1 (a) State what is meant by a capacitance of 370 μF

_____

_____

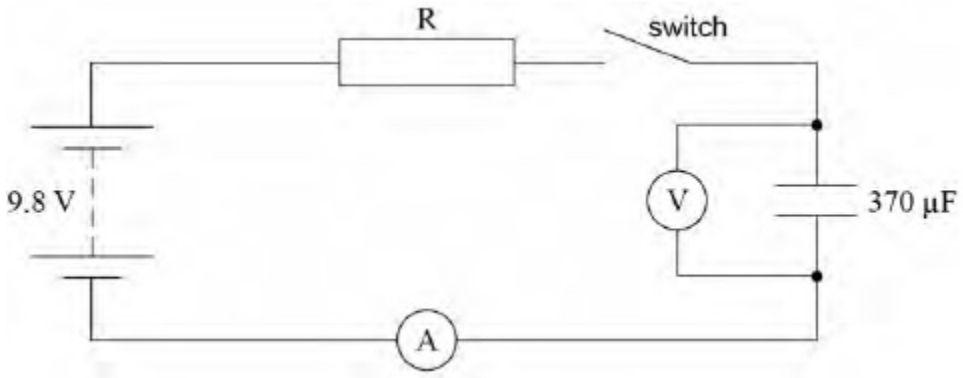
_____

_____

(2)

(b) The charging of a 370 μF capacitor is investigated using the circuit shown in **Figure 1**. Both meters in the circuit are ideal.

Figure 1



The power supply of emf 9.8V has a negligible internal resistance. The capacitor is initially uncharged. When the switch is closed at time $t = 0$ charge begins to flow through resistor R. The time constant of the charging circuit is 1.0 s

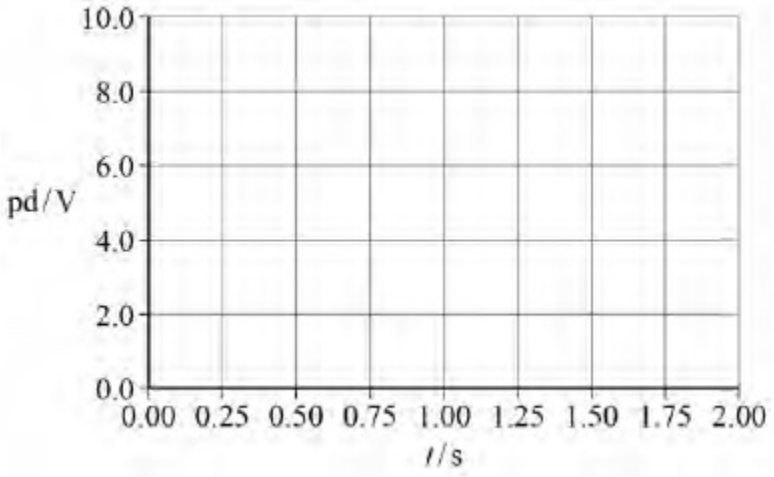
Calculate the resistance of R.

resistance of R = _____ Ω

(1)

(c) Identify, with the symbol X on **Figure 2**, the potential difference (pd) across the capacitor when the switch has been closed for 2.0 s
Sketch the graph that shows how the pd varies from $t = 0$ to $t = 2.0$ s

Figure 2



(2)

(d) Calculate the time taken for the charging current to fall to half its initial value.

time = _____ s

(1)

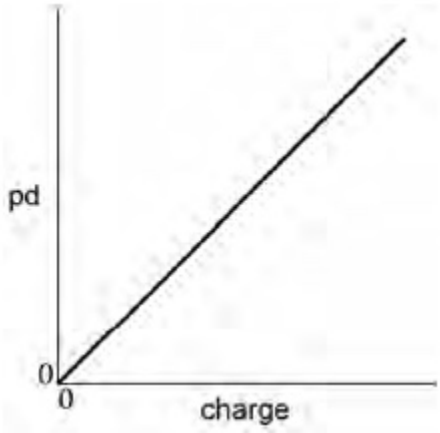
(e) Calculate the time taken for the charge on the capacitor to reach 3.0 mC

time = _____ s

(3)

(Total 9 marks)

2 The graph shows the variation of potential difference (pd) with charge for a capacitor while it is charging.



Which statement can be deduced from the graph?

A The charging current is constant. ⬭

B The energy stored in the capacitor increases uniformly with time. ⬭

C The capacitance of the capacitor is constant. ⬭

D The power supply used to charge the capacitor had a constant terminal pd. ⬭

(Total 1 mark)

3 The figure below shows a capacitor of capacitance 370 pF. It consists of two parallel metal plates of area 250 cm^2. A sheet of polythene that has a relative permittivity 2.3 completely fills the gap between the plates.

not to scale

(a) Calculate the thickness of the polythene sheet.

thickness = _____m

(2)

(b) The capacitor is charged so that there is a potential difference of 35 V between the plates. The charge on the capacitor is then 13 nC and the energy stored is 0.23 μJ.

The supply is now disconnected and the polythene sheet is pulled out from between the plates without discharging or altering the separation of the plates.

Show that the potential difference between the plates increases to about 80 V.

(2)

(c) Calculate the energy that is now stored by the capacitor.

energy stored = _____μJ

(2)

(d) Explain why there is an increase in the energy stored by the capacitor when the polythene sheet is pulled out from between the plates.

_____

_____

_____

_____

(2)

(Total 8 marks)