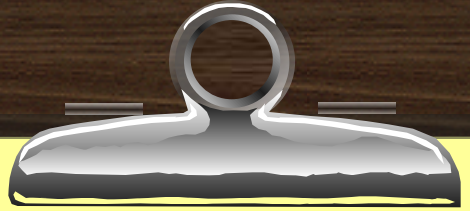
Chapter 4-2 Notes

Newton's First Law

- Newton's First Law – An object at rest remains at rest and an object in motion continues in motion with a constant velocity unless acted on by an outside force.
- The tendency of an object not to accelerate is called inertia.
- When the net external force on an object is zero, its acceleration is zero.



Demo

- The net external force is the vector sum of all the forces acting on an object.
- A simple problem occurs when all forces act directly along the x and y axis. You would just add and subtract and use Pythagorean theorem.
- However, most of the time, we must use vector component method.

Mass

- Inertia depends on the amount of mass.
- The greater the mass, the less the body accelerates under a force.
- The opposite is true also.
- Therefore, mass, which is a measure of the amount of matter in an object, is also a measure of the inertia of an object.

Equilibrium

- Objects that are either at rest or moving with a constant velocity are in equilibrium.
- Newton's 1st law states one condition must be true for equilibrium: the net external force acting on a body in equilibrium must be equal to zero.

- An apple falls, the gravitational force on the apple is 2 N downward, and the force of the wind on the apple is 1 N to the right at an angle of 20 degrees. Find the magnitude and direction of the net force of the apple.

Chapter 4-3

Newton's 2nd and 3rd Laws

Newton's 2nd Law

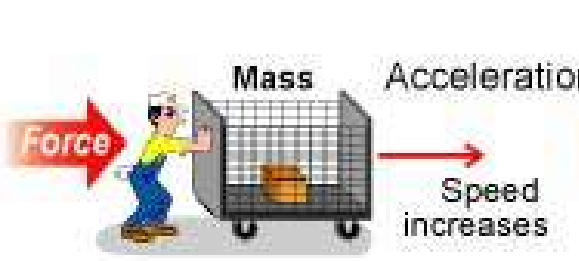
- Force is proportional to mass and acceleration.
- Force = Mass x Acceleration (F=ma)
- $A = (V_f - V_i)/\text{time}$

Newton's Second Law of Motion

$$\text{Acceleration } (\text{m/sec}^2) \rightarrow a = \frac{F}{m}$$

F ← Force (N)

m ← Mass (kg)



$$a = \frac{F}{m}$$

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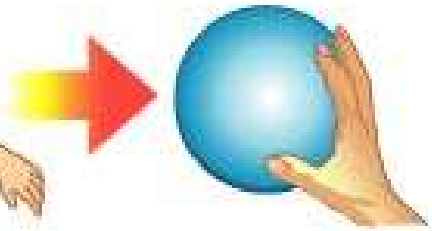
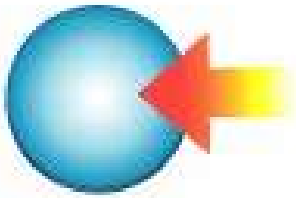
Newton's 3rd Law

- Forces always exist in pairs.
- Every action has an equal and opposite reaction.

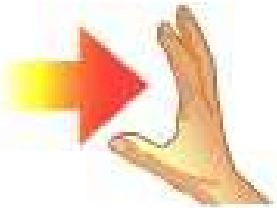
Newton's Third Law of Motion



When you throw a ball you create action and reaction forces.



Action force on ball



Reaction force on you

For every action force, there is a reaction force equal in strength and opposite in direction.

Practice 4B

- #1. The net external force on the propeller of a 3.2 kg model airplane is 7 N forward. What is the acceleration of the plane?
- Knowns?
- Unknown?
- Equation?
- Answer?