PHYSICS

Newton's First Law

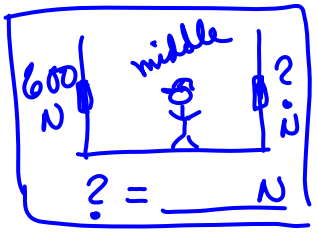
- **Mechanics – <u>the study of Physics that deals with motion and force.</u>**

- **Major Players:**
  - **Aristotle (father of _____) 384 – 322 BC At 17 he entered Plato's academy – until 37. Tutored Alexander the Great. Started own school. Classified almost all existing knowledge. Natural motion vs. violent motion (imposed from without). 4 Kingdoms: Earth, Air, Fire, and Water … and 5th is Quintessence (the perfect substance of the perfect spheres of heavenly bodies). [experiments: 1) heavier objects naturally fall faster (later found to be taken as incorrect if you take this as an absolute statement), 2) accurate zoology]**
  - **Galileo (father of _____) 1564 – 1642 Died on Christmas day. Studied motion in U. of Pisa (dropped objects from leaning tower), telescope in U. of Padua (saw mountains on moon, moons of Jupiter, sun spots). House arrested for publishing disagreement with Church (telescope observations, Copernican Earth centered view, disagreements with Aristotle). Went blind at 74. [experiment: 1) objects accelerate from gravity 2) heavier and lighter objects fall the same if friction is ignored]**
  - **Newton (father of _____) 1642 – 1727 Born on Christmas day as Galileo died. Many discoveries and inventions (gravity, calculus, 2 laws of motion, white light has colors of rainbow, reflecting telescope) At 14 – 23 worked on farm but planned science and math. At 42 published perhaps greatest scientific paper ever: "Principia". Parliament for 2 years – never spoke – one day he stood up – everyone fell silent to hear the great Newton speak – he asked someone to close the window because there was a draft.[experiments: 1) celestial mechanics operate like an object on a rope 2) prism 'breaks up white light']**

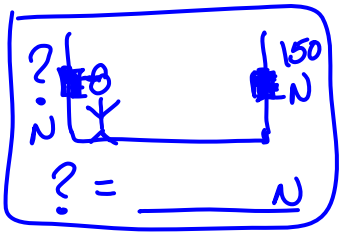
- **The Law of Inertia**
  - **Every object continues in its state of _____, or of uniform _____ in a straight _____, unless it is compelled to change that state by _____ impressed upon it.**
  - **An object in _____ will stay in _____ and an object at _____ will stay at _____ unless acted on by an unbalanced _____.**
  - **An object at _____ tends to stay at _____ and an object in _____ tends to stay in _____ with the same speed and in the same direction unless acted upon by an unbalanced _____.**

- **Examples of the 1st Law**
  - **The tablecloth and dishes – *please do not try this at home*.**
  - **The coin & glass**
  - **The dollar and book**

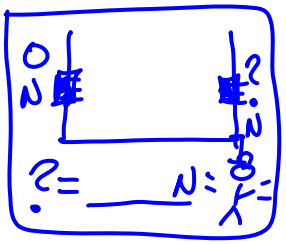
- **Net Force**
  - **What is a force? … It is a _____ or _____.**
  - **If inertia is maintained, forces balance. …**
    - **Either the object:**
      - **stays still**
      - **stays at same speed in the same line**
    - **The sum of forces equals zero. … _____ … The *system* is in _____.**
    - **A force is a _____, which means it has magnitude and direction.**
  - **If there is a net force, then the forces _____ to some number of Newtons or Pounds.**
  - **A _____ is usually not seen because everything might be still. But it's there!**
    - **a book lying on the table**
    - **a hanging plant**
    - **a perfectly matched football tackle and a perfect blocker**
    - **Below is a painter on a hanging plank.**



He's standing in the middle.



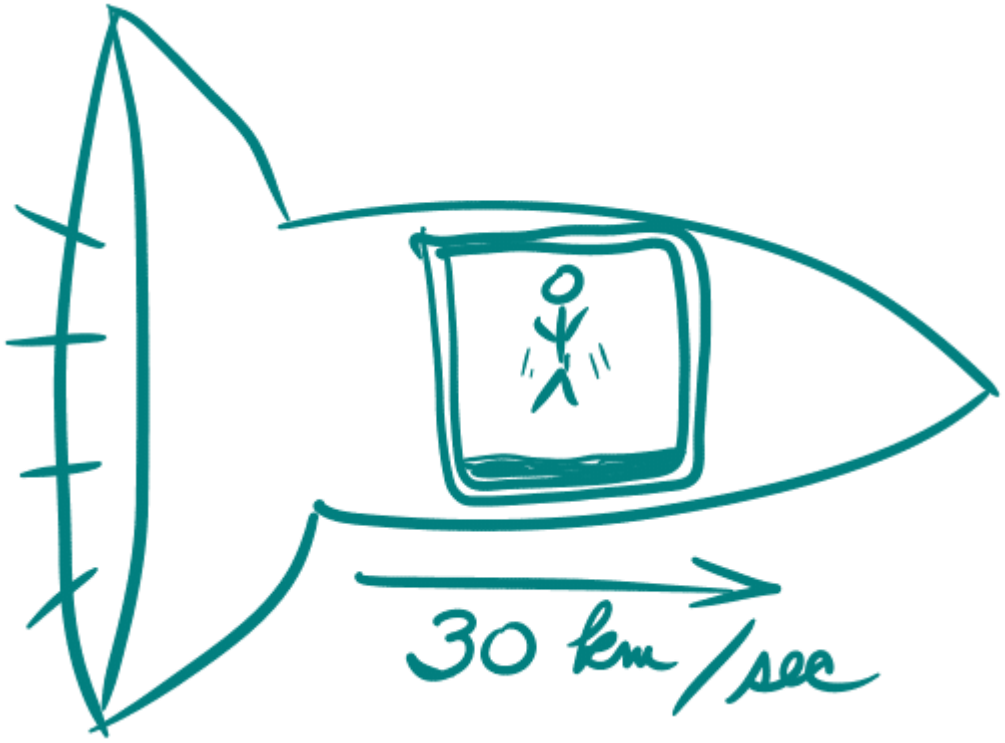
He's standing near the left.



He's hanging at the extreme right.

- ## Equilibrium while in Motion
  - **Rest is easy to see as a state of _____.**
  - **A bowling ball rolling at a constant speed in a straight line is also in _____ (if no _____).**
  - **If you have equilibrium, you either have no forces, or two forces (that balance) or a set of balanced forces that could even be quite large.**
  - **Is a bird flying at constant velocity in equilibrium? Does the thrust of the wings equal the drag of the air it pushes against? Could it fly if there was no air?**

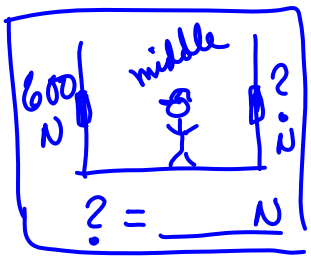
  - **If you jump in a rocket that is orbiting the earth at 30 km/sec, do you land in the same spot inside the rocket that you jumped from? [Extra credit: What is the mph of this rocket?]**



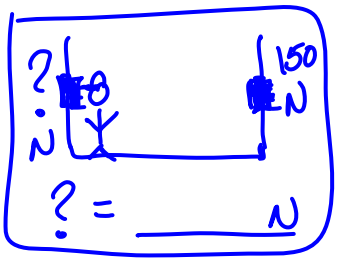
PHYSICS

Newton's First Law Worksheet

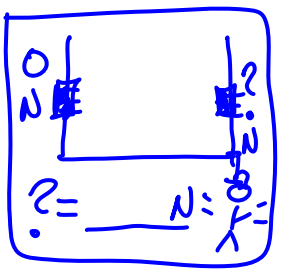
- **The Law of Inertia**
  - #1 _____
- **Examples of the 1st Law**
  - #2 _____
- **Net Force**
  - What is a force? … It is a **push or pull**.
  - If inertia is maintained, forces balance. …
    - Either the object:
      - stays still
      - stays at same speed in the same line
    - The sum of forces equals zero. … **Σ F = #3**_____ … The *system* is in **Equilibrium**.
    - A force is a **vector**, which means it has magnitude and direction.
  - If there is a net force, then the forces **#4** _____ **(add, subtract, multiply, divide)** to some number of Newtons or Pounds.
  - A **Support Force** is usually not seen because everything might be still. But it's there!
    - a book lying on the table
    - a hanging plant
    - a perfectly matched football tackle and a perfect blocker
    - Below is a painter on a hanging plank. (#5, #6, #7, below)



He's standing in the middle.



He's standing near the left.



He's hanging at the extreme right.

- **Equilibrium while in Motion**
  - Rest is easy to see as a state of **#8** _____.
  - A bowling ball rolling at a constant speed in a straight line is also in **#9** _____ **(if no friction)**.
  - If you have **#10** _____, you have either you have no forces, or two forces (that balance) or a set of balanced forces that could even be quite large.
  - Is a bird flying at constant velocity in equilibrium? #11 _____

    Does the thrust of the wings equal the drag of the air it pushes against? #12 _____

    Could it fly if there was no air? **#13** _____
  - If you jump in a rocket that is orbiting the earth at 30 km/sec, do you land in the same spot

    inside the rocket that you jumped from? **#14** _____

    [**Extra credit:** What is the mph of this rocket? For credit, show your work and report your answer in scientific notation.]