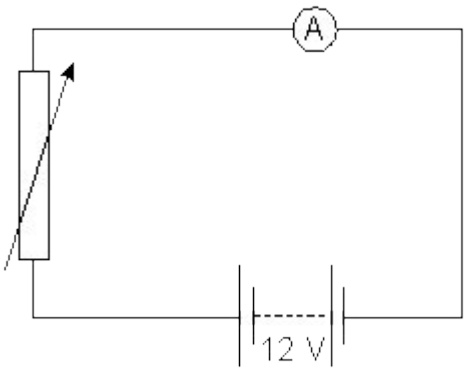
(Total 11 marks)

Q35.

The diagram below shows how one type of fuel gauge in a car works. A sliding contact makes contact with a resistance wire wound in a coil (rheostat). It is connected to a float via a pivot P. When the petrol level changes the circuit resistance changes. This causes the pointer in the fuel gauge to move and show how much petrol is in the petrol tank.



The circuit diagram is shown below.



The petrol gauge is an ammeter. Explain why the reading on the ammeter falls as the petrol is used.

_____

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_____

_____

_____

(Total 3 marks)

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