University of Virginia

Department of Physics

Physics 606: How Things Work II

Lecture #2 Slides:

Falling Balls

Physical Quantities

- Position – an object's location
- Velocity – its change in position with time

Newton's First Law, Second Version

An object that is free of external influences moves at a constant velocity.

Physical Quantities

- Position – an object's location
- Velocity – its change in position with time
- Force – a push or a pull

Newton's First Law

An object that is not subject to any outside forces moves at a constant velocity.

Question:

A rotary lawn mower spins its blade rapidly over the lawn and cuts the tops of the grasses off. Would the blade still cut the grasses if they weren't attached to the ground?

Physical Quantities

- Position – an object's location
- Velocity – its change in position with time
- Force – a push or a pull
- Acceleration – its change in velocity with time
- Mass – measure of its inertia

Newton's Second Law

The force exerted on an object is equal to the product of that object's mass times its acceleration. The acceleration is in the same direction as the force.

$$\text{force} = \text{mass} \cdot \text{acceleration}$$

Falling Balls

Question:

Suppose that I throw a ball upward into the air. After the ball leaves my hand, is there any force pushing the ball upward?

Observations About Falling Balls

- A dropped ball:
  - Begins a rest, but soon acquires downward speed
  - Covers more and more distance each second
- A tossed ball:
  - Rises to a certain height
  - Comes briefly to a stop
  - Begins to descend, much like a dropped ball

Type of Force

- Weight – earth's gravitational force on object

Weight and Mass

- An object's weight is proportional to its mass
  - weight $\propto$ mass
  - weight = constant $\cdot$ mass
- On the Earth's surface, that constant is
  - 9.8 newtons/kilogram
  - called *acceleration due to gravity*