Question:

Block of mass $m = 0.5$ kg moving with vel. $v_1 = 0.7$ m/s slows to $v_2 = 0.4$ m/s in 0.6 sec due to friction

acc. of block

$$a = \frac{v_2 - v_1}{\Delta t_1} = \frac{.4 - .7}{.6}$$

$$\boxed{a = -.5 \text{ m/s}^2}$$

dist traveled over 0.6 sec

$$v_2^2 = v_1^2 + 2a\Delta x_1$$

$$(.4)^2 = (.7)^2 + 2(-.5)\Delta x$$

$$\Rightarrow \boxed{\Delta x_1 = .33\text{ m}}$$

dist traveled over 0.6 sec (another way)

$$\Delta x = v_1 t_1 + \tfrac{1}{2} a t_1^2$$

$$= (.7)(.6) + \tfrac{1}{2}(-.5)(.6)^2$$

$$\boxed{\Delta x_1 = .33\text{ m}}$$

time to come to rest

$$a = \frac{v_{rest} - v_0}{\Delta t_{rest}} \Rightarrow \Delta t_r = \frac{v_r - v_0}{a}$$

$$(-.5) = \frac{0 - .7}{-.5} \Rightarrow \boxed{\Delta t_{rest} = 1.4\text{ sec}}$$

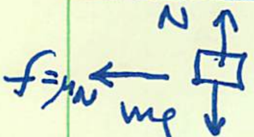
dist. traveled to rest

$$\Delta x = v_1 t_{rest} + \tfrac{1}{2} a t_{rest}^2$$

$$= .7(1.4) + \tfrac{1}{2}(-.5)(1.4)^2$$

$$\boxed{\Delta x_{rest} = .49\text{ m}}$$

forces on mass



frictional force

ΣF_x:

$$-f = -ma$$

$$\Rightarrow f = (.5\text{ kg})(.5\text{ m/s}^2)$$

$$\boxed{f = .25\text{ N}}$$

normal force

ΣF_y:

$$N - mg = m\cancel{a_y}^{\,0}$$

$$N = mg = .5(9.8)$$

$$\boxed{N = 4.9\text{ Newt}}$$

coef. of friction

$$f = \mu N$$

$$.25 = \mu(4.9)$$

$$\Rightarrow \boxed{\mu = .05}$$

Work done to bring m to stop

$$W_f = \vec{f} \cdot \vec{d}$$

$$= fd\cos 180$$

$$= .25(.49)(-1)$$

$$\boxed{W_f = -.1225\text{ J}}$$

OR

$$W_{net} = \Delta KE$$

$$\Rightarrow W_f = \cancel{KE_2}^{\,0} - KE_1$$

$$= -\tfrac{1}{2} m v_1^2$$

$$= -\tfrac{1}{2}(.5)(.7)^2$$

$$\boxed{W_f = -.1225\text{ J}}$$

Work done by normal

$$W_N = \vec{N} \cdot \vec{d}$$

$$= Nd\cos 90^\circ$$

$$\boxed{W_N = 0}$$

Power provided by friction

$$P = \frac{W}{t} = \frac{.1225\text{ J}}{1.4\text{ sec}}$$

$$\Rightarrow \boxed{P = .0875\text{ W}}$$

dist traveled to stop
USING ENERGY

$\Sigma KE_1 + \Sigma U_1 + \Sigma W_{ext} = \Sigma KE_2 + \Sigma U_2$

$\frac{1}{2}mv_1^2 + 0 + (-fd) = 0 + 0$

$\Rightarrow \frac{1}{2}(.5)(.7)^2 - (.25)d = 0$

$\Rightarrow$ $\boxed{d = .49\,m}$

(same as kinematics)

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initial mechanical energy in system

$E_1 = \frac{1}{2}mv_1^2 + U_1$

$= \frac{1}{2}(.5)(.7)^2$

$\boxed{E_1 = .1225\,J}$

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impulse during first 0.6 sec

$J = F\Delta t$

$= f\,\Delta t$

$= (-.25)(.6)$

$\boxed{J_{.6} = -.15\,N\cdot s}$

OR

$J = \Delta p = p_2 - p_1$

$= mv_2 - mv_1$

$= .5(.4) - .5(.7)$

$\boxed{J_{.6} = -.15\,N\cdot s}$

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initial momentum in system

$p_1 = mv_1$

$= (.5)(.7)$

$\boxed{p = .35\,kgm/s}$

GRAPHS