Serial #

King Fahd University of Petroleum and Minerals, Physics Department

PHYS 101 REC Fall 2018 (181)

SEC # 25, Quiz # 5

Name: ID #

Please show all steps and substitutions.

The only force acting on a 2.0 kg body as it moves along a positive *x* axis has an *x* component $F_x = 6x$ N, with x in meters. The velocity at $x = 3.0$ m is 8.0 m/s. What is the velocity of the body at $x = 4.0$ m?

$$K_f = K_i + W$$

$$\frac{1}{2} m\, v_f^2 = K_i + W \implies v_f = \sqrt{\frac{2(K_i + W)}{m}}$$

$$W = \int_{x_i}^{x_f} F_x dx = 6 \int_{3.0}^{4.0} x dx = 6 \left[\frac{1}{2} x^2\right]_{3.0}^{4.0} = 21 \text{ J}.$$

$$K_i = \frac{1}{2} m v_i^2 = \frac{1}{2}(2.0)(8.0)^2 = 64 \text{ J}.$$

$$v_f = \sqrt{\frac{2(64 \text{ J} + 21 \text{ J})}{2.0 \text{ kg}}} = 9.22 \text{ m/s}.$$

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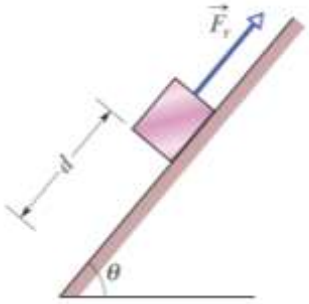
SEC # 26, Quiz # 5

Name: ID #

Please show all steps and substitutions.

In the figure, a block of ice slides down a frictionless ramp at angle 60° while an ice worker pulls on the block (via a rope) with a force that has a magnitude of 100 N and is directed up the ramp. As the block slides through distance d = 0.25 m along the ramp, its kinetic energy increases by 75 J. How much greater would its kinetic energy have been if the rope had not been attached to the block?



$$\Delta K = W_{net} = W_g + W_{F_r}$$

$$W_{F_r} = \vec{F}_r . \vec{d} = Fd\cos\phi = (100\text{ N})(0.25\text{ m})\cos -180° = -25\text{ J}.$$

$$W_g = \Delta K - W_{F_r} = 75\text{ J} - (-25\text{ J}) = 100\text{ J}.$$

Without the rope, the work would be purely gravitational. Thus,

$$\Delta K_2 = W_g = 100\text{ J}.$$

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SEC # 27, Quiz # 5

Name: ID #

Please show all steps and substitutions.

A 12.0 N force with a fixed orientation does work on a particle as the particle moves through the three-dimensional displacement $\vec{d} = (2.00\,\hat{\imath} - 4.00\,\hat{\jmath} + 3.00\,\hat{k})$ m. What is the angle between the force and the displacement if the change in the particle's kinetic energy is (a) +30.0 J and (b) -30.0 J?

$$\Delta K = W$$

$$W = \vec{F}.\vec{d} = Fd\cos\phi$$

$$\phi = \cos^{-1}\frac{W}{Fd} = \cos^{-1}\frac{\Delta K}{Fd}$$

$$d = \sqrt{2.00^2 + (-4.00)^2 + (3.00)^2} = 5.385 \text{ m.}$$

a)

$$\phi = \cos^{-1}\frac{\Delta K}{Fd} = \cos^{-1}\frac{30.0 \text{ J}}{(12.0 \text{ N})(5.385 \text{ N})} = 62.3°$$

b)

$$\phi = \cos^{-1}\frac{\Delta K}{Fd} = \cos^{-1}\frac{-30.0 \text{ J}}{(12.0 \text{ N})(5.385 \text{ N})} = 118°$$