

## Types of Forces

### Lesson Notes

#### Goals

- The main goal is to account for all the interactions and to represent them in a **free-body diagram**.
- Always think *Interactions*. Ask *How is the object interacting with the surroundings?*

#### What is a Force?

A **force** is a push or pull that acts upon an object as a result of its interaction with other objects.

#### Two Broad Categories of Forces:

- Contact Forces:** Normal Force, Tension Force, Friction Force, Spring Force, Air Resistance Force, Applied Force
- Field Forces:** Gravity, electrical, magnetic

| Force Type and Symbol                  | Description, Note   | Example(s)  |
|--|---|---|
| Gravity Force<br>( $F_{\text{grav}}$ ) | The <i>non-contact</i> force acting between <u>any</u> two objects with mass; most significant when one or both objects are very massive.<br>Always acts downwards on objects.              | 1. The Earth pulls downward upon any object that is near it.  |
| Normal Force<br>( $F_{\text{norm}}$ )  | The force resulting when an object presses against another object.<br>This force is often observed to be a support force from a stable surface upon which or against which an object rests. | 1. A person stands on the floor. The floor pushes up on the person with an $F_{\text{norm}}$ .<br>2. Book at rest on a table. The table pushes up on the book with an $F_{\text{norm}}$ . |
| Tension Force<br>( $F_{\text{tens}}$ ) | The force transmitted through a string, rope, cable, or wire that is pulled tight.<br>The rope pulls with a tension force on both objects.  | 1. A box hangs from the ceiling by a cable. The cable exerts an upward tension force on the box.<br>2. A dog is pulled by a dog chain. The chain exerts a force upon the dog.             |

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|--|---|---|
| Spring Force<br>( $F_{\text{spring}}$ )      | The force exerted upon an object by a stretched or compressed spring.   | 1. A mass is suspended from the ceiling by a spring. The spring exerts an upward pull upon the mass.  |
| Friction Force<br>( $F_{\text{frict}}$ )     | The force between two surfaces that are sliding (or attempting to slide) across each other.<br>Friction opposes the motion of the sliding object.   | 1. A truck skids to a stop along a road. Friction exerts a backward force upon the truck.<br>2. A baseball player slides across the infield dirt. There is a backward friction force on the player. |
| Air Resistance Force<br>( $F_{\text{air}}$ ) | A force acting upon an object that is moving through air.<br>Air resistance is greatest for high speed objects that have poor aerodynamics.   | 1. A skydiver is falling. Air resistance acts upward on the skydiver.<br>2. A truck is moving at high speed. Air resistance acts backward on the truck.   |
| Applied Force<br>( $F_{\text{app}}$ )        | The force exerted upon an object by a person (usually) or thing.<br>This force is usually a “catch-all” type of force to account for any force not covered by the other types. If you’ve already counted the crate-worker interaction by another type (such as normal force), don’t count it again. | 1. A worker pushes a crate up a hill. There is an applied force on the crate (by the person).   |