Name of the Student:_____
Max. Marks : 22 Marks **Time : 22 Minutes**

Q1.

The photograph shows a 'quiet boil' electric kettle. The makers of the kettle claim that it boils water with much less noise than a standard kettle.

A laboratory technician takes some measurements to compare a 'quiet boil' electric kettle with a standard electric kettle.

The table shows the results recorded by the technician.

	Quiet boil kettle	Standard kettle
Mass of water / kg	1.20	1.20
Initial temperature of water / °C	10	10
Final temperature of water / °C	100	100
Potential difference / V	243	247
Current / A	11.9	11.8
Time taken to heat water to boiling point / s	168	172
Average sound intensity / mW m^{-2}	3.72	10.5

A student uses the values in the table to calculate the efficiency of each kettle at heating the water to boiling point. He calculates the efficiency of the 'quiet boil' kettle to be 0.93

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Calculate the efficiency of the standard kettle.
specific heat capacity of water = 4180 J kg^{-1} K^{-1}

(4)

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Efficiency = ...

(b) The intensity of the sound produced by each kettle was measured with a sound meter which was 30.0 cm from the centre of the kettle.

Calculate the energy transferred by sound while the water in the standard kettle is brought to the boil. You may treat the kettle as a point source.

(4)

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Energy transferred = ...

(c) The label on the original packaging of the quiet boil electric kettle states, 'This kettle is much more efficient than a standard kettle because it produces less sound.'

Explain the extent to which this statement is supported by your calculations.

(2)

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(Total for question = 10 marks)

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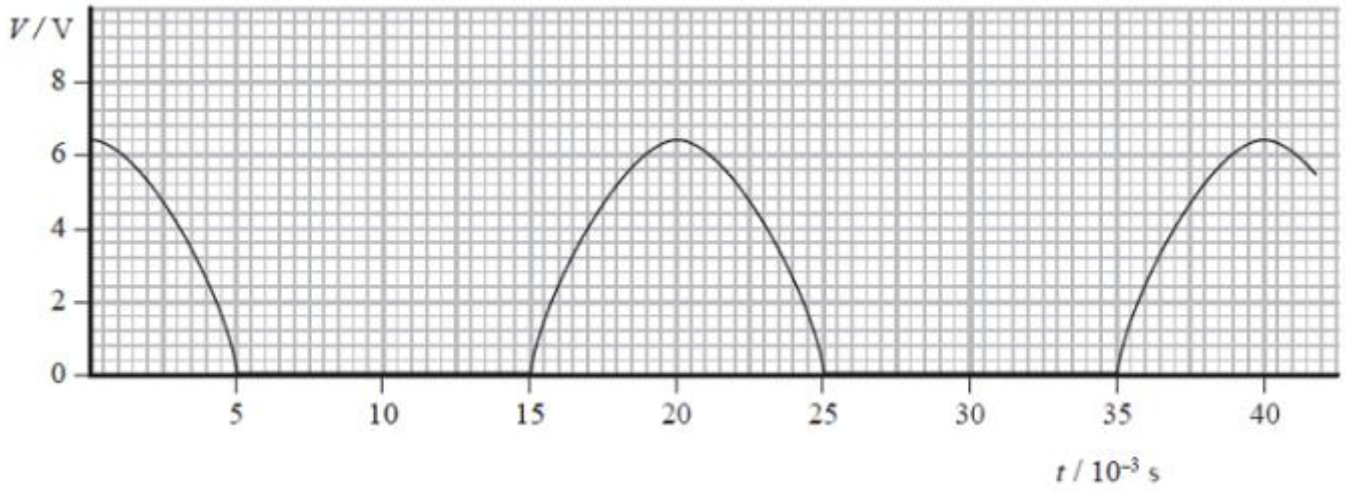
Q2.

The graph shows how the output *V* from the terminals of a power supply labelled d.c. (direct current) varies with time *t*. This type of supply will not allow current to flow backwards through it.



(a) A student connects a capacitor across the terminals of this power supply in order to try to produce a constant voltage.

Suggest how this produces a constant voltage.

(2)

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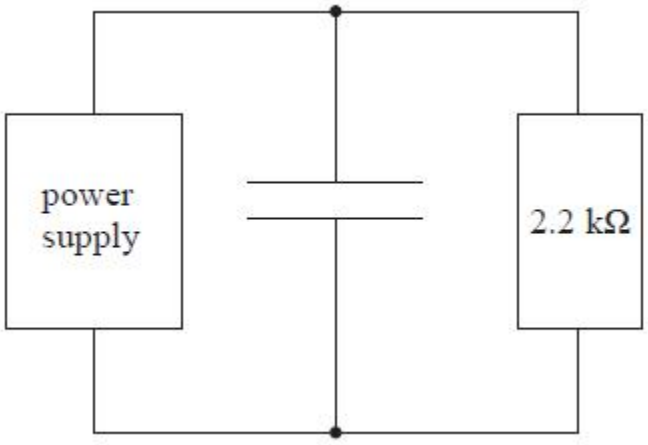
(b) The student then connects a resistor across the capacitor as shown.



The graph shows the variation of the potential difference *V* across the resistor with time *t*.

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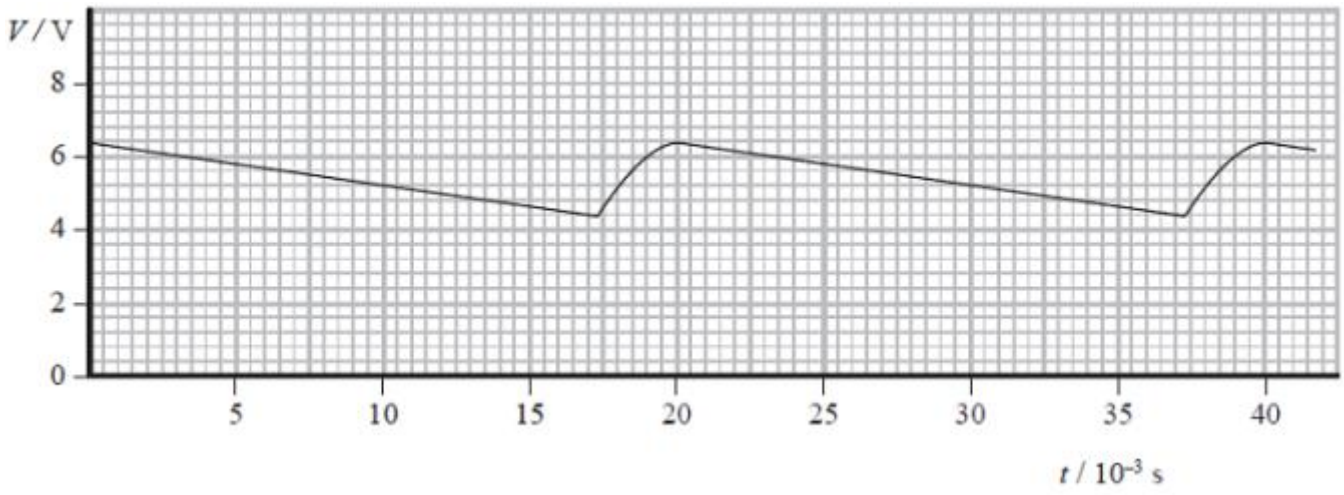

(i) Estimate the average potential difference across the resistor.

(1)

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Average potential difference = ...

(ii) Calculate the average current in the resistor.

(2)

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Average current = ...

(iii) Determine the time in each cycle for which the capacitor discharges through the resistor.

(1)

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Discharge time = ...

(iv) Calculate the charge passing through the resistor during one discharge of the capacitor and hence determine the capacitance of the capacitor.

(4)

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Charge = ...

Capacitance = ...

(c) The student wants to produce a potential difference across the same resistor that has less variation in magnitude.
State, with a reason, what the student could do to achieve this.

(2)

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(Total for question = 12 marks)

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