key Level I Physics Pd 1

Work and Energy

AT Work and energy (21 S2)

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

1) A 550 g mass is hung from a 55 N/m spring. How far does the mass stretch the spring?

$F_s = kx$

$mg = kx$

$\frac{mg}{k} = x$

$\frac{(.55\,kg)(9.8\,m/s^2)}{55\,N/m} = .098\,m \approx 10\,cm$

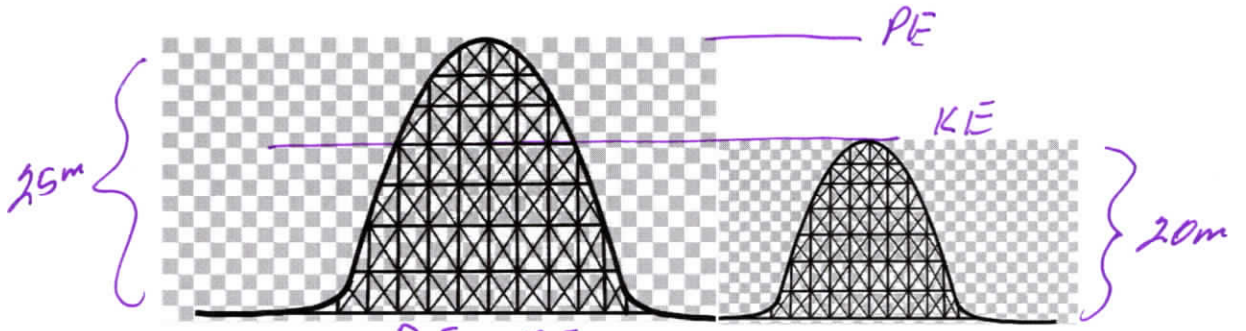
$\Sigma F_y = F_s - w = 0$

$F_s = w$

$F_s = mg$

key Level I Physics Pd 1

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 speed of a 65 kg rider in the train at the top of the second hill (the one that is 20 m tall). Assume the train is frictionless, and that the rider rides in the middle of the train.



$PE = KE$

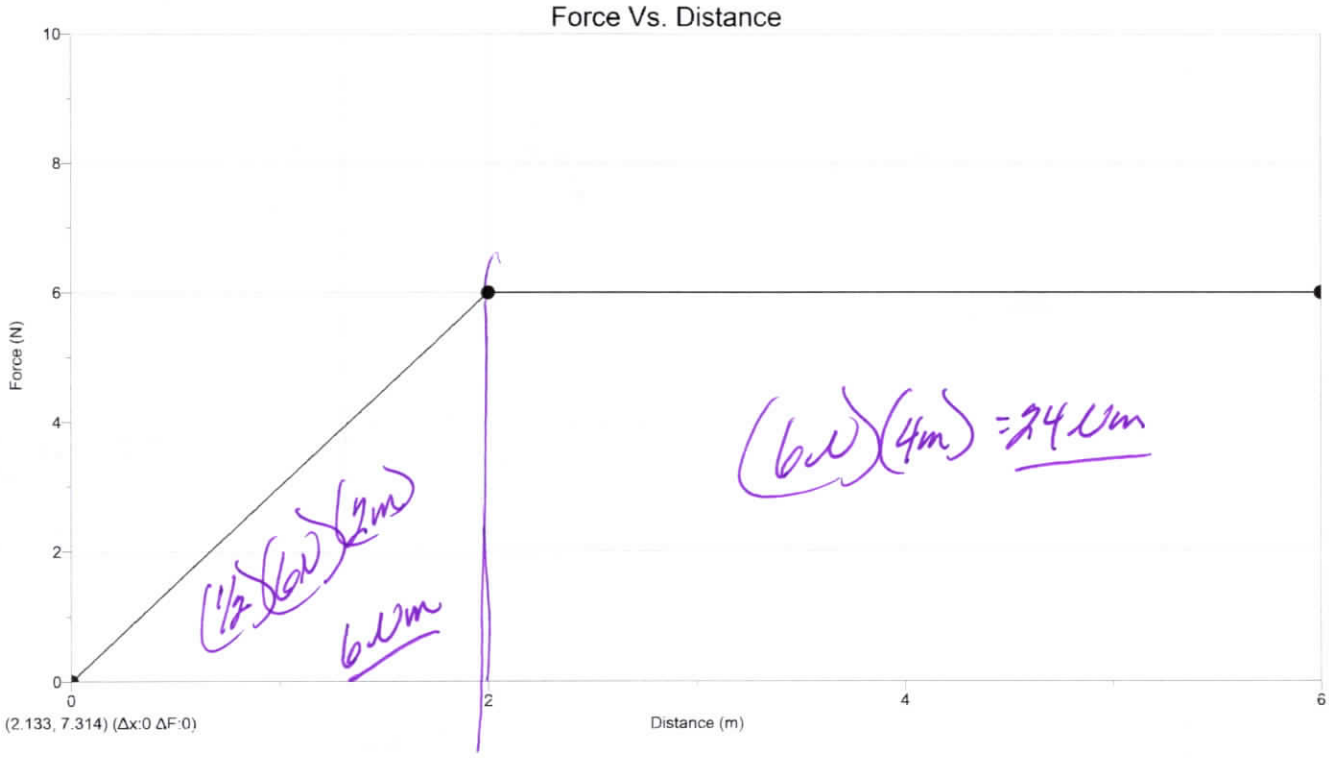
$mgh = \frac{1}{2}mv^2$

$\sqrt{2gh} = v$

$\sqrt{(2)(9.8\,m/s^2)(5m)} = v = 9.8\,m/s$

key Level I Physics Pd 1

3) An object is pushed in a manner that the graph below represents the force and distance. Determine the work that is done. (If this doesn't print well, ask for clarification)



30 Nm

key Level I Physics Pd 1

4) A person claims to be able to produce 1 horsepower (746 watts). How long should it take them to run up a steep hill that is 3 m high? They have a mass of 62 kg.

$W = Fx$ $\qquad P = \frac{W}{t} = \frac{mgh}{t}$

$t = \frac{mgh}{P} = \frac{(62\text{kg})(9.8\frac{\text{m}}{\text{s}^2})(3\text{m})}{746\text{w}}$

$t = 2.44\text{s}$

key Level I Physics Pd 1

5) Determine the work that is done stretching a spring with a spring rate of 55N/m a distance of 28cm.

$F = Kx$

$W = \frac{1}{2} Fx$

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

$W = \left(\frac{1}{2}\right)\left(55\frac{N}{m}\right)(.28m)^2$

$W = 2.156\ J$

key Level I Physics Pd 1

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

158 J

key Level I Physics Pd 1

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. The spring rate of the spring was measured to be 600 N/m (Use this value...the measurement was somewhat approximate)

$KE = W$

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

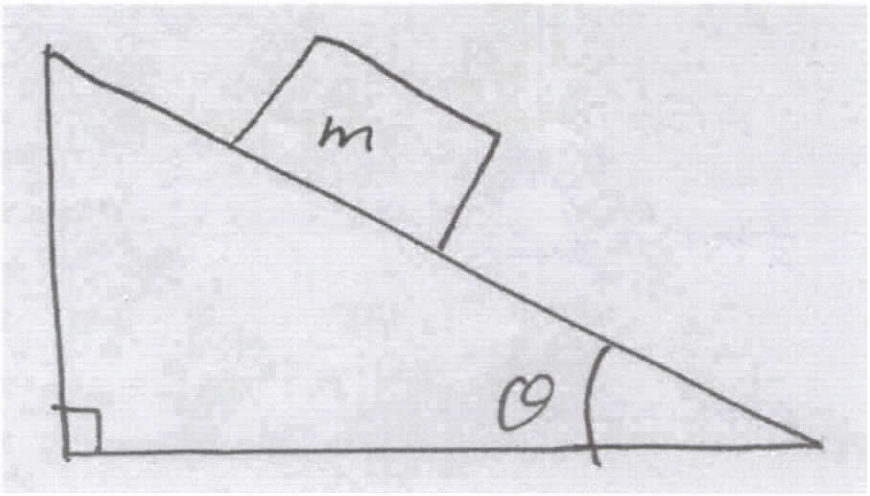
$mv^2 = Kx^2$

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

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

key Level I Physics Pd 1

8) The 32 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 (as in frictionless) needed to push the box up the incline.



$IMA = \frac{x_{in}}{x_{out}} = \frac{9m}{1.5m} = 6$

Ideally ... AMA = IMA Frictionless

~~AMA~~

$AMA = \frac{F_{out}}{F_{in}}$

$F_{in} = \frac{F_{out}}{AMA}$

$\frac{(32kg)(9.8 m/s^2)}{6} = 52 N$