

Unit 2 - Forces

Unit 2A - Introduction to Forces

(A) Definition of Force

(B) Types of Forces

For simplicity sake, all forces (interactions) between objects can be placed into two broad categories:

(i)

frictional force

tension force

normal force

air resistance force

applied force

spring force

(ii)

gravitational forces

electrical forces,

magnetic forces

(C) Measuring Forces

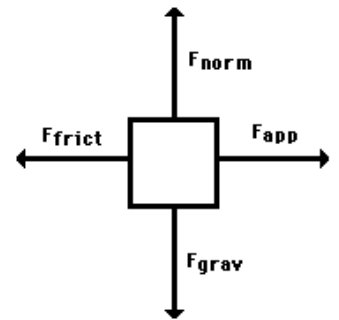
(D) Forces are Vector Quantities

(E) Representing Forces

(F) - Free Body Diagrams

Free-body diagrams are diagrams used to show the relative magnitude and direction of all forces acting upon an object in a given situation. A free-body diagram is a special example of the vector diagrams

The size of the arrow in a free-body diagram is reflects the magnitude of the force. The direction of the arrow shows the direction in which the force is acting. Each force arrow in the diagram is labeled to indicate the exact type of force.



Practice

Apply the method described in the paragraph above to construct free-body diagrams for the various situations described below. Answers are shown and explained at the bottom of this page.

- (i) A book is at rest on a table top.
Diagram the forces acting on the book.

- (ii) A weight is suspended motionless from the ceiling by two ropes.

- (iii) An egg is free-falling from a nest in a tree. Neglect air resistance.
Diagram the forces acting on the egg as it is falling.

- (iv) A flying squirrel is gliding (no *wing flaps*) from a tree to the ground at constant velocity.
Consider air resistance. Diagram the forces acting on the squirrel.

- (v) A rightward force is applied to a book in order to move it across a desk with a rightward acceleration. Consider frictional forces. Neglect air resistance. Diagram the forces acting on the book.
- (vi) A rightward force is applied to a book in order to move it across a desk at constant velocity. Consider frictional forces. Neglect air resistance. Diagram the forces acting on the book.
- (vii) A college student rests a backpack upon his shoulder. The pack is suspended motionless by one strap from one shoulder. Diagram the vertical forces acting on the backpack.
- (viii) A skydiver is descending with a constant velocity. Consider air resistance. Diagram the forces acting upon the skydiver.
- (ix) A force is applied to the right to drag a sled across loosely-packed snow with a rightward acceleration. Diagram the forces acting upon the sled.
- (x) A football is moving upwards towards its peak after having been *booted* by the punter. Diagram the forces acting upon the football as it rises upward towards its peak.
- (xi) A car is coasting to the right and slowing down. Diagram the forces acting upon the car.