Momentum Encyclopedia Article

Momentum

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Momentum

Momentum is a measure of an object’s potential impact in a collision. There are two types of momentum, linear momentum, for particles or objects which do not rotate, and angular momentum, for objects which do rotate. In general an object has both types of momentum at the same time.

Linear momentum, usually just called "momentum," is an object’s mass multiplied by its velocity. Like velocity, momentum has both magnitude and its direction--it is described mathematically as a vector. Newton’s second law, one of the most fundamental laws in all of physics, states that the total force on an object equals the rate of change of its momentum over time.

Newton's second law is true for a particle, an object, or a group of objects. Therefore, if there is no net force on an group of objects, their momentum does not change. This is referred to as the law of *conservation of momentum*.

When objects collide they can impart their momentum to each other. A swinging golf club hits a stationary ball, giving some of its momentum to the ball, which is sent flying. A struck cue ball rolls across a billiard table with a certain momentum; when it strikes the eight ball, its momentum may be partially or totally transferred to the eight ball, which then rolls with some momentum, and a little left for the cue ball to gently roll away. (Since the table is not perfectly smooth, a small amount of momentum is lost to the felt and table.)

Rotating objects have angular momentum. A ball on a string swung parallel to the ground above a boy’s head has an angular momentum equal to the ball’s mass multiplied by its velocity multiplied by the length of the string. (In general this depends on the details of the shape of the ball.) Angular momentum is also a vector, but its direction is complicated; in this case it points up into the sky above the boy’s head.

Asimilar law to Newton's second law applied to angular momentum, with *torque* taking the place of force. Angular momentum is conserved if there is no net torque on an object or set of objects. Thus, in order to spin faster, an ice skater pulls her arms in towards her body; since angular momentum is conserved, her spin increases because the shape of her mass (her body--in an oversimplified sense, the length of her "rope") has gotten slimmer.