

Work and Nonconservative Forces

PH III

$$W_{NC} = E_i - E_f$$

$$W_{NC} = f_k d$$

Energy in a car (internal combustion)



$$E_i = E_f$$

$$mgh_i = \frac{1}{2}mv_f^2 + mgh_f$$

$$gh_i = \frac{1}{2}v_f^2$$

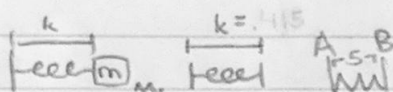
$$a. v_f = \sqrt{2(9.8)(4)} = 8.85 \text{ m/s}$$

$$mgh_i = \frac{1}{2}mv_f^2 + W_{NC}$$

$$W_{NC} = m(gh_i - \frac{1}{2}v_f^2)$$

$$\frac{W_{NC}}{E_i} = \frac{m(gh_i - \frac{1}{2}v_f^2)}{mgh_i}$$

b. 54% of E_i converted to heat



$$\mu_k = .415$$

Find where the block stops

$$m = 4 \text{ kg}$$

$$d = 5 \text{ cm}$$

$$W_{NC} = f_k d = \mu_k mg d$$

$$= .415(4)(9.8)(.05) = .8134 \text{ J/pass}$$

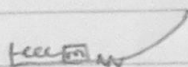
$$x = 10 \text{ cm} \quad k = 700 \text{ N/m}$$

$$E_i = \frac{1}{2}kx_i^2 = \frac{1}{2}(700)(.1)^2 = 3.5 \text{ J}$$

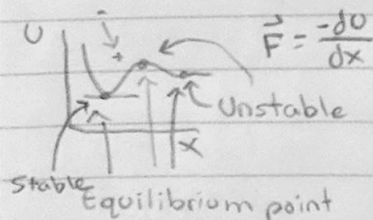
$$\frac{W_{NC}}{E_i} = \frac{.8134}{3.5} = .2324 \approx \frac{1}{4} \text{ # of complete passes}$$



$$.303(5) = 1.5 \text{ cm to the right of A}$$



$U(x)$ with conservative forces, we can create PE functions



$$E = KE + PE$$