GCSE Physics

Electricity

Question Paper

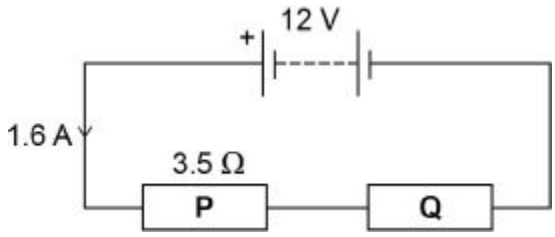
Time available: 55 minutes
Marks available: 47 marks

1. (a) Draw a diagram to show how 1.5 V cells should be connected together to give a potential difference of 4.5 V.

Use the correct circuit symbol for a cell.

(2)

A student built the circuit shown in the diagram below.



(b) Calculate the total resistance of the circuit in the diagram above.

Use the equation:

$$\text{resistance} = \frac{\text{potential difference}}{\text{current}}$$

Total resistance = _____ Ω

(2)

(c) The resistance of **P** is 3.5 Ω.

Calculate the resistance of **Q**.

Resistance of **Q** = _____ Ω

(1)

(d) The student connects the two resistors in the diagram above in parallel.

What happens to the total resistance of the circuit?

Tick **one** box.

It decreases ☐

It increases ☐

It does not change ☐

(1)

Give a reason for your answer.

_____

_____

_____

_____

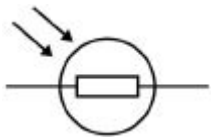
(1)

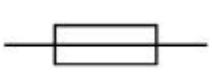
(Total 7 marks)

2. The plug of an electrical appliance contains a fuse.

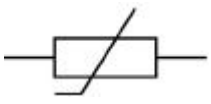
(a) What is the correct circuit symbol for a fuse?

Tick **one** box.

 ☐

 ☐

 ☐

 ☐

(1)

(b) The appliance is connected to the mains electrical supply. The mains potential difference is 230 V.

Calculate the energy transferred when 13 C of charge flows through the appliance.

Use the equation:

energy transferred = charge flow × potential difference

_____

_____

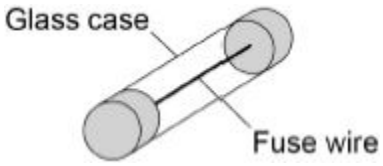
_____

_____

Energy transferred = _____ J

(2)

The diagram below shows the structure of a fuse.



(c) Write down the equation that links charge flow, current and time.

_____

(1)

(d) The fuse wire melts when 1.52 coulombs of charge flows through the fuse in 0.40 seconds.

Calculate the current at which the fuse wire melts.

_____

_____

_____

_____

Current = _____ A

(3)

(e) The mass of the fuse wire is 0.00175 kg. The specific latent heat of fusion of the fuse wire is 205 000 J/kg.

Calculate the energy needed to melt the fuse wire.

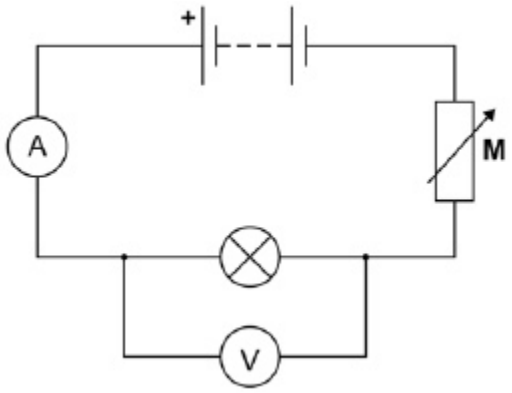
Use the Physics Equations Sheet.

Energy = _____ J

(2)

(Total 9 marks)

3. The diagram shows the circuit used to obtain the data needed to plot the current-potential difference graph for a filament lamp.



(a) Why is component **M** included in the circuit?

Tick **one** box.

To keep the current constant. ☐

To keep the potential difference constant. ☐

To vary the current. ☐

(1)

(b) Why does the resistance of the lamp increase as the potential difference across the lamp increases?

_____

_____

_____

(1)

(c) The potential difference across the lamp is 12.0 V

Calculate the energy transferred by the lamp when 8.5 C of charge flows through the lamp.

Use the equation:

energy transferred = charge flow × potential difference

_____

_____

_____

Energy transferred = _____ J

(2)

(d) The table gives data about two types of lamp that householders may use in their homes.

Type of lamp	**Energy efficiency**	**Mean lifetime in hours**
Halogen	10%	2000
LED	90%	36000

Both types of lamp produce the same amount of light.

Describe the environmental advantages of using the LED lamp compared with the halogen lamp.

_____

_____

_____

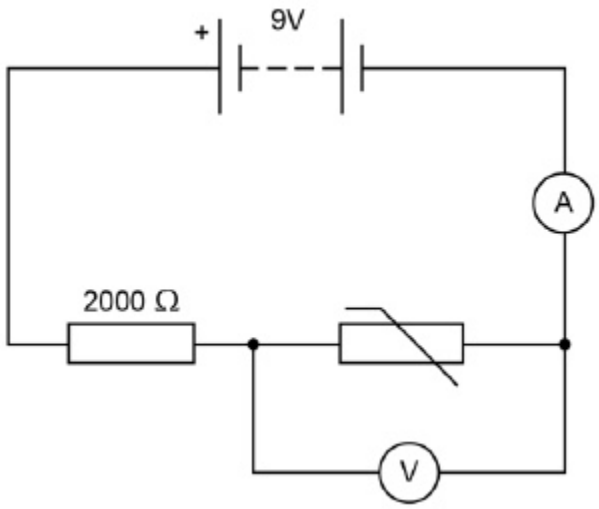
_____

_____

(2)

(Total 6 marks)

4. The diagram shows a temperature sensing circuit used to control a heating system in a house.



(a) What quantity does the ammeter measure?

_____

(1)

(b) The current in the circuit is 3.5 mA when the potential difference across the thermistor is 4.2 V

Calculate the resistance of the thermistor.

_____

_____

_____

Resistance = _____ Ω

(3)

(c) Calculate the charge that flows through the thermistor in 5 minutes when the current is 3.5 mA.

_____

_____

_____

Charge = _____ C

(3)

(d) Explain why the potential difference across the thermistor changes as the temperature in the house decreases.

_____

_____

_____

_____

(2)

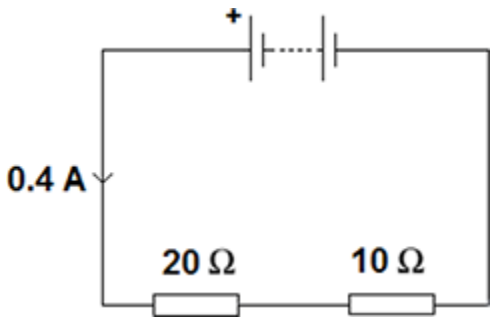
(e) The circuit shown in the diagram can be modified to turn lights on and off by replacing the thermistor with a Light Dependent Resistor (LDR).

Draw the circuit symbol for an LDR in the space below.

(1)

(Total 10 marks)

5. An electrical circuit is shown in the figure below.



(a) The current in the circuit is direct current.

What is meant by direct current?

Tick **one** box.

Current that continuously changes direction. ☐

Current that travels directly to the component. ☐

Current that is always in the same direction. ☐

(1)

(b) The equation which links current, potential difference and resistance is:

potential difference = current × resistance

Calculate the potential difference across the battery in the circuit in the figure above.

_____

_____

Potential difference = _____ V

(3)

(c) The equation which links current, potential difference and power is:

power = current × potential difference

Calculate the power output of the battery in the figure above.

Give your answer to one significant figure.

_____

Power = _____ W

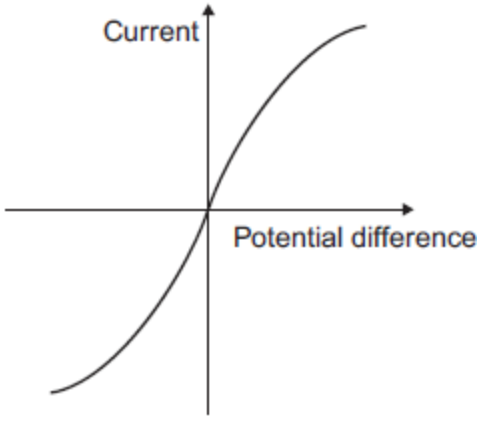
(2)

(Total 6 marks)

6. The current in a circuit depends on the potential difference provided by the cells and the total resistance of the circuit.

(a) **Figure 1** shows the graph of current against potential difference for a component.

Figure 1



What is the name of the component?

Draw a ring around the correct answer.

diode **filament bulb** **thermistor**

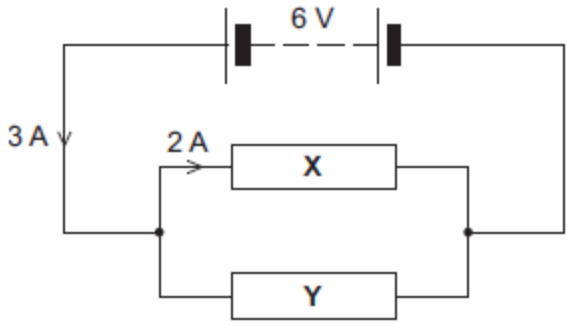
(1)

(b) **Figure 2** shows a circuit containing a 6 V battery.

Two resistors, **X** and **Y**, are connected in parallel.

The current in some parts of the circuit is shown.

Figure 2



(i) What is the potential difference across **X**?

Potential difference across **X** = _____ V

(1)

(ii) Calculate the resistance of **X**.

_____

_____

Resistance of **X** = _____ Ω

(2)

(iii) What is the current in **Y**?

Current in **Y** = _____ A

(1)

(iv) Calculate the resistance of **Y**.

_____

Resistance of **Y** = _____ Ω

(1)

(v) When the temperature of resistor **X** increases, its resistance increases.

What would happen to the:

- potential difference across **X**
- current in **X**
- total current in the circuit?

Tick (✓) **three** boxes.

	Decrease	**Stay the same**	**Increase**
Potential difference across **X**			
Current in **X**			
Total current in the circuit			

(3)

(Total 9 marks)