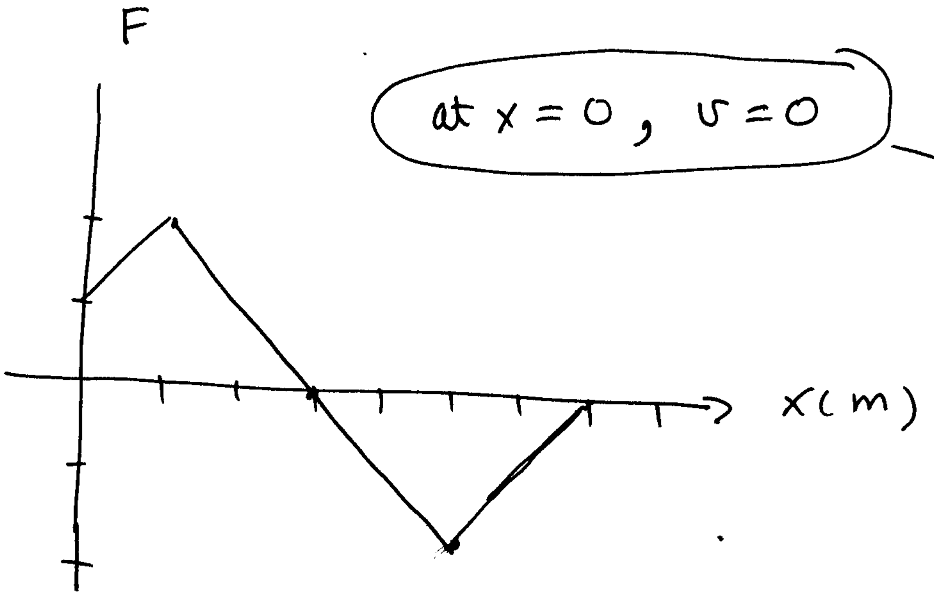
Oct 14, 01

CH7 - Rec - 1

H&R6 - Q4



at $x = 0$, $v = 0$

(a) Find x for which the particle has maximum kinetic energy.

$$W = K_f - \underbrace{K_i}_{=0}$$

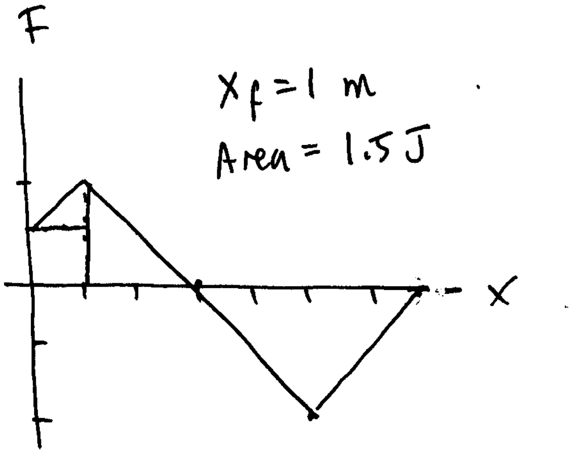
$$W = K_f$$

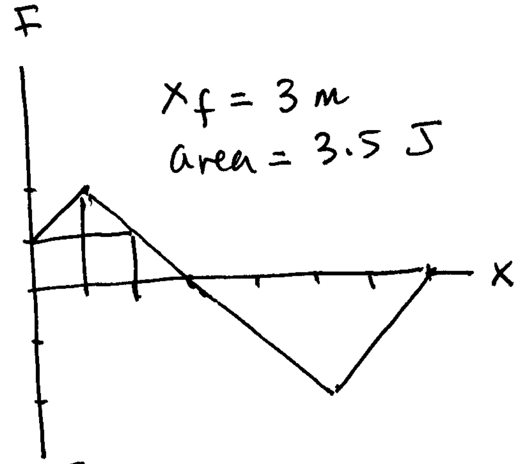
K_f is maximum, when W is maximum.

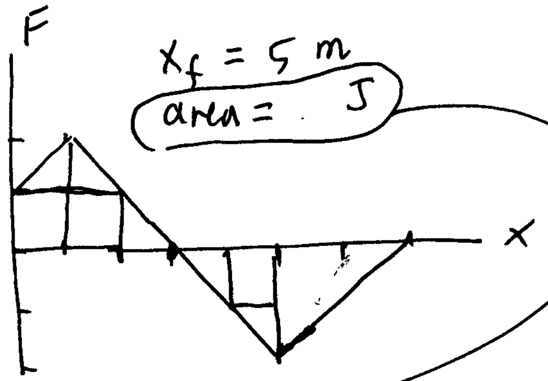
Since we have a variable force

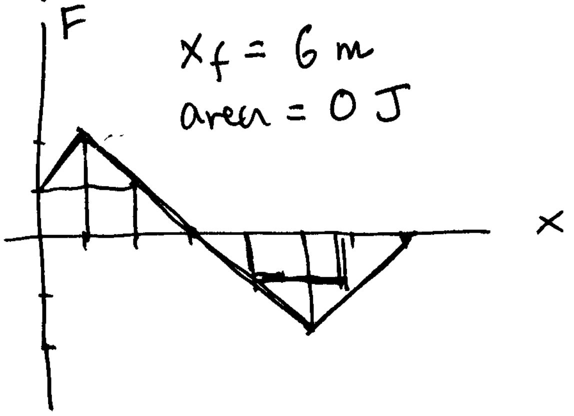
$$W = \int_{x=0}^{x_f} F\,dx$$

but $\int_{x=0}^{x_f} F\,dx$ is the area under the curve from $x = 0$ to x_f









Note for a curve under the x-axis, the area is negative

area = 3.5 − 2 = 1.5 J

above x-axis	below x-axis
x = 0 to 3	x = 3 to 5

From above figures, maximum work occurs for $x_f = 3$ m. Thus $x_f = 3$m is the position for which the kinetic energy is maximum.

(b) Find x for which the particle has maximum speed.

$$K = \frac{1}{2} m v^2$$

Maximum speed means maximum Kinetic energy. Thus $x = 3m$ is the position where the particle has maximum speed.

(c) Find x when speed is zero.

$$K = \frac{1}{2} m v^2 = 0$$

$W = 0 = K_f$ when $x_f = 6m$ (see (a))

Also at $x = 0$, $v = 0$

(d) What is the particle's direction of travel after it reaches $x = 6m$?

At $x = 0$, the particle is accelerated by a positive force until it reaches its maximum velocity (in positive x-axis) at $x = 3$ m. The negative force between $x = 3$ m and 6m decelerates the particle until its velocity becomes zero at $x = 6$m. The negative force at $x = 6$m accelerates the particle in the negative x-axis. So the particle returns back (has negative velocity) twords the origin $x = 0$.

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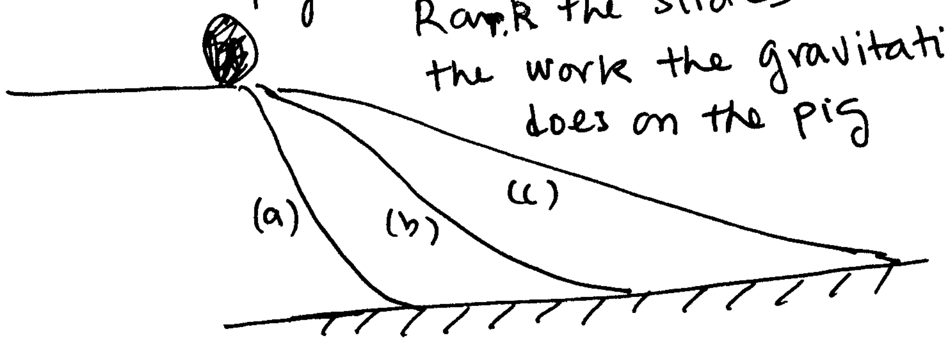
4+7 – Rec – 4

H&R6 – Q7



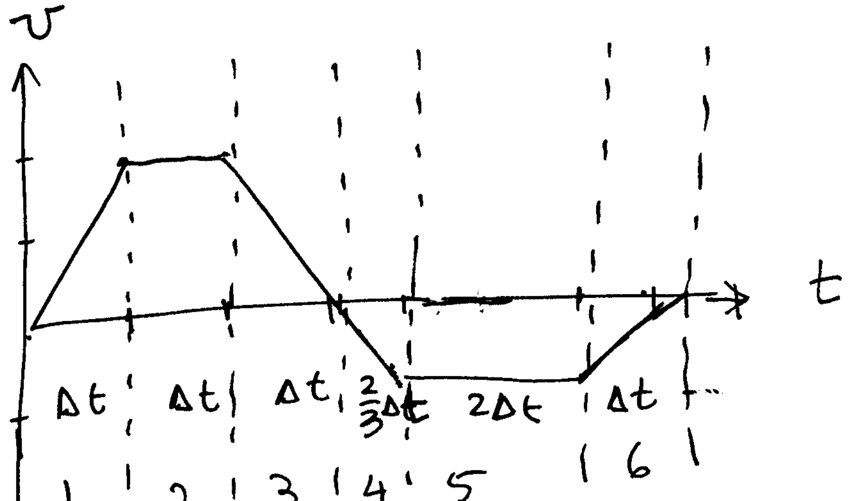
pig wants to slide
Rank the slides according to the work the gravitational Force does on the pig

$$W_g = \vec{F_g} \cdot \vec{d}$$
$$= (mg)(\underbrace{d\cos\phi}_{})$$

projection of the displacement along F_g = height

since the heights are the same for all slides, All slides have same W_g.

H&R6 – 12



periods →

(a) Rank periods according to the work done on the particle.

$$W = K_f - K_i$$
$$= \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2$$

(b) Rank periods according to the rate at which the force transfer energy

$$P_{avg} = \frac{W}{\Delta t}$$

Period	K_f	K_i	$W = K_f - K_i$	(a)	$P_{avg} = \frac{W}{\Delta t}$	(b)
1	$\frac{1}{2} m (2)^2$	0	$2m$	1	$\frac{2m}{\Delta t}$	1
2	$\frac{1}{2} m (2)^2$	$\frac{1}{2} m (2)^2$	0	3	0	3
3	0	$\frac{1}{2} m (2)^2$	$-2m$	6	$-\frac{2m}{\Delta t}$	6
4	$\frac{1}{2} m (-1)^2$	0	$\frac{m}{2}$	2	$\frac{m/2}{2/3\,\Delta t}$	2
5	$\frac{1}{2} m (-1)^2$	$\frac{1}{2} m (-1)^2$	0	3	0	3
6	0	$\frac{1}{2} m (-1)^2$	$-\frac{m}{2}$	5	$\frac{-m}{2\Delta t}$	5

Oct 14, 01 Ch7-Rec-6

H&R6-P1

Electron $m = 9.11\times10^{-31}$ kg

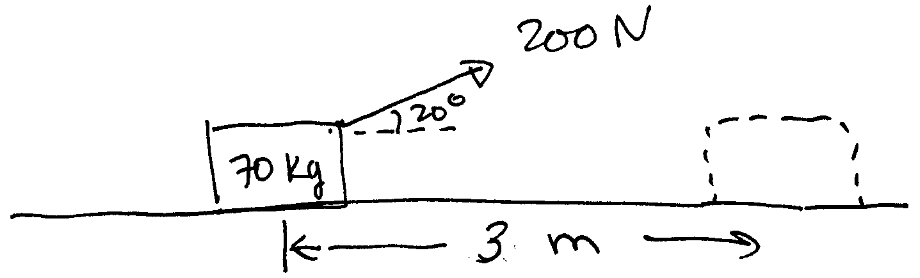
Kinetic Energy $= 6.7\times10^{-19}$ J

$v = ?$

A. $K = \frac{1}{2} m v^2$

$$v = \sqrt{\frac{2K}{m}} = \sqrt{\frac{2(6.7\times10^{-19})}{9.11\times10^{-31}}} = 1.6\times10^{6} \text{ m/s}$$

H&R6-P7



(a) Work done by the worker

$$W = \vec{F}\cdot\vec{d} = (200)(3)\cos(20^\circ)$$
$$= 590 \text{ J}$$

(b) work done by the gravitational force

$$W_g = \vec{F_g}\cdot\vec{d} = 0 \quad \text{because } F_d \perp \vec{d}$$

(c) work done by the normal force

$$W_N = \vec{N}\cdot\vec{d} = 0 \quad \text{because } \vec{N} \perp \vec{d}$$

(d) $W_{total} = 590$ J

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H&R 6-P10

$x = 3.0t - 4.0t^2 + 1.0t^3$
$m = 3.0$ kg
what is the work done between
$t = 0$ s and 4.0 s

$$W = K_f - K_i$$
$$= \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2$$

We need to find v

$$v = \frac{dx}{dt} = 3.0 - 2(4.0)t + 3(1.0)t^2$$
$$v(t=0) = 3.0 \text{ m/s}$$
$$v(t=4) = 3.0 - 2(4.0)(4) + 3(1.0)(4)^3$$
$$= 163 \text{ m/s}$$

$$W = \frac{1}{2}(3)(163)^2 - \frac{1}{2}(3)(3)^2$$
$$= 400 \text{ J.}$$

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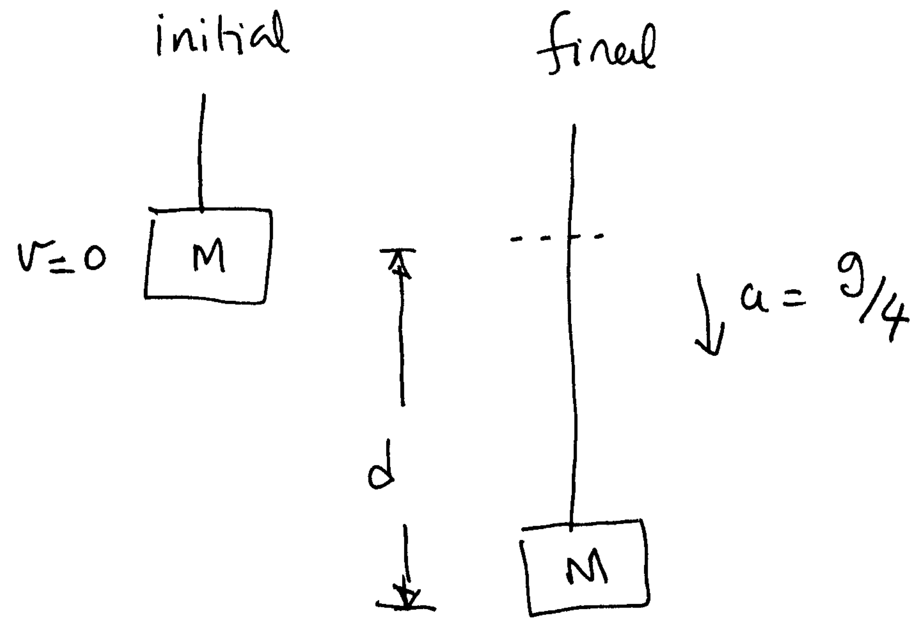
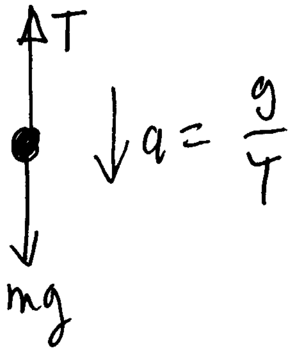
CH7 - Rec - 8

H&R 6th P19



(a) What is the work done by the cord's force on the block?



Newton's Second Law

$$\vec{F}_{net} = m\vec{a}$$

$$T - Mg = -M\left(\frac{g}{4}\right)$$

$$T = M\left(g - \frac{g}{4}\right)$$

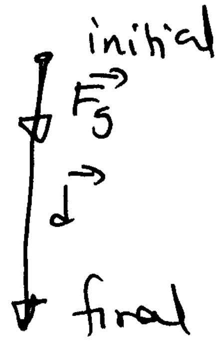
$$= \frac{3}{4}Mg$$

$$W_T = \vec{T}\cdot\vec{d} = \left(\frac{3}{4}Mg\right)(d)\cos(180^\circ)$$

$$= -\frac{3}{4}Mgd$$

(b) What is the work done by the gravitational force on the block?

$$W_g = \vec{F}_g \cdot \vec{d} = Mg\, d \cos 0^\circ$$
$$= Mgd$$



(c) What is the Kinetic Energy of the block?

$$W = K_f - K_i$$

$W_g + W_T$

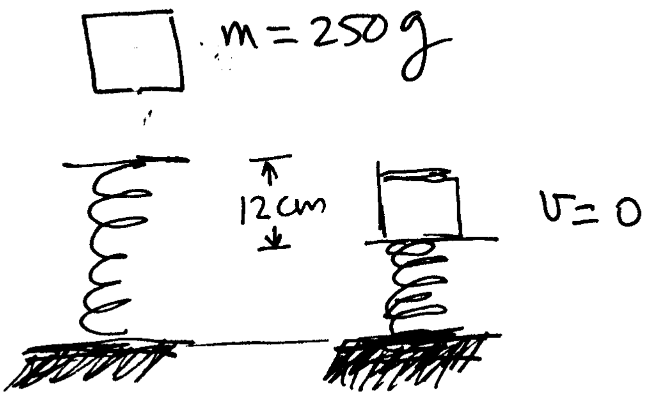
zero because $v_i = 0$

$$K_f = W_T + W_g = -\frac{3}{4} Mgd + Mgd$$
$$= \frac{1}{4} Mgd$$

(d) What is the speed of the block

$$K_f = \frac{1}{2} m v_f^2$$
$$v_f = \sqrt{\frac{2K_f}{m}} = \sqrt{\frac{2 \frac{1}{4} Mgd}{M}} = \sqrt{\frac{gd}{2}}$$

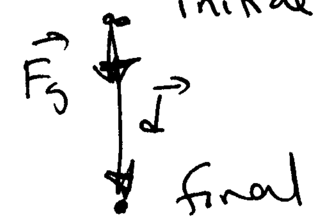
HER6 - P22



$k = 2.5 \frac{N}{cm}$

(a) what is the work done by the gravitational work on the block

$$W_g = \vec{F}_g \cdot \vec{d}$$



$$= mgd$$

$$= (0.250)(9.8)(0.12)$$

$$= 0.29 \text{ J}$$

(b) what is the work done by the sping force on the block.

$$W_s = \frac{k}{2}(x_i^2 - x_f^2)$$

$$= \frac{250}{2}(0 - (0.12)^2)$$

$2.5 \frac{N}{cm} = 250 \frac{N}{m}$

$$= -1.8 \text{ J}$$

(c) what is the speed of the block just before it hits the spring?

$$W_{net} = K_f - K_i$$

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$$W_g + W_s = \frac{1}{2} m v_f^2 - \frac{1}{2} m v_i^2$$

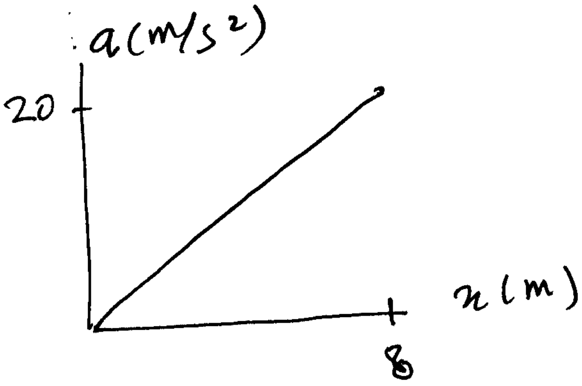
$= 0$

$$v_i = \sqrt{\frac{-2(W_g + W_s)}{m}}$$

$$= \sqrt{\frac{-2(0.29 - 1.8)}{0.250}} = 3.5 \text{ m/s}$$

HER6-25

$m = 10$ Kg



What is the work done on the brick when it is moved from $x = 0$ to 8 m ?

area under the curve

$$W = \int_{x=0}^{x=8} F\,dx = m \int_{x=0}^{x=8} a\,dx$$

$$= 10 \frac{(8)(20)}{2}$$

$$= 800 \text{ J}$$

H&R6 - P 29

$$W = \int_{x_i}^{x_f} F_x\,dx + \int_{y_i}^{y_f} F_y\,dy$$

$$= \int_{2}^{-4} 2x\,dx + \int_{3}^{-3} 3\,dy$$

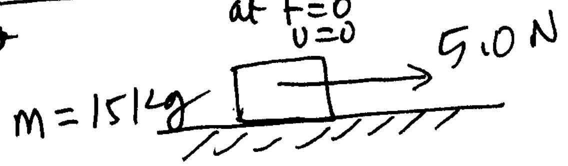
$$= 2\int_{2}^{-4} x\,dx + 3\int_{3}^{-3} dy$$

$$= 2\left[\frac{x^2}{2}\right]_{x=2}^{x=-4} + 3\left[y\right]_{y=3}^{y=-3}$$

$$= 2\left(\frac{(-4)^2}{2} - \frac{(2)^2}{2}\right) + 3\left((-3)-(3)\right)$$

$$= 12 + (-18) = -6\,J$$

H&R6 - P 33



W in 1st sec ?
2nd sec ?
3rd sec ?

P at t = 3 sec ?

$$F = ma \Rightarrow a = \frac{5.0}{15} = \frac{1}{3}\ m/s^2$$

$$v_f = v_i + at$$

$$W = K_f - K_i$$

t	v
0	0
1	1/3
2	2/3
3	1

in 1st second $W = \frac{1}{2}(15)(\frac{1}{3})^2 - 0 = 0.83J$

in 2nd second $W = \frac{1}{2}(15)(\frac{2}{3})^2 - \frac{1}{2}(15)(\frac{1}{3})^2$

$= 2.5\ J$

in 3rd second $W = \frac{1}{2}(15)(1)^2 - \frac{1}{2}(15)(\frac{2}{3})^2$

$= 4.2 J$

at $t = 3$

$P = \vec{F} \cdot \vec{v} = (5.0)(1)$

$= 5W$