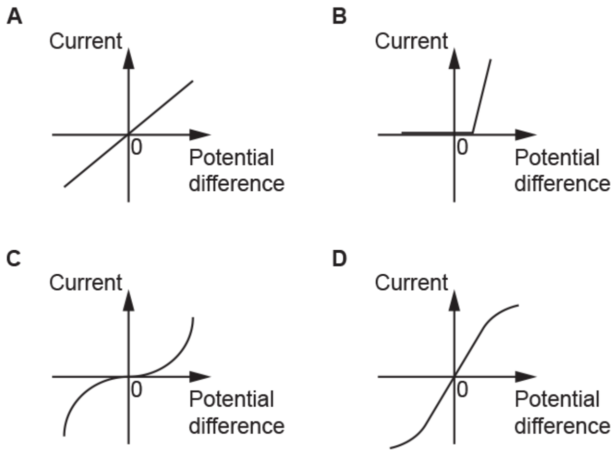
Simple Circuits (H)

1. A student investigates four different electrical components.

She plots current-potential difference graphs for the components.



Which of the above shows the characteristic graph for a diode?

Your answer ☐ **[1]**

2. Voltage is increased before transmission through the National Grid.

It is increased from 25 000 V up to 400 000 V. This increases the voltage 16 times.

i. How much would this increase in voltage affect the current?

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____ **[2]**

ii. Use the formula: **power = current^2 × resistance**

to explain why this voltage increase is important to power loss in transmission cables.

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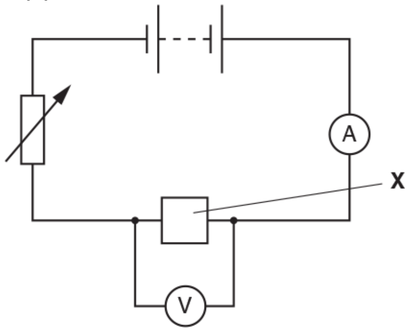
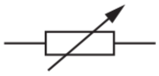
____ **[2]**

3 (a). A student builds a circuit to investigate the resistance of component **X**.



i. What is the name of this component? 

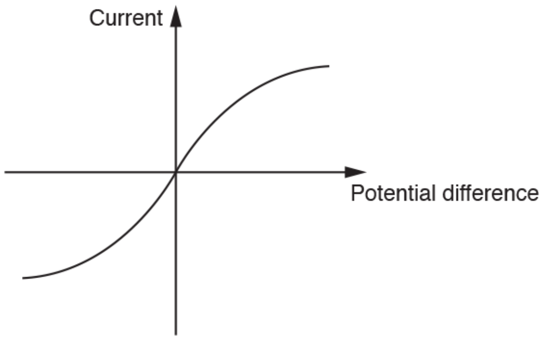
____ **[1]**

ii. Why is this component needed in this circuit?

____ **[1]**

(b). The student uses the circuit to take current and potential difference readings.

The student plots a graph of her results.



i. Look at the graph. What is component **X** in the circuit?

____ **[1]**

ii. The resistance of component **X** varies as the potential difference changes.

Describe how the graph shows this and explain why this happens.

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____

____ **[3]**

(c). Component **X** has a resistance of 16 Ω when a current of 0.25 A flows.

i. Calculate the potential difference across component **X**.

Use the equation: Potential difference = Current × Resistance

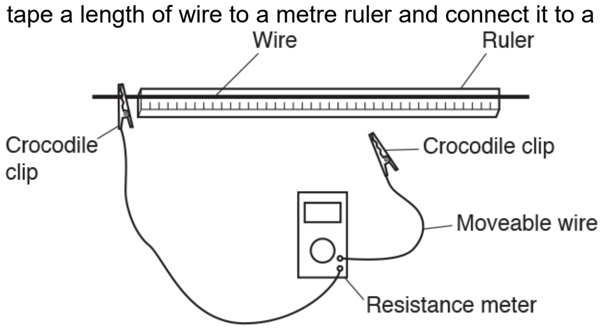
Answer = ... V **[2]**

ii. Calculate the power of component **X** when a current of 0.25 A flows.

Answer = ... W **[3]**

4 (a). Two students investigate the resistance of a wire.

They tape a length of wire to a metre ruler and connect it to a resistance meter using crocodile clips.



Look at their results.

Length of wire (cm)	Resistance (Ω)			
	Attempt 1	Attempt 2	Attempt 3	Mean
25	8.8	8.3	8.5	8.533
50	16.2	16.1	16.4	16.4
75	23.5	23.8	18.7	23.7
100	30.8	31.1	31.0	31.0

i. Describe the pattern shown by these results.

Use data in your answer.

---**[2]**

ii. The students made **two** mistakes when they recorded their results and completed the table.

Identify the mistakes **and** explain what they should have done.

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____ **[2]**

iii. The students have correctly handled an anomaly in their results.

Identify the anomaly and explain how it was correctly handled.

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____

____ **[2]**

iv. The students plan to plot a graph of mean resistance against length.

What would you expect a graph of these results to look like?

____

____

____ **[2]**

(b).

i. The actual mean resistance values are more than expected.

Suggest **two** possible errors with the experiment.

____

____

____ **[2]**

ii. For **one** of the errors, suggest how the experimental procedure could be improved.

____

____ **[1]**

5. A domestic wind turbine has a power rating which varies from 1.0 kW to 3.0 kW.

i. The domestic wind turbine has an electrical resistance of 23 Ω.

It generates a current of 11 A on a windy day.

Calculate the power output in kW of the turbine on this day.

Answer = ______________________________ kW **[4]**

ii. Suggest why the manufacturer gives a range for the power rating of the wind turbine.

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____ **[1]**

iii. Using just **one** domestic wind turbine may be an unreliable source of power for a house.

State a reason why.

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____ **[1]**

6. A TV works with a 12.0 V battery. It has a current of 3.19 A.

Calculate the power rating of the TV.

Power = ... W **[3]**

7 (a). Energy is transferred at high voltages in the national grid.

This house is near to a transmission line.

Explain why radio waves may be produced by the transmission line.

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____ **[2]**

(b). Explain why it is more efficient to transfer energy at high voltages.

____

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____ **[2]**

(c). The transmission line has a power loss of 6.156 kW.

Its resistance is 15.39 Ω.

Calculate the current in the transmission line.

Current = ... A **[5]**

8 (a). A TV has the label below on it.

OCR TV Voltage: 230 V Power: 65 W Frequency: 50 Hz

Calculate the **current** in the TV when it is turned on.

Use the equation: power = potential difference × current

Give your answer to **2** significant figures.

Current = ... A **[4]**

(b). The TV is turned on for 30 minutes.

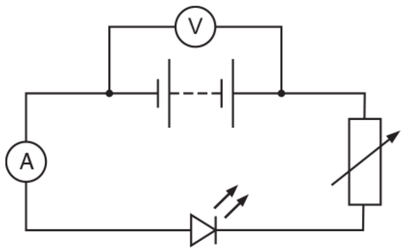
Calculate the energy transferred by the TV.

Energy used = ... J **[4]**

9 (a). A student investigates the electrical characteristics of a light emitting diode (LED).

The student builds a circuit to investigate how the current through an LED and the potential difference across it vary when the LED lights up.

Look at the circuit diagram.



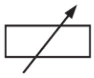
i. The student has made **two** errors connecting the circuit.

Identify the errors.

1 --

2 --

[2]

ii. What is the purpose of the component  in the circuit?

[1]

(b). The student then connects the circuit correctly. He measures the current through the LED as 0.03 A when the potential difference across it is 3.0 V.

i. Calculate the resistance of the LED.

Use the equation: potential difference = current × resistance

Resistance = ... Ω **[3]**

ii. Calculate the charge which flows when this LED operates for 2.5 minutes.

Charge = ... C **[4]**

iii. Calculate the energy transferred when this LED operates for 2.5 minutes.

Use the equation: energy transferred = charge × potential difference

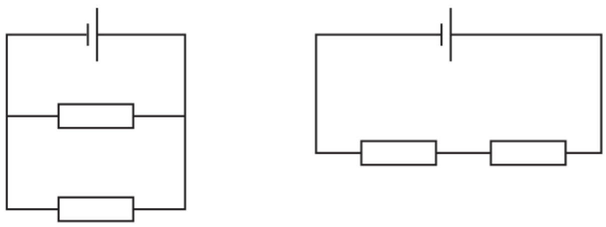
Energy transferred = ... J **[2]**

10. Calculate the charge when 200 J of energy is transferred with a potential difference of 40 V.

Use the equation: energy transferred = charge × potential difference

Charge = ... C **[3]**

11 (a). A student builds two electrical circuits. Each circuit uses identical cells and identical fixed resistors.



A **B**

Explain why circuit **A** has a lower total resistance than circuit **B**.

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____ **[2]**

(b). A student investigates the resistance of a filament lamp.

i. Explain why the resistance of a filament lamp increases when current increases.

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____ **[2]**

ii. Design a circuit diagram which could be used to investigate how the resistance of a filament lamp changes with current.

Use the circuit symbols below. Each symbol can be used once, more than once, or not at all.

[2]

iii. Describe how the student would use the circuit you have drawn in **(ii)** to investigate how the resistance of a filament lamp changes with current.

[3]

12. Water can be heated using a 12 V heater.

A transformer is used to change a 120 V supply into 12 V.
The current in the secondary coil is 9.0 A.

Calculate the current in the primary coil.

Use an equation from the data sheet.

Current = ... A **[2]**

END OF QUESTION PAPER