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 : 23 Marks **Time : 23 Minutes**

Mark Schemes

Q1.

(a) charge (stored) ✓ per unit potential difference ✓

[**or** $C = Q/V$ where Q = charge (stored by one plate) ✓ V = pd (across plates) ✓]

2

(b) (i) $C \left(= \frac{Q}{V}\right) = \frac{13.2 \times 10^{-6}}{6.0}$ ✓ $= 2.2 \times 10^{-6}$ (F) ✓ (or 2.2 μF)

2

(ii) when t = time constant $Q = 0.63 \times 13.2 = 8.3$ (μC) ✓

[**or** = 0.63 × 13(.0) (from graph) = 8.2 (μC)]

reading from graph gives time constant = 15 (± 1) (ms) ✓

2

(iii) resistance of resistor $= \left(= \frac{\text{time constant}}{C} \right) = \frac{15 \times 10^{-3}}{2.2 \times 10^{-6}}$ = 6820 (Ω) ✓

1

(iv) gradient = current ✓

1

(c) (i) maximum current = $\left(= \frac{V}{R} \right) = \frac{6.0}{6820}$ = 0.88 (mA) ✓

[**or** value from initial gradient of graph: allow 0.70 – 1.00 mA for this approach]

1

(ii) curve starts at marked I_{max} on I axis and has decreasing negative gradient ✓

line is asymptotic to t axis and approaches ≈ 0 by t = 60 ms ✓

2

[11]

Q2.

(a) time to halve = 0.008 s or two coordinates correct

C1

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$C = T_{1/2}/(0.69 \times 150)$ or eg $0.4 = 1.4\ e^{-0.015/150C}$

A1

77 μF (consistent with numerical answer)

A1

3

(b) **max 3 from**

as capacitor discharges:

pd decreases

B1

current through resistor decreases (since $I \propto V$)

B1

rate at which charge leaves the capacitor decreases (since $I = \Delta Q/\Delta t$)

B1

rate of change of charge is proportional to rate of change of pd
(since $V \propto Q$)

B1

condone quicker discharge when pd is larger

B1

3

(c) energy stored $\propto V^2$ or use of $\frac{1}{2} CV^2$
or initial energy = 78.4 (or 75.5) μJ
or final energy using V = 0.38–0.4 0 V
(answer in range 5.6 – 6.4 μJ)

C1

fraction remaining = $(0.4/1.4)^2$ or 0.072 – 0.081
or energy lost = 72 μJ

C1

91.8 to 92.8% lost

A1

3

(d) (i) charge = 77 μC to 82 μC

B1

1

(ii) charge required = $77 \times 10^{-6} \times 5 \times 3.15 \times 10^7$ (= 12128 C)
or 1A–h =3600 C

C1

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3.36(3.4) Ah

A1

2

[12]

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