4 **(a)** Mains electricity is supplied for use in homes at a potential difference (p.d.) of 230 V.

However, it is supplied at 130 kV by a power station.

A transmission wire connects the power station to substations near homes where the voltage is reduced to 230 V.

(i) The power output of the power station is 400 MW.

Calculate the current in the transmission wire at 130 kV.

current = ... A [1]

(ii) Calculate the current required to transfer a power of 400 MW at 230 V.

current = ... A [1]

(iii) A typical home uses a maximum current of 80 A.

Based on this information, suggest and explain whether individual homes are connected in series or in parallel to the electricity supply.

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.....

..... [1]

(iv) Suggest why a current-carrying wire becomes warm. Use ideas about particles in your answer.

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..... [2]

(v) The resistance of a transmission wire is 0.10 Ω.

Calculate the power wasted as thermal energy in the transmission wire when the potential difference supplied is 130 kV.

power = ... W [1]

(vi) Suggest why the transmission wires are supplied at 130 kV rather than 230 V.

.....

..... [1]

(b) (i) A student collects data to investigate the I–V characteristic of a resistor.

Draw the circuit diagram of the electrical circuit used in this experiment.

[3]

(ii) Describe how the circuit is used to collect the necessary data.

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..... [2]

[Total: 12]