

Questions

Q1.

Answer the question with a cross in the box you think is correct ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

Which of the following units is equivalent to the volt?

☐ **A** C s^{-1}

☐ **B** J s^{-1}

☐ **C** J C^{-1}

☐ **D** J s

(Total for question = 1 mark)

Q2.

Answer the question with a cross in the box you think is correct (☐). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☐.

A phone is connected to a charger. The current in the charger is 5 mA.

Which of the following gives the charge in coulombs entering the phone in 8 minutes?

☐ **A** $\frac{5 \times 10^{-3}}{480}$

☐ **B** $\frac{5 \times 10^{-3}}{8}$

☐ **C** $5 \times 10^{-3} \times 480$

☐ **D** $5 \times 10^{-3} \times 8$

(Total for question = 1 mark)

Q3.

Answer the question with a cross in the box you think is correct ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

The unit of resistance is the ohm.

Which of the following is equivalent to the ohm?

- ☐ **A** $\text{J C}^{-2} \text{s}$
- ☐ **B** $\text{J C}^2 \text{s}^{-1}$
- ☐ **C** $\text{J C}^{-1} \text{s}^{-1}$
- ☐ **D** J C s

(Total for question = 1 mark)

Q4.

Answer the question with a cross in the box you think is correct ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

The definitions for current and potential difference both include

- ☐ **A** charge.
- ☐ **B** resistance.
- ☐ **C** time.
- ☐ **D** work done.

(Total for question = 1 mark)

Q5.

The resistance of some electrical components decreases as the applied potential difference increases.

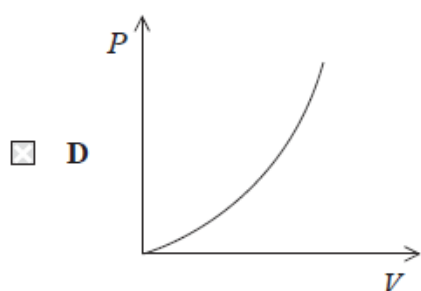
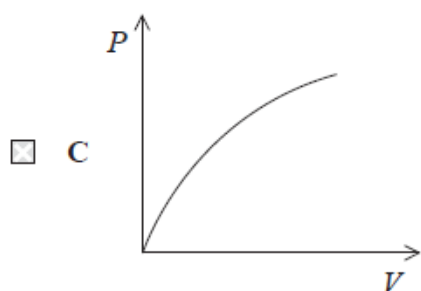
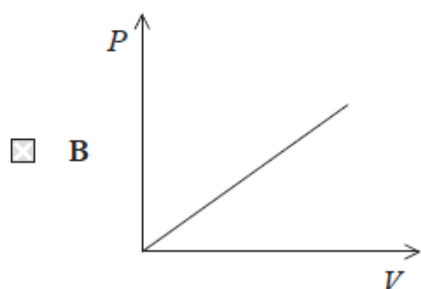
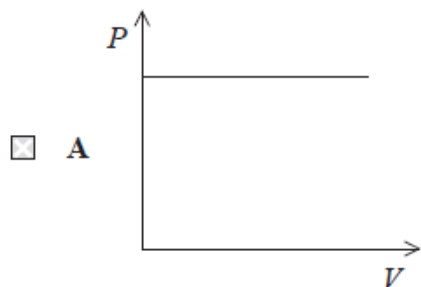
Which row of the table contains two components that behave in this way?

☐ A	diode	ohmic conductor
☐ B	ohmic conductor	filament lamp
☐ C	negative temperature coefficient thermistor	diode
☐ D	negative temperature coefficient thermistor	filament lamp

(Total for question = 1 mark)

Q6.

Which of the following graphs shows how power P dissipated by an ohmic conductor varies with potential difference V across the conductor?



(Total for question = 1 mark)

Q7.

Answer the question with a cross in the box you think is correct ☐. If you change your mind about an answer, put a line through the box ☐ and then mark your new answer with a cross ☐.

There is a current I in a wire. The charge on an electron is e .

Which of the following gives the number of electrons passing a point on the wire in time t ?

☐ A Ite

☐ B $\frac{I}{te}$

☐ C $\frac{Ie}{t}$

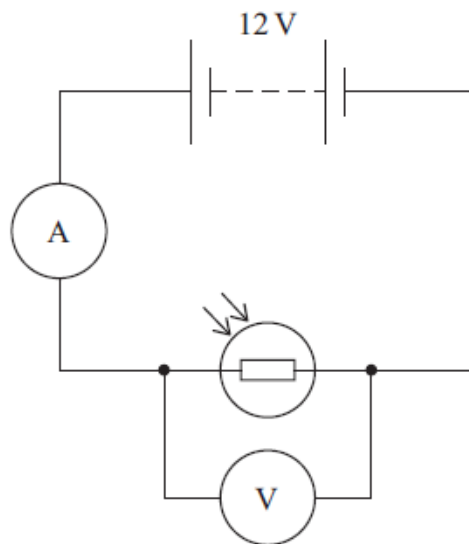
☐ D $\frac{It}{e}$

(Total for question = 1 mark)

Q8.

Answer the question with a cross in the box you think is correct (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

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



The internal resistance of the battery is negligible.

The light intensity incident on the LDR increases.

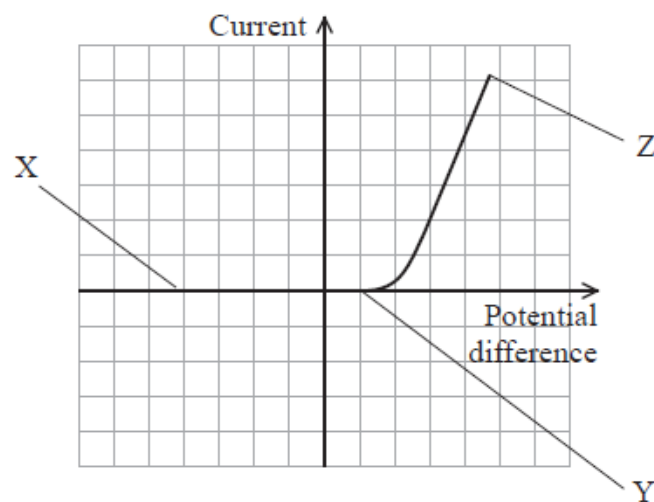
Which row of the table describes what happens to the readings on the voltmeter and the ammeter?

	Voltmeter reading	Ammeter reading
☐ A	decreases	decreases
☐ B	stays the same	increases
☐ C	stays the same	decreases
☐ D	increases	increases

(Total for question = 1 mark)

Q9.

The current-potential difference graph for an ideal diode is shown. The graph has been labelled at three separate points by the letters X, Y and Z.



At which point(s) is the resistance of this diode infinite.

- ☐ A X and Y
- ☐ B Y and Z
- ☐ C X only
- ☐ D Z only

(Total for question = 1 mark)

Q10.

Answer the question with a cross in the box you think is correct ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

Which of the following units is equivalent to the volt?

- ☐ **A** J s^{-1}
- ☐ **B** W s^{-1}
- ☐ **C** J C^{-1}
- ☐ **D** W C^{-1}

(Total for question = 1 mark)

Q11.

Answer the question with a cross in the box you think is correct ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

Which of the following describes a change in energy of 1 eV?

- ☐ **A** A charge of 1 C is accelerated across a potential difference of 1 V.
- ☐ **B** A charge of 1 C passes a point in a time of 1 s.
- ☐ **C** An electron is accelerated across a potential difference of 1 V.
- ☐ **D** There is a current of 1 A for a time of 1 s.

(Total for question = 1 mark)

Q12.

Answer the question with a cross in the box you think is correct (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

Which of the following units is equivalent to the coulomb?

- ☐ **A** A s^{-1}
- ☐ **B** J V^{-1}
- ☐ **C** W A^{-1}
- ☐ **D** W V^{-1}

(Total for question = 1 mark)

Q13.

Answer the question with a cross in the box you think is correct (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

The cell in a solar-powered lamp stores 6.0 kJ of energy.
The lamp is switched on and the cell discharges fully.
The cell has a constant e.m.f. of 1.5 V.

Which of the following is the charge that passes through the lamp?

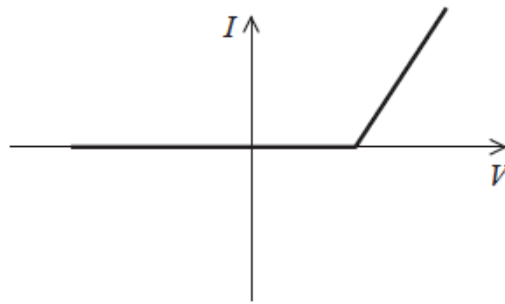
- ☐ **A** 0.25 C
- ☐ **B** 4.0 C
- ☐ **C** 4000 C
- ☐ **D** 9000 C

(Total for question = 1 mark)

Q14.

Select one answer from A to D and put a cross in the box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

The graph shows how current I varies with potential difference V for an electrical component.



Which component is represented by this graph?

- ☐ **A** Diode
- ☐ **B** Filament lamp
- ☐ **C** Ohmic conductor
- ☐ **D** Thermistor

(Total for question = 1 mark)

Q15.

Answer the question with a cross in the box you think is correct (☒). If you change your mind, put a line through the box (☒) and then mark your new answer with a cross (☒).

At a point in a circuit there is a current of 3.0 A.

Which of the following gives the total charge passing this point in 2.0 minutes?

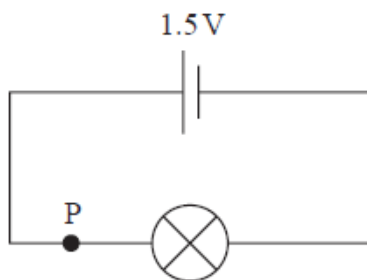
- ☐ **A** 0.025 C
- ☐ **B** 1.5 C
- ☐ **C** 6.0 C
- ☐ **D** 360 C

(Total for question = 1 mark)

Q16.

Answer the question with a cross in the box you think is correct ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

A lamp is connected in the circuit as shown. The cell has negligible internal resistance.



In 30 seconds, the charge passing point P is 0.4 C.

Which of the following gives the energy, in joules, transferred by the cell during this time?

☐ **A** $1.5 \times 0.4 \times 30$

☐ **B** 1.5×0.4

☐ **C** $\frac{1.5 \times 0.4}{30}$

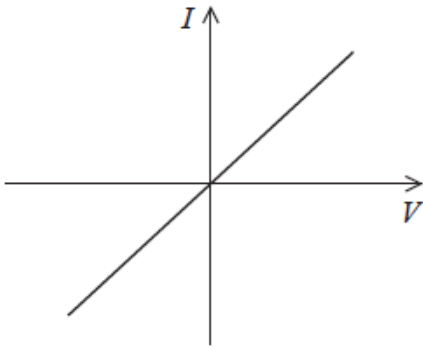
☐ **D** $\frac{1.5}{0.4 \times 30}$

(Total for question = 1 mark)

Q17.

Answer the question with a cross in the box you think is correct ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

The graph shows how current I varies with potential difference V for an electrical component.



Which component is represented by the graph?

- ☐ **A** diode
- ☐ **B** filament lamp
- ☐ **C** resistor at constant temperature
- ☐ **D** thermistor

(Total for question = 1 mark)

Q18.

Answer the question with a cross in the box you think is correct ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

The current at a point in a circuit is 1.25 A.

Which of the following expressions gives the number of electrons passing the point in 45 seconds?

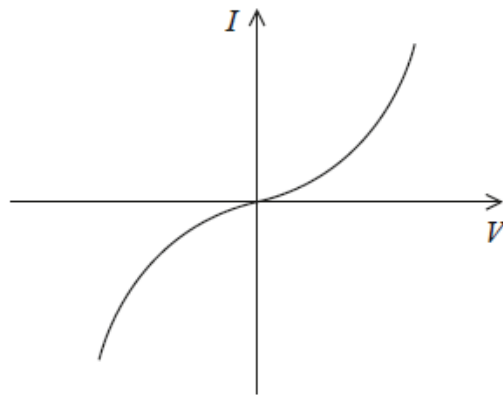
- ☐ **A** $\frac{1.25 \times 45}{1.60 \times 10^{-19}}$
- ☐ **B** $\frac{1.25 \times 1.60 \times 10^{-19}}{45}$
- ☐ **C** $\frac{1.60 \times 10^{-19}}{1.25 \times 45}$
- ☐ **D** $\frac{45}{1.25 \times 1.60 \times 10^{-19}}$

(Total for question = 1 mark)

Q19.

Answer the question with a cross in the box you think is correct ☐ . If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐ .

Which electrical component has the current-potential difference graph shown?



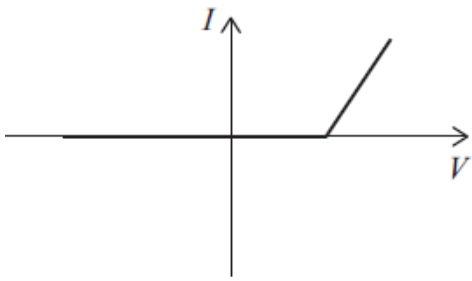
- ☐ **A** diode
- ☐ **B** filament lamp
- ☐ **C** resistor
- ☐ **D** thermistor

(Total for question = 1 mark)

Q20.

Answer the question with a cross in the box you think is correct (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☐).

The graph shows how current I varies with potential difference V for an electrical component.



Which component is represented by this graph?

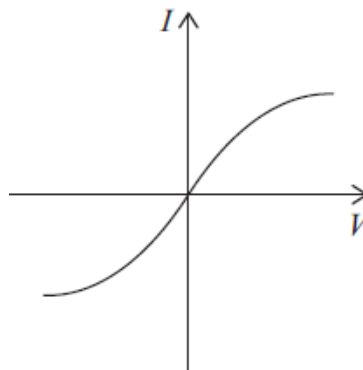
- ☐ **A** diode
- ☐ **B** filament lamp
- ☐ **C** ohmic conductor
- ☐ **D** thermistor

(Total for question = 1 mark)

Q21.

Answer the question with a cross in the box you think is correct (☐). If you change your mind about an answer, put a line through the box (☐) and then mark your new answer with a cross (☐).

The graph shows how current I varies with potential difference V for an electrical component.



Which of the following components would give this graph?

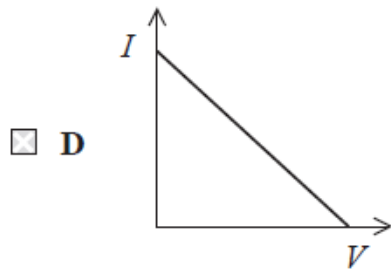
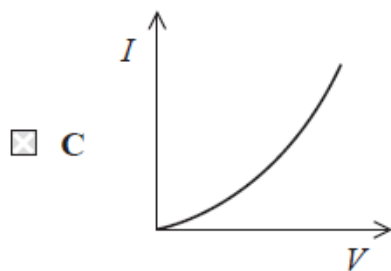
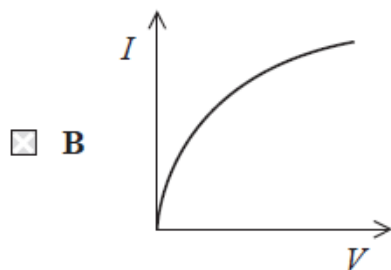
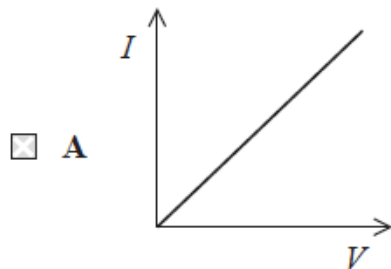
- ☐ **A** diode
- ☐ **B** filament bulb
- ☐ **C** resistor
- ☐ **D** thermistor

(Total for question = 1 mark)

Q22.

Answer the question with a cross in the box you think is correct ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

Which of the following graphs shows how current I varies with potential difference V for a negative temperature coefficient thermistor?

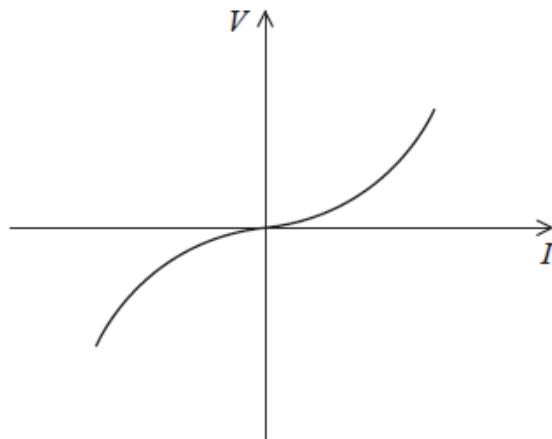


(Total for question = 1 mark)

Q23.

Answer the question with a cross in the box you think is correct ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

The graph shows how potential difference V varies with current I for an electrical component.



Which electrical component is represented by this graph?

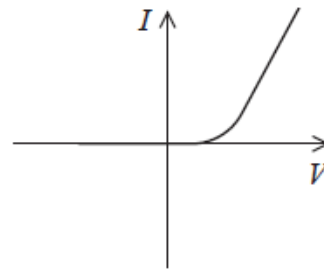
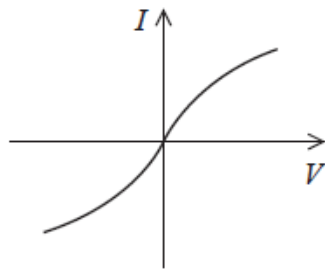
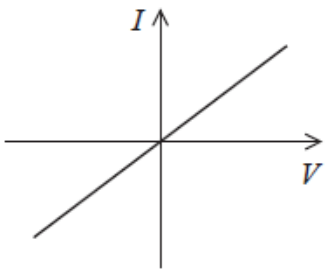
- ☐ **A** diode
- ☒ **B** filament lamp
- ☐ **C** ohmic conductor
- ☐ **D** thermistor

(Total for question = 1 mark)

Q24.

Answer the question with a cross in the box you think is correct ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

The graphs show how current I varies with potential difference V for three components.



Which of the following components is **not** represented by any of the three graphs?

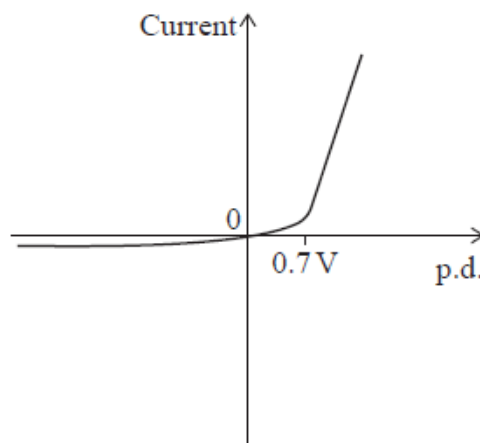
- ☐ **A** diode
- ☐ **B** filament bulb
- ☐ **C** negative temperature coefficient thermistor
- ☐ **D** ohmic conductor

(Total for question = 1 mark)

Q25.

Answer the question with a cross in the box you think is correct ☐. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☐.

The current-potential difference (p.d.) graph for a diode is shown.



Which of the following statements is correct for this diode?

- ☐ **A** This diode does not conduct in the reverse direction.
- ☐ **B** The resistance of this diode in the reverse direction is infinite.
- ☐ **C** The resistance of this diode decreases when the p.d. is above 0.7 V.

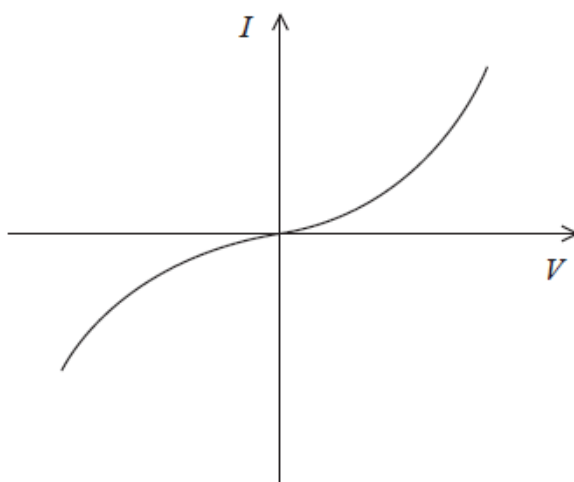
- ☐ **D** This diode does not conduct when the p.d. is below 0.7 V.

(Total for question = 1 mark)

Q26.

Answer the question with a cross in the box you think is correct ☐. If you change your mind about an answer, put a line through the box ☐ and then mark your new answer with a cross ☐.

A graph of current against potential difference for an electrical component is shown.



Which component would give this graph?

- ☐ **A** diode
- ☐ **B** filament bulb
- ☐ **C** ohmic conductor
- ☐ **D** thermistor

(Total for question = 1 mark)

Q27.

A circuit contains a filament bulb. When the potential difference across the filament is 8.9 V, the resistance of the filament is 7.5 Ω .

Calculate the time taken for a charge of 5.0 C to flow past a point in the filament.

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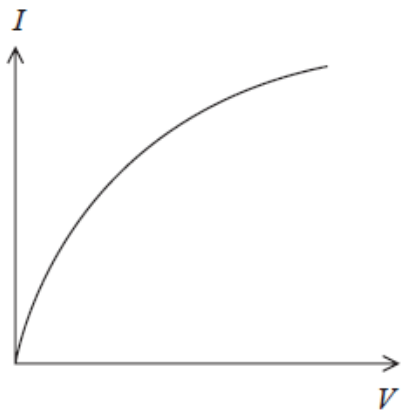
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Time taken =

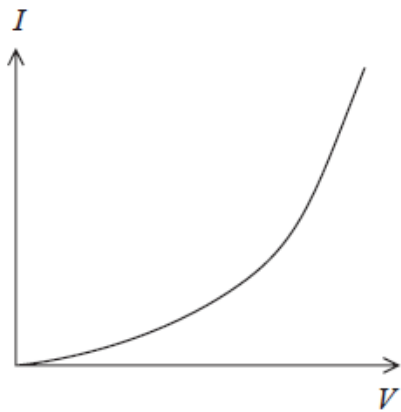
(Total for question = 3 marks)

Q28.

* The graphs show how current I varies with potential difference V for a filament bulb and for a negative temperature coefficient thermistor.



Filament bulb



Thermistor

Explain the shape of each graph. Your answer should include reference to the movement of conduction electrons in each component.

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(Total for question = 6 marks)

Q29.

The photograph shows an electric skateboard.



(Source: www.digitaltrends.com)

One particular type of electric skateboard uses an electric motor connected to a 22 V rechargeable lithium-ion battery. A fully-charged battery is able to pass 36,000 C of charge through the circuit and will allow continuous operation of the skateboard for 40 minutes.

(a) Calculate the total energy stored in a fully-charged lithium-ion battery.

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Total energy stored =

(b) The electric skateboard travels at a speed of 16 kilometres per hour.

(i) Calculate the time taken for the electric skateboard to travel 2.0 m.

(2)

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Time taken =

(ii) While the electric skateboard is in use, the battery provides a constant current.

Calculate the number of electrons that flow past a point in the circuit during the time taken for the electric skateboard to travel 2.0 m.

(3)

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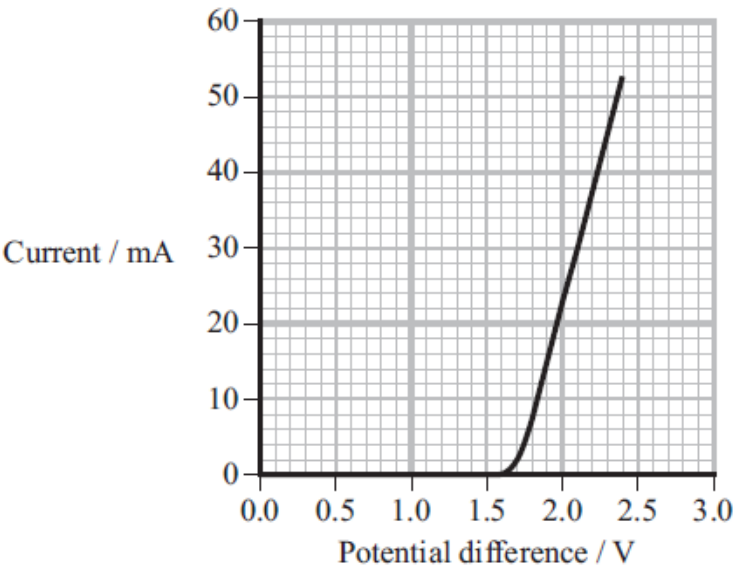
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Number of electrons =

(Total for question = 7 marks)

A student investigated the electrical properties of a light emitting diode (LED).

He varied the potential difference (p.d.) across the LED, and recorded corresponding values of the current in the LED. The graph shows the results.



(a) Draw a circuit diagram the student could use for this investigation.

(3)

(b) Determine the power of the LED when the p.d. across the LED was 2.2 V.

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Power =

(c) The student increased the p.d. across the LED from 0 V to 2.4 V.

Describe, without further calculations, how the resistance of the LED changed.

(2)

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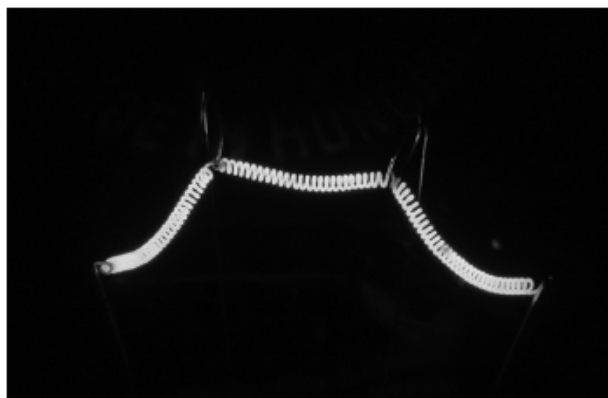
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Q31.

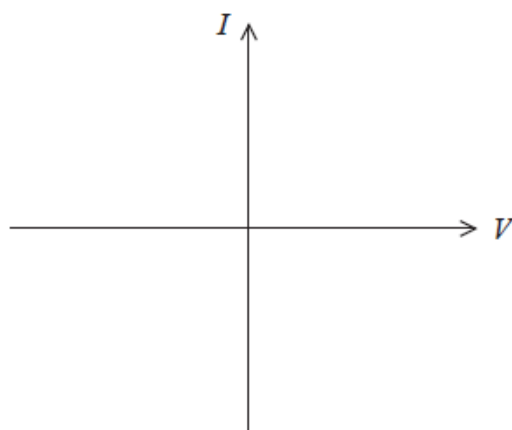
The photograph shows a thin, coiled, tungsten wire used in a filament light bulb.



(Source: © goran cakmazovic/Shutterstock)

(a) Complete the sketch graph to show how current varies with potential difference for a filament bulb.

(2)



(b) The tungsten wire has a diameter of 0.046 mm and a length of 580 mm. When emitting light, there is a current of 0.44 A in the filament and a potential difference of 140 V across the filament.

(i) Calculate the drift velocity v of the electrons in the tungsten wire.

number of charge carriers per m^3 in tungsten = 1.26×10^{29}

(3)

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$V =$

(ii) When the potential difference across the tungsten filament is 140 V the current in the filament is 0.44 A.

The table shows typical resistivity values for tungsten at different temperatures.

Temperature / °C	20	700	1700	2700	3200
Resistivity / Ωm	0.55×10^{-7}	2.43×10^{-7}	5.57×10^{-7}	9.04×10^{-7}	10.85×10^{-7}

Deduce the temperature of the filament.

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(Total for question = 8 marks)