Answers Test 2 2007

1. a) $r = A \quad \mathcal{E} = 0$

$r = A+T \quad \mathcal{E} = \dfrac{Q}{4\pi(A+T)^2}$

$r = B \quad \mathcal{E} = -\dfrac{Q}{4\pi B^2}$

$r = B+T \quad \mathcal{E} = \dfrac{Q}{4\pi(B+T)^2}$

b) $A < r < A+T$ and $B < r < B+T \quad \vec{E} = 0$

$A+T < r < B \quad E = \dfrac{1}{4\pi\varepsilon_0}\dfrac{Q}{r^2}$

$V(A) - V(B+T) = \dfrac{1}{4\pi\varepsilon_0} Q\left(\dfrac{1}{A+T} - \dfrac{1}{B}\right)$

c) $C = \dfrac{Q}{|\Delta V|} = \dfrac{4\pi\varepsilon_0 B(A+T)}{B-A-T}$

2. a) $r < A \quad E = \dfrac{Q r}{2\pi A^2 L \varepsilon_0}$

$r > A \quad E = \dfrac{Q}{2\pi\varepsilon_0 L}\dfrac{1}{r}$

b) $V(0) - V(5A) = \dfrac{Q}{2\pi\varepsilon_0 L}\left(\dfrac{1}{2} + \ln 5\right)$

Answers Test 2 2007 (cont)

3. a) $i = \dfrac{2V}{R + 2R_3}$

b) $i = \dfrac{V}{R + R_3}$

$$Q = CV\,\frac{R}{R + R_3}$$

4. a)

$$j(x) = \text{(to the right)} \begin{cases} \dfrac{i}{A}, & 0 < x < \dfrac{2}{3}W \\ \dfrac{i}{2A}, & \dfrac{2}{3}W < x < W \\ \dfrac{i}{A}, & W < x < \dfrac{5}{3}W \end{cases}$$

b) $V(A) - V(B) = \dfrac{3}{2}\rho\,\dfrac{i}{A}W$

c) $R = \dfrac{3}{2}\,\dfrac{\rho W}{A}$