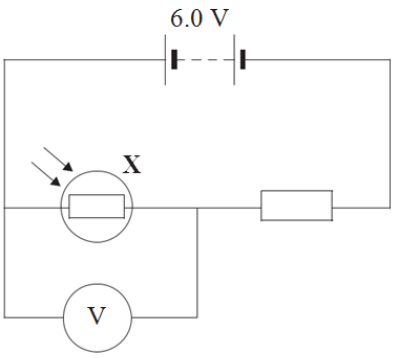
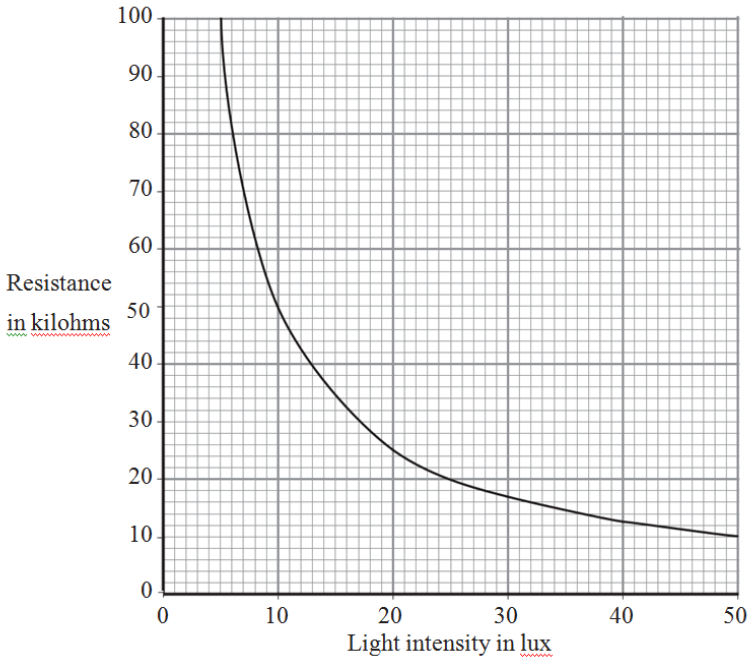
CIRCUIT DEVICES AND RESISTANCE 1

Q:1 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.



(a)(i) What is component X?

_____

(1 mark)

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

_____

(1 mark)

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

Use the equation in the box to calculate the reading on the voltmeter when the light intensity is 20 lux.

potential difference = current × resistance

Show clearly how you work out your answer.

_____

_____

_____

Voltmeter reading _____ volts

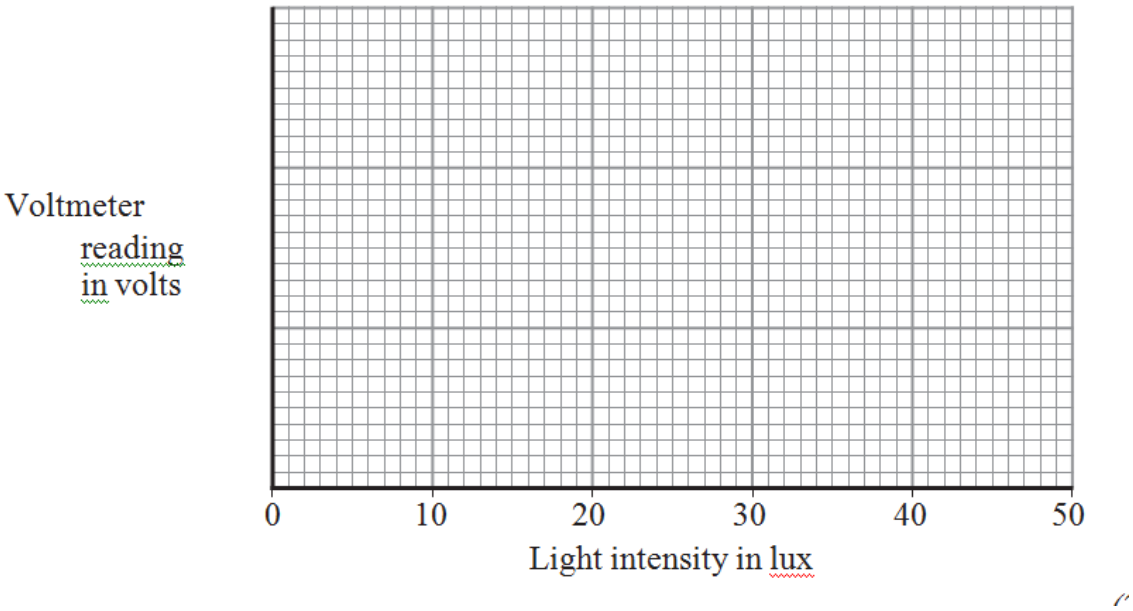
(2 marks)

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

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

(1 mark)

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



(2 marks)

(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.

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

_____

Maximum resistance _____kilohms

(1 mark)

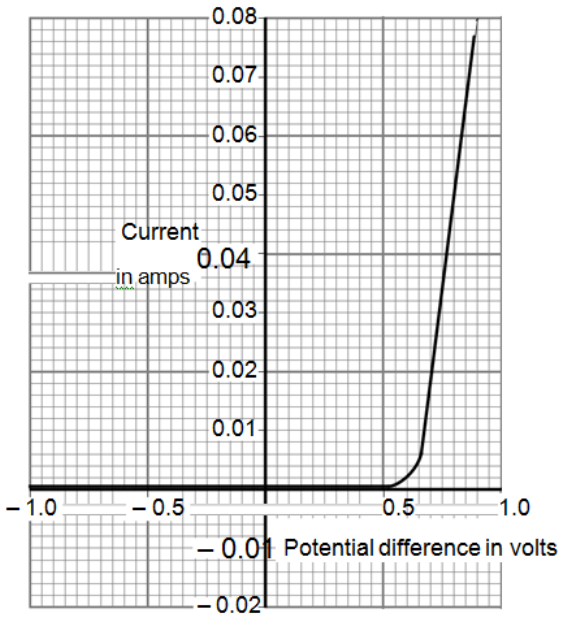
(c)(ii) Explain why this light-sensing circuit would not be used to measure values of light intensity.

_____

_____

(2 marks)

Q:2 The current – potential difference graph for one type of electrical component is drawn below.

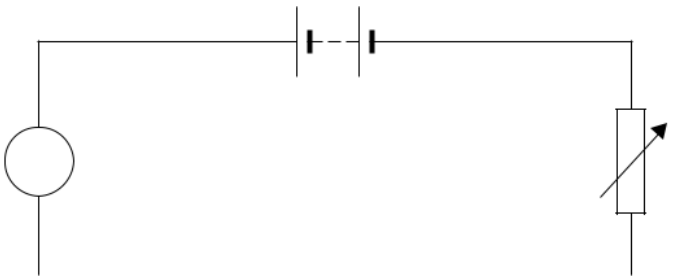


(a) What is the component?

_____

(1 mark)

(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 marks)

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

Current . _____ amps

(1 mark)

(c) (ii) Use the equation in the box to calculate the resistance of the component when the potential difference across it is 0.8 volts.

potential difference = current □□resistance

Show clearly how you work out your answer.

_____

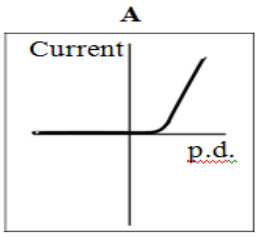
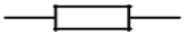
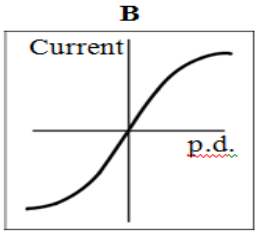
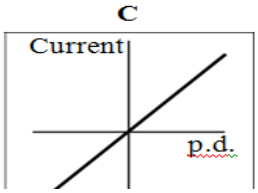
_____

Resistance = _____

(2 marks)

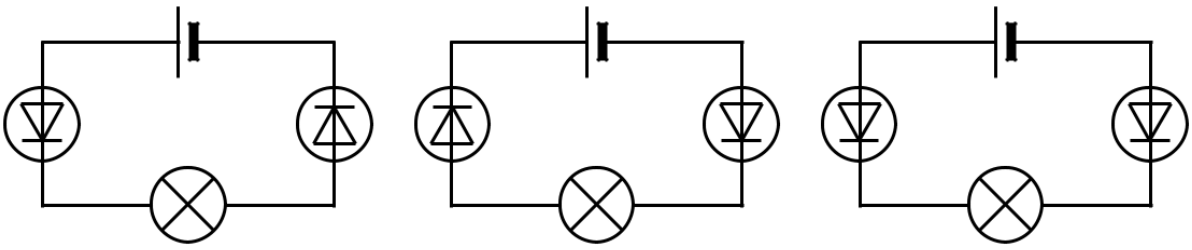
Q:3 **(a)** The graphs, A, B and C, show how the current through a component varies with the potential difference (p.d.) across the component. Draw a line to link each graph to the correct component.

Draw only three lines

Component	
A 	A resistor at constant temperature 
B 	A filament lamp 
C 	A diode 

(2 marks)

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



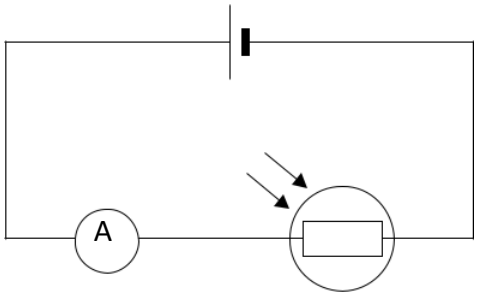
J K L

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

_____

(1 mark)

Q:4 The diagram shows a simple circuit.

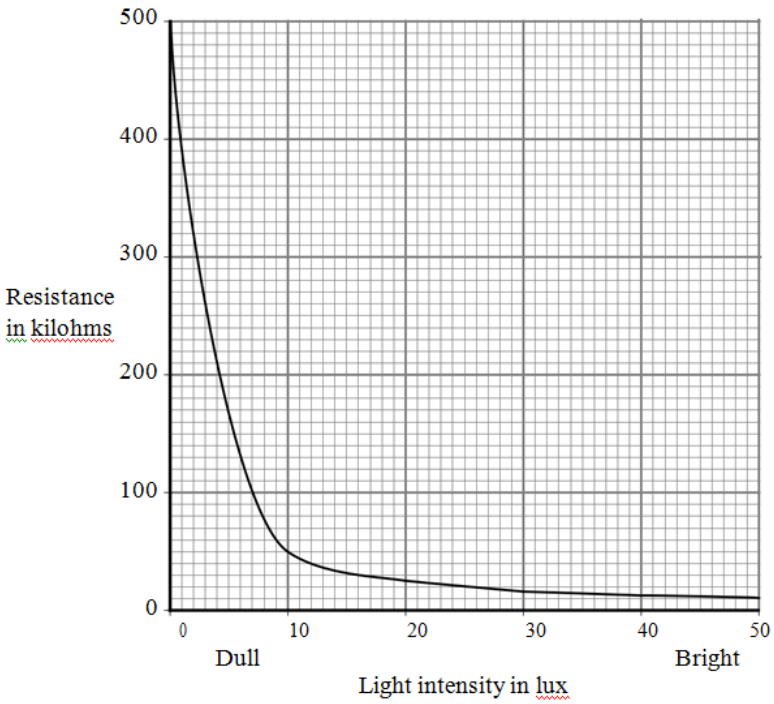


(a) The circuit includes an LDR. What do the letters LDR stand for? Draw a ring around your answer.

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

(1 mark)

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



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

_____

_____

_____

(3 marks)

(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 mark)

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

_____

_____

(1 mark)

(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. ☐

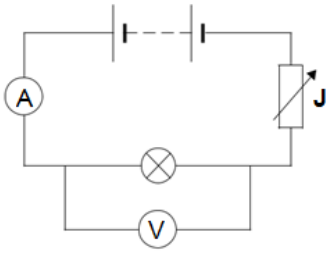
a circuit to switch on central heating when it gets cold ☐

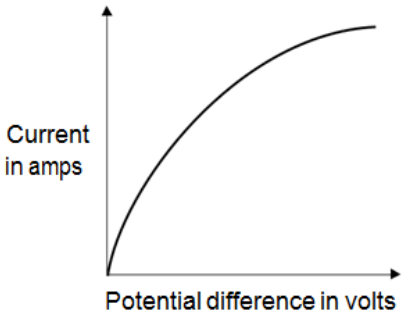
a circuit to switch on security lighting when it gets dark ☐

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

(1 mark)

Q:5 The diagram shows the circuit used to obtain the data needed to plot the current – potential difference graph for a filament bulb.





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

_____

_____

(1 mark)

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

_____

_____

(1 mark)

(a) (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.

Use the correct equation from the Physics Equations Sheet.

_____

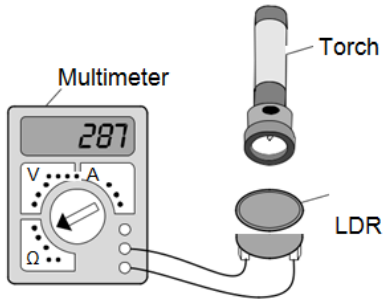
_____

_____

Power =_____

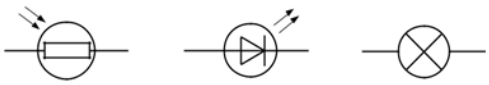
(3 marks)

Q:6 A student used the apparatus below to find out how the resistance of a light-dependent resistor (LDR) depends on light intensity.



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 mark)

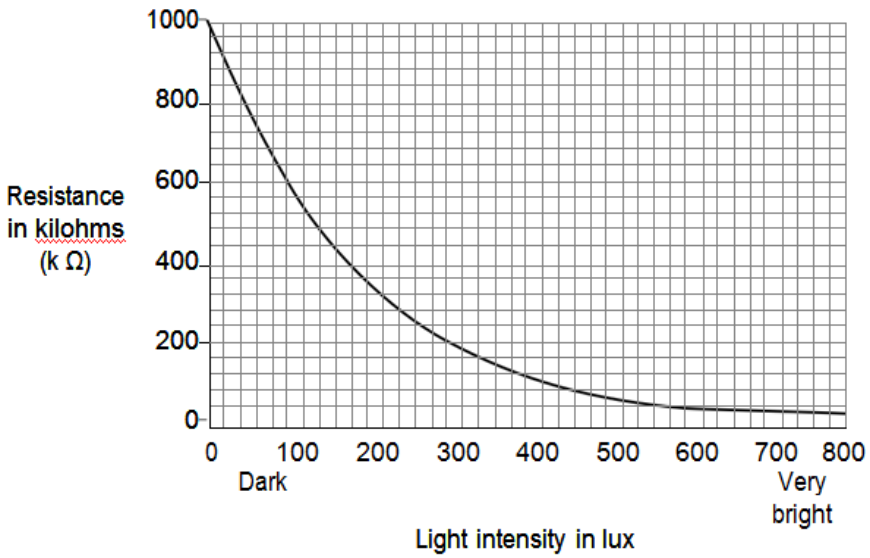
(a) (ii) Name one factor that will affect the intensity of the light hitting the LDR.

_____

_____

(1 mark)

(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

_____

_____

_____

(2 marks)

(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

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

Why not?

_____

_____

(1 mark)

(c) (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 mark)

(d) Which one of the following circuits probably includes a LDR? Tick (✓) one box.

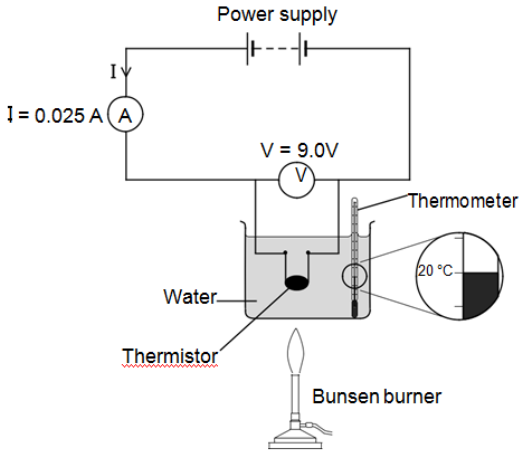
A circuit that automatically switches outside lights on when it gets dark. ☐

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 mark)

Q:7 **(a)**Figure 4 shows the apparatus used to obtain the data needed to calculate the resistance of a thermistor at different temperatures.



(a) (i) In the box below, draw the circuit symbol for a thermistor.

[1 mark]

(a) (ii) Use the data given in Figure 4 to calculate the resistance of the thermistor at 20 °C.

Use the correct equation from the Physics Equations Sheet.

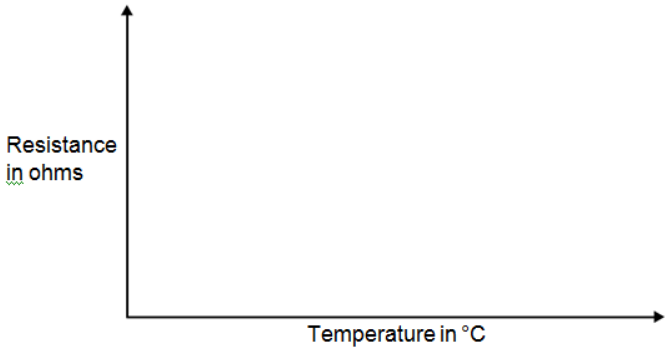
Resistance =_____ ohms

[2 marks]

(a) (iii) Figure 5 shows the axes for a sketch graph.

Complete Figure 5 to show how the resistance of the thermistor will change as the temperature of the thermistor increases from 20 °C to 100 °C.

Figure 5



[1 mark]

(a) (iv) Which one of the following is most likely to include a thermistor? Tick (☒) one box.

An automatic circuit to switch a plant watering system on and of☐

An automatic circuit to switch an outside light on when it gets dark.

An automatic circuit to switch a heating system on and off.

[1 mark]

(b) The ammeter used in the circuit has a very low resistance. Why is it important that ammeters have a very low resistance?

_____

_____

[1 mark]

(c) Table 2 gives the temperature of boiling water using three different temperature scales.

Table 2

Temperature	Scale
100	Celsius (°C)
212	Fahrenheit (°F)
80	Réaumur (°Re)

Scientists in different countries use the same temperature scale to measure temperature.

Suggest one advantage of doing this.

_____

[1 mark]

(d) A student plans to investigate how the resistance of a light-dependent resistor (LDR) changes with light intensity.

The student starts with the apparatus shown in Figure 4 but makes three changes to the apparatus.

One of the changes the student makes is to replace the thermistor with an LDR.

Describe what other changes the student should make to the apparatus.

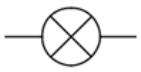
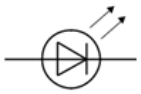
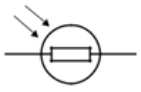
_____

_____

_____

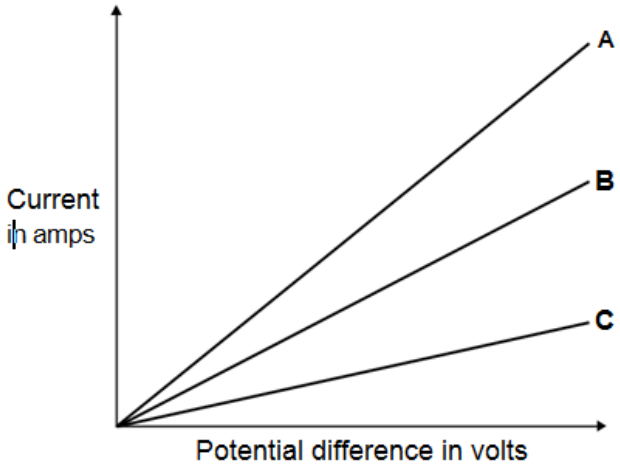
[2 marks]

Q:8 (a) Draw one line from each circuit symbol to its correct name.

Circuit symbol	Name
	Diode
	Light-dependent Resistor (LDR)
	Lamp
	Light-emitting diode (LED)

(3 marks)

Q:9(a) Figure 1 shows the current–potential difference graph for three wires, A, B and C.



(a) (i) Using Figure 1, how can you tell that the temperature of each wire is constant?

_____

_____

(1 mark)

a) (ii) Which one of the wires, A, B or C, has the greatest resistance?

Give a reason for your answer.

_____

_____

(2 mark)

(b) A student measured the resistance of four wires.

Table 1 shows the resistance of, and other data about, each of the four wires, J, K, L and M.

Table 1

Wire	Type of metal	Length in cm	Diameter in mm	Resistance in .....
J	copper	50	0.17	0.36
K	copper	50	0.30	0.12
L	copper	100	0.30	0.24
M	constantan	100	0.30	7.00

(b) (i) The last column of Table 1 should include the unit of resistance.

What is the unit of resistance?

_____

(1 mark)

(b) (ii) The resistance of a wire depends on many factors.

Look at Table 1. Which two wires from J, K, L and M show that the resistance of a wire depends on the length of the wire?

☐ Wire ☐ and wire

Give a reason for your answer.

_____

_____

_____

(2 marks)

(b) (iii) A student looked at the data in Table 1 and wrote this conclusion:

'The resistance of a wire depends on the type of metal from which the wire is made.' The student could not be certain that her conclusion is true for all types of metal.

Suggest what extra data is needed for the student to be more certain that the conclusion is correct.

_____

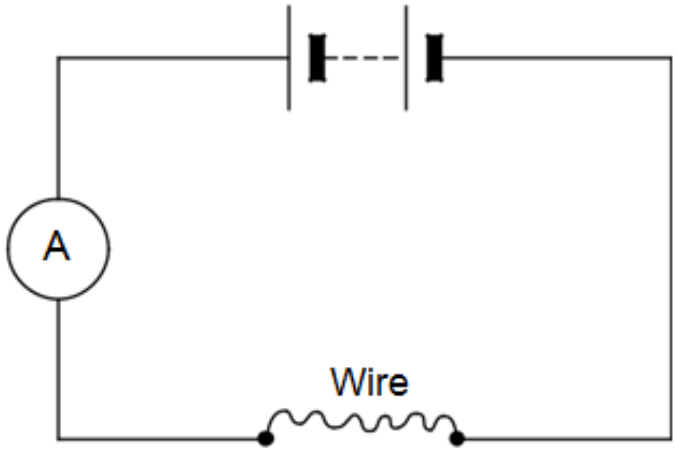
_____

(1 mark)

(c) The resistance of a wire can be calculated using the readings from an ammeter and a voltmeter.

(c) (i) Complete Figure 2 by drawing a voltmeter in the correct position in the circuit. Use the correct circuit symbol for a voltmeter.

Figure 2



(c) (ii) In a circuit diagram, a wire can be represented by the symbol for a resistor. In the box below, draw the circuit symbol for a resistor.

[1 mark]

TOTAL MARKS=56