Introduction to Physical Science

Vectors and Scalars

Presented by Robert Wagner

Displacement

- What do we mean by displacement?
  - The change in position of an object
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  -
  -
  -
  - SI unit of displacement is the meter

Displacement

- Displacement explained
  - Only looks at initial and final position
  - Does NOT tell us about total motion!
  - Is a vector quantity - magnitude and direction
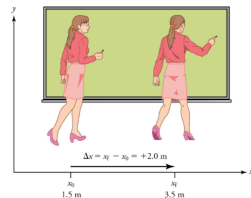 - Example: Motion of professor

Figure 2.3 A professor paces left and right while lecturing. Her position relative to Earth is given by x. The $+2.0$ m displacement of the professor relative to Earth is represented by an arrow pointing to the right.

Displacement

- Displacement explained
  - Only looks at initial and final position
  - Does NOT tell us about total motion!
  - Is a vector quantity - magnitude and direction
  - Example: Motion of professor
- Distance vs. Distance traveled
  - Distance is the magnitude of the displacement vector

$x_0 = 1.5m$

$x_f = 3.5m$

$\Delta x = x_f - x_0$

$\Delta x = 3.5m - 1.5m$

$\Delta x = +2.0m$

The positive sign indicates movement in the +x direction

Vectors and Scalars

- Scalar Quantity:
  - Has a magnitude, but no direction
  - Temperature:
  - Distance: 5.0 meters
- Vector Quantity
  - Has a magnitude and a direction
  - Velocity: 30 m/s East
  - Force: 35 N down
  - Can be indicated with an arrow - longer arrow means a larger magnitude ; direction of arrow indicates the direction
  - Can be indicated with a + or - sign. The sign tells the direction ; numerical value indicates magnitude

Coordinate Systems

- In general,
  - Horizontal motion: motion to the right is positive
  - Vertical motion: motion upward is positive
- Sometimes it is more convenient to switch these
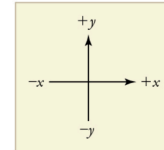 - Example: falling objects

Figure 2.7 It is usually convenient to consider motion upward or to the right as positive (+) and motion downward or to the left as negative (−).

Summary

- Displacement is the net motion of an object. It is a vector quantity

- Vectors have a magnitude and a direction - Scalars have only a magnitude

- Coordinate systems can be chosen to make the analysis of the problem easier