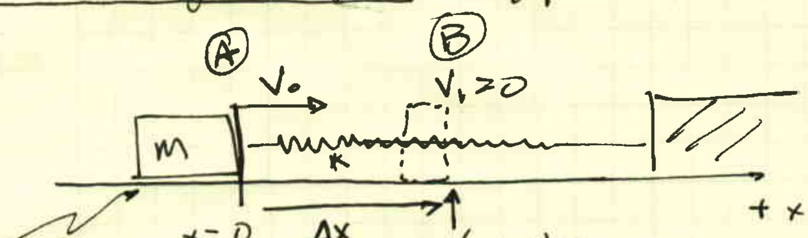
Block-Spring on a rough surface ① /1



Not frictionless : μ

(spring No stretch/compress position is $x_0 = 0$)

At $\Delta x = x_1 - x_0$ compression; the block stops,
$= x_1 - 0$ max. compression.

Q: find $\Delta ME = ME_1 - ME_0$.

MODEL

1 BODY.

Interactions

Hookes spring

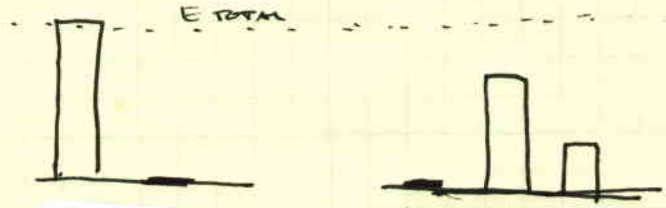
earth.

frict.

Model

Conservation of Energy throughout the process –

$W_{by\,frict} \Rightarrow$ GAIN in Therm. Energy in system.



$K_A + U_{sp} = K_B + U_{sp} + TE$
Ⓐ B
$-W_{by\,frict}$

Energy Conservation statement.

$K_0 \quad E_A = E_B \qquad \Delta x = x_1.$

$$K_0 = \tfrac{1}{2} m v_0^2 = U_{sp}(x_1) + (-W_{frict})$$
$$= \tfrac{1}{2} k x_1^2 - \vec{f} \cdot \vec{\Delta x}$$
$$= \tfrac{1}{2} k x_1^2 - f(\cos 180)\, x_1$$
$$= \tfrac{1}{2} k x_1^2 + f x_1$$

$ME = K + U.$ So $\Delta ME = (\cancel{K_1} + U_1) - (\underbrace{K_0}_{\frac{1}{2} m v_0^2} + \underbrace{U_0}_{0})$, $K_1 = 0$

$\Delta ME = U_1 - U_0$

$$\boxed{\Delta ME = \tfrac{1}{2} k x_1^2 - \tfrac{1}{2} m v_0^2 = -f x_1 = -\mu m g x_1}$$

lost Energy

Big IDEA * Work by frict = lost ME in system