Physics 102 - September 14, 2009

- Reading Posted
- Recitations Start Today
Last Time

Nature of Science

Science

Laws Before

Experiment

\[
\frac{x_2 - x_1}{t_2 - t_1} = \frac{\Delta x}{\Delta t} = \text{Average Speed}
\]

+ direction \rightarrow \text{Ave. Velocity}
\[ V_3, t_3 \]

\[ V_{24}, t_{24} \]

**Ave. Acceleration**

\[ \frac{V_{24} - V_3}{t_{24} - t_3} = \frac{\Delta v}{\Delta t} = a \]

\[ x, v, a, t \]

Kinematic variables
Newton's Laws

I: Law of Inertia
A body persists in its state of motion unless acted on by an external net force.

II: Force Law
The acceleration of an object is proportional to the net force applied to it and inversely proportional to the mass of the object.

\[ \sum F = ma \]

III Law of Action and Reaction
For every action, there is an equal and opposite reaction.
Newton's laws + kinematical def.

Inertia

\[ v = \frac{\Delta x}{\Delta t} \]

\[ a = \frac{\Delta v}{\Delta t} \]

Action–reaction

Make calculations/predictions of motion of objects under the influence of forces

Deterministic Universe
Gravity

Gravitational Force

\[ F_{\text{grav}} = \frac{G m_1 m_2}{r^2} \]

Electromagnetic Force

(Coulsomb's Law)

\[ F_{\text{em}} = \frac{k q_1 q_2}{r^2} \]

Attractive
Battery tossed in air

\[ F = ma \]

F same, a same all pts

Newton's laws of motion can be subtle

Two stars a distance \( d \) apart

Star 1 has mass \( M \)

Star 2 has mass \( 4M \)

How does the gravitational attraction of Star 1 for Star 2 compare to the gravitational attraction of Star 2 for Star 1?

Action reaction forces are the same