

27. A teapot is initially at rest on a horizontal tabletop, then one end of the table is lifted slightly. Does the normal force increase or decrease? Does the force of static friction increase or decrease?
28. Which is usually greater, the maximum force of static friction or the force of kinetic friction?
29. A 5.4 kg bag of groceries is in equilibrium on an incline of angle $\theta = 15^\circ$. Find the magnitude of the normal force on the bag.

Conceptual Questions

30. Imagine an astronaut in space at the midpoint between two stars of equal mass. If all other objects are infinitely far away, what is the weight of the astronaut? Explain your answer.
31. A ball is held in a person's hand.
- Identify all the external forces acting on the ball and the reaction force to each.
 - If the ball is dropped, what force is exerted on it while it is falling? Identify the reaction force in this case. (Disregard air resistance.)
32. Explain why pushing downward on a book as you push it across a table increases the force of friction between the table and the book.
33. Analyze the motion of a rock dropped in water in terms of its speed and acceleration. Assume that a resistive force acting on the rock increases as the speed increases.
34. A sky diver falls through the air. As the speed of the sky diver increases, what happens to the sky diver's acceleration? What is the acceleration when the sky diver reaches terminal speed?

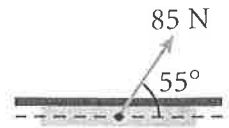
Practice Problems

For problems 35–37, see Sample Problem D.

35. A 95 kg clock initially at rest on a horizontal floor requires a 650 N horizontal force to set it in motion. After the clock is in motion, a horizontal force of 560 N keeps it moving with a constant velocity. Find μ_s and μ_k between the clock and the floor.

36. A box slides down a 30.0° ramp with an acceleration of 1.20 m/s^2 . Determine the coefficient of kinetic friction between the box and the ramp.

37. A 4.00 kg block is pushed along the ceiling with a constant applied force of 85.0 N that acts at an angle of 55.0° with the horizontal, as in the figure. The block accelerates to the right at 6.00 m/s^2 . Determine the coefficient of kinetic friction between the block and the ceiling.

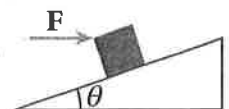


For problems 38–39, see Sample Problem E.

38. A clerk moves a box of cans down an aisle by pulling on a strap attached to the box. The clerk pulls with a force of 185.0 N at an angle of 25.0° with the horizontal. The box has a mass of 35.0 kg, and the coefficient of kinetic friction between box and floor is 0.450. Find the acceleration of the box.
39. A 925 N crate is being pulled across a level floor by a force \mathbf{F} of 325 N at an angle of 25° above the horizontal. The coefficient of kinetic friction between the crate and floor is 0.25. Find the magnitude of the acceleration of the crate.

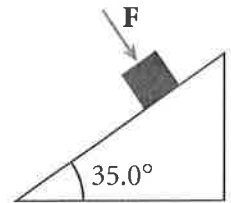
MIXED REVIEW

40. A block with a mass of 6.0 kg is held in equilibrium on an incline of angle $\theta = 30.0^\circ$ by a horizontal force, \mathbf{F} , as shown in the figure. Find the magnitudes of the normal force on the block and of \mathbf{F} . (Ignore friction.)

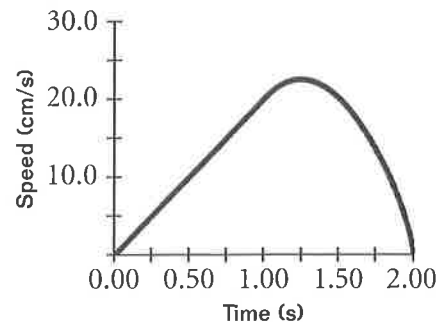


41. A 2.0 kg mass starts from rest and slides down an inclined plane $8.0 \times 10^{-1} \text{ m}$ long in 0.50 s. What net force is acting on the mass along the incline?
42. A 2.26 kg book is dropped from a height of 1.5 m.
- What is its acceleration?
 - What is its weight in newtons?

43. A 5.0 kg bucket of water is raised from a well by a rope. If the upward acceleration of the bucket is 3.0 m/s^2 , find the force exerted by the rope on the bucket of water.
44. A 3.46 kg briefcase is sitting at rest on a level floor.
- What is the briefcases's acceleration?
 - What is its weight in newtons?
45. A boat moves through the water with two forces acting on it. One is a $2.10 \times 10^3 \text{ N}$ forward push by the motor, and the other is a $1.80 \times 10^3 \text{ N}$ resistive force due to the water.
- What is the acceleration of the 1200 kg boat?
 - If it starts from rest, how far will it move in 12 s?
 - What will its speed be at the end of this time interval?
46. A girl on a sled coasts down a hill. Her speed is 7.0 m/s when she reaches level ground at the bottom. The coefficient of kinetic friction between the sled's runners and the hard, icy snow is 0.050, and the girl and sled together weigh 645 N. How far does the sled travel on the level ground before coming to rest?
47. A box of books weighing 319 N is shoved across the floor by a force of 485 N exerted downward at an angle of 35° below the horizontal.
- If μ_k between the box and the floor is 0.57, how long does it take to move the box 4.00 m, starting from rest?
 - If μ_k between the box and the floor is 0.75, how long does it take to move the box 4.00 m, starting from rest?
48. A 3.00 kg block starts from rest at the top of a 30.0° incline and accelerates uniformly down the incline, moving 2.00 m in 1.50 s.
- Find the magnitude of the acceleration of the block.
 - Find the coefficient of kinetic friction between the block and the incline.
 - Find the magnitude of the frictional force acting on the block.
 - Find the speed of the block after it has slid a distance of 2.00 m.
49. A hockey puck is hit on a frozen lake and starts moving with a speed of 12.0 m/s . Exactly 5.0 s later, its speed is 6.0 m/s . What is the puck's average acceleration? What is the coefficient of kinetic friction between the puck and the ice?
50. The parachute on a race car that weighs 8820 N opens at the end of a quarter-mile run when the car is traveling 35 m/s . What net retarding force must be supplied by the parachute to stop the car in a distance of 1100 m?
51. A 1250 kg car is pulling a 325 kg trailer. Together, the car and trailer have an acceleration of 2.15 m/s^2 directly forward.
- Determine the net force on the car.
 - Determine the net force on the trailer.
52. The coefficient of static friction between the 3.00 kg crate and the 35.0° incline shown here is 0.300. What is the magnitude of the minimum force, F , that must be applied to the crate perpendicularly to the incline to prevent the crate from sliding down the incline?



53. The graph below shows a plot of the speed of a person's body during a chin-up. All motion is vertical and the mass of the person (excluding the arms) is 64.0 kg. Find the magnitude of the net force exerted on the body at 0.50 s intervals.



54. A machine in an ice factory is capable of exerting $3.00 \times 10^2 \text{ N}$ of force to pull a large block of ice up a slope. The block weighs $1.22 \times 10^4 \text{ N}$. Assuming there is no friction, what is the maximum angle that the slope can make with the horizontal if the machine is to be able to complete the task?