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## Glossary of Motion

**acceleration:** the rate at which an object's velocity changes over a period of time

**acceleration due to gravity:**

acceleration of an object as a result of gravity

**average acceleration:** the change in velocity divided by the time over which it changes

**average speed:** distance traveled divided by time during which motion occurs

**average velocity:** displacement divided by time over which displacement occurs

**carrier particle:** a fundamental particle of nature that is surrounded by a characteristic force field; photons are carrier particles of the electromagnetic force

**deceleration:** acceleration in the direction opposite to velocity; acceleration that results in a decrease in velocity

**dependent variable:** the variable that is being measured; usually plotted along the y-axis

**displacement:** the change in position of an object

**distance:** the magnitude of displacement between two positions

**distance traveled:** the total length of the path traveled between two positions

**dynamics:** the study of how forces affect the motion of objects and systems

**elapsed time:** the difference between the ending time and beginning time

**external force:** a force acting on an object or system that originates outside of the object or system

**force:** a push or pull on an object with a specific magnitude and direction; can be represented by vectors; can be expressed as a multiple of a standard force

**force field:** a region in which a test particle will experience a force

**free-body diagram:** a sketch showing all of the external forces acting on an object or system; the system is represented by a dot, and the forces are represented by vectors extending outward from the dot

**free-fall:** the state of movement that results from gravitational force only

**friction:** a force past each other of objects that are touching; examples include rough surfaces and air resistance

**independent variable:** the variable that the dependent variable is measured with respect to; usually plotted along the x-axis

**inertia:** the tendency of an object to remain at rest or remain in motion

**inertial frame of reference:** a coordinate system that is not accelerating; all forces acting in an inertial frame of reference are real forces, as opposed to fictitious forces that are observed due to an accelerating frame of reference

**instantaneous acceleration:** acceleration at a specific point in time

**instantaneous speed:** magnitude of the instantaneous velocity

**instantaneous velocity:** velocity at a specific instant, or the average velocity over an infinitesimal time interval

**kinematics:** the study of motion without considering its causes

**law of inertia:** see Newton's first law of motion

**mass:** the quantity of matter in a substance; measured in kilograms

**model:** simplified description that contains only those elements necessary to describe the physics of a physical situation

**net external force:** the vector sum of all external forces acting on an object or system; causes a mass to accelerate

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**Newton's first law of motion:** a body at rest remains at rest, or, if in motion, remains in motion at a constant velocity unless acted on by a net external force; also known as the law of inertia

**Newton's second law of motion:** the net external force on an object with mass proportional to and in the same direction as the acceleration of the object, and inversely proportional to the mass

**Newton's third law of motion:** whenever one body exerts a force on a second body, the first body experiences a force that is equal in magnitude and opposite in direction to the force that the first body exerts

**normal force:** the force that a surface applies to an object to support the weight of the object; acts perpendicular to the surface on which the object rests

**position:** the location of an object at a particular time

**scalar:** a quantity that is described by magnitude, but not direction

**slope:** the difference in y-value (the rise) divided by the difference in x-value

(the run) of two points on a straight line

**system:** defined by the boundaries of an object or collection of objects being observed; all forces originating from outside of the system are considered external forces

**tension:** the pulling force that acts along a medium, especially a stretched flexible connector, such as a rope or cable; when a rope supports the weight of an object, the force on the object due to the rope is called a tension force

**thrust:** a reaction force that pushes a body forward in response to a backward force; rockets, airplanes, and cars are pushed forward by a thrust reaction force

**time:** change, or the interval over which change occurs

**vector:** a quantity that is described by both magnitude and direction

**weight:** the force  $w$  mathematically as:  $w = mg$  where  $g$  is the magnitude and direction of the acceleration due to gravity

**y-intercept:** the y-value when  $x = 0$ , or when the graph crosses the y-axis