Physics 2326 - Dr. Terry Honan

Test 1 - A - Answers

Problem 1 (i) A (ii) B (iii) B

Problem 2 (a) $-6.83\ \text{N}\,\hat{x}$ (b) 3.75×10^{9} (c) $1.13\times10^{6}\ m/s$

Problem 3 (a) $k_e\,\frac{-Q}{b^2}\,\langle 0,\,1\rangle + k_e\,\frac{2\,Q}{\left(a^2+b^2\right)^{3/2}}\,\langle -a,\,b\rangle$ (b) $x=-a$ and $x=\frac{a}{3}$ (c) $k_e\,q\,Q\left(\frac{2}{\sqrt{a^2+b^2}}-\frac{1}{b}\right)$

Problem 4 (a) $0.0036\ V\cdot m$ (b) 11 V (c) $\langle -6.4,\,9.6,\,-14.4\rangle\times10^{-19}$ N

Problem 5 For $r>R$, $\vec{E}=k_e\,\frac{q+Q}{r^2}\,\hat{r}$, $V=k_e\,\frac{q+Q}{r}$. For $r<R$, $\vec{E}=k_e\,\frac{Q}{r^2}\,\hat{r}$, $V=k_e\left(\frac{Q}{r}+\frac{q}{R}\right)$.

Problem 6 For $r<a$, $\vec{E}=0$. For $a<r<b$, $\vec{E}=\frac{\rho}{2\,\varepsilon_0}\,\frac{r^2-a^2}{r}\,\hat{r}$. For $r>b$, $\vec{E}=\frac{\rho}{2\,\varepsilon_0}\,\frac{b^2-a^2}{r}\,\hat{r}$.

Problem 7 $V=k_e\int_{-L/2}^{L/2}\frac{\lambda(x)\,dx}{\sqrt{(x_0-x)^2+y_0^2}}$

Problem 8 (a) At $r=2$ cm, $\vec{E}=1.575\times10^{8}\,\frac{\text{V}}{\text{m}}\,\hat{r}$. At $r=4$ cm, $\vec{E}=\vec{0}$. At $r=6$ cm, $\vec{E}=7.5\times10^{6}\,\frac{\text{V}}{\text{m}}\,\hat{r}$.
(b) At $r=4$ cm, $V=5.4\times10^{5}$ V. At $r=6$ cm, $V=4.5\times10^{5}$ V.

Test 1 - B - Answers

Problem 1 (a) $0.0565\ \text{V}\cdot\text{m}$ (b) -14 V

Problem 2 For $r<R$, $\vec{E}=\frac{1}{2\,\pi\,\varepsilon_0}\,\frac{\lambda}{r}\,\hat{r}$. For $r>R$, $\vec{E}=\frac{1}{2\,\pi\,\varepsilon_0}\,\frac{\lambda+2\,\pi\,R\,\sigma}{r}\,\hat{r}$.

Problem 3 (a) $k_e\,Q\,q\left(\frac{1}{R}-\frac{1}{\sqrt{R^2+d^2}}\right)$ (b) 8.67×10^{9}

Problem 4 (a) $\langle 783,\,7696,\,-261\rangle\,\frac{\text{N}}{\text{C}}$ (b) 0.1430 J

Problem 5 4.19×10^{6} m/s

Problem 6 (a) $\vec{E}=\hat{z}\,\frac{2\,k_e\,Q\,z_0}{R^2}\int_0^R\frac{r\,dr}{\left(r^2+z_0^2\right)^{3/2}}$ (b) $\vec{E}\to\hat{z}\,\frac{Q}{2\,\pi\,R^2\,\varepsilon_0}$ (c) $\vec{E}\to\hat{z}\,\frac{k_e\,Q}{z_0^2}$

Problem 7 (a) At $r=3$ cm, $\vec{E}=6\times10^{7}\,\frac{\text{V}}{\text{m}}\,\hat{r}$. At $r=5$ cm, $\vec{E}=\vec{0}$. At $r=9$ cm, $\vec{E}=-3.33\times10^{6}\,\frac{\text{V}}{\text{m}}\,\hat{r}$.
(b) At $r=5$ cm, $V=-4.5\times10^{5}$ V. At $r=9$ cm, $V=-3\times10^{5}$ V.