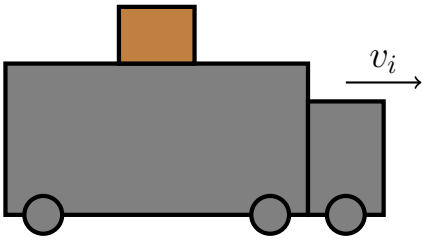
Lecture 11: Laws of Motion

Warm-Up Activity

The truck is initially at speed v_i, moving to the right. Suddenly, it slams on its brakes, causing the crate on top of the truck to begin to slide. Which direction is the force of friction **on the truck** by the crate?



L11-1: Book on the Wall – Hold Still

- You push a book against a vertical wall so the book does not move.
  - Sketch a picture of the book and the wall.
  - Identify and describe each force acting on the book.
  - Draw and label a free-body diagram for the book.
- What do you know about the magnitudes of the forces acting on the book?
- What happens to each force if you push harder?

L11-2: Book on the Wall – Slide Down

- You push a different book horizontally against a vertical wall so that the book slides downward at constant speed.
- You know the coefficients of friction are μ_{bw} (between the book and the wall) and *zero* (between the book and your hand). You also know the mass m of the book.
  - Draw a free-body diagram for this situation.
  - Determine the magnitude of the force that your hand must exert on the book.
  - Make sense of your answer in at least three different ways.

Main Ideas

- There are many different *kinds* of forces that we can analyze differently.
- Objects can only change their motion when acted upon by an external force.
- The net force on an object is equal to its mass times its acceleration.
- Forces are vectors.
- When more than one force acts on an object, we can add all the forces together.
- We can model forces quantitatively.
- When an object is at rest or moving at constant speed, the forces balance and the object is in equilibrium.