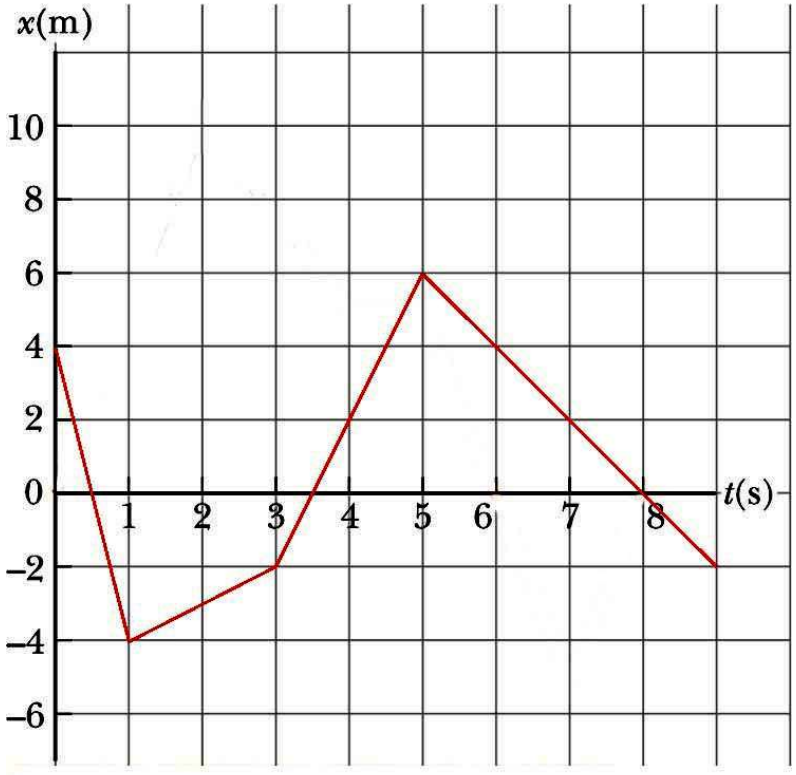
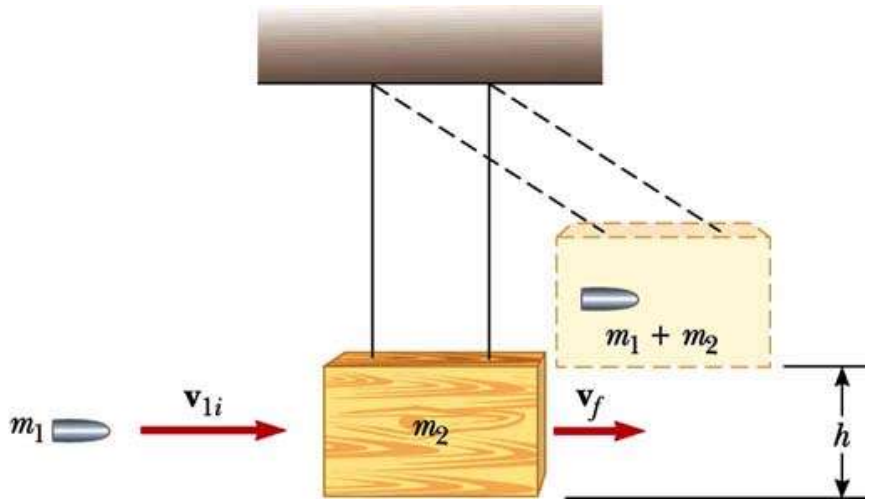
Example Problems

The position-time graph for an object moving along a straight path is shown. (a) Find the average velocity of this object during the time intervals 2.0 s to 4.0 s. (b) Find the instantaneous velocity at t=2.0 s. (c) Find the average acceleration between t= 2.0 s and t=4.0 s. (d) Find the average speed between t=0.0 s and t=8.0 s.



Momentum Conservation

A 20.0-g bullet with an initial horizontal velocity of v_{1i} strikes and is immediately embedded in a block of wood of mass 1.000 kg that is originally at rest. After the perfectly inelastic collision, the block, with the bullet inside, rises to a maximum height of h=0.400 m. What is v_{1i} ?



Chapter 3 Example Problems

34. An arrow is shot from a height of 1.5 m toward a cliff of height H. It is shot with a velocity of 30 m/s at an angle of 60^o above the horizontal. It lands on the top edge of the cliff 4.0 s later. (a) What is the height of the cliff? (b) What is the maximum height reached by the arrow along its trajectory? (3) What is the arrow's impact speed just before hitting the cliff?

An arrow is shot with an initial speed of 30.0 m/s from the ground level toward a cliff of 35.0 m height. It lands with a descending angle of 15.0^o on the cliff a short time later. What is the total flight time of the arrow? Neglect air resistance. (Hint: First solve for the final speed of the arrow, from which the horizontal and vertical components can be written.)

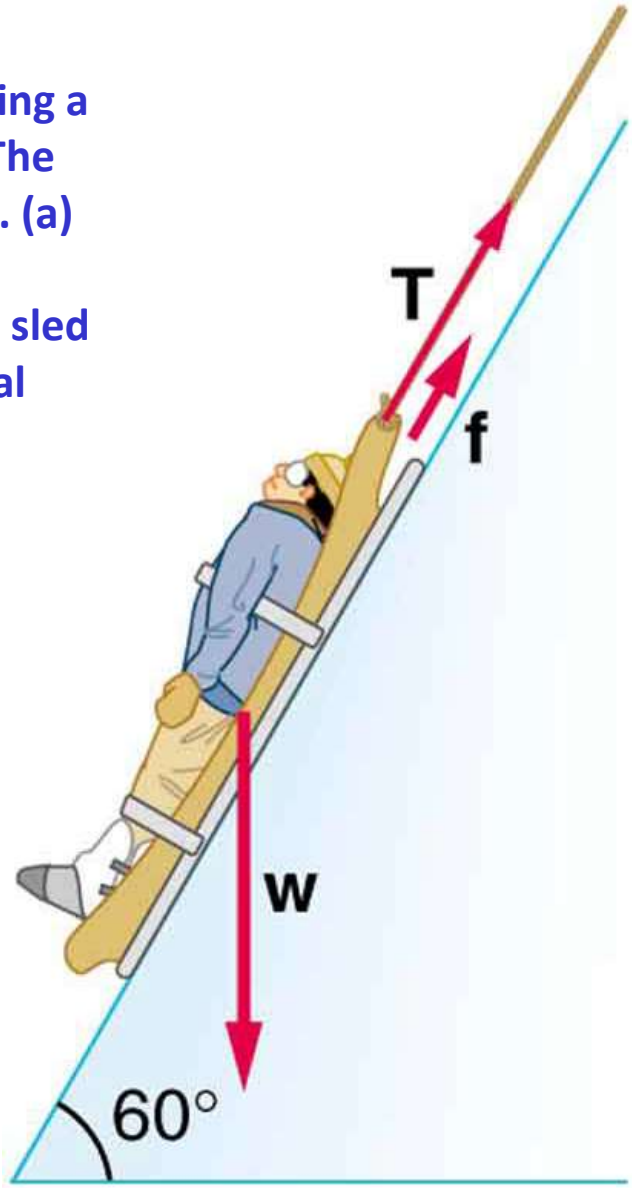
An arrow is shot at an angle of 75.0^o above the horizontal toward a cliff of 60.0-m height. It lands on the cliff 4.00 s later at the very edge of the cliff. Ignore air resistance. What is the (horizontal) distance the archer is from the base of the vertical cliff?

Chapter 3 Example Problems

60. (a) An airplane is flying in a jet stream that is blowing at 45.0 m/s in a direction 20^{o} south of east. Its direction of motion relative to the Earth is 45.0^{o} south of west, while its direction of travel relative to the air is 5.00^{o} south of west. What is the airplane's speed relative to the air mass? (b) What is the airplane's speed relative to the Earth?

Example Problems

8. Suppose the ski patrol lowers a rescue sled and victim, having a total mass of 90.0 kg, down a 60.0° slope at constant speed. The coefficient of friction between the sled and the snow is 0.100. (a) How much work is done by friction as the sled moves 30.0 m along the hill? (b) How much work is done by the rope on the sled in this distance? (c) What is the work done by the gravitational force on the sled? (d) What is the total work done?



Examples

61. A 75.0-kg cross-country skier is climbing a 3.0^{o} slope at a constant speed of 2.00 m/s and encounters air resistance of 25.0 N. Find his power output for work done against the gravitational force and air resistance. (b) What average force does he exert backward on the snow to accomplish this? (c) If he continues to exert this force and to experience the same air resistance when he reaches a level area, how long will it take him to reach a velocity of 10.0 m/s?

Example Problems

Two pucks collide on a frictionless air hockey table. One puck (2.00 kg) was originally at rest. If the incoming puck (1.00 kg) loses precisely one-half of its original speed after the elastic collision, in what direction (angle) is it traveling now? (Hint: Assume incoming velocity is something convenient, such as 1m/s. First calculate what the speed of the heavier puck is after the collision. Write momentum conservation equations with two unknown angles. Eliminate the second angle by using $\sin^2+\cos^2=1$.)

45. Two identical pucks collide on an air hockey table. One puck was originally at rest. (a) If the incoming puck has a speed of 6.00 m/s and scatters to an angle of 30.0°, what is the velocity (magnitude and direction) of the second puck? (Use result $\theta_1 - \theta_2 = 90^\circ$) (b) Confirm that the collision is elastic.