

## 4.8: End of Chapter Key Terms

### Definition: Forces

- **Force:** A vector quantity that causes an object to accelerate, change its velocity, or deform; measured in newtons (N).
- **Vector:** A quantity that has both magnitude and direction.
- **Magnitude:** The size or amount of a quantity, often referred to as the "strength" of a force.
- **Direction:** The line or course along which something is moving or pointing.
- **Contact Force:** A force that acts at the point of contact between two objects, such as friction, tension, and normal force.
- **Non-contact Force:** A force that acts over a distance without physical contact, such as gravitational, electromagnetic, and nuclear forces.
- **Gravity:** The force of attraction between two masses, typically noticeable between Earth and objects on it; measured in newtons (N).
- **Weight:** The force of gravity acting on an object's mass, calculated as  $\text{weight} = \text{mass} \times \text{gravitational acceleration}$  ( $W = mg$ ).
- **Normal Force:** The support force exerted upon an object in contact with another stable object, acting perpendicular to the surface.
- **Friction:** The force that opposes the relative motion or tendency of such motion of two surfaces in contact.
- **Tension:** The pulling force transmitted along a string, rope, cable, or similar object.
- **Spring Force:** The restoring force exerted by a spring, proportional to the displacement of the spring from its equilibrium position (Hooke's Law).
- **Air Resistance:** The force that opposes the motion of an object through air, a type of frictional force.
- **Applied Force:** A force that is applied to an object by a person or another object.
- **Net Force:** The overall force acting on an object when all the individual forces acting on the object are combined.
- **Balanced Forces:** Forces that are equal in magnitude and opposite in direction, resulting in no change in an object's motion.
- **Unbalanced Forces:** Forces that are not equal and opposite, causing a change in an object's motion.
- **Newton's First Law of Motion (Law of Inertia):** A principle stating that an object at rest will stay at rest, and an object in motion will stay in motion at constant velocity unless acted upon by a net external force.
- **Inertia:** The tendency of an object to resist changes in its state of motion.
- **Newton's Second Law of Motion:** A principle stating that the acceleration of an object is directly proportional to the net force acting on it and inversely proportional to its mass ( $F = ma$ ).
- **Newton's Third Law of Motion:** A principle stating that for every action, there is an equal and opposite reaction.
- **Centripetal Force:** A force that acts on an object moving in a circular path, directed toward the center of the circle.
- **Centrifugal Force:** An apparent force that acts outward on a body moving around a center, arising from the body's inertia.
- **Momentum:** The quantity of motion of a moving body, calculated as the product of its mass and velocity ( $p = mv$ ).
- **Impulse:** The change in momentum resulting from a force applied over a period of time, calculated as  $\text{impulse} = \text{force} \times \text{time}$  ( $J = Ft$ ).
- **Torque:** A measure of the force that can cause an object to rotate about an axis, calculated as  $\text{torque} = \text{force} \times \text{lever arm distance}$  ( $\tau = rF \sin\theta$ ).
- **Equilibrium:** The state in which the net force on an object is zero, resulting in no acceleration.
- **Static Equilibrium:** The condition where an object is at rest and the net force acting on it is zero.
- **Dynamic Equilibrium:** The condition where an object is moving at constant velocity and the net force acting on it is zero.
- **Free-body Diagram:** A graphical representation used to visualize the forces acting on an object.
- **Elastic Force:** The force exerted by an elastic material when it is stretched or compressed.
- **Gravitational Force:** The attractive force that acts between any two masses.
- **Electromagnetic Force:** The force associated with electric and magnetic fields, responsible for electric and magnetic interactions.
- **Nuclear Force:** The strong attractive force that binds protons and neutrons together in the nucleus of an atom.

- **Action-at-a-Distance Force:** Forces that can act on an object without physical contact, such as gravitational, electromagnetic, and nuclear forces.

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