

Newton's Laws of Motion

I. First law of motion

- A. Every object continues in its state of rest, or of uniform motion in a straight line, unless it is compelled to change that state by forces impressed upon it
- B. Continues!! Inertia!!
 - 1. we fly around in car in accident because we continue to move
 - 2. all things on Earth are moving on surface, and orbiting Sun

II. Second Law of Motion

- A. Acceleration of an object is directly proportional to the net force acting on the object, is in the direction of the net force, and is inversely proportional to the mass of the object

- B. Acceleration $\approx \frac{\text{Net force}}{\text{Mass}}$ the cause of acceleration

- 1. Acceleration = $\frac{\Delta \text{ velocity}}{\Delta \text{ time}}$ the definition of acceleration

- a. acceleration of gravity on Earth is $9.81 \frac{\text{m}}{\text{s}^2}$

- b. the same Δv for each second of falling

- 2. greater mass has greater force acting upon it, but same acceleration

- 3. $F=ma$

- C. air resistance is a force acting upon falling objects

- 1. dependent upon speed and area exposed to air it is going through

- 2. in vacuum, all objects fall at same acceleration

- 3. terminal velocity of falling object is when it ceases to accelerate

- a. net forces = zero

- b. depends on the air resistance required to overcome the weight

- 1) heavier objects have greater weight

- 2) objects with large frontal areas have greater air resistance

III. Third law of motion

- A. Whenever one object exerts a force on a second object, the second object exerts an equal and opposite force on the first

- B. Remember $F=ma$,

- 1. increase m , decrease a ;

- 2. or decrease m , increase a

- C. action-reaction pairs

- 1. desk exerts force on rock, rock exerts force on desk

- 2. cannon exerts force on ball, ball exerts force on cannon

- D. external forces are required to move objects