(c) What is the speed V_f at the end of 8.5 m displacement.

$$W_f = K_f - K_i$$

$$= \frac{1}{2} m V_f^2 - \frac{1}{2} m V_i^2 \qquad V_i = 0$$

$$V_f = \sqrt{\frac{2W}{m}} = \sqrt{\frac{2 \times 153}{222 Kg}} = 1.17 \ m/s \ \text{Ans}$$

problem: During a storm, a box is sliding across a slick, oily parking lot through a displacement $\vec{d} = (-30m)\hat{i}$ while a steady wind pushes against the crate with a force $\vec{F} = (2.N)\hat{i} + (-6N)\hat{j}$.

(a) How much work does this force do on the crate during the displacement.

$$W = \vec{F} \cdot \vec{d} = [(2.N)\hat{i} + (-6N)\hat{j}] \cdot [-3m\hat{i}]$$

$$= -6J$$

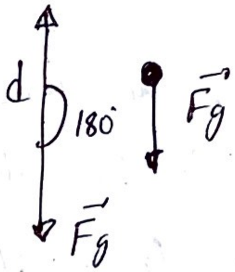
(b) If the box has a kinetic energy of 10 J at the beginning of the displacement $\vec{d}$, what is its kinetic energy at the end of $\vec{d}$?

$$K_f - K_f = W \quad \text{or} \quad K_f = W + K_f$$

$$= (-6J) + 10J = 4J$$

Less kinetic energy means the box has been slowed.

Work done by the Gravitational Force:



$W_g = mgd\cos\theta$

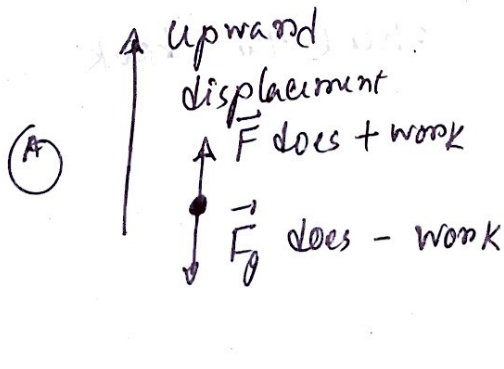
$= mgd\,(-1)$

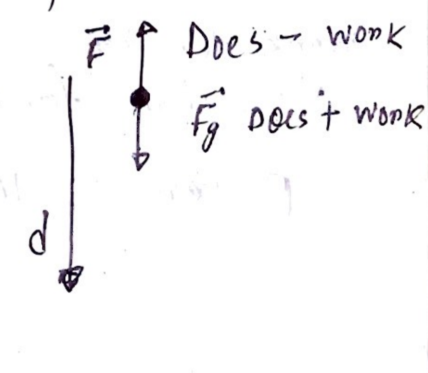
$= -mgd$

The minus sign tells us that during the object's rise, the gravitational force acting on the object transfers energy in the amount mgd from the kinetic energy of the object. That's why the object is slowing down

* After the object has reached its maximum height, it will fall back, the ϕ would be zero between F_g & d $\quad W_g = mgd\cos 0 = +mgd$.

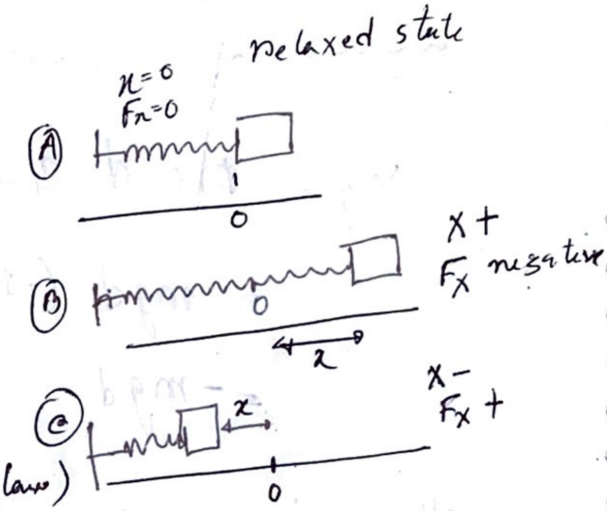
* If we lift a particle-like object by applying a vertical force $\vec{F}$ to it, the applied force does positive work. However the gravitational force does negative work.





Sample problem 7.05 7.04

Work done by a spring force



For spring, the force $\vec{F}_s$ ~~from~~ is propotional to the displacement $\vec{d}$ of the free end from its position:

The spring force $\vec{F}_s = -k\vec{d}$ (Hook's law)

$\vec{F}$ is oppositie to $\vec{d}$

$$\vec{F}_x = -kx$$

$$F = \frac{1}{2}kx^2$$

If x is positive (B), (pulled toward right), F_x is negative

If x is negative (pulled toward left), F_x is positive.

* Notably spring force is a varible force because it is a function of ~~k~~ x. Hook's law is a linear relationship between F & x.

Check the book, 160, [R, H.W]

7.06

Check the expression for work done in spring force.

[Check point 2, 7-4,

Work done by variable forces: Check the book, 162,

power, 166,

Lec - 9

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power

The time rate at which work is done by a force is said to be the power due to the force. If a force does an amount of work W in an amount of time Δt, the average power due to the force during that time interval is $P_{avg} = \frac{W}{\Delta t}$.

The instantaneous power P is the instantaneous time rate of doing work, can be written as

$$P = \frac{dW}{dt}$$

Unit of Power is the watt (W) after James Watt, who greatly improved the rate at which steam engines could do work.

$$1 \text{ watt} = 1 W = 1 J/s$$

$$1 \text{ horse power} = 1 hp = 746 W.$$

If you apply a force on an object with 30° angle,

$$P = \frac{dW}{dt} = \frac{F\cos\theta \, dx}{dt} = F\cos\theta \frac{dx}{dt}$$

$$P = Fv\cos\theta = \vec{F} \cdot \vec{V}$$