

Drawing Free-Body Diagrams

Lesson Notes

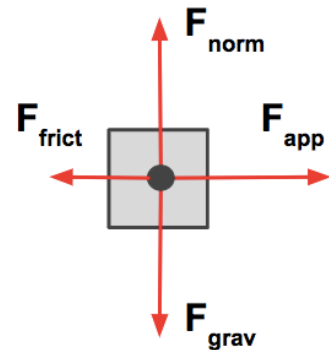
Goal

- To draw a free-body diagram that shows the types of individual forces that act upon an object, their direction, and their relative strength.

What is a Free-Body Diagram?

A special type of force diagram that **represents all the forces acting upon an object**. Arrows represent the forces. The **force arrows ...**

- ... are labeled according to type,
- ... are pointing in the direction of the force,
- ... and have a length that is in proportion to their relative strength (longer arrows are stronger forces).



Types of Forces

Our video on the topic of Recognizing Force Types is our most thorough source of information on the topic of identifying the types of forces that act upon objects. A brief summary of those force types is presented here. While useful, this summary lacks the thoroughness that is required to adequately identify force types. We recommend our video.

F_{grav}	Always present.
F_{tens}	Force from string, rope, wire, cable, etc.
F_{spring}	Force from compressed/stretched spring
F_{frict}	Two surfaces sliding across each other
F_{air}	Object moves through surrounding air
F_{norm}	Results from two surfaces pressing against each other
F_{app}	A person pushing/pulling on an object

Method for Drawing Free-Body Diagrams

The task of drawing a free-body diagram involves ...

- Identifying the types of forces acting on the object,
- Determining the direction of those forces,
- Deciding upon the relative size of opposing forces,
- Drawing a force diagram with arrows having a labeled force type and the proper size relative to any opposing force.

Examples:

1. A book is at rest on a table.

Forces Present:



2. A book is attached to a string and hanging from the ceiling.

Forces Present:



3. A person pushes a crate to the right across the floor at a constant speed.

Forces Present:



4. A skydiver is falling downward and speeding up.

Forces Present:



5. A rightward-moving car has locked wheels and is skidding to a stop.

Forces Present:



6. A freight elevator is attached by a cable, being pulled upward, and slowing down. It is not touching the sides of the elevator shaft.

Forces Present:

