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

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Name of the Student:_____
Max. Marks : 25 Marks **Time : 25 Minutes**

Q1.

(a) (i) Define the capacitance of a capacitor.

_____

_____

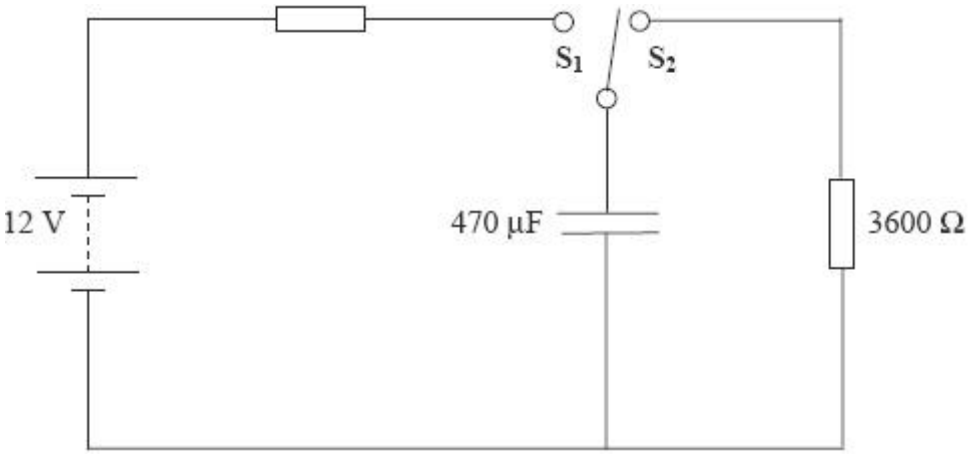
(1)

(ii) Calculate the charge, in C, stored on a 470 μF capacitor which has a potential difference of 2.3×10^2 V across it.

(1)

(b) A 470 μF capacitor is connected in a circuit which enables it to charge when the switch is in position $\mathbf{S_1}$ and discharged when the switch is in position $\mathbf{S_2}$. The arrangement is shown in **Figure 1.**

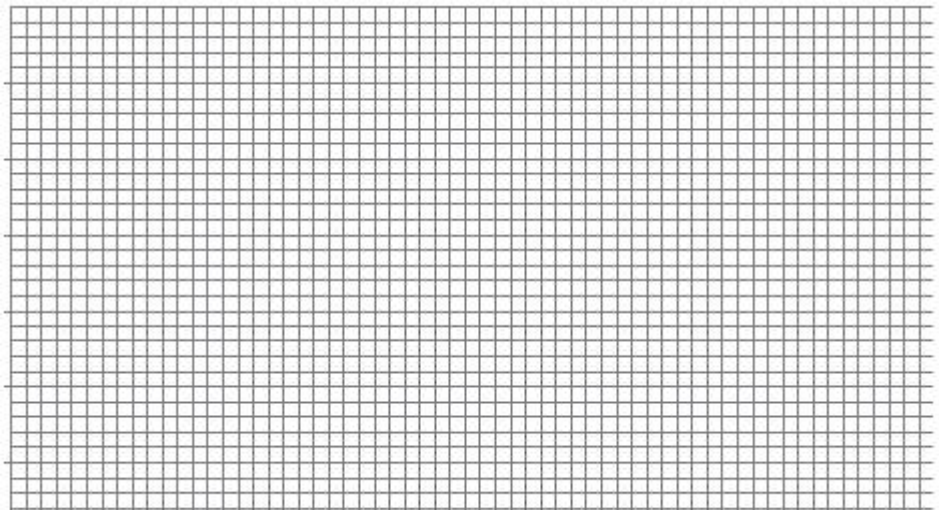
Figure 1



(i) Calculate the time constant of the discharge circuit when the switch is in position $\mathbf{S_2}$. Give your answer in s.

(1)

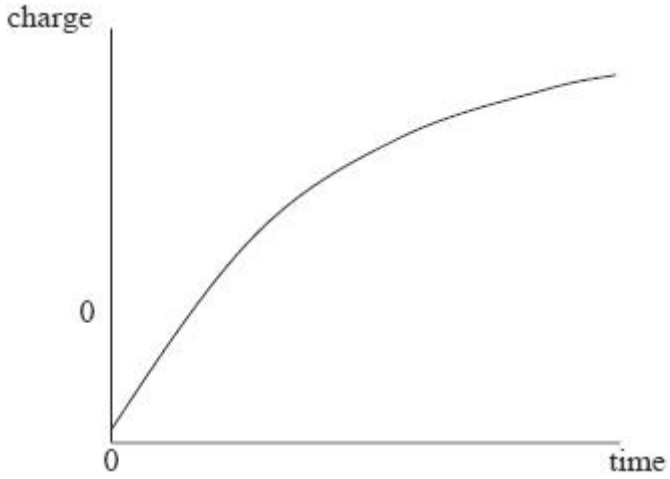
(ii) The capacitor is fully charged and then discharged. On the axes below, mark appropriate scales and draw a graph to show the variation of the potential difference across the capacitor with time for the discharge of the capacitor.



(3)

(c) **Figure 2** shows the variation of charge with time for the charging of the capacitor.

Figure 2



Explain why the charge across the capacitor changes in the way shown by the graph.

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(3)

(Total 9 marks)

Q2.

A 680 μF capacitor is charged fully from a 12 V battery. At time t = 0 the capacitor begins to discharge through a resistor. When t = 25 s the energy remaining in the capacitor is one quarter of

the energy it stored at 12 V.

(a) Determine the pd across the capacitor when t = 25s.

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_____

_____

_____

(2)

(b) (i) Show that the time constant of the discharge circuit is 36 s.

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_____

(ii) Calculate the resistance of the resistor.

_____

_____

(4)

(Total 6 marks)

Q3.

(a) As a capacitor was charged from a 12 V supply, a student used a coulomb meter and a voltmeter to record the charge stored by the capacitor at a series of values of potential difference across the capacitor. The student then plotted a graph of pd (on the *y*-axis) against charge (on the *x*-axis).

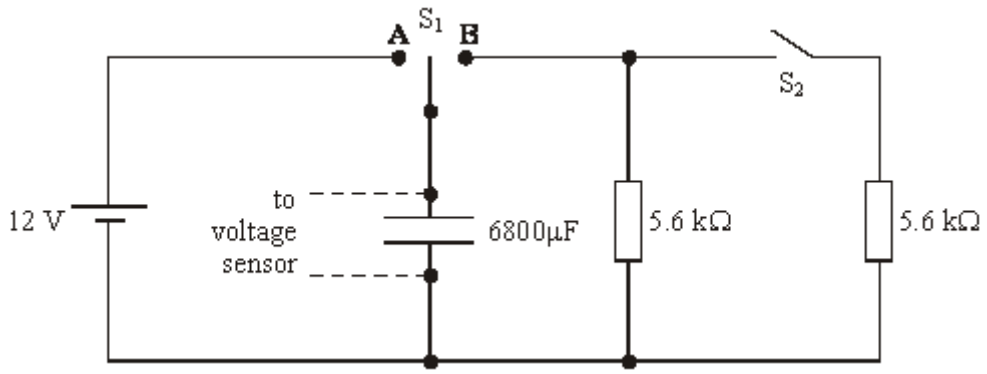
(i) Sketch the graph obtained.

(ii) State what is represented by the gradient of the line.

(iii) State what is represented by the area enclosed by the line and the *x*-axis of the graph.

(3)

(b) The student then connected the capacitor as shown in the diagram below to carry out an investigation into the discharge of the capacitor.



The student used a voltage sensor, datalogger and computer to obtain values for the pd across the capacitor at various times during the discharge.

(i) At time $t = 0$, with switch S_2 open, switch $S_1$was moved from position **A** to position **B**. Calculate the pd across the capacitor when $t = 26$ s.

(ii) At time $t = 26$ s, as the discharge continued, the student closed switch S_2. Calculate the pd across the capacitor 40 s after switch S_1 was moved from position **A** to position **B**.

(iii) Sketch a graph of pd against time for the student's experiment described in parts (b)(i) and (b)(ii).

(7)

(Total 10 marks)