1(a). A student has written two sentences about the resistance of different electrical components.

The resistance of a filament lamp is so high in one direction, that no current can pass through. The resistance of a thermistor changes as the light intensity changes.

The student has made **two** mistakes about the components.

Identify the mistakes and write the correct word or words to replace each of them.

Mistake 1 _____

Correct word(s) 1 _____

Mistake 2 _____

Correct word(s) 2 _____ **[4]**

(b). Calculate the current in a 180 W resistor when the potential difference across the resistor is 12 V.

Use the equation: power = potential difference × current

Current = ... A **[3]**

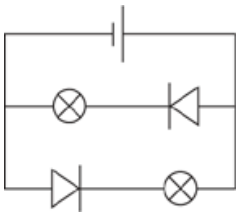
(c). Calculate the energy transferred when 20 C of charge moves through a potential difference of 12 V.

Use the equation sheet.

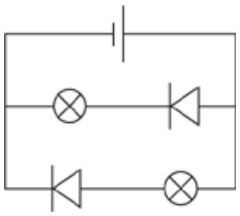
Energy transferred = ... J **[3]**

2. In which circuit will both lamps light up?

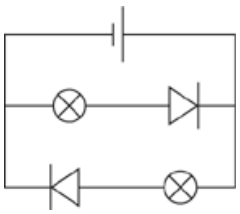
A



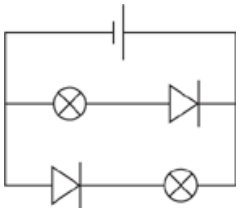
B



C



D



Your answer ☐ **[1]**

3(a). A student investigates the current–potential difference characteristics of a diode.

Fig. 19.1 shows the circuit diagram the student sets up to measure the current in the diode and the potential difference across the diode.

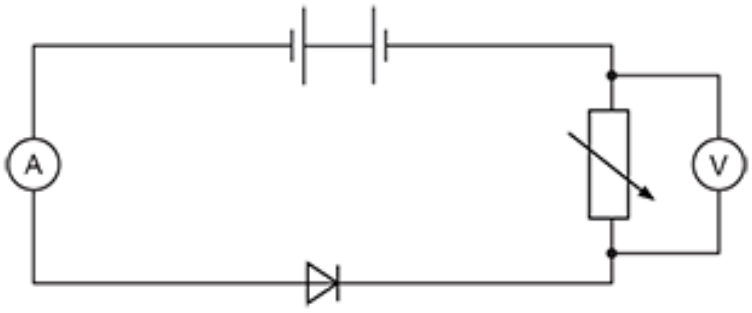


Fig. 19.1

The student has made **two** mistakes when setting up the circuit.

Identify the two mistakes and explain how to correct them.

Mistake 1 _____

Correction 1 _____

Mistake 2 _____

Correction 2 _____

[4]

(b). A student investigates the current–potential difference characteristics of a diode and records the current for different values of the potential difference. **Fig. 19.2** shows a graph of their results.

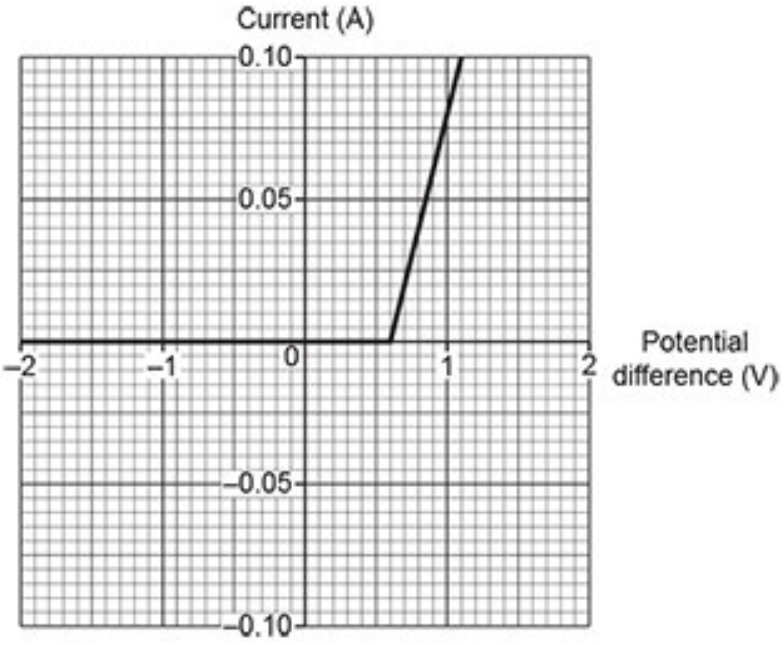


Fig. 19.2

i. State the potential difference when the diode starts to conduct.

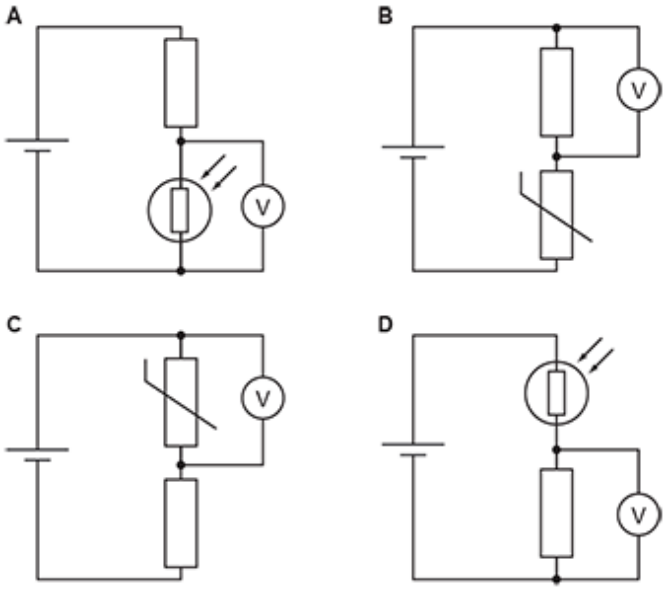
_____ **[1]**

ii. Use the gradient of the graph to calculate a value for the resistance of the diode when it is conducting.

Resistance = ... Ω **[4]**

4. An engineer uses a sensing circuit which produces a high output voltage when it gets dark.

Which circuit does the engineer use?



Your answer ☐ **[1]**

5. A teacher plugs an electric kettle into the domestic electricity supply.

The kettle has a power rating of 2300 W.

What is the current in the kettle?

Use the Equation Sheet June 23 J249-01-02-03-04.

A 0.10 A
B 3 A
C 10 A
D 13 A

Your answer ☐ **[1]**

6. A student does an experiment to measure the specific heat capacity of a metal block.

Fig. 20.1 shows the student's equipment.

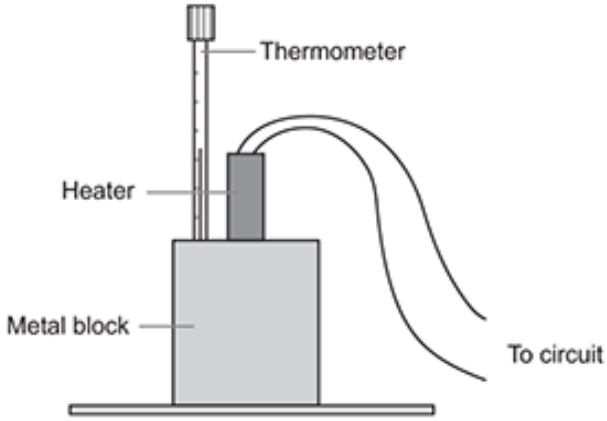


Fig. 20.1

The student measures current and potential difference to calculate the power of the heater.

Complete the circuit diagram in **Fig. 20.2** to show how the student measures current and potential difference.

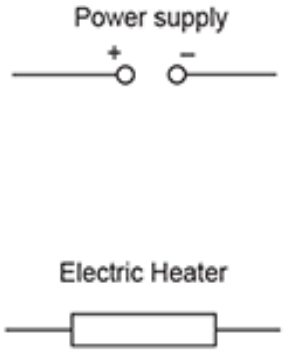


Fig. 20.2

[2]

7. A wind turbine generates electricity at 900 V.

The wind turbine is connected to the national grid using a transformer.

i. The potential difference across the primary coil is 900 V.
The potential difference across the secondary coil is 36 000 V.
The current in the primary coil is 2800A.

ii. Calculate the current in the **secondary** coil.

Use the Data sheet_J249 01/02/03/04, June 2022.

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

ii. Explain why the use of the transformer in **(i)** reduces power loss in the national grid.

[3]

iii. Another transformer has a power input of 864 900 W.

The current in the primary coil is 1860A.

Calculate the resistance of the primary coil.

Use the equation: power = $(\text{current})^2 \times \text{resistance}$

Resistance = ... Ω **[3]**

8. *Two students, **P** and **Q**, investigate how the resistance of wire varies with its length. Each student uses different lengths of the **same** wire and the **same** equipment for their experiment.

- **Table 18.1** shows the data that student **P** obtained.
- **Table 18.2** shows the data that student **Q** obtained.

Table 18.1

Student P data

Length of wire (cm)	Resistance Trial 1 (Ω)	Resistance Trial 2 (Ω)	Mean resistance (Ω)	Resistance per unit length (Ω/ cm)
10	12	20	16	1.6
15	25	30	28	1.9
19	21	29	25	1.32

Table 18.2

Student Q data

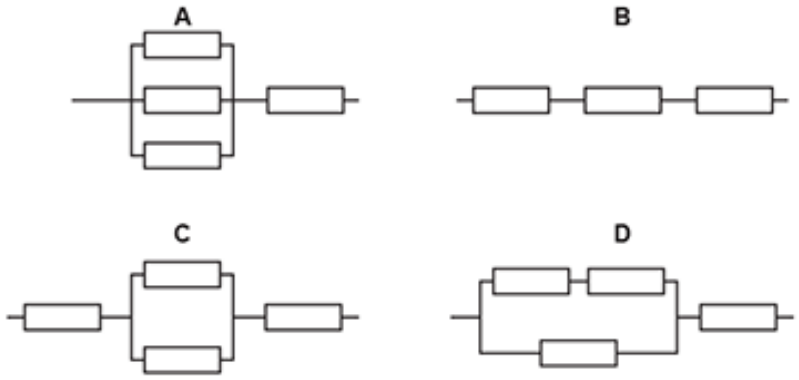
Length of wire (cm)	Resistance Trial 1. (Ω)	Resistance Trial 2 (Ω)	Mean resistance (Ω)	Resistance per unit length (Ω / cm)
10.0	11.0	11.2	11.1	1.10
20.0	19.8	20.2	20.0	1.00
30.0	33.0	33 2	33.1	1.10
40.0	48.0	48.4	48.2	1.20
50.0	55.1	55.5	55.3	1.10

The manufacturer of the wire states that the value for its resistance per unit length is 1.2 **(Ω)** / cm.

Compare the data recorded in the two tables. Explain which student's data is the most accurate and precise.

[6]

9. A student sets up four arrangements, **A, B, C** and **D**, using identical fixed resistors.



Which arrangement has the lowest resistance?

Your answer ☐ **[1]**

END OF QUESTION PAPER