Phys 112 HW 4 Ch24 Garrett Hellwig

Problems 1, 4, 5, 6, 7, 12, 14, 16, 17, 21

1] $\Delta V = 12V$ $q = 84Ah$ $q = It$ $1hour = 3600s$

$q = 84A \cdot 3600s = 3\times10^5 C$ $30kC$

$\mathcal{E} = qV$ $\mathcal{E} = 30kC \cdot 12V = 3.6MJ$

a) 30kC
b) 3.6MJ

4] $d = 12cm$ $F_e = -3.9\times10^{-15}N$ $e = 1.6e{-}19C$ $F = Eq$

$E = \frac{F}{q} = \frac{3.9e{-}15N}{1.6e{-}19C} = 2.43\times10^4 N/C$

$\Delta V = -E\Delta x = -2.43\times10^4 N/C \cdot 0.12m = 2.9kV$

a) $2.43\times10^4 N/C$
b) 2.9kV

5] $\sigma = 0.1\mu C/m^2$ $\Delta V = 50V$

$E = \frac{\sigma}{2\epsilon_0} = \frac{0.1\mu C/m^2}{2\epsilon_0} = 5.6kN/C$

$\Delta V = E \cdot d$ $50V = 5.6kN/C \cdot d$ $d = \frac{50V}{5.6kN/C} = 8.85mm$

$d = 8.85mm$

6] point B and C are at equipotential so $V_B = V_C$ $q = 1.6e{-}19C$

$\Delta V = 3.94\times10^{-19}J$

$V = \frac{U}{q}$ $\Delta V = \frac{\Delta U}{q} = \frac{3.94\times10^{-19}J}{1.6\times10^{-19}C} = 2.46V$

a) $V_B - V_A = \Delta V = 2.46V$
b) $V_C - V_A = V_B - V_A = 2.46V$
c) $V_C - V_D = 0V$

7] $\vec{E} = 4\hat{i} + 0\hat{j} + 0\hat{k}$ $\vec{A} = 0\hat{i} + 3\hat{j} + 0\hat{k}$ $\vec{B} = 4\hat{i} + 0\hat{j} + 0\hat{k}$

$V_B - V_A = -\int_A^B \vec{E}\,d\vec{s}$ $V_B - V_A = -\int_0^4 4x\,dx = 2x^2\Big|_0^4 = -32V$

$V_B - V_A = -32V$

No.

Date

HW 4 Garrett Haldane

12) $\Delta V = -1V$ $r = 10m$ $A = \pi r^2 = 100\pi = 314 m^2$

Sphere $V = k\frac{Q}{r}$

$-1V = k\frac{Q}{10m}$ $Q = \frac{-1V \cdot 10m}{k} = -1.11 \times 10^{-9} C$

$\boxed{Q = -1.11 nC}$

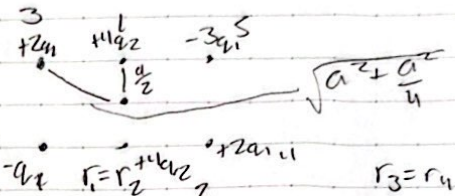
14) $q = 1\mu C$ $r_A = 2m$ $r_B = 1m$ c) A (r_A) — q (r_B) B b) b (r_b) — q (r_a) a

$V_A = k\frac{q}{r_A}$ $V_B = k\frac{q}{r_B}$ $V_A - V_B = kq\left(\frac{1}{r_A} - \frac{1}{r_B}\right) = k1\mu C \cdot \left(\frac{1}{2m} - \frac{1}{1m}\right) = -4.495kV$

b) B the same calculation

$\boxed{\begin{array}{l} a) -4.495kV \\ b) -4.495kV \end{array}}$

16) $q_1 = 3.4pC$ $q_2 = 6pC$ $a = 39cm$



$r_3 = r_4 = r_5 = r_6$

$r_3 = 0.436m$

$V_{tot} = \sum_i k\frac{q_i}{r_i} = \frac{2q_{12}}{r_1} + \frac{2q_{31}}{r_3} + \frac{4q_{61}}{r_3}$

$\boxed{V_{tot} = 2.12V} = \frac{8q_2}{r_1} + \frac{4q_1}{r_3} - \frac{4q_1}{r_3}$

$= \frac{4.8pC}{0.195m}$

$= 2.12V$

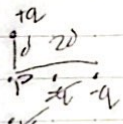
$q_{12} = q_{22}$ $q_{31} = q_{41}$

$q_{12} = 4q_2$ $q_{31} = 2q_1$

$q_{61} = 3q_{51}$

$q_{61} = -q_1$

17) $q = 5fC$ $d = 4cm$



$V = kq\left(\frac{1}{d} - \frac{1}{20}\right)$

$V = k5fC\left(\frac{1}{0.01} - \frac{1}{0.05}\right)$

$\boxed{V = 0.562mV}$

21) $p = 1.47D$ $r = 52nm$ $D = 3.34 \times 10^{-30} C$

$p = 4.91 \times 10^{-30}$

$V = k\frac{p\cos\theta}{r^2}$ $\theta = 0$

$V = k\frac{4.91 \times 10^{-30} \times 1}{52 \times 10^{-18}} = 1.63 \times 10^{-5} = 16.3\mu V$

$\boxed{V = 16.3\mu V}$