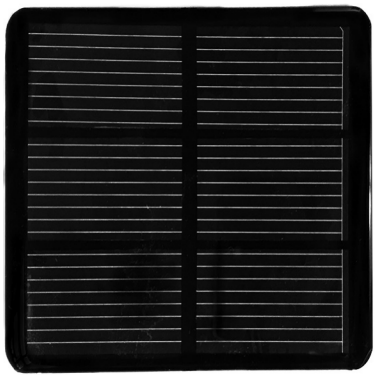
3 A student investigated how the power output of a solar cell is affected by temperature. The intensity of light incident on the solar cell remained constant.

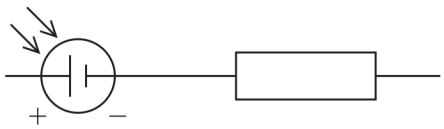
He used a square solar cell, as shown.



The student determined the power output of the solar cell at different temperatures.

(a) Complete the diagram to show a circuit that would allow him to determine the power output of the solar cell.

(2)



(b) Describe how the student could ensure that the intensity of light incident on the solar cell remained constant.

(2)

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(c) State a method the student could use to increase the temperature of the solar cell.

(1)

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(d) At room temperature, the student measured a potential difference of 2.74 V and a current of 45 mA for the solar cell.

Calculate the power output of the solar cell.

(2)

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Power output = ...

(e) He measured the intensity of the light incident on the solar cell to be 200 W m^{-2}.

Calculate the efficiency of the solar cell at room temperature.

dimensions of solar cell = 60 mm × 60 mm

(3)

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Efficiency = ...

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(f) The student made measurements of the potential difference V and current I for the solar cell over a range of temperatures.

His results are recorded in the table.

Temperature / °C	V / V	I / mA
15	2.76	45.8
20	2.62	47
30	2.46	48
50	2.05	51.5

(i) Criticise these results.

(2)

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(ii) Over the range of temperatures shown, the relationship between the power output of the solar cell and its temperature is linear.

Describe how the student could use a graphical method to determine the change in power output for each 1 °C of temperature increase.

(3)

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(Total for Question 3 = 15 marks)