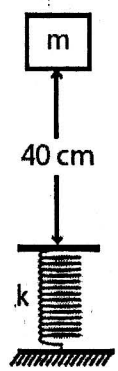
PHYS101
QUIZ#6 - CHAPTER 7
DATE: 4/11/12

Name: Key Id#: Sect#

A 4.0 kg block is dropped from a height of 40 cm onto a spring of spring constant k. If the maximum distance the spring is compressed = 0.15 m, find the value of the spring constant k.

(solve the problem using the work energy theorem)



$\Delta K = W_g + W_s$

dropped $\Rightarrow v_i = 0$

maximum compression $\Rightarrow v_f = 0$

$\Delta K = 0$

$W_g = mgh = mg(0.4+0.15) = 4 \times 9.8 \times 0.55$

$= 21.56\ J$

$W_s = \frac{1}{2} k (x_i^2 - x_f^2)$ $\quad x_i = 0$

$x_f = 0.15\ m$

$W_s = -\frac{1}{2} k (0.15)^2 = -0.01125\, k$

$0 = 21.56 - 0.01125\, k \Rightarrow \boxed{k = 1916\ N/m}$

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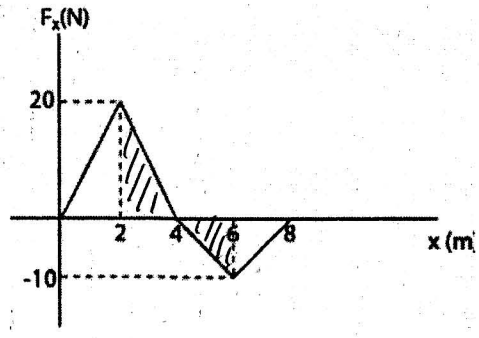
The speed of the particle of mass 2 kg at x = 2 m is 30 m/s.
What is the speed of the particle at x = 6 m?



$$\Delta K = W$$

$$\frac{1}{2} m(v_f^2 - v_i^2) = \text{Area under the curve}$$

$$\text{Area} = \frac{1}{2} 20 \times 2 - \frac{1}{2} 10 \times 2 = 10 \text{ J}$$

$$\frac{1}{2} \times 2 \times v_f^2 - \frac{1}{2} \times 2 \times (30)^2 = 10$$

$$v_f^2 = 910 \Rightarrow \boxed{v_f = 30.2 \text{ m/s}}$$

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A car accelerates from zero to 35 m/s in 2.0 s. Assuming the same average power is delivered by the car, how long does it take to accelerate it from zero to 80 m/s.

$$P_{avg} = \frac{W}{\Delta t} = \frac{\Delta K}{\Delta t} = \frac{K_f - K_i}{\Delta t} \qquad K_i = 0$$

$$P_{1avg} = \frac{\frac{1}{2} m v_{f_1}^2}{\Delta t_1}$$

$$P_{2avg} = \frac{\frac{1}{2} m v_{f_2}^2}{\Delta t_2}$$

$$P_{1avg} = P_{2avg} \Rightarrow \frac{v_{f_1}^2}{\Delta t_1} = \frac{v_{f_2}^2}{\Delta t_2}$$

$$\Delta t_2 = \Delta t_1 \frac{v_{f_2}^2}{v_{f_1}^2} = 2 \times \frac{(80)^2}{(35)^2}$$

$$\boxed{\Delta t_2 = 10.4 \text{ s}}$$