

Conservation of Energy

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Keywords

Work and Energy (measured in Joules)

- $W = Fd \cos \theta$

Mechanical Energy = Kinetic Energy + Potential Energy

- $KE = \frac{1}{2}mv^2$

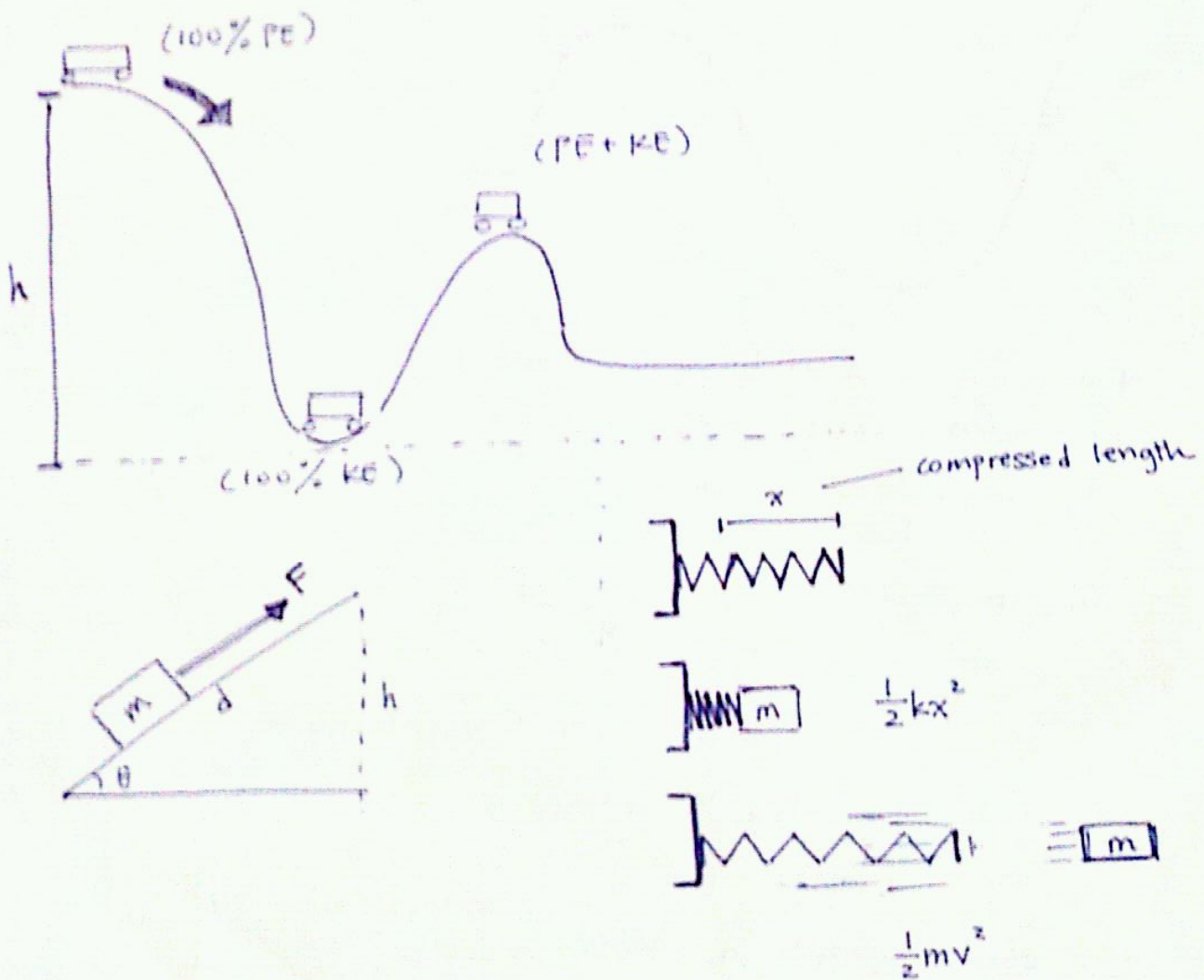
- $PE_g = mgh$

- Elastic PE = $\frac{1}{2}kx^2$

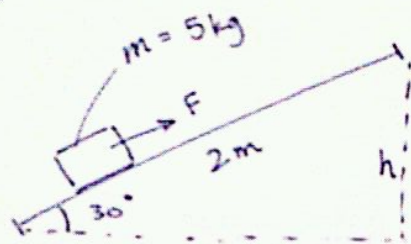
Law of Conservation of Energy

- $E_1 = E_2$

- $KE_1 + PE_1 = KE_2 + PE_2$



Examples



How much force does it take to push the 5 kg block up the ramp?

$$h = 2(\sin 30) = 1\text{ m}$$

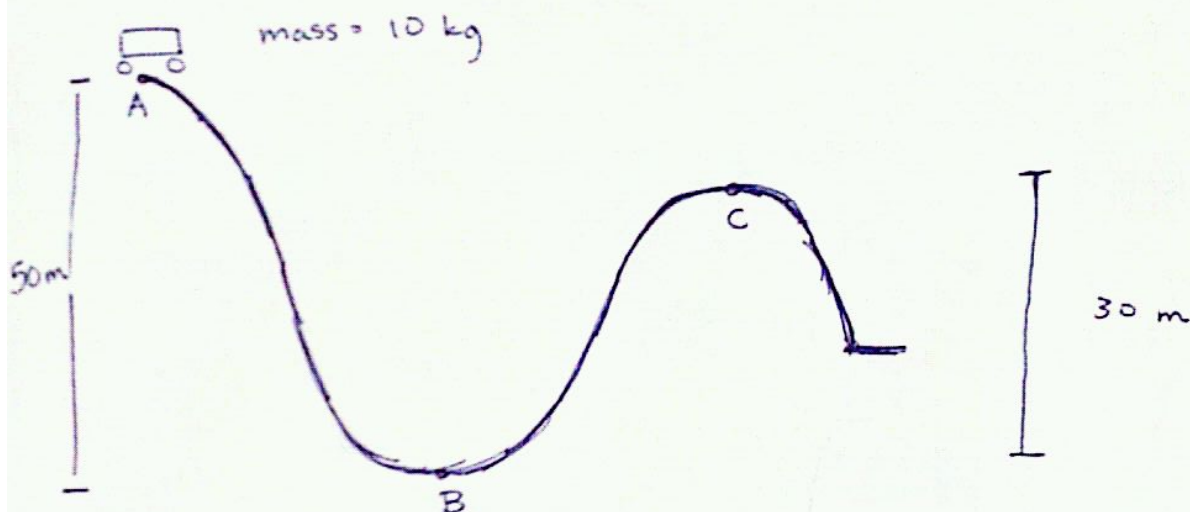
$$W = F_g h = Fd$$

$$F_g h = mgh$$

$$\Rightarrow 5(9.8)(1) = 49\text{ J}$$

$$Fd = 49\text{ J}$$

$$F = \frac{49\text{ J}}{2\text{ m}} = 24.5\text{ N}$$



What is gravitational PE and KE at points A? B? C?

A. (100% GPE) $GPE = mgh$ [And velocity?]

$$10(9.8)(50) = 4900\text{ J}$$

$$\text{velocity} = 0\text{ m/s}$$

B. (100% KE) $KE_B = PE_A$

$$\frac{1}{2}mv^2 = mgh \Rightarrow \frac{1}{2}(10)v^2 = 10(9.8)(50)$$

$$v = 31.305\text{ m/s}$$

C. (KE + PE) $PE_A = KE_C + PE_C$

$$4900 = \frac{1}{2}mv^2 + mgh$$

$$4900 = \frac{1}{2}(10)v^2 + (10)(9.8)(30)$$

$$PE_C = 2940$$

$$v = 19.8\text{ m/s}$$

$$KE_C = 1960$$

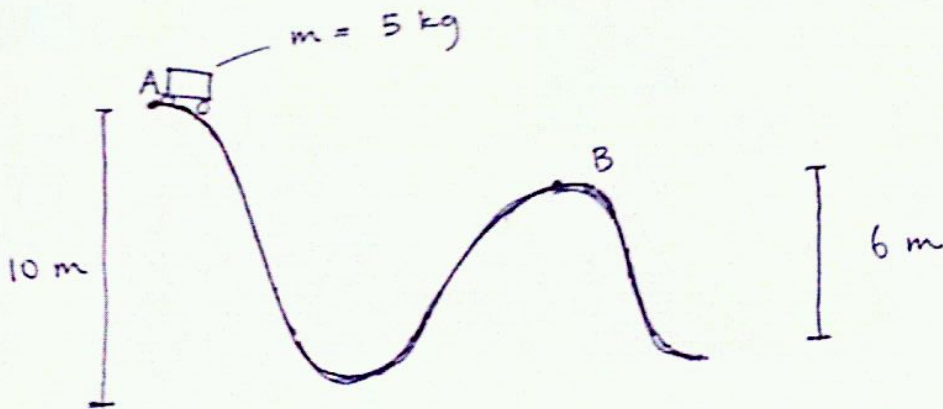
Multiple Choice

A spring has a constant k of 440 N/m . How much must this spring be stretched to store 25 J of potential energy?

- a) 0.1136 m
- b) 0.0568 m
- c) 0.2383 m
- d) 0.3371 m

The net energy an object moving up a rough ramp is 60 J . The height of the ramp is 10 m at an angle of 30° to the horizontal. The object has a mass of 4 kg . Find μ .

- a) 0.12
- b) 0.71
- c) 0.49
- d) 0.8



What is the speed at point B?

- a) 4.427 m/s
- b) 8.854 m/s
- c) 78.4 m/s
- d) 6.261 m/s