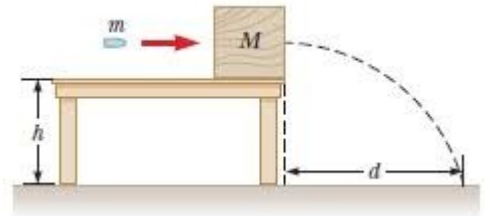


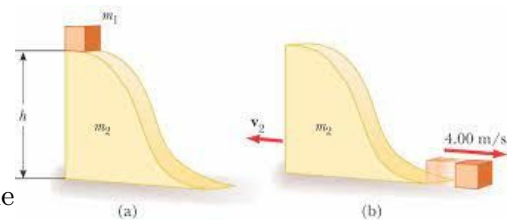
General Physics (Phys 1011) : worksheet 3

1. A speeding motorist traveling down a straight highway at 110 km/h passes a parked patrol car. It takes the police constable 1.0 s to take a radar reading and to start up his car. The police vehicle accelerates from rest at 2.1 m/s^2 . When the constable catches up with the speeder, how far down the road are they and how much time has elapsed since the two cars passed one another?
2. A 4000 kg truck is parked on a 15° slope. How big is the friction force on the truck?
3. A block of mass 0.500 kg slides on a flat smooth surface with a speed of 2.80 m/s. It then slides over a rough surface with μ_k and slows to a halt. While the block is slowing,
 - (a) What is the frictional force on the block?
 - (b) What is the magnitude of the block's acceleration?
 - (c) How far does the block slide on the rough part before it comes to a halt?
4. A block slides down a rough incline sloped at an angle of 40° from the horizontal. Starting from rest, it slides a distance of 0.800 m down the slope in 0.600 s. What is the coefficient of kinetic friction for the block and surface?

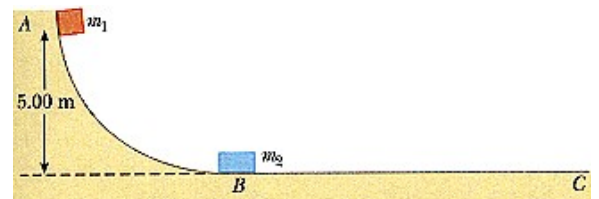
5. An 8.00g bullet is fired into a 2.50-kg block that is initially at rest at the edge of a frictionless table of height $h = 1.00 \text{ m}$ (as seen in Fig. below). The bullet remains in the block, and after impact the block lands $d = 2.00 \text{ m}$ from the bottom of the table. Determine the initial speed of the bullet



6. A small block of mass $m_1 = 0.500 \text{ kg}$ is released from rest at the top of a curve-shaped frictionless wedge of mass $m_2 = 3.00 \text{ kg}$, which sits on a frictionless horizontal surface, as shown in Figure below. When the block leaves the wedge, its velocity is measured to be 4.00 m/s to the right, as in Figure (b).

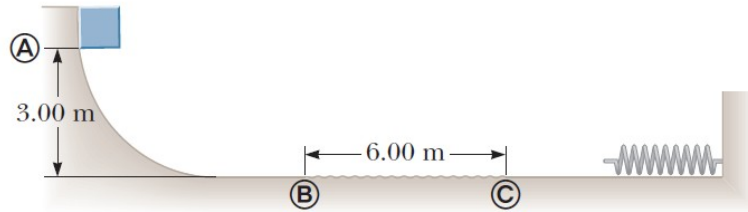


- (a) What is the velocity of the wedge after the block reaches the horizontal surface?
 - (b) What is the height h of the wedge?
7. Consider a frictionless track ABC as shown in Figure below. A block of mass $m_1 = 5.00 \text{ kg}$ is released from A. It makes a head-on elastic collision at B with a block of mass $m_2 = 10.0 \text{ kg}$ that is initially at rest. Calculate the maximum height to which m_1 rises after the collision

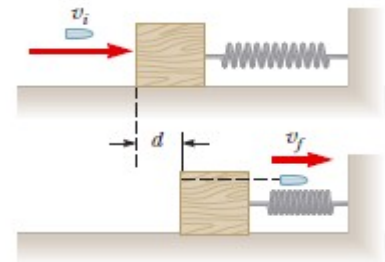


General Physics (Phys 1011) : worksheet 3

8. A 10.0-kg block is released from point **A** in Figure below. The track is frictionless except for the portion between **B** and **C**, which has a length of 6.00 m. The block travels down the track, hits a spring of force constant $k = 2250 \text{ N/m}$, and compresses the spring 0.300 m from its equilibrium position before coming to rest momentarily. Determine the coefficient of kinetic friction between the block and the rough surface between B and C.

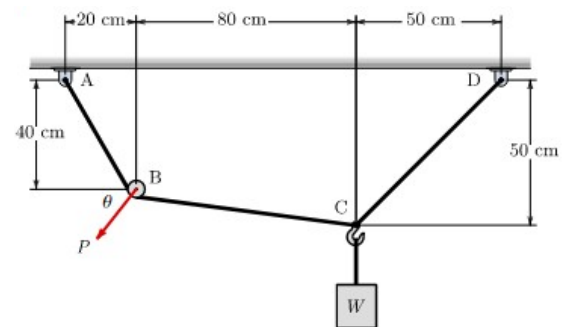


9. A 5.00-g bullet moving with an initial speed of $v_i = 400 \text{ m/s}$ is fired into and passes through a 1.00-kg block, as shown in Figure below. The block, initially at rest on a frictionless, horizontal surface, is connected to a spring of force constant 900 N/m . If the block moves $d = 5.00 \text{ cm}$ to the right after impact, Find
- the speed v_f at which the bullet emerges from the block and
 - the energy lost in the collision



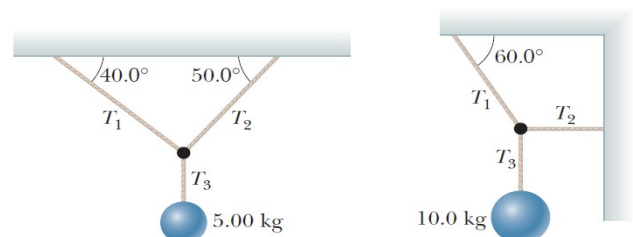
10. Two hanging weights

A 100 N weight W is supported by cable ABCD. There is a frictionless pulley at B and the hook is firmly attached to the cable at point C. What is the magnitude and direction of force P required to hold the system in the position shown?



11. Use Newton's law of universal gravitation to calculate the weight of a 70-kg person standing on the surface of the earth. Then repeat the calculation by using $W = mg$ and compare your two results.
12. Four objects are situated along the y axis as follows: a 2.00 kg object is at +3.00 m, a 3.00-kg object is at +2.50 m, a 2.50-kg object is at the origin, and a 4.00-kg object is at -0.5 m. Where is the center of mass of these objects?

13. The figure shows loads hanging from the ceiling of an elevator that is moving at constant velocity. Find the tension in each of the three strands of cord supporting each load.

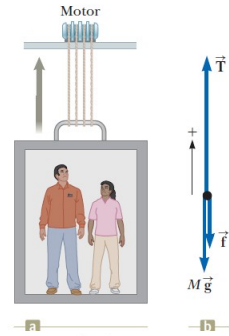


General Physics (Phys 1011) : worksheet 3

14. An elevator car has a mass of 1 600 kg and is carrying passengers having a combined mass of 200 kg. A constant friction force of 4000 N retards its motion.

(A) How much power must a motor deliver to lift the elevator car and its passengers at a constant speed of 3.00 m/s?

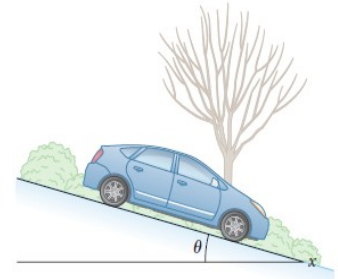
(B) What power must the motor deliver at the instant the speed of the elevator is v if the motor is designed to provide the elevator car with an upward acceleration of 1.00 m/s^2 ?



15. A car of mass m is on an icy driveway inclined at an angle θ as in Figure below.

(A) Find the acceleration of the car, assuming the driveway is frictionless.

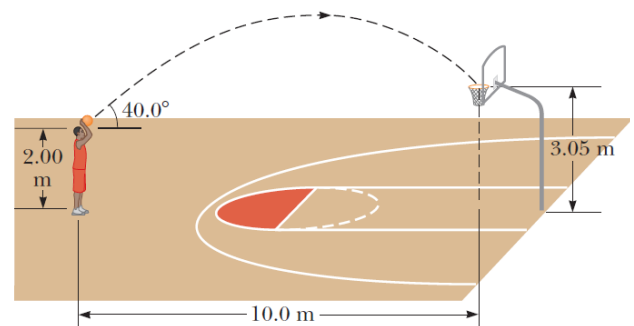
(B) Suppose the car is released from rest at the top of the incline and the distance from the car's front bumper to the bottom of the incline is d . How long does it take the front bumper to reach the bottom of the hill, and what is the car's speed as it arrives there?



16. A basketball player is standing on the floor 10.0 m from the basket as in Figure P4.60. The height of the basket is 3.05 m, and he shoots the ball at a 40.0° angle with the horizontal from a height of 2.00 m.

(a) What is the acceleration of the basketball at the highest point in its trajectory?

(b) At what speed must the player throw the basketball so that the ball goes through the hoop without striking the backboard?



17. The Benefits of Impulse A car traveling at 27 m/s collides with a building. The collision with the building causes the car to come to a stop in approximately 1 second. The driver, who weighs 860 N, is protected by a combination of a variable-tension seatbelt and an airbag (Figure). (In effect, the driver collides with the seatbelt and airbag and *not* with the building.) The airbag and seatbelt slow his velocity, such that he comes to a stop in approximately 2.5 s.

a. What average force does the driver experience during the collision?

b. Without the seatbelt and airbag, his collision time (with the steering wheel) would have been approximately 0.20 s. What force would he experience in this case?

