HT No: 7

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Problema 1

a) $V_{ab} = \int E \cdot dl$

$V_{ab} = Ed$

$E = \frac{V_{ab}}{d} = \frac{20V}{1.8\times10^{-3}} = 11.11\frac{kV}{m}$

b) $E = \frac{\sigma}{\varepsilon_0}$ $\quad \varepsilon_0 E = \sigma$ $\quad \sigma = 98.37\times10^{-9}\frac{C}{m^2}$

c) $C = \varepsilon_0\frac{A}{d} = \frac{(7.6\times10^{-9})(8.8542\times10^{-12})}{1.8\times10^{-3}}$

$C = 3.74\times10^{-12}$

d) $C = \frac{Q}{V}$ $\quad Q = CV = 20(3.74\times10^{-12}) = 74.77pF$

a) $E = 11.1\frac{kV}{m}$ c) $C = 3.74\,p$

b) $\sigma = 98.4\frac{nC}{m^2}$ d) $Q = 74.8pC$

Problema 2.

a) $C = \varepsilon_0\frac{A}{d}$ $\quad Q = CV$ $\quad Q = \frac{V\varepsilon_0 A}{d} = \frac{200(8.8542\times10^{-12})(1\times10^{-3})}{3\times10^{-3}}$

$Q = .590pC$

b) $C = KC_0$ $\quad C = 5(2.95\times10^{-12}) = 14.75\times10^{-12}\,C_1$

$Q = 200(14.75\times10^{-12}) = 2.45\times10^{-9}$

$Q_f - Q_0 = 2.45\times10^{-9} - 590\times10^{-12} = 2.36\times10^{-9}$

c) $Q = VC$

$V = \frac{Q}{C} = \frac{2.95 \times 10^{-9}}{2.95 \times 10^{-12}} = 999.52\ V \approx 1000V$

$V_f - V_0 = 800V.$

a) $C = 590\ pC$

b) $\Delta Q = 236\ nC.$

c) $\Delta V = 800V$

Problema 3.

a) $Q = VC. = \frac{250\,(2.5\times10^{-3})(8.8542\times10^{-12})}{1.5\times10^{-2}} = C = 1.4757\times10^{-11}$

$Q = 368.9 \times 10^{-12}$

b) $C = KC_0 = \frac{80(8.842\times10^{-12})(7.5\times10^{-3})}{1.5\times10^{-2}} = 118.06\times10^{-12}$

$V = \frac{Q}{C} \quad \frac{368.9\times10^{-12}}{118.06\times10^{-12}} = 3.12\ Volt.$

c) $U_0 = \frac{1}{2} C V^2 = \frac{1}{2}(250)^2(1.475\times10^{-11}) = 4.61\times10^{-8}$

$U_f = \frac{1}{2}(3.12)^2(118.06\times10^{-12}) = 5.7462\times10^{-10}$

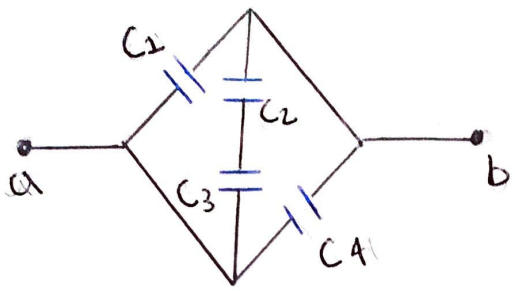
$\Delta U = -45.5\times10^{-9}$

a) $Q = 369\ pC.$

b) $V = 3.12\ volt \quad C = 118\ pF$

c) $\Delta U = -45.5\ nJ$

Problema 4.



$C_1 = 4\,\mu F$
$C_2 = 7\,\mu F$
$C_3 = 5\,\mu F$
$C_4 = 6\,\mu F$
$V_{ab} = 100$ Volt

a) $C_{23} = \frac{C_3 C_2}{C_3 + C_2} = \frac{7(5)}{12} = 2.9167$

$C_{eq} = 2.9167\,\mu F + 4\,\mu F + 6\,\mu F$

$C_{eq} = 12.9\,\mu F$

$Q = \frac{C}{V} = \frac{12.9}{100} = 129.17\,mC$

$Q_{23} = CV = 100(2.9167\,\mu F) =$

$Q_{23} = 241.67\,\mu C$

b) $V_2 = \frac{241.67 \times 10^{-6}}{7 \times 10^{-6}} = 41.67$ V

$V_3 = \frac{241.67 \times 10^{-6}}{5 \times 10^{-6}} = 58.33$ V

c) $U_1 = \frac{1}{2}(4 \times 10^{-6})(100)^2 = 20 \times 10^{-3}$ J

$U_2 = \frac{1}{2}(7 \times 10^{-6})(41.67)^2 = 6.08 \times 10^{-3}$ J

$U_3 = \frac{1}{2}(5 \times 10^{-6})(58.33)^2 = 8.51 \times 10^{-3}$ J

$U_4 = \frac{1}{2}(6 \times 10^{-6})(100)^2 = 30 \times 10^{-3}$ J

$U_T = \frac{1}{2}(12.9 \times 10^{-6})(100)^2 = 64.5 \times 10^{-3}$ J

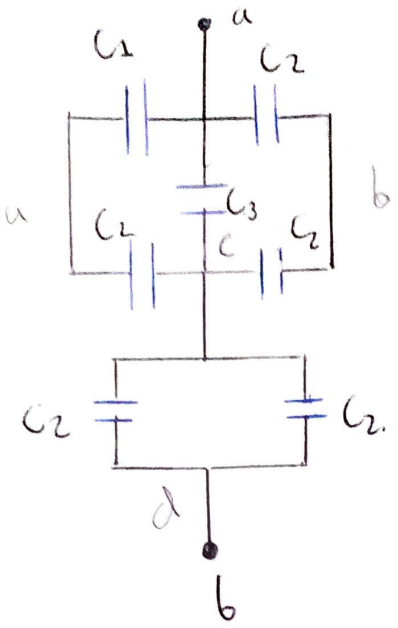
a) $C_{eq} = 12.9\,\mu F$

b) $V_2 = 41.7$ V $\quad V_3 = 58.3$ V.

c) $U_1 = 20$ mJ, $U_2 = 6.08$ mJ, $U_3 = 8.51$ mJ

$U_4 = 30$ mJ $\quad U_T = 64.5$ mJ

Problema 5



a) $C_1 = 5\mu F \quad C_2 = 10.0\mu F$

$C_3 = 2.00\mu F$

$C_{12} = \frac{(5)(10)}{15} = 3.33\mu F$

$C_{22} = \frac{10(10}{20} = 5\mu F$

$C_{abc} = 3.33\mu F + 5\mu F + 2\mu F = 10.33\mu F$

$C_d = 10\mu F + 10\mu F = 20\mu F$

$$C_{eq} = \frac{C_{abc} C_d}{C_d + C_{abc}} = 6.81 \times 10^{-6} F$$

b) $V_{ab} = V_d + V_{abc}$

$V_3 = \frac{Q}{C} = \frac{83.6 \times 10^{-6}}{2 \times 10^{-6}} = 41.8V$

$Q_b = 41.8(5 \times 10^{-6}) = 209 \times 10^{-6} C$

$Q_a = 41.8(3.33 \times 10^{-6}) = 139.194 \times 10^{-6} C$

$Q_{abc} = 83.6 \times 10^{-6} + 209 \times 10^{-6} + 139.194 \times 10^{-6} =$

$Q_{abc} = 431.794 \times 10^{-6} = Q_d$

$V_d = \frac{431.794 \times 10^{-6}}{20 \times 10^{-6}} = 21.5897 V_d$

$V_{ab} = V_d + V_{abc}$

$V_{ab} = 21.5897 + 41.8 = 63.3897$

c) $U = \frac{1}{2} C_{eq} V_{ab}^2 = \frac{1}{2}(60)^2 (6.81 \times 10^{-6}) = 12.258 \times 10^{-3}$

a) $C_{eq} = 6.81\mu F$ c) $U = 12.3 mJ$

b) $V_{ab} = 63.4 V$