PHYS 262 — Homework 11 (Ch 25) — Spring '03

1. (SB 2) change in electrical potential energy $= \Delta KE$

$$qV = \Delta KE$$

$$q = \frac{7.37 \times 10^{-17}\,\text{J}}{115\,\text{V}}$$

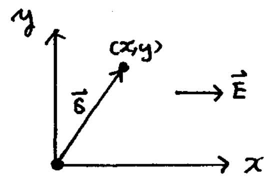
$$= 6.41 \times 10^{-19}\,\text{C} \;\#$$

2. (SB 6) (a)

$$\Delta U = q\,\Delta V$$

$$= -qEx \quad (\because \Delta V = -\vec{E}\cdot\vec{s} \text{ for uniform field})$$

$$= -6\times10^{-4}\,\text{J} \;\#$$



(b)

$$\Delta V = -Ex$$

$$= -50\,\text{V} \;\#$$

3. (SB 10)

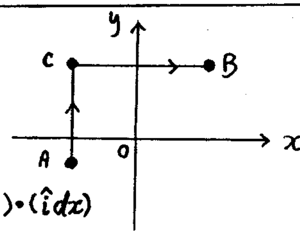
$$V_B - V_A = (V_C - V_A) + (V_B - V_C)$$

$$= -\int_A^C \vec{E}\cdot d\vec{s} - \int_C^B \vec{E}\cdot d\vec{s}$$

$$= -\int_{-0.3}^{0.5} (-325\hat{j})\cdot(\hat{j}\,dy) - \int_{-0.2}^{0.4} (-325\hat{j})\cdot(\hat{i}\,dx)$$

$$= \int_{-0.3}^{0.5} 325\,dy \quad (\because \hat{j}\cdot\hat{j} = 1,\; \hat{i}\cdot\hat{j} = 0)$$

$$= 260\,\text{V} \;\#$$



4. (SB 15) By conservation of energy,

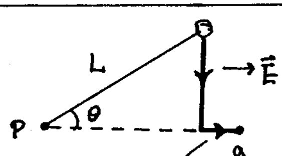
$$K_f + U_f = K_i + U_i$$

$$K_f = U_i - U_f$$

$$\tfrac{1}{2}mv_f^2 = -q\int_i^f \vec{E}\cdot d\vec{s}$$

$$= -qE(L\cos\theta - L)$$

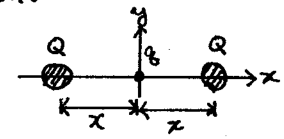
$$v_f = 0.300\,\text{m/s} \;\#$$



path taken in the evaluation of the line integral (which is path independent)

5. (SB 17) (a) The force on q by the two charges are equal in magnitude but opposite in direction

$$\therefore F = 0\,\text{N} \;\#$$



(b)

$$F = qE \Rightarrow E = 0\,\text{N/C} \;\#$$

(c)

$$V = 2k_e\frac{Q}{x} = 45.0\,\text{kV} \;\#$$

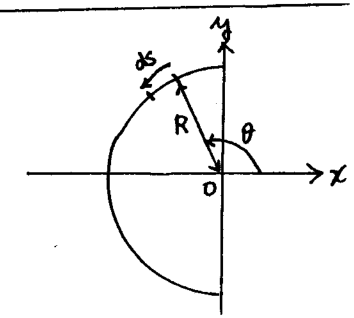
6. (SB 42) $l = 0.14\,\text{m}$, $q = -7.50\,\mu\text{C}$

$$\frac{2\pi R}{2} = l \Rightarrow R = \frac{l}{\pi}$$

$$\lambda = \frac{q}{l} \quad (\because \text{uniformly charged})$$

$$dq = \lambda\,ds$$

$$ds = R\,d\theta \quad (\because s = R\theta)$$



$$V = k_e\int\frac{dq}{r} \quad (r = \text{distance between } ds \text{ and } 0)$$

$$= k_e\int_{\frac{\pi}{2}}^{\frac{3\pi}{2}} \frac{\lambda R\,d\theta}{R}$$

$$= k_e\lambda\int_{\frac{\pi}{2}}^{\frac{3\pi}{2}} d\theta$$

$$= \frac{k_e q\pi}{l}$$

$$= -1.51\times10^{6}\,\text{V} \;\#$$