ENG1004: Engineering Physics 1

Tutorial 3: Energy and work

Conceptual questions

1. A hill has a height h. A child on a sled (total mass m) slides down a slope starting from rest at the hill's top. Does his speed at the bottom of the hill depend on the angle of the slope for the following cases?
    a. It is icy and there is no friction.
    b. There is friction (deep snow). In both cases, explain your answer.

2. Why is it easier to climb a mountain via a zig-zag path than to climb straight up?

Question 1

A person applies a constant horizontal force to push a 1050 kg car 17.8 m along level ground and does 2300 J of work. (a) If the car starts at rest, what is its final speed? (b) What is the force exerted by the person?

Adapted from Benson, "University Physics", Revised Edition, John Wiley & Sons, inc., 1996.

Answer

(a) 2.09 m/s; (b) 129 N

Question 2

A 100 kg block is pulled at a constant speed of 5.0 m/s across a horizontal floor by an applied force of 122 N directed 37° above the horizontal. What is the rate at which the force does work on the block?

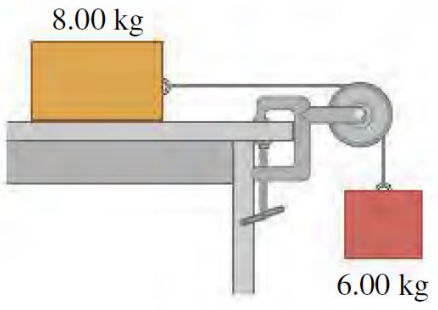
Adapted from Walker, "Halliday and Resnick Fundamentals of Physics", 9th Edition, John Wiley & Sons, Inc., 2011.

Answers

4.9×10^2 W

Question 3

Consider the system shown in the figure. The rope and pulley have negligible mass, and the pulley is frictionless. Initially the 6.00 kg block is moving downward and the 8.00 kg block is moving to the right, both with a speed of 0.900 m/s. The blocks come to rest after moving 2.00 m. Use the work–energy theorem or conservation of energy to calculate the coefficient of kinetic friction between the 8.00 kg block and the table top.



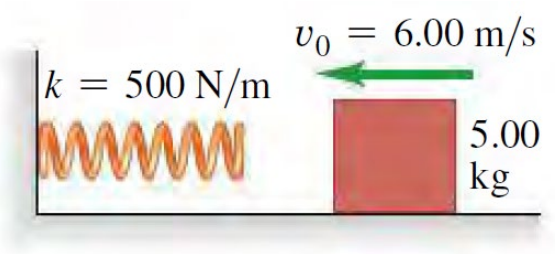
Adapted from Young and Freedman, "University Physics with Modern Physics", 14th Edition, Pearson, 2015.

Answer

0.786

Question 4

A 5.00 kg block is moving at v_0 = 6.00 m/s along a frictionless, horizontal surface toward a spring with force constant k = 500 N/m that is attached to a wall. The spring has negligible mass. (a) Find the maximum distance the spring will be compressed. (b) If the spring is to compress by no more than 0.150 m, what should be the maximum value of v_0?



Adapted from Young and Freedman, "University Physics with Modern Physics", 14th Edition, Pearson, 2015.

Answers

(a) 0.600 m; (b) 1.50 m/s