

## Information on Different Types of Forces

- **Forces that act on all objects.**
  - Weight:  
The force of gravity acting on an object due to its mass. An object's weight is directed downward, toward the center of the gravitating body; like the earth or moon, for example.
- **Forces associated with solids.**
  - Normal:  
The force between two solids in contact that prevents them from occupying the same space. The normal force is directed perpendicular to the surface. A "normal" in mathematics is a line perpendicular to a curve or surface; thus the name "normal force".
  - Friction:  
The force between solids in contact that resists their sliding across one another. Friction is always parallel to the surfaces in contact and in a direction that opposes the relative motion between the surfaces.
  - Tension:  
The force exerted by an object being pulled upon from opposite ends, like a string, rope, cable, chain, etc. Tension is directed along the axis of the object.
  - Elastic:  
The force exerted by an object under deformation (typically tension or compression) that will return it to its original shape when released, like a spring or elastic band. Elastic forces, like tension, are typically directed along an axis (although there are exceptions to this rule).
- **Forces associated with fluids.** Fluids include liquids and gases.
  - Buoyant:  
The force exerted on an object immersed in a fluid. Buoyancy is usually directed upward (although there are exceptions to this rule).
  - Drag:  
The force that resists the motion of an object through a fluid. Drag is directed opposite the direction of motion of the object relative to the fluid.
  - Lift:  
The force that a moving fluid exerts as it flows around an object; typically a wing or wing-like structure, but also golf balls and baseballs. Lift is generally directed perpendicular to the direction of fluid flow (although there are exceptions to this rule).
  - Thrust:  
The force that a fluid exerts when expelled by a propeller, turbine, rocket, squid, clam, etc. Thrust is directed opposite the direction the fluid is expelled.
- **Forces associated with charges.**
  - Electric:  
The attraction or repulsion between charged bodies. Experienced in everyday life through static cling and in school as the explanation behind much of elementary chemistry.
  - Magnetic  
The attraction or repulsion between magnetic bodies. Experienced in everyday life through magnets and in school as the explanation behind why a compass needle points north. (Actually, magnetism is the attraction or repulsion between charged bodies in motion, but this description is good enough for now.)

- **Fundamental forces.** All the forces in the universe can be explained in terms of the following four fundamental interactions.
  - Gravity:  
The interaction between objects due to their mass. Weight is the name for the force of gravity.
  - Electromagnetism:  
The interaction between objects due to their charge. All the forces discussed above except weight are electromagnetic in origin.
  - Strong Nuclear Force:  
An interaction between subatomic particles. This is the force that holds protons and neutrons together in the nucleus and holds quarks together in the protons and neutrons. It cannot be felt outside of the nucleus.
  - Weak Nuclear Force:  
An interaction between subatomic particles. This force, which is many times weaker than the strong nuclear interaction, is involved in certain forms of radioactive decay.
- **Fictitious forces.** These are apparent forces that objects experience in an accelerating coordinate system like an accelerating car, airplane, spaceship, elevator, or amusement park ride. Fictitious forces are not authentic forces in the sense that they do not arise from an external object, but rather as a consequence of trying to keep up with a changing environment.
  - Centrifugal:  
The force experienced by all objects in a rotating coordinate system that seems to pull them away from the center of rotation.
  - "G Force":  
Not really a force (or even a fictitious force) but rather an apparent gravity-like acceleration experienced by objects in an accelerating coordinate system.

#### A Summary of Some Common Forces

Name/symbol(s)	When/where	Direction
weight <b>W, <math>F_g</math></b>	due to gravity	down
normal <b>N, <math>F_n</math></b>	surfaces in contact	normal to surface
friction <b>f, <math>F_f</math></b>	surfaces in contact	parallel to surface
tension <b>T, <math>F_T</math></b>	strings, ropes, cables, etc	along the axis
elasticity <b>F<sub>s</sub></b>	springs, elastic bands, etc.	along the axis
buoyancy <b>B, <math>F_B</math></b>	immersed in a fluid	up
drag <b>D, <math>F_D</math></b>	moving through a fluid	opposite of velocity of object
lift <b>L, <math>F_L</math></b>	moving through a fluid	perpendicular to flow
thrust <b>T, <math>F_T</math></b>	pushing a fluid	opposite of velocity of fluid