

Exercises in Physics
Assignment # 11

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P1.

$$U = mgdy$$

$$y(t) = a \sin t$$

$$a \sin 2\pi =, a \sin 0 = 0$$

$$U = mg \cdot 0 = 0$$

$$\begin{aligned} \int_{P_1}^{P_2} F \cdot dr &= \int_0^{2\pi} F(r(t)) \cdot \frac{dr(t)}{dt} dt \\ \int_0^{2\pi} (x(t) \frac{dx(t)}{dt} + y(t) \frac{dy(t)}{dt} + z(t) \frac{dz(t)}{dt}) dt \\ \int_0^{2\pi} -a^2 \sin t \cos t + a^2 \sin t \cos t + b^2 t \\ &= \left[\frac{b^2}{2} t^2 \right]_0^{2\pi} = 2\pi^2 b^2 \end{aligned}$$

P2.

$$U = mgdy$$

$$y(t) = a \sin t$$

$$a \sin 2\pi =, a \sin 0 = 0$$

$$U = mg \cdot 0 = 0$$

$$\begin{aligned} F &= kr(t) = ka \cos t + ka \sin t + kbt \\ \int_{P_1}^{P_2} F \cdot dr &= \int_0^{2\pi} F(r(t)) \cdot \frac{dr(t)}{dt} dt \\ \int_0^{2\pi} (kx(t) \frac{dx(t)}{dt} + ky(t) \frac{dy(t)}{dt} + kz(t) \frac{dz(t)}{dt}) dt \\ \int_0^{2\pi} -ka^2 \sin t \cos t + ka^2 \sin t \cos t + kb^2 t \\ &= \left[\frac{kb^2}{2} t^2 \right]_0^{2\pi} = 2\pi^2 kb^2 \end{aligned}$$

P3.

$$l_B = \sqrt{0.3^2 + 0.4^2} = 0.5m$$

$$dl = l_B - l_o = 0.2m$$

$$U_B = \frac{1}{2}k\Delta x^2 \times 2$$

$$0.2^2 \times 800 = 32J$$

$$U_B = \frac{1}{2}k\Delta x^2 \times 2$$

$$0.1^2 \times 800 = 8J$$

$$dU = U_B - U_A = 24J$$

$$U_G = mgh$$

$$= 2 \times 9.81 \times 0.3$$

$$= 5.89J$$

$$24J - 5.89J = 18.11J$$

$$K_A = \frac{1}{2}mv^2$$

$$= \frac{1}{2}10 \times 2^2$$

$$= 20J$$

$$K_B = 20J - 18.11J = 1.89J$$

$$v = \sqrt{1.89 \times 2 \div 2} = 1.37m/s$$

P4.

$$F_y = 50 \cos 30^\circ = 25\sqrt{3}N$$

$$l_B = \sqrt{2^2 + 1.5^2} = 2.5m$$

$$dl = l_B - l_A = 1m$$

$$U_B = \frac{1}{2}k\Delta x^2$$

$$1^2 \times 30 \times \frac{1}{2} = 15J$$

$$U_A = \frac{1}{2}k\Delta x^2$$

$$0.5^2 \times 30 \times \frac{1}{2} = 3.75J$$

$$dU = U_B - U_A = 11.25J$$

$$dKe = -dU = -11.25J$$

$$dKe = \frac{1}{2}mv_B^2 - \frac{1}{2}mv_A^2$$

$$\frac{1}{2}mv_B^2 - \frac{1}{2}mv_A^2 = -11.25$$

$$mv_B^2 - mv_A^2 = -22.5$$

$$v_B^2 - v_A^2 = -11.25$$

$$Ke = 25\sqrt{3} \times 1.5 = 64.95J$$

$$64.95 - 11.25 = 53.7J$$

$$v_B = 7.33m/s$$