Forces & Motion

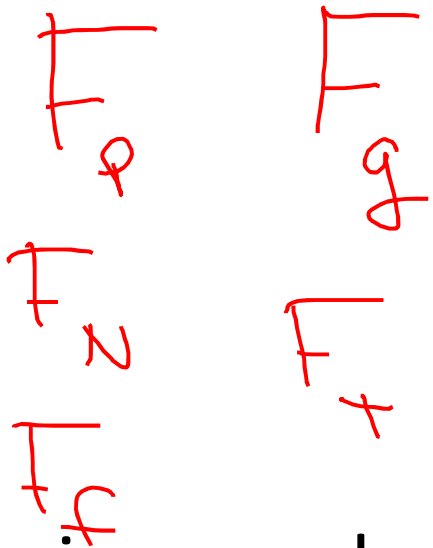
11.1 Balanced & Unbalanced Forces, Newton's First Law

Forces Change Motion

- Force: push or pull
  - Any time you change the motion of an object you use a force.
- 3 Major Types of forces:
  1. Contact force- one object pushes/pulls another object by touching it; 1st object applies a contact force on second.
  2. Gravity- force of attraction b/w 2 masses
  3. Friction- force that resists motion b/w 2 surfaces that are pressed together

Forces - five forces you need to know

- * FP- Force of Push or Pull
- * FN - Force of Normal
- * Ff- Force of Friction
- * Fg- Force of Gravity
- * FT- Force of Tension



- Force of Push/Pull (FP) * This is caused when a person pushes or pulls an object
- Force of Normal (FN) * This is the force that prevents one object from moving through another object. * It is a contact force. * It is perpendicular to the surface.

Forces

- Force of Normal (FN)
  - This is the force that prevents one object from moving through another object.
  - It is a contact force.
  - It is perpendicular to the surface.
- Force of Gravity (Fg)
  - It is also known as the weight.
  - It always pulls straight down towards the center of the Earth.
  - It is found by multiplying the objects mass x gravity

Force of Gravity = mass x gravity Fg = m x g

g is always 9.8m/s2

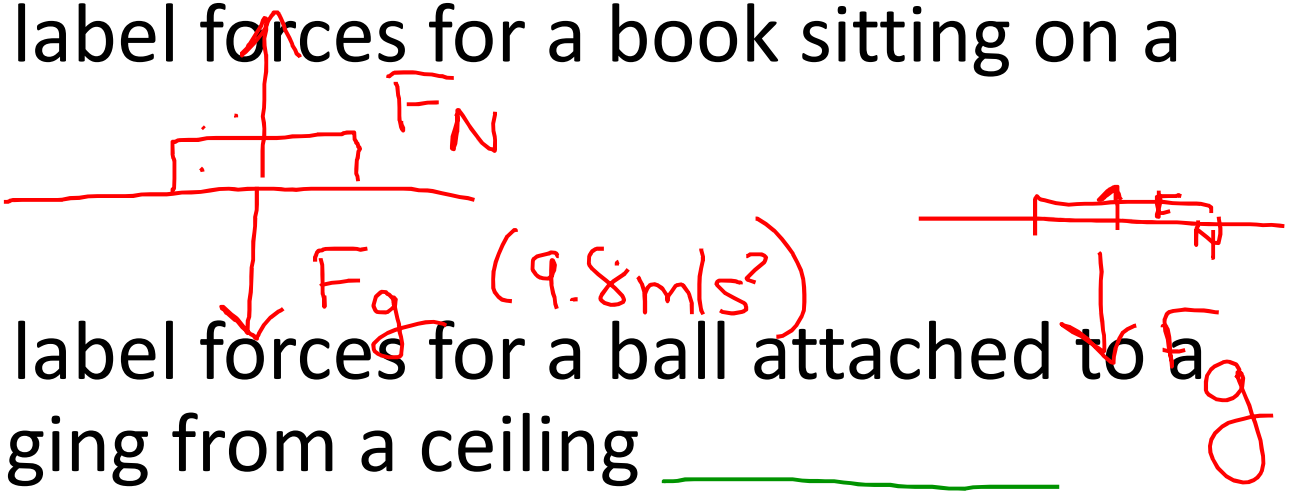
Forces

- Force of Tension (FT)
- It is the force when there is a rope, string, cable, etc.
- It always pulls parallel along the length of the rope

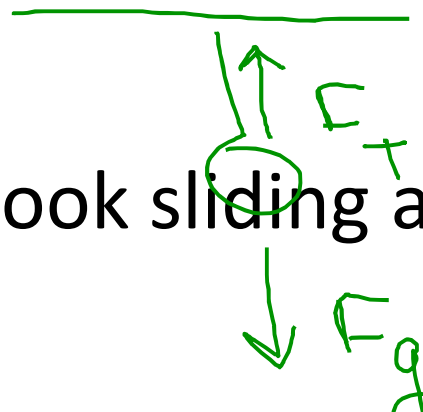
Free Body Diagrams Practice –

(pic of all forces acting on object in a situation)

- Draw and label forces for a book sitting on a table.

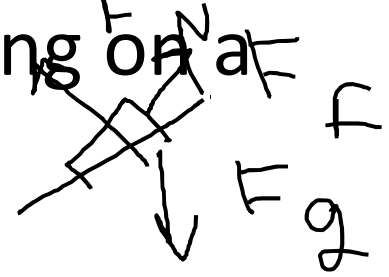


- Draw and label forces for a ball attached to a string hanging from a ceiling



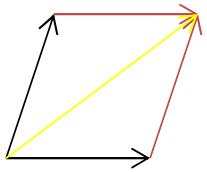
- Draw and label forces for a book sliding across a table at constant speed.

- Draw and label forces for a book sitting on a slanted table but is not moving.



Forces Change Motion

- Force is a vector- both size & directions
- Vector Addition- 2 Methods:
  - Parallelogram Method



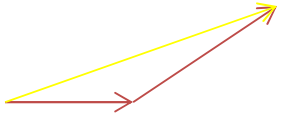
Parallel vectors

Resultant vectors

  - Tip-Tail Method
    - connect the tip of one vector to the tail of the other vector
    - make your resultant vector (dashed line) from the tail of the first to the tip of the second

*you will know to use the Tip to Tail method because both vectors are separate

resultant vector



- Considering size & direction of all forces acting on an object allows you to predict changes in object's motion.

Balanced Forces

- Net force- when all forces are combined; the overall force acting on an object
  - If net force = 0; forces are balanced
  - Same effect as no force at all
  - Motion does not change
  -  balanced forces
  - Object w/ forces acting on it can be moving @ constant velocity as long as forces are balanced
  - Balanced forces cannot change object's speed or direction

Unbalanced Forces

- Only unbalanced force can change the motion of an object
- motion changes due to unbalanced forces
- Object moves in direction of stronger force

Unbalanced forces

Early Thoughts on Motion & Forces

- Early Greeks though it was necessary to apply continuous force to keep object in motion.
- Galileo concluded in absence of friction, a moving object will continue moving even if no force acting on it.
  - Takes a force- friction- to stop an object that is already moving.
- Galileo reasoned- no real difference b/w object moving @ constant velocity + an object standing still

Newton's First Law of Motion

- Isaac Newton restated Galileo's conclusions as his first law
- Newton's First Law: objects at rest remain at ret, objects in motion remain in motion w/ same velocity unless acted upon unbalanced force.
- Aka Law of Inertia
- Inertia- resistance of an object to change in speed or direction of its motion.
  - Closely related to mass (easier to push/pull empty, rather than full box)
  - Reason people wear seat belts

Examples of Newton's First Law

- Blood rushes from your head to your feet while quickly stopping when riding on a descending elevator.
- The head of a hammer can be tightened onto the wooden handle by banging the bottom of the handle against a hard surface.
- A brick is painlessly broken over the hand of a physics teacher by slamming it with a hammer. (CAUTION: do not attempt this at home!)
- To dislodge ketchup from the bottom of a ketchup bottle, it is often turned upside down and thrusted downward at high speeds and then abruptly halted.
- Headrests are placed in cars to prevent whiplash injuries during rear-end collisions.
- While riding a skateboard (or wagon or bicycle), you fly forward off the board when hitting a curb or rock or other object that abruptly halts the motion of the skateboard.