

PHYS 208 –FALL 2016 – All Sections

Midterm Exam I

Multiple Choice: 1) B ; 2) D ; 3) B

Problem 1: a) Minimum one vector E in the correct direction for $x < -d$, $-d < x < 0$, and $x > 0$.

$$b) E_x = kq \left(\frac{1}{x^2} + \frac{1}{(d+x)^2} - \frac{x}{(d^2+x^2)^{3/2}} \right); E_y = kq \frac{d}{(d^2+x^2)^{3/2}}$$

$$c) V(x) = kq \left(\frac{1}{x} + \frac{1}{d+x} - \frac{1}{(d^2+x^2)^{1/2}} \right)$$

$$d) U = -\frac{\sqrt{2} kq^2}{2 d}$$

Problem 2: a) $\rho = \frac{3}{4\pi} \frac{Q}{r_2^3 - r_1^3}$

b) Three distinct regions with correct density of the electric field lines.

$$c) E(r) = \begin{cases} 0, & \text{for } r < r_1 \\ kQ \frac{r - \frac{r_1^3}{r^2}}{r_2^3 - r_1^3}, & \text{for } r_1 < r < r_2 \\ kQ \frac{1}{r^2}, & \text{for } r > r_2 \end{cases}$$

Problem 3: a) $V(y) = 2k \frac{Q}{L} \ln \left(\frac{L}{2y} + \sqrt{\left(\frac{L}{2y} \right)^2 + 1} \right)$

b) $v = 2.40 \times 10^4 \text{ m/s}$