

## Zero Total Force (ZTF) Skill Objectives

What you should know and be able to do by the end of the unit.

1. Be able to describe the fundamental nature of matter and its interactions.
  - Know the four fundamental forces in the universe and what they do.
  - Be able to identify the parts of an atom that are fundamental and the parts of an atom that are composed of other particles.
  - Know the particles that make up the non-fundamental particles in an atom.
2. Be able to explain the properties of gravity and be able to calculate the force of gravity upon an object.
  - Recognize gravity as a fundamental mutually attractive interaction between all particles of mass.
  - Use Earth's gravitational field strength in order to determine the force of gravity acting upon an object.
3. State, explain, give examples of, and be able to apply Newton's 1<sup>st</sup> Law.
  - Based upon the total force on an object, determine whether the object's velocity is constant or changing.
  - Based upon an object's velocity (either changing or constant), determine whether or not the total force on the object is zero (whether or not all the forces balance/cancel each other out).
  - Explain Newton's 1<sup>st</sup> Law using the statement: "If  $\Delta v = 0$ , then  $\Sigma F = 0$ ".
4. Given a physical situation or a description of the forces acting on an object, be able to:
  - Draw a force diagram for the object
  - Label the forces on the object with proper notation
  - Represent the forces in a vector addition diagram
  - Use a vector addition diagram in order to solve for the unknown forces acting upon an object
  - State whether the system's velocity is changing or the system's velocity is constant
5. State, explain, and give examples of Newton's 3<sup>rd</sup> Law.
  - When two object's are interacting with each other, be able to apply Newton's 3<sup>rd</sup> Law in order to compare the force of the two object's on each other.
  - Given a particular force, be able to identify its 3<sup>rd</sup> Law counterpart.
  - Explain Newton's 3<sup>rd</sup> Law using the statement: " $\mathbf{F}_{AB} = -\mathbf{F}_{BA}$ ".
6. Be able to identify when friction is a relevant force acting upon a system
  - Be able to explain what causes friction to occur
  - Know how to calculate the force due to friction acting upon an object
  - Know what variables determine the force due to friction upon an object

### • Additional Study Hints

- Look over all our activities, worksheets, and questions of the day.
- Form a study group and review together and quiz each other.