Chapter 5   Newton's Second Law

Example Problems

5.2 Friction

E1. A monkey is planning on dragging a box full of books from his office to his monkey-mobile. The combined weight of the box and books is 134 N. If the coefficient of static friction between the pavement and the box is 0.55 N/N, calculate the force that the monkey needs to push on the box in order to "just" get the box of books moving.

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

$f_f =$

$N =$

$\mu =$

a) _____ ◀——— units

E2. A monkey pushes a 12 kg wooden crate across the floor at a constant velocity. If the coefficient of kinetic friction between the crate and the floor is 0.255 N/N, with what force must the monkey push on the crate in order to maintain a constant velocity?

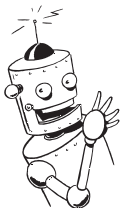*Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve*

$f_f =$

$N =$

$\mu =$

a) _____ ◀——— units

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E3. A monkey needs to move a 931 N sofa to a different location in the room. It takes a force of 120 N just to start the sofa sliding across the floor, calculate the coefficient of static friction between the sofa and the floor.

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

$f_f =$

$N =$

$\mu =$

a) _____ ⟵ units

E4. A baseball player of mass of 79 kg slides into second base. The retarding force against the players body and the ground is 470 N, calculate the coefficient of kinetic friction between the player and the ground and the acceleration of the player.

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve
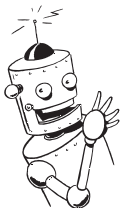
$f_f =$

$N =$

$\mu =$

a) _____ ⟵ units   b) _____ ⟵ units

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E5. In order to maintain a constant velocity, a monkey has to exert a 36 N horizontal force as he drags a sled across a sidewalk. If the coefficient of friction between the runners on the sled and the sidewalk is 0.69 N/N, calculate the mass of the sled.

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

$f_f =$

$N =$

$\mu =$

a) _____ ⟵ units

E6. What is the greatest acceleration that can be generated by a runner if the coefficient of static friction between the shoes and track is 0.95 N/N?

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve
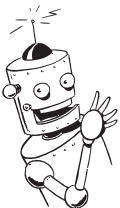
$a =$

$\mu =$

$g =$

a) _____ ⟵ units

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E7. A block is given a push so that it slides across the floor at an initial speed of 4.0 m/s. Given that the coefficient of kinetic friction is 0.20 N/N, how far will the crate slide before it comes to rest and what is the acceleration of the crate as it slows?

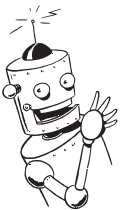*Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve*

a) _____ ⟵ units   b) _____ ⟵ units

E8. You are driving a 2500.0 kg car at a constant speed of 14.0 m/s along an icy road. As you approach the intersection the traffic light turns red so you slam on the brakes. Your wheels lock-up and the tires begin to skid on the icy road surface. The car slides to a halt over a distance of 25.0 m. Calculate the coefficient of kinetic friction between your tires and the icy road.

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

a) _____ ⟵ units

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Student Problems

5.2 Friction

1. A gorilla has just bought a new refrigerator. The delivery man has left and the gorilla has realized that the refrigerator is not quite in the right position so the gorilla has to move it. If the refrigerator has a mass of 180 kg and the coefficient of static friction between the bottom of the refrigerator and the floor is 0.21, calculate the minimum force the gorilla must push on the refrigerator in order to just start it moving.

   Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

   $f_f =$

   $N =$

   $\mu =$

   a) _____ ⟵ units

2. A monkey exerts a 21 N horizontal force as she pulls a 38 N sled at a constant speed across a cement sidewalk. Calculate the coefficient of kinetic friction between the sidewalk and the metal runners of the sled.

   Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve
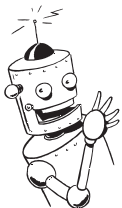
   $f_f =$

   $N =$

   $\mu =$

   a) _____ ⟵ units

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3. A gorilla slides a 0.60 kg mug of root beer from one end of a counter to a thirsty monkey at the other end. A 1.2 N force of friction between the mug and the counter brings the mug to a stop right in front of the monkey. Calculate the coefficient of sliding friction between the mug and the counter and the acceleration of the mug as it slows to a stop.

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

$f_f =$

$N =$

$\mu =$

a) _____ ⟵ units   b) _____ ⟵ units

4. A 50 kg block is at rest on a horizontal surface. The block is pulled horizontally by a string but will not move unless the tension in the string is at a minimum 350 N. Calculate the coefficient of static friction between the block and the surface.
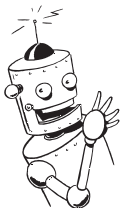
Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

$f_f =$

$N =$

$\mu =$

a) _____ ⟵ units

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5. The crate is pushed at a constant velocity by a force of 58 N. If the coefficient of kinetic friction between the crate and the floor is 0.28, calculate the mass of the crate.

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve

$f_f =$

$N =$

$\mu =$

a) _____ ⟵ units

6. At a wedding reception, a small 35 kg monkey runs part of the way across the dance floor, drops to his knees, and then slides to a stop. If the kinetic coefficient of kinetic friction between the monkey's pants and the floor is 0.15 N/N, calculate the frictional force acting the monkey as he slides across the floor and find his acceleration.

Record all givens, draw a picture, arrow all vectors, write the formula, substitute and solve
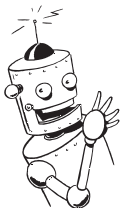
$f_f =$

$N =$

$\mu =$

a) _____ ⟵ units   b) _____ ⟵ units

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