

Lesson 2: Force and Its Representation

What is Force? A force is a push or pull upon an object resulting from the object's *interaction* with another object. Forces *only* exist as a result of an interaction. Forces are measured in units called Newton's because of Isaac Newton. One Newton is the amount of force required to give a 1 kg mass an acceleration of 1 m/s^2 . Thus we can say:

$$1\text{Newton} = 1\text{kg} \cdot \text{m/s}^2.$$

Another thing to note is that force is a vector quantity. It has BOTH magnitude and a direction. We can use diagrams with vectors to describe the forces acting on an object.

Types of Forces - There are several type of forces. The first thing to note is that forces fall into two broad types of categories: contact forces and action-at-a-distance forces.

Contact forces are those types of forces that result when two interacting objects are perceived to be physically contacting or touching each other.

Action-at-a-distance forces are those types of forces that result when the two interacting objects are not in physical contact with each other, yet are able to exert a push or pull despite their physical separation.

Two important examples of Action-at-a-distance forces are electricity and magnetism. Now we look at a table with other types of frequently encountered forces and their descriptions.

Type of Force	Description of Force	Category of Force
Applied Force	a force that is applied to an object by another person or another object	Contact
Gravity Force	force with which the earth, moon, or other massively large object attracts another object towards itself	Action-at-a-distance
Normal Force	support force exerted upon an object that is in contact with another stable object	Contact
Friction Force	force exerted by a surface as an object moves across it or makes an effort to move across it	Contact
Air Resistance Force	frictional force that acts upon objects as they travel through the air	Contact
Tension Force	force transmitted through a string, rope, cable or wire when it is pulled tight by forces acting from opposite ends	Contact
Spring Force	force exerted by a compressed or stretched spring upon any object that is attached to it	Contact

Free Body Diagrams

A Free-Body Diagram is a diagram used to show the relative magnitude and direction of all forces acting upon an object in a given situation. In the diagrams, the size of the arrow reflects the magnitude of the force

ex.1 A math book on a table is pushed to the left and comes to a stop.

ex.2 an egg is free-falling from a nest in a tree, neglect air resistance

ex.3 a girl is suspending motionless from the ceiling by two ropes

ex.4 a car is coasting to the right and slowing down, neglect air resistance