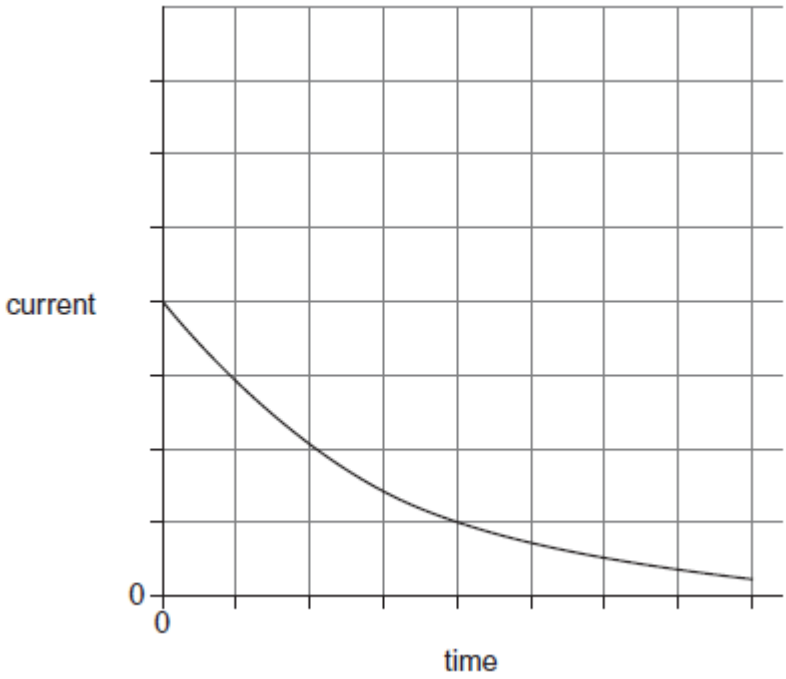
**Name of the Student**:_____
**Max. Marks : 22 Marks** **Time : 22 Minutes**

## Q1.

(a) The graph shows how the current varies with time as a capacitor is discharged through a 150 Ω resistor.




(i) Explain how the initial charge on the capacitor could be determined from a graph of current against time.

_____

_____

_____

_____

**(1)**

(ii) The same capacitor is charged to the same initial potential difference (pd) and then discharged through a 300 kΩ resistor. Sketch a second graph on the same axes above to show how the current varies with time in this case.

**(3)**

(b) In an experiment to show that a capacitor stores energy, a student charges a capacitor from a battery and then discharges it through a small electric motor. The motor is used to lift a mass vertically.

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(i) The capacitance of the capacitor is 0.12 F and it is charged to a pd of 9.0 V.
The weight of the mass raised is 3.5 N.
Calculate the maximum height to which the mass could be raised.
Give your answer to an appropriate number of significant figures.

maximum height _____ m

**(4)**

(ii) Give **two** reasons why the value you have calculated in part (i) would not be achieved in practice.

1. _____

_____

_____

_____

2. _____

_____

_____

_____

**(2)**

**(Total 10 marks)**

## Q2.

The specification for a pacemaker requires a suitable charge to be delivered in 1.4 ms. A designer uses a circuit with a capacitor of capacitance 3.0 μF and a 2.5 V power supply to deliver the charge. The designer calculates that a suitable charge will be delivered to the heart as the capacitor discharges from a potential difference (pd) of 2.5 V to a pd of 1.2 V in 1.4 ms.

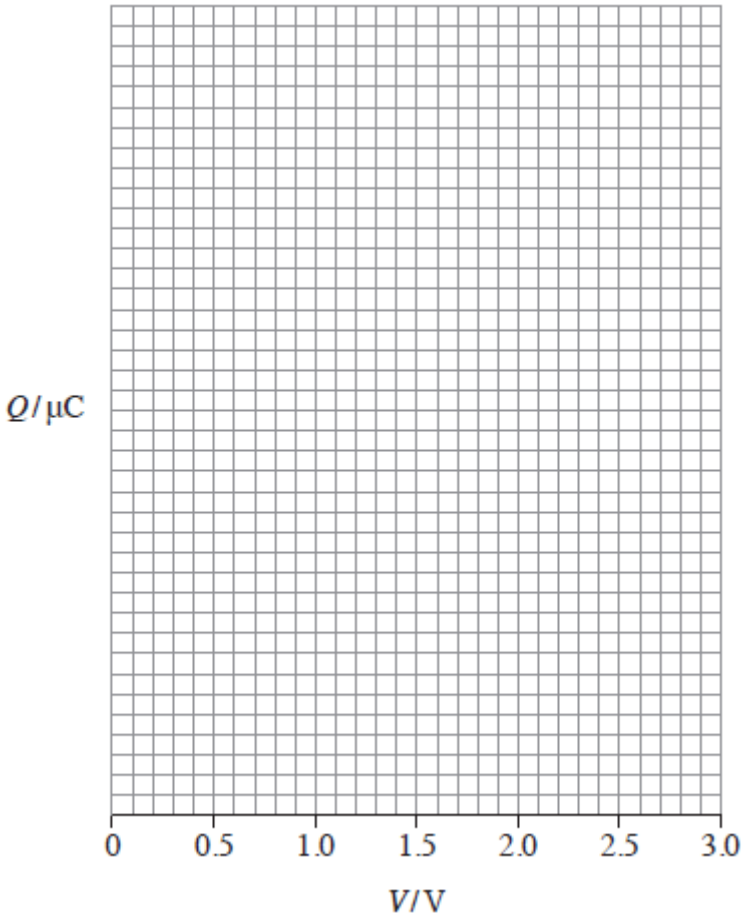
(a) (i) Calculate the charge on the capacitor when it is charged to a pd of 2.5 V.

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charge _____ C

**(1)**

(ii) Draw a graph showing how the charge, $Q$, on the capacitor varies with the pd, $V$, as it discharges through the heart.
Include an appropriate scale on the charge axis.




**(3)**

(b) Calculate the energy delivered to the heart in a single pulse from the pacemaker when the capacitor discharges to 1.2 V from 2.5 V.

energy _____ J

**(3)**

(c) (i) Calculate the resistance of the heart that has been assumed in the design.

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resistance _____ Ω

**(3)**

(ii) Explain why the rate of change of pd between the capacitor plates decreases as the capacitor discharges.

_____

_____

_____

_____

_____

**(2)**

**(Total 12 marks)**

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