key Level I Physics Pd 2

Work and Energy

AT work and energy (10)

Directions: Solve the following problems, showing all work and circling your answer. Each is worth 5 points

1) A 1200 kg is cruising down the road at 15 m/s. Determine the work that must be done to stop the car?

$\Delta E = W = \frac{1}{2}mv^2 = \left(\frac{1}{2}\right)(1200\,kg)(15\,m/s)^2 =$

135,000 J

2) A 2 kg mass is moving at 5 m/s horizontally, and strikes a horizontally mounted spring that has a spring constant of 45 N/m. Determine how far the spring is compressed in the process of stopping the 2 kg mass.

$KE = PE$

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

$mv^2 = Kx^2$

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

$\sqrt{\frac{(2\,kg)(5\,m/s)^2}{(45\,N/m)}} = 1.05\,m$

3) Determine the power rating required of a motor that is powering a go-cart that has a total of resistive forces (air resistance, and other friction) of 1220 N when traveling at 12 m/s.

$P = \frac{W}{t} = \frac{Fx}{t} = Fv = (1220\,N)(12\,m/s) =$

14,640 watts

19.6 h.p.

4) A spring with a spring constant of 20 N/m is stretched 2 m (Wow!!! That's far!!). Determine the amount of work that is done.

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

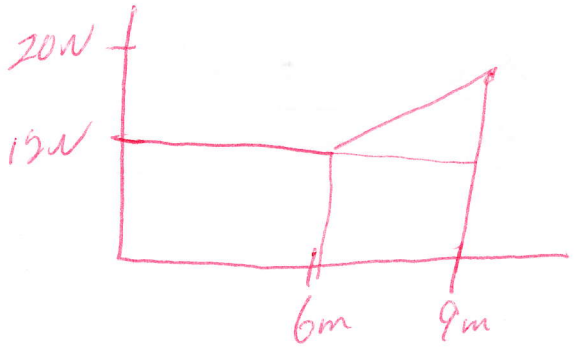
$W = \left(\frac{1}{2}\right)\left(20\ N/m\right)\left(2m\right)^2$

$W = 40\ J$

5) A pulley arrangement is used to lift a 158 kg mass. A person pulls 5 meters of rope as the mass raises 0.5 meters. Determine the ideal mechanical advantage of this machine.

$$IMA = \frac{x_{in}}{x_{out}} = \frac{5m}{.5m} = 10$$

6) A constant force of 12 N acts to move an object through a distance of 6 m. Once the object has moved through the 6 m, the force increases steadily until a force of 20N is being applied. While the force was increasing, the object moved through an additional 3 m. Determine the work done while the object moved through the 9m distance.



$(12N)(9m) = 108J$

$(\frac{1}{2})(8N)(3m) = 12J$

$120J$

7) A 2 kg mass stretches a spring 12cm. How far will a 3.5 kg mass stretch the spring?

$$F_1 = kx_1$$

$$\frac{F}{x_1} = k$$

$$\frac{m_1 g}{x_1} = k$$

$$F_2 = kx_2$$

$$m_2 g = k x_2$$

$$m_2 g = \frac{m_1 g}{x_1} x_2$$

$$\frac{m_2 g x_1}{m_1 g} = x_2$$

$$\frac{m_2 x_1}{m_1} = x_2 = \frac{(3.5\text{kg})(12\text{cm})}{2\text{kg}} = 21\text{cm}$$

8) Sledding down hills is really fun. On a really slippery, icy hill, you measure your speed at the bottom to be 12 m/s. How high was the hill?

$PE = KE$

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

$2gh = v^2$

$h = \frac{v^2}{2g}$

$h = \frac{(12\ m/s)^2}{2(9.8\ m/s^2)}$

$h = 7.35\ m$