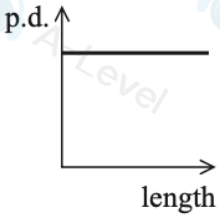
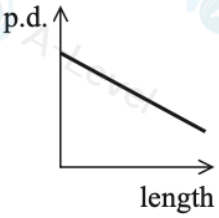
DO NOT WRITE IN THIS AREA DO NOT WRITE

4 The current in a length of uniform wire is constant.

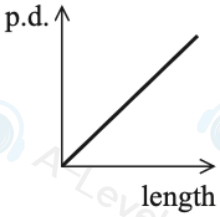
Which of the following graphs shows how the potential difference (p.d.) across the wire varies with the length of the wire?



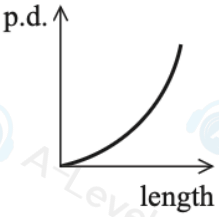
☒ **A**



☒ **B**



☒ **C**



☒ **D**

(Total for Question 4 = 1 mark)

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3: Which of the following units is equivalent to the coulomb?

☒ **A** As^{-1}

☒ **B** JV^{-1}

☒ **C** WA^{-1}

☒ **D** WV^{-1}

(Total for Question 3 = 1 mark)

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7 Solar panels are devices that use sunlight as a source of energy to generate electricity. A solar panel has a surface area of 1.54 m^2. The intensity of radiation incident on the Earth's surface is 1050 $W m^{-2}$. The manufacturer states that the maximum output power of the solar panel is 250 W.

Which of the following could be used to calculate the maximum efficiency of the solar panel?

☐ **A** $\frac{250 \times 1.54}{1050}$

☐ **B** $\frac{1050}{250 \times 1.54}$

☐ **C** $\frac{1050 \times 1.54}{250}$

☐ **D** $\frac{250}{1050 \times 1.54}$

(Total for Question 7 = 1 mark)

10 In a series circuit, 3.1×10^{19} electrons pass a particular point in a time of 30 seconds.

Which of the following gives the magnitude of the current in amperes in this circuit?

☒ **A** $\frac{(3.1 \times 10^{19}) \times (1.6 \times 10^{-19})}{30}$

☒ **B** $\frac{3.1 \times 10^{19}}{(1.6 \times 10^{-19}) \times 30}$

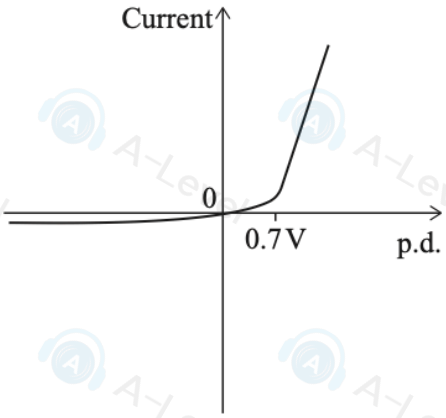
☒ **C** $(3.1 \times 10^{19}) \times (1.6 \times 10^{-19}) \times 30$

☒ **D** $\frac{(3.1 \times 10^{19}) \times 30}{1.6 \times 10^{-19}}$

(Total for Question 10 = 1 mark)

DO NOT WRITE IN THIS AREA

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

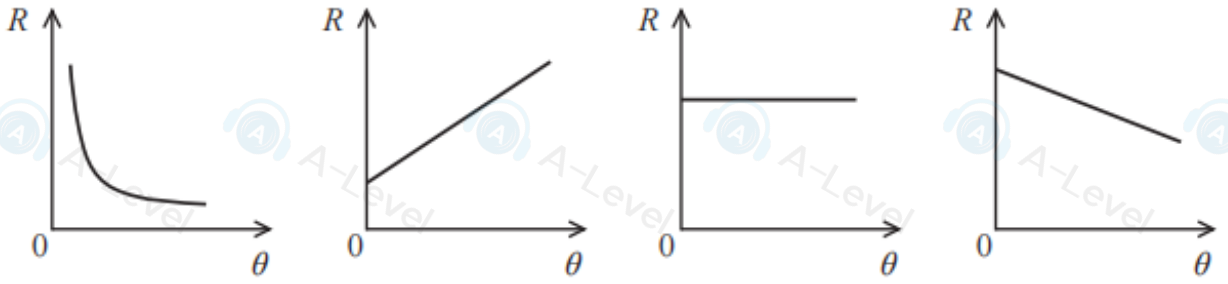


Which of the following statements is correct for this diode?

- ☒ **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 2 = 1 mark)

9 Which graph shows how the resistance R of a filament bulb varies with temperature θ in °C?



☒ **A** ☒ **B** ☒ **C** ☒ **D**

(Total for Question 9 = 1 mark)

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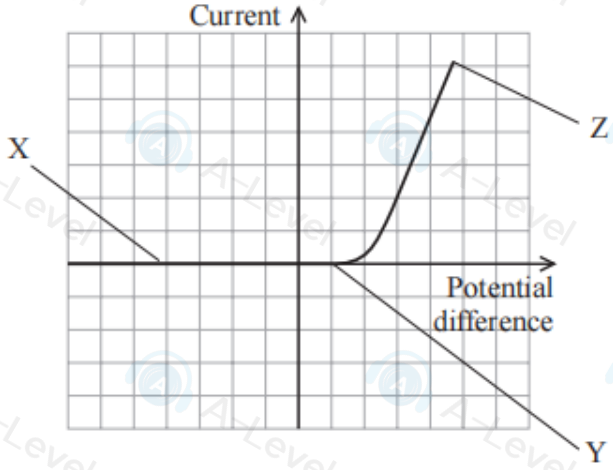
4 The current-potential difference graph for an ideal diode is shown. The graph has been labelled at three separate points by the letters X, Y and Z.



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

☐ **A** X and Y

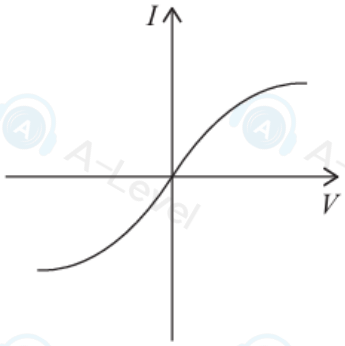
☐ **B** Y and Z

☐ **C** X only

☐ **D** Z only

(Total for Question 4 = 1 mark)

1 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 = 1 mark)

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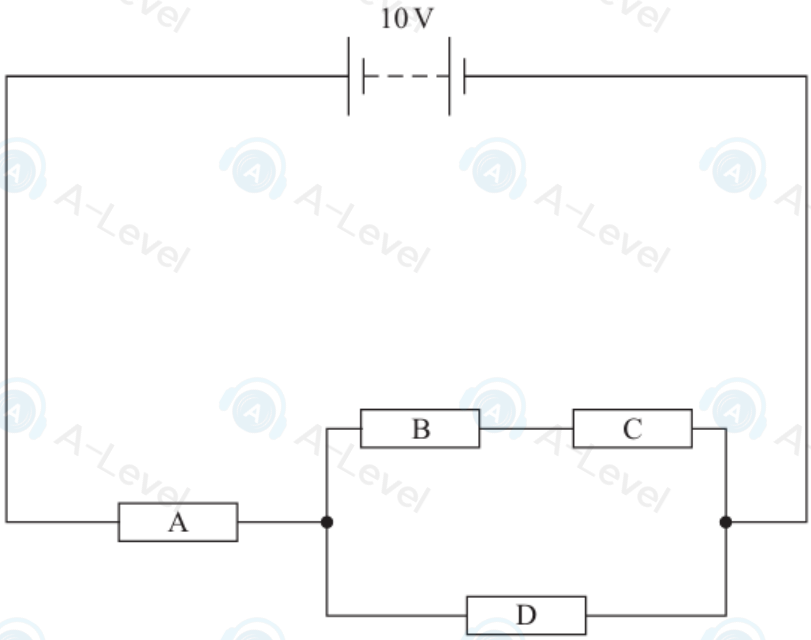
18 Four identical resistors, A, B, C and D, are placed in a circuit, as shown.



(a) Determine the power dissipated in each of the resistors.

resistance of each resistor = 2.0 Ω.

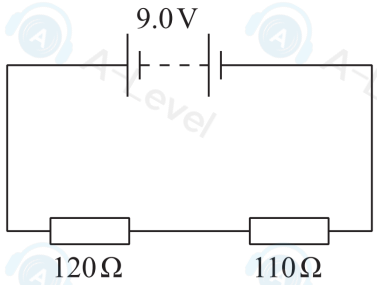
(6)

(b) Explain, without further calculation, what would happen to the power dissipated by resistor A if resistor D were disconnected from the circuit.

(2)

(c) If the resistors in the circuit used in (a) were replaced with filament lamps, the

18 (a) A 9.0 V battery of negligible internal resistance is connected as shown.

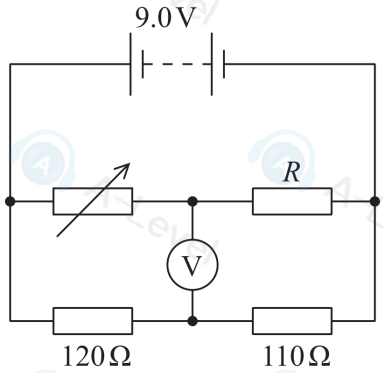


(i) Calculate the potential difference (p.d.) across the 120 Ω resistor.

(2)

p.d. = ...

(ii) A student added to the circuit, as shown below, in order to determine the resistance R of a resistor.

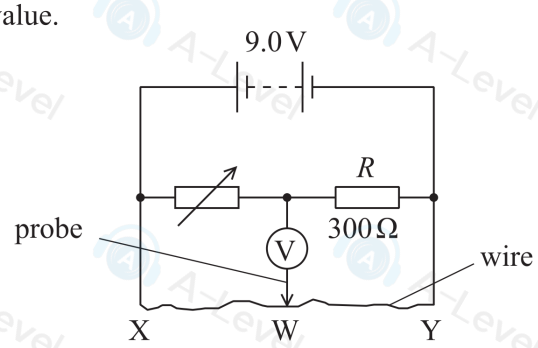


As the student adjusted the variable resistor, the reading on the voltmeter changed. When the variable resistor had a resistance of 295 Ω, the reading on the voltmeter was 0 V. This happened because the p.d. across the variable resistor was equal to the p.d. across the 120 Ω resistor.

Show that the value of R is about 300 Ω.

(2)

(b) A different form of the circuit is shown below. The 120 Ω and 110 Ω resistors were replaced with a wire XY of length 1.000 m. R is 300 Ω and the variable resistor was altered to a different value.



(i) The student moved the probe attached to the voltmeter along the wire until, at W, the reading on the voltmeter was 0 V. This occurred when the length XW was 33.0 cm.

Calculate the resistance of the variable resistor, assuming that the wire XY has a uniform cross-sectional area.

(2)

Resistance of the variable resistor = ...

(ii) The student discovered that the wire was thinner between X and W than it was between W and Y.

Explain why this results in an error in the calculated value of the resistance of the variable resistor.

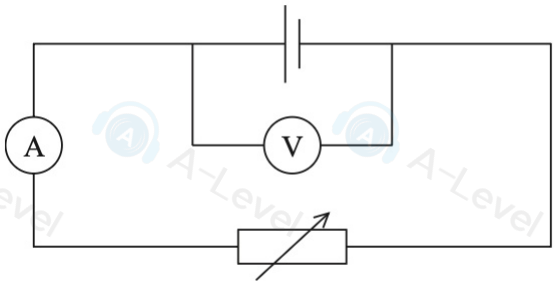
(2)

(iii) Describe how the student could check that the diameter of the wire is uniform.

(3)

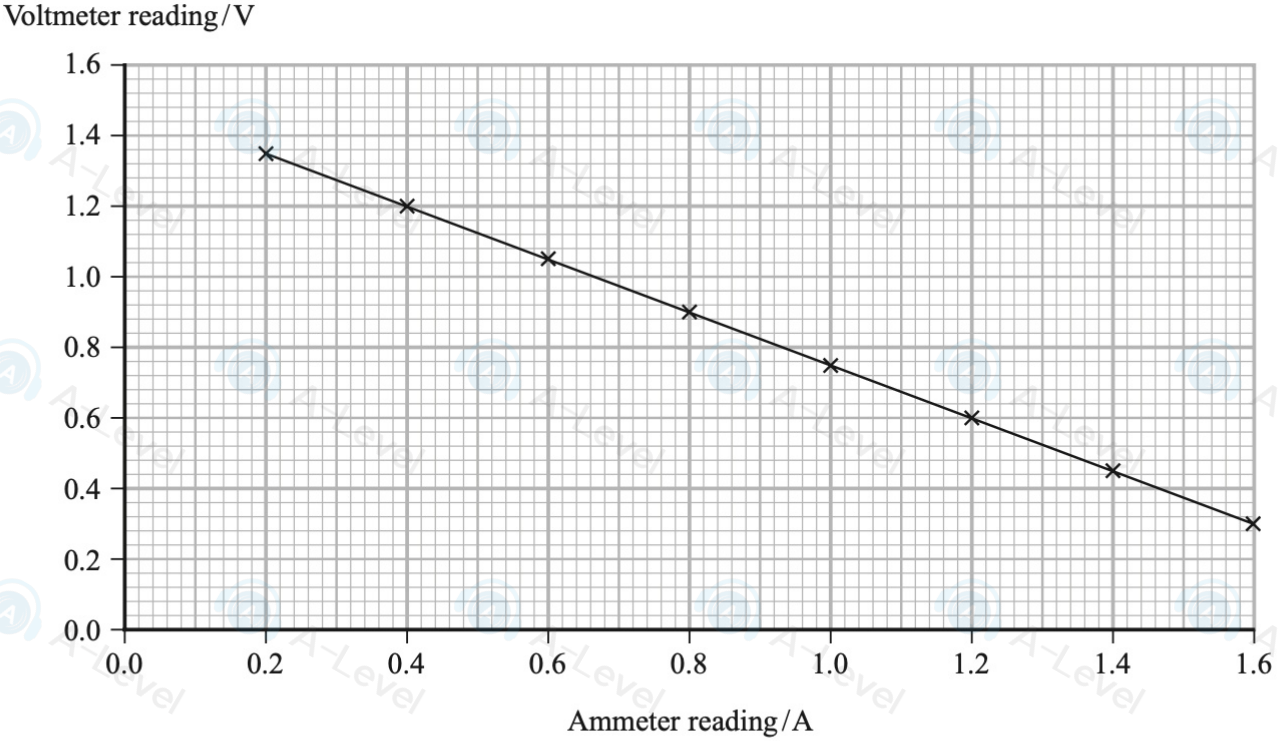
(Total for Question 18 = 11 marks)

12 A student investigated the internal resistance of a cell, using the circuit shown.



The student used the variable resistor to vary the reading on the ammeter. He recorded corresponding readings from the voltmeter.

The student plotted the results on a graph, as shown.



(a) Determine the e.m.f. ε of the cell, and the internal resistance r of the cell.

(3)

.....

.....

.....

.....

.....

ε = ...

r = ...

(b) The student placed an identical cell in series with the original cell in the circuit. He connected the voltmeter across both cells and repeated the investigation.

The student plotted a new graph of these voltmeter and ammeter readings.

Describe how the new graph is different from the graph for one cell.

(2)

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14 A student investigated the e.m.f. and internal resistance of a battery.

(a) The student connected a high resistance voltmeter across the battery. The battery was not connected to any other components.

Explain why the reading on the voltmeter gave the e.m.f. of the battery.

(2)

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(b) The student investigated how the potential difference V across the battery varied with the current I in the battery.

Draw a circuit diagram for this investigation.

(2)

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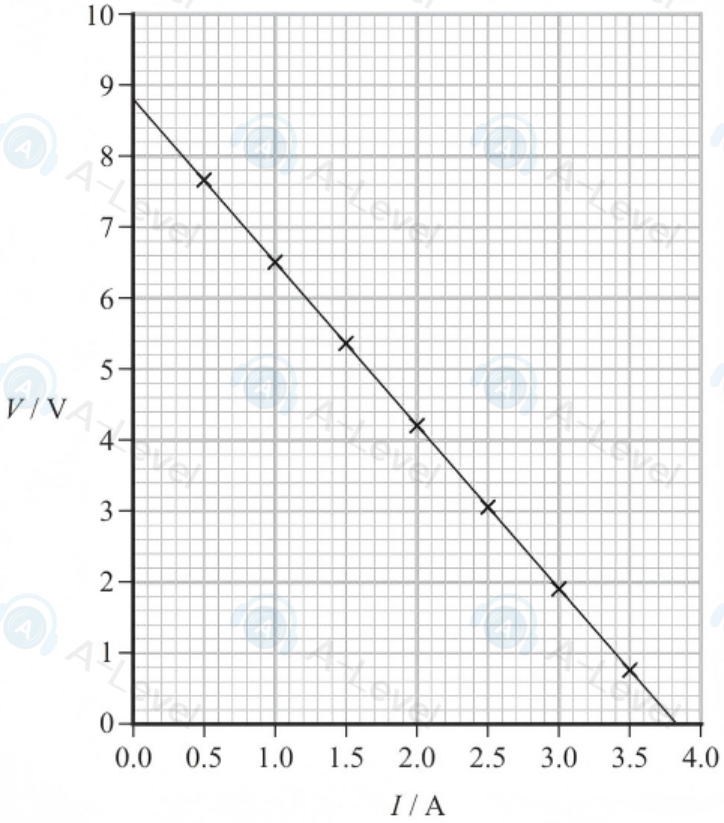
(c) The student plotted her results on a graph as shown.



(i) Determine the e.m.f. and internal resistance of the battery.

(3)

e.m.f. = ...

Internal resistance = ...

(ii) Explain why there is a maximum current that can be supplied by the battery.

(2)

(Total for Question 14 = 9 marks)