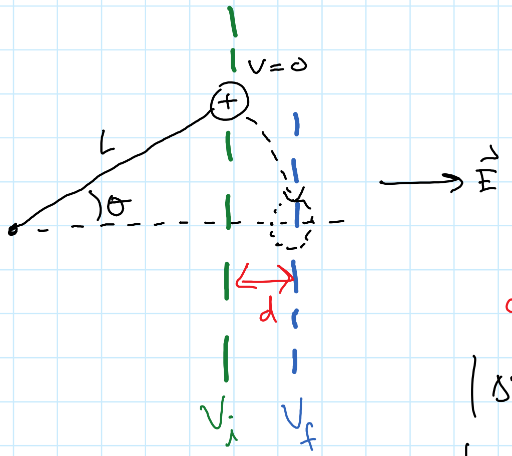
Phy 4B Review 4/28

Friday, April 28, 2017 11:06 AM

Book 25-9



Just like a pendulum
use energy conservation

$d = L - L\cos\theta$

$|\Delta V| = |E\, d|$

$|W| = |q\, \Delta V| = \Delta KE$

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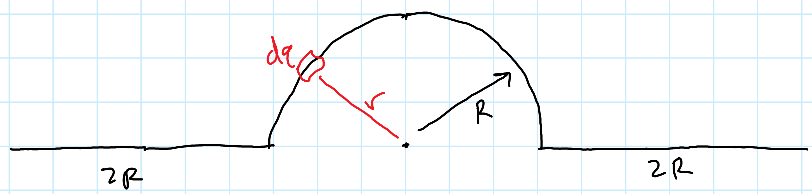


curve:

$$\int dV = \int \frac{k\, dq}{r}$$

$$V_c = \int \frac{k\, dq}{r} = \frac{k}{r}\int dq = \frac{kQ}{r}$$

$$= \frac{k}{r}\int_0^{\pi} \lambda\, r\, d\theta$$

$$= \frac{k}{\cancel{r}}\, \lambda\, \cancel{r} \underbrace{\int_0^{\pi} d\theta}_{\pi}$$

$$= k\lambda\pi$$

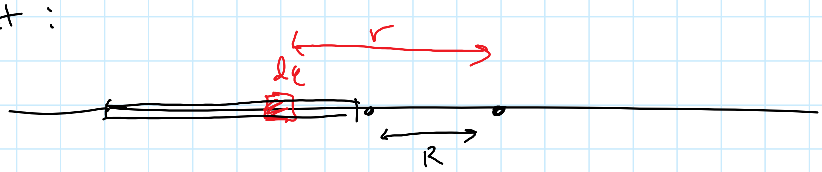
$$= k\frac{Q}{\pi r}\pi$$

$$= kQ$$ ← total charge on the curve

πr

$= \frac{kQ}{r}$ ← total charge on the curve

Straight :



$$V = \int_R^{3R} \frac{k\, dq}{r}$$

$r = x$

$$= k \int_R^{3R} \frac{\lambda\, dx}{x}$$

$$= k\lambda \; \ln x \Big|_R^{3R}$$

$(\ln 3R - \ln R)$

$\ln\left(\frac{3R}{R}\right)$

$\ln 3$

$$V_s = k\lambda \ln 3$$

$$V_{total} = V_s + V_c + V_s$$

$$= 2(k\lambda \ln 3) + k\lambda\pi$$

Potential Energy:

gravity: $F_g = mg$

$$W = \int \vec{F} \cdot d\vec{y}$$

$$= \underbrace{mgy_1}_{U_g} - mgy_2$$

$$W = -\Delta U$$

spring:

$$\vec{F} = -k\vec{x}$$

$$W = \int kx\,dx$$

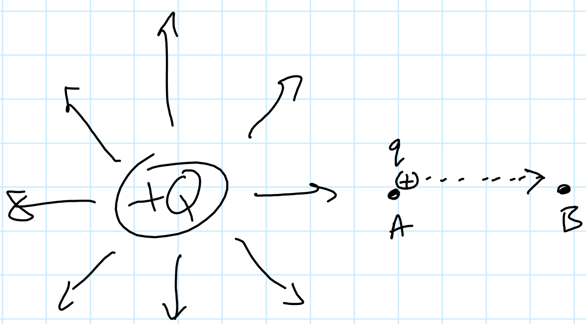
$$= \underbrace{\tfrac{1}{2}kx_1^2}_{U_s} - \tfrac{1}{2}kx_2^2$$

$W = -\Delta U$ ← always

electric:

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

$$\Delta V = \frac{\Delta U}{q}$$



ΔV due to $+Q$

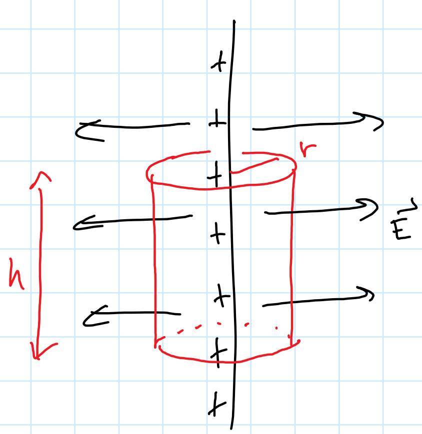
$$\Delta V = V_B - V_A$$

$$= \frac{kQ}{r_B} - \frac{kQ}{r_A}$$

to find ΔU_{el} or W

multiply by q

Prob 2



$$\oint \vec{E}\cdot d\vec{A} = \frac{q_{in}}{\epsilon_0}$$

$$\int_{top} \vec{E}\cdot d\vec{A} \,(=0) + \int_{side} \vec{E}\cdot d\vec{A} + \int_{bottom} \vec{E}\cdot d\vec{A} \,(=0) = \frac{q_{in}}{\epsilon_0}$$

$$E A_{side} = \frac{q_{in}}{\epsilon_0}$$

$$E A_{side} = \frac{q_{in}}{\epsilon_0}$$

$$E \, 2\pi r h = \frac{q_{in}}{\epsilon_0}$$

$$E = \frac{1}{2\pi\epsilon_0} \frac{q_{in}}{h} \frac{1}{r}$$

$$= \frac{1}{2\pi\epsilon_0} \lambda \frac{1}{r} \quad \hat{r}$$

$r < r_1$ $\qquad E = \dfrac{-5\lambda_0}{2\pi\epsilon_0 r} \hat{r}$

$r_1 < r_2$ $\qquad E = 0$

$r_2 < r < r_3$ $\qquad E = \dfrac{-6\lambda_0}{2\pi\epsilon_0 r} \hat{r}$

$r_3 < r_4$ $\qquad E = 0$

$r > r_4$ $\qquad E = \dfrac{-4\lambda_0}{2\pi\epsilon_0 r} \hat{r}$