Motion Encyclopedia Article

Motion

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Motion

The process by which something moves from one position to another is referred to as motion; that is, a changing position involving time, velocity and acceleration. Motions can be classified as linear or translational (motion along a straight line), rotational (motion about some axis), or curvilinear (a combination of linear and rotational). A detailed description of all aspects of motion is called kinematics and is a fundamental part of **Mechanics**.

The kinematical description of motion really began with Galileo. From observations Galileo introduced two concepts: velocity as the time rate of change of position and acceleration as the time rate of change of velocity. With velocity, acceleration, time and **distance** traveled (change of position) the complete kinematical description of motion was possible. Four algebraic **equations** resulted, each involving three variables and an initial position or velocity.

The position of an object must be given, or implied, relative to a frame of reference and its motion is then described relative to this frame. Within this frame, position, change of position, velocity, and acceleration require a magnitude (how much) and a direction, both being equally important for a complete description. Physical concepts having this nature are called vectors in contrast to scalar concepts which require only a magnitude for their description (for example, time and mass). Saying the mall is a 5 mi (8 km) drive may be true but doesn't guarantee one will find the mall. However, specifying 5 mi (8 km) north would give the mall's precise location. Magnitude and direction are equally important.

In circular motion velocity is always parallel to the direction of motion and perpendicular to the radius of motion. The acceleration required to change the velocity's direction, called centripetal acceleration, is always perpendicular to the velocity and toward the center of motion. To change the velocity's magnitude an acceleration is required in the direction of the velocity. Hence, acceleration is required to change both magnitude and direction of velocity and are in different directions. This is applicable to curvilinear motion in general.