

For each question, draw a free-body diagram and label all forces. Then use Newton's second law to answer the question. Use kinematics if necessary.

1. Ryan pushes a 10. kg box on a frictionless horizontal floor accelerating it horizontally at 8.5 m/s^2 . What force is he applying?
2. Ryan pushes a 10. kg box across a horizontal cement floor with a force of 85 N. There is a frictional force of 20. N opposing the motion. What is the acceleration of the box?
3. Ryan pushes a 10. kg box across a smoother horizontal floor with a force of 85 N. The box accelerates at 7.5 m/s^2 . What is the force of friction between the floor and the box?
4. A 3.0 kg ball is falling towards earth while experiencing air resistance of 6.0 N. What is the ball's acceleration?
5. A 40.0 kg box is being pushed along the ground with a force of 550 N.
 - a. Assuming there is no friction, determine the acceleration of the box.
 - b. Now assume there is a force of friction that equals 80.0 N. What is the acceleration of the box now?
6. A $2.4 \times 10^5 \text{ kg}$ rocket is accelerated upwards with a thrust of $5.0 \times 10^6 \text{ N}$. Determine the acceleration of the rocket. (Neglect air resistance)
7. As they are skating, Jason gives Ajay a push with a force of 120 N. As he is being pushed, Ajay accelerates at 1.5 m/s^2 . (Assume there is no friction)
 - a. What is Ajay's mass?
 - b. What is Ajay's weight?
 - c. Describe Ajay's motion once Jason stops pushing him.
8. A pair of pants with a mass of 0.80 kg fall off a clothesline. If there is a constant air resistance of 4.0 N, determine the acceleration of the pants.
9. The "Hellevator" ride at Playland exerts an upwards force on a 50. kg rider causing her to accelerate upwards at 15 m/s^2 . What force is the ride exerting on the rider?
10. Two friends are pulling a 75 kg sled across a frozen pond on a windy day. Amy pulls with 175 N and Naomi pulls with 125 N in the same direction. There is a frictional force of 140. N and the wind pushes back on the sled with a force of 120. N. What is the sled's acceleration?
11. As Angus pushes a 450 kg crate across a floor with a force of 1500. N, Scott hinders his progress by pushing in the opposite direction with a force of 300. N. If the box accelerates at 0.30 m/s^2 , determine the force of friction on the crate.

12. Jackie finds his twin brother Jackson (55 kg) lying on the ice after a fall. Jackie, who is a much better skater, pushes him to his bench which is 40. m away with a force of 500. N. How long does this take? (Assume there is no friction)
13. Calvin is driving his 2300 kg car at 20. m/s. As he approaches a red light, he steps on the brakes and his car comes to rest after 50. m. Determine the force of friction as the car breaks.
14. Heather pushes a book across the table with a force of 15 N from rest for a total of 5.0 s. Once she stops pushing, the box stops after 3.0s. What is the force of friction on the book? (This problem is challenging!)