Practice Question Set For A-Level
Subject : Physics
Paper-2 Topic: Fields And Their Consequences (Capacitance)

Name of the Student:_____
Max. Marks : 23 Marks **Time : 23 Minutes**

Q1.

(a) Define the capacitance of a capacitor.

_____

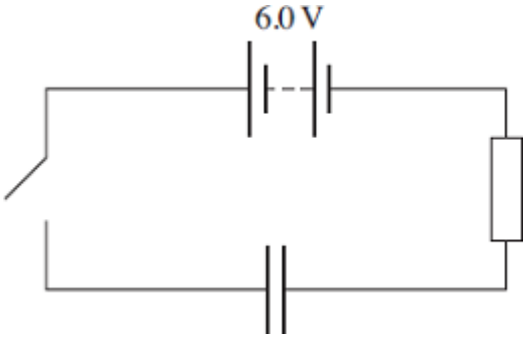
_____

_____

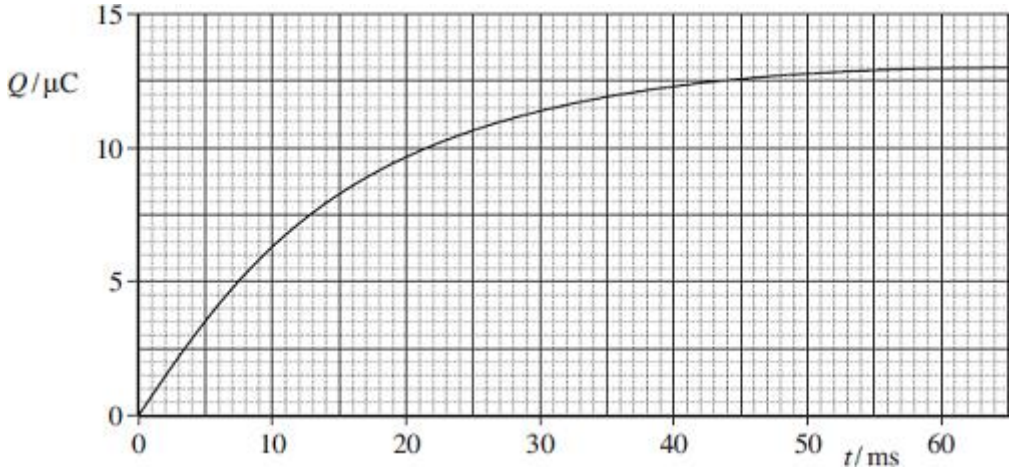
_____

(2)

(b) The circuit shown in the figure below contains a battery, a resistor, a capacitor and a switch.



The switch in the circuit is closed at time $t = 0$. The graph shows how the charge Q stored by the capacitor varies with t.



(b) (i) When the capacitor is fully charged, the charge stored is 13.2 μC. The electromotive force (emf) of the battery is 6.0 V. Determine the capacitance of the capacitor.

answer = _____ F

(2)

(ii) The time constant for this circuit is the time taken for the charge stored to increase from 0 to 63% of its final value. Use the graph to find the time constant in milliseconds.

answer = _____ ms

(2)

(iii) Hence calculate the resistance of the resistor.

answer = _____ Ω

(1)

(iv) What physical quantity is represented by the gradient of the graph?

_____

_____

(1)

(c) (i) Calculate the maximum value of the current, in mA, in this circuit during the charging process.

answer = _____ mA

(1)

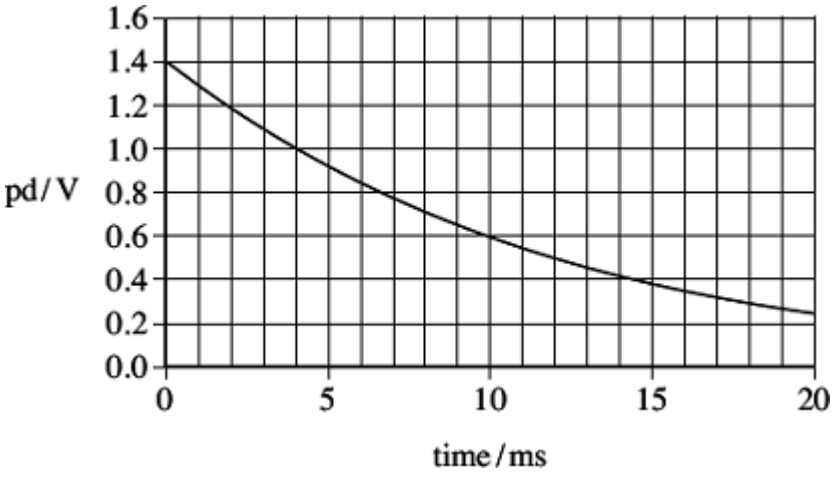
(ii) Sketch a graph on the outline axes to show how the current varies with time as the capacitor is charged. Mark the maximum value of the current on your graph.

(2)

(Total 11 marks)

Q2.

The figure below shows part of the discharge curve for a capacitor that a manufacturer tested for use in a heart pacemaker.



The capacitor was initially charged to a potential difference (pd) of 1.4 V and then discharged through a 150 Ω resistor.

(a) Show that the capacitance of the capacitor used is about 80 μF.

_____

_____

_____

_____

_____

(3)

(b) Explain why the rate of change of the potential difference decreases as the capacitor discharges.

_____

_____

_____

_____

_____

_____

(3)

(c) Calculate the percentage of the initial energy stored by the capacitor that is lost by the capacitor in the first 0.015 s of the discharge.

energy lost _____%

(3)

(d) The charge leaving the capacitor in 0.015 s is the charge used by the pacemaker to provide a single pulse to stimulate the heart.

(i) Calculate the charge delivered to the heart in a single pulse.

charge _____C

(1)

(ii) The manufacturer of the pacemaker wants it to operate for a minimum of 5 years working at a constant pulse rate of 60 per minute.
Calculate the minimum charge capacity of the power supply that the manufacturer should specify so that it will operate for this time.
Give your answer in amp-hours (Ah).

minimum capacity _____Ah

(2)

(Total 12 marks)