

## newton's laws of motion - practice problems

1. An 8 kg crate of lab supplies is pushed right with a 30 N force. Friction pushes left with a 6 N force, and the crate's label says fragile. What is the crate's acceleration?

2. A 4 kg cart starts from rest on a level track. A net force of 10 N pushes it to the right for 0.050 min while a student records video from the side. What is its acceleration, and how far does it move?

3. What is the weight of a 65 000 g person near Earth's surface?

4. Two students pull a 15 kg cart. One pulls left with 40 N and the other pulls right with 40 N. What is the cart's acceleration?

5. A net force of 72 N makes a cart accelerate at  $3 \text{ m/s}^2$ . What is the mass of the cart?

6. A 12 kg crate is pushed with a 40 N force across a rough floor. What is its acceleration?

7. A 12 kg sled accelerates right at  $2 \text{ m/s}^2$ . Friction pushes left with 5 N. What applied force to the right is needed?

8. A 60 kg canoe drifts near a dock. The water current pushes it right with 0.140 kN, and wind pushes it left with 0.200 kN. The canoe is 4.5 m long, but model it as one object. What is the canoe's acceleration?

9. A 3 kg drone has a 30 N force to the right. It accelerates left at  $4 \text{ m/s}^2$ . What leftward force must also be acting on it?

10. A 500 g ball accelerates to the right at  $30 \text{ m/s}^2$  while a student throws it. What force does the student apply to the ball?

11. In the previous example, what force does the ball apply to the student's hand?

12. Two ice skaters push off each other. Skater A has a mass of 60 kg, skater B has a mass of 45 kg, and each feels a 90 N force during the push. What is each skater's acceleration?

13. A 75 kg person pushes a 5 kg box. The box accelerates right at  $6 \text{ m/s}^2$ . If the only horizontal force on the box is the push, what acceleration does the person feel from the box's push back?

14. A 12 kg backpack is dropped near Earth's surface. What is its weight, and what acceleration would it have if gravity were the only force on it?

15. A 900 kg car has a 3.2 kN engine force forward and 0.80 kN of resistive forces backward. What is the car's acceleration?

16. A 10 000 g cart accelerates at  $2 \text{ m/s}^2$  when a certain net force acts on it. If the same net force acts on a 25 000 g cart, what is the new acceleration?