Level I Answer Key Pd 3

Work, Energy, & Springs

AT work energy spring (21)

Directions: Solve the following problems. Your work will be graded, not just the answer. This test is worth 50 points. Each question is worth 5 points.

1) A 500 g mass is hung from a 62 N/m spring. How far does the mass stretch the spring?

$F = kx$

$mg = kx$

$(.5\,kg)(9.8\,m/s^2) = (62\,N/m)x$

$.079\,m = x$

$\Sigma F = F - w = ma$

$F - w = 0$

$F = w$

$F = mg$

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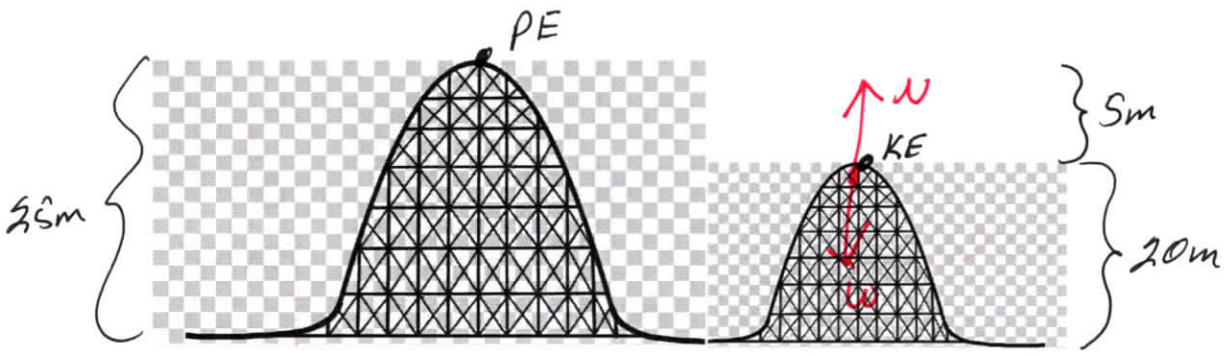
2) Imagine there is a 2,000 kg roller coaster train stopped at the top of the tall hill, which is 25m high. That train is released to go down that large drop, and back up the next hill, which is 20 m tall. The radius of curvature of the top of the smaller hill is 4m. Determine the apparent weight of a 65 kg rider in the train. Assume the train is frictionless, and that the rider rides in the middle of the train.



$\Sigma F_y = N - W = m\bar{a}$

$N - W = \frac{mv^2}{r}$

$N - W = \frac{m2gh}{r}$

$N - mg = \frac{m2gh}{r}$

$N = mg + \frac{m2gh}{r}$

$N = m\left(g + \frac{2gh}{r}\right)$

$N = (65kg)\left[9.8m/s^2 - \frac{(2)(9.8m/s^2)(5m)}{4m}\right]$

$N = 14.7N$

$PE = KE$

$mgh = \frac{1}{2}mv^2$

$2gh = v^2$

$v = 7m/s$

Like they Are Being Pulled Down With 14.7N...

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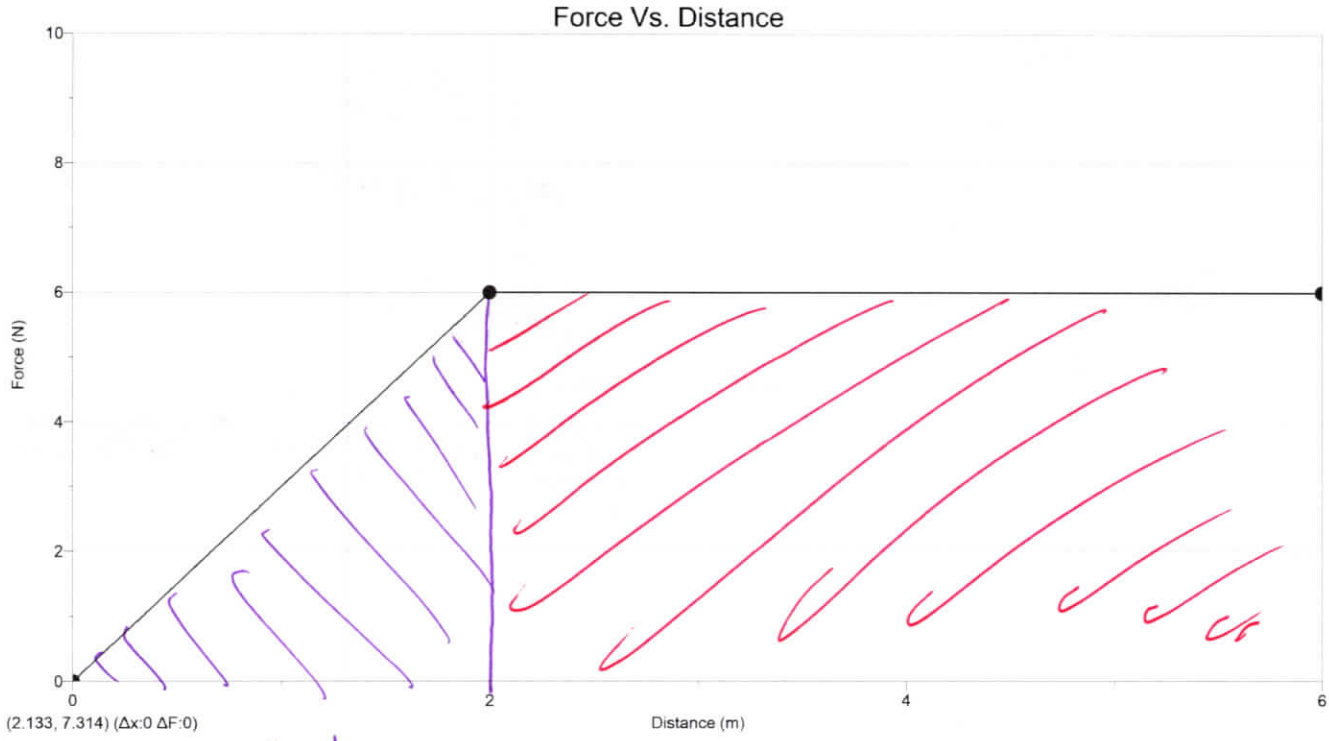
3) An object is pushed in a manner that the graph below represents the force and distance. Determine the work that is done.



$\left(\frac{1}{2}\right)(6N)(2m)$

$6Nm$

$(6N)(4m)$

$24Nm$

$30Nm$

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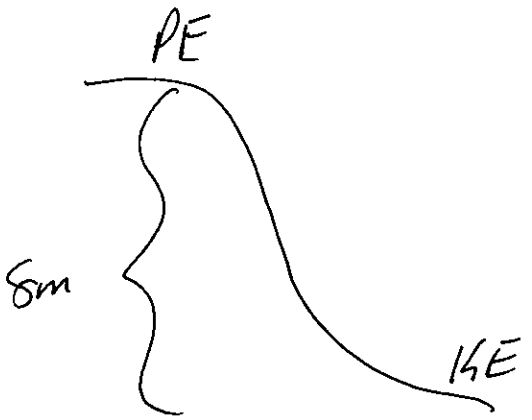
4) Imagine that you are sledding over the winter. Determine the greatest possible speed you could have at the bottom of a hill that is 8m high.



$PE = KE$

$mgh = \frac{1}{2}mv^2$

$\sqrt{2gh} = v$

$\sqrt{(2)(9.8\,m/s^2)(8m)} = 12.5\,m/s$

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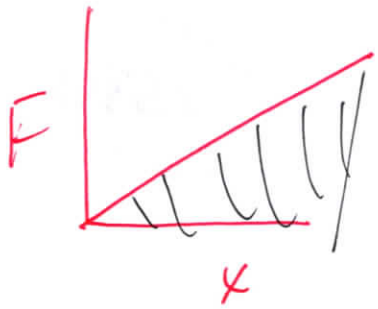
5) Determine the work that is done stretching a spring with a spring rate of 52N/m a distance of 28cm.



$W = \frac{1}{2}Kx^2$

$\left(\frac{1}{2}\right)\left(52\frac{N}{m}\right)(.28m)^2$

$W = 2.04 J$

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6) Determine how much work must be done to stop a cart that is moving with 158J of kinetic energy.

158J

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$K = 600 N/m$

7) You may have noticed.... the PASCO carts we have in the room (the grey & black carts, not the encoded carts) have spring loaded plungers on one end. The carts have a mass of 0.5kg. Determine the maximum compression of the spring if the cart is rolling at 3m/s and collides plunger-first into a solid barrier.

$KE = W$

$\frac{1}{2}mv^2 = \frac{1}{2}Kx^2$

$mv^2 = Kx^2$

$\sqrt{\frac{mv^2}{K}} = x$

$\sqrt{\frac{(.5kg)(3m/s)^2}{(600 N/m)}} = .087m \Rightarrow \underline{8.7cm}$

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8) A block of mass 2 kg has a coefficient of friction of 0.6 against the floor. Determine the power required to pull the block at a constant 2m/s

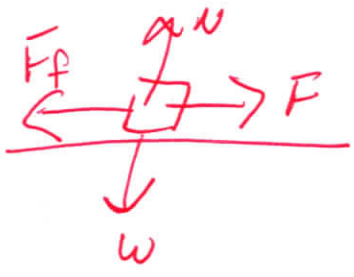
$P = \frac{W}{t} = \frac{F_x}{t} = Fv$

$P = \mu N v$

$P = \mu N v$

$P = (.6)(2\text{kg})(9.8\text{m/s}^2)(2\text{m/s})$

$P = 23.5 \text{ watts}$



$\Sigma F_y = N - W = 0$

$N = mg$

$\Sigma F_x = F - F_f = 0$

$F = F_f$

$F = \mu N$

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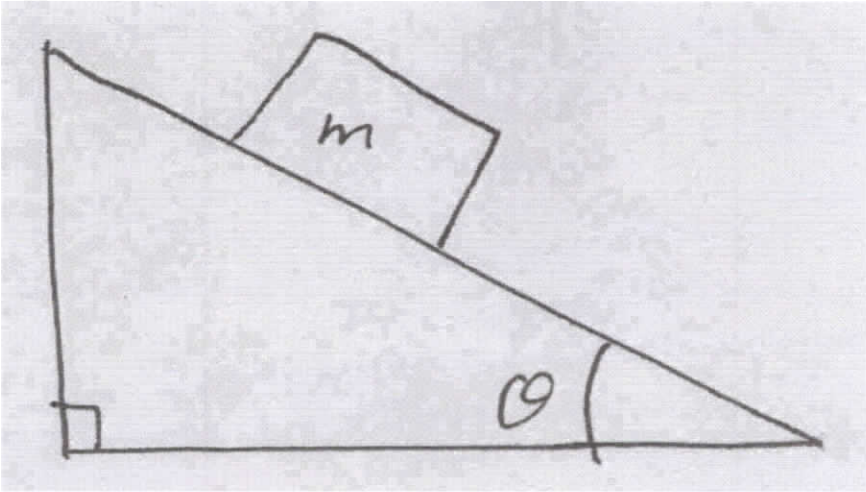
9) The 12 kg box is pushed up the incline. The height of the incline 1.5m and the length ramp up the incline is 9m. Determine the smallest possible force needed to push the box up the incline.



$PE = W$

$mgh = Fx$

$\frac{mgh}{x} = F$

$\frac{(12kg)(9.8m/s^2)(1.5m)}{(9m)} = 19.6N$

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10) Determine the weight of a 5 kg object.