Solution for PHYCS 102 Test II dated 28/11/2000

$$\left.\begin{array}{l} Q_1 + Q_2 = 150\ \mu \\ V = \dfrac{Q_1}{10\ \mu} = \dfrac{Q_2}{5\mu} \end{array}\right\} \begin{array}{l} Q_1 = 100\,\mu\ c \\ Q_2 = 50\ \mu\ c \end{array}$$

1.

2. The upper loop:

$2I_1 + 5I_2 = 16 \quad \therefore I_1 = 3A$

$I_3 = I_1 - I_2 = 1A$

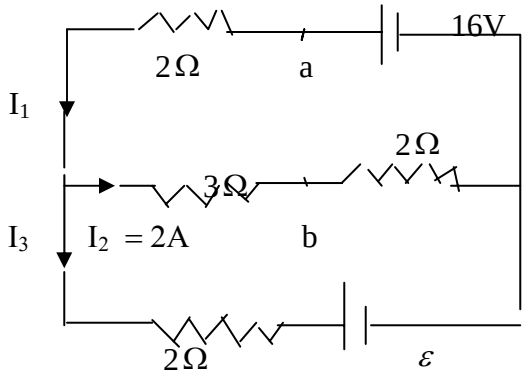
The lower loop:

$-2I_3 + 5I_2 = \varepsilon \quad \therefore \varepsilon = 8\,V$

$V_{ab} = 2I_1 + 3I_2 = 12V$

or

$V_{ab} = -2I_2 + 16 = 12V$



3a. $C_1 = \dfrac{\varepsilon_o A k}{d} = 15.93\ PF\ ,\ C_2 = \dfrac{\varepsilon_o A}{d} = 8.85 PF$

$C = C_1 + C_2 = 24.78\ \ PF$

b. $E_1 = \dfrac{V}{kd} = 5.56\ x\,10^4\ V/m$

4a. $C_{eq} = \{C_1 = (C_2 // C_3)\}\ ,\ C_{eq} = \dfrac{30\ (10+5)}{30\ +(10\ +5)} = 10\ \mu F$

b. $V_1 = \dfrac{Q_1}{C_1} = \dfrac{C_{eq}\ x\ 60}{C_1} = 20\,V$

or

$$\left.\begin{array}{l} 60 = V_1 + V_2 \\ Q = 30V_1 = 15V_2 \end{array}\right\} \Rightarrow V_1 = 20V$$

5a. $P = \dfrac{V^2}{R}\ ,\quad R = 80.67\ \Omega$

b. $I = \dfrac{V}{R} = 2.73A\ ,\quad J = \dfrac{I}{A} = 13.9\ x\ 10^6\ A/m^2$

c. $E = \rho J = 0.778\ \ V/m$

d. $n = D\ N_{av}/A = 6.29\ \ x\ 10^{22}/cm^3$

$J = nev_d\ ,\ v_d = 1.38\ mm/s$