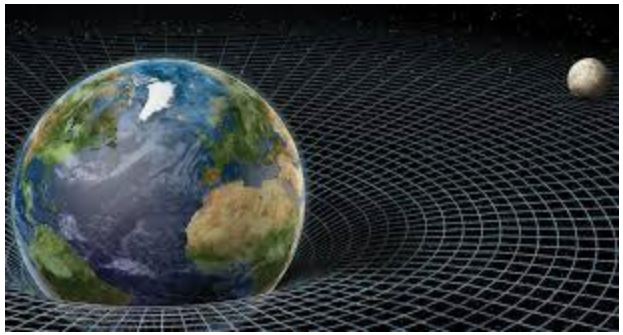
GRAVITY

Astronomy

GRAVITY

Topics:

- Galileo Galilei
- Isaac Newton
  - Laws of Motion
- Mutual Gravitation
- Orbital &Escape Velocity
  - Johannes Kepler’s Laws
- Albert Einstein
  - Special Relativity
  - General Theory of Relativity

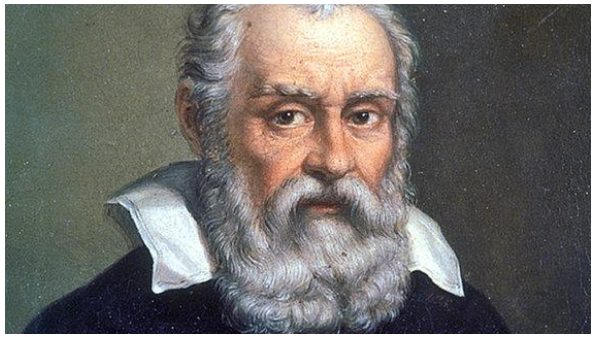


Galileo and Newton

Galileo Galilei

- Born on _____15, 1564 in Pisa, Italy
- Italian _____
  - Meaning, he studied multiple mathematical subjects

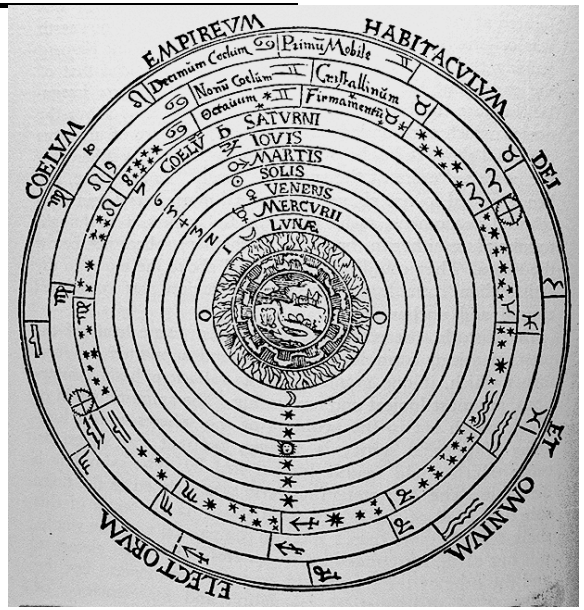
    Ex: astronomy, physics, engineering, etc.
- Major scientist credited with much of the initial understandings of _____, even before _____



Galileo and Newton

Galileo and Motion

- Galileo began studying the motion of _____ moving bodies even before he built his first _____
- Ideas were swayed by _____ :
  - Had a _____ focus
    - Meaning Earth is the center of the universe
  - Comprised of _____ elements:
    - Earth, water, air, and fire
  - Each element had a proper “place”
    - Earth and water = _____
    - Air and fire = _____
  - When objects fell it was because they were moving to their proper locations



Galileo and Newton

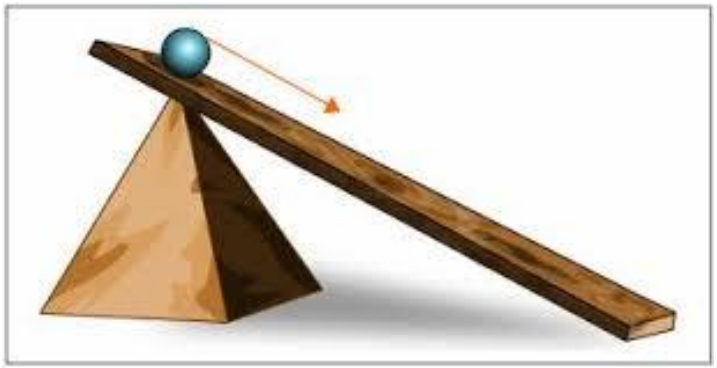
Galileo and Motion

- Aristotle's thoughts:
  - Natural motions – when objects fall downward because they are moving toward their _____ place
  - Violent motions – produced when move in other _____ other than towards their proper places
  - These motions _____ as soon as the force pushing them does
- Many scholars used _____ work to help explain what they were studying and revealing
- _____ broke that trend

Galileo and Newton

Galileo and Motion

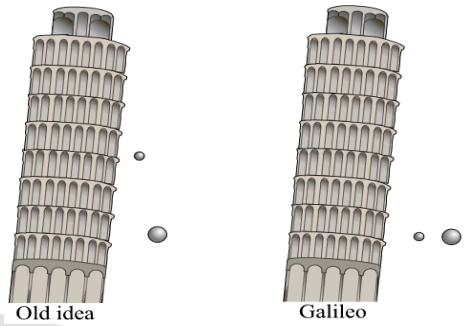
- Galileo started studying _____ objects
  - _____ were too great and he felt he couldn't study them accurately
  - Used bronze spheres and rolled them down an incline to reduce the velocity and lengthen the time of the "fall"
  - Realized it was _____ to regular falling bodies



Galileo and Newton

Galileo and Motion

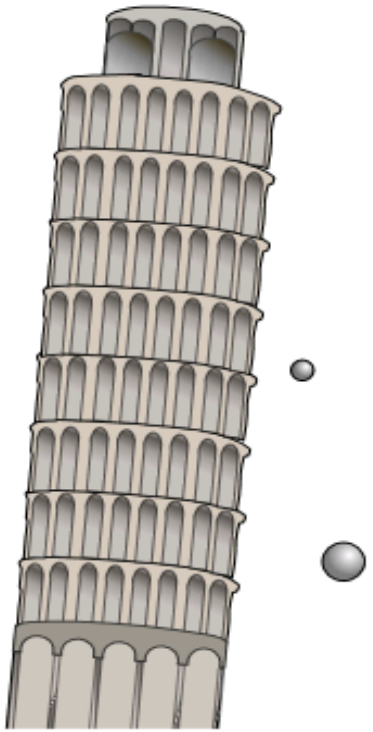
- Galileo started studying falling objects (cont.)
  - Found that falling bodies _____ as they fell unlike the constant rates that _____ stated
  - Realized that near the Earth's surface, falling objects fell at a velocity of _____ or 32 ft/sec at the end of 1 second
  - Acceleration of Gravity – steady increase on the _____ of a falling body by 9.8 m/s^2 for each second
  - This acceleration does _____ depend on weight
    - Both acceleration of gravity and the weight factor contradict what Aristotle stated



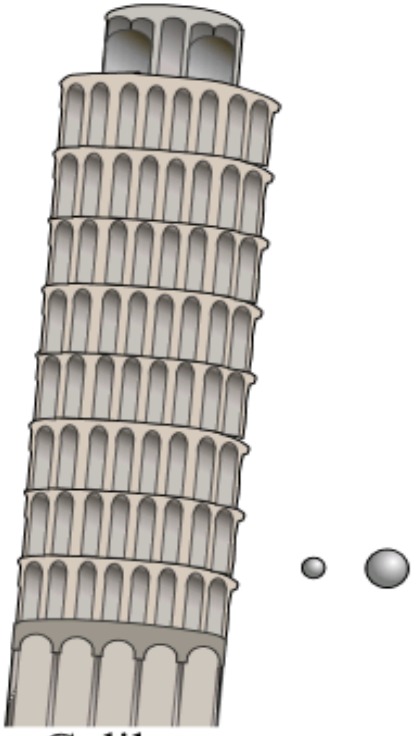
Galileo and Newton

Galileo and Motion

- Galileo started studying falling objects (cont.)
  - Rumor has it that he experimented by dropping objects off of the Leaning Tower of _____ but air _____ would have skewed the results



Old idea



Galileo

Galileo and Newton

Galileo and Motion

- Galileo started studying falling objects (cont.)
  - Dave _____ demonstrated this on the moon during the Apollo _____ mission
  - This all contradicted Aristotle's _____ motion

Galileo and Newton

Galileo and Motion

- Galileo then focused on Aristotle's "_____" motion
  - According to Aristotle, motion must be _____ by a cause
  - Galileo said that if there was no _____, the object would continue to move forever … therefore disagreeing with _____ again
  - Eventually this idea became Newton's first law of motion
  - Published his work in 1638 right before he became blind
  - He passed away in _____
  - Credited with the first set of true experimental science even though some of his work was flawed by _____ and _____

Galileo and Newton

Isaac Newton

- Isaac Newton
  - Born in Wools Thorpe, _____ on _____
  - Following the English calendar, Newton was born the same year _____ died
  - Gives Galileo a lot of credit for his work prior to his own time

Galileo and Newton

Newton and the Laws of Motion

- Thanks to Galileo, _____, and others, Isaac Newton put together the 3 laws of motion
  - These led him to an understanding of _____
- 1st Law of Motion – *A body continues at _____ or in _____ motion in a straight line unless acted on by some _____*
  - Ex: astronauts will drift off in space continuously unless hit by another force

Galileo and Newton

Newton and the Laws of Motion

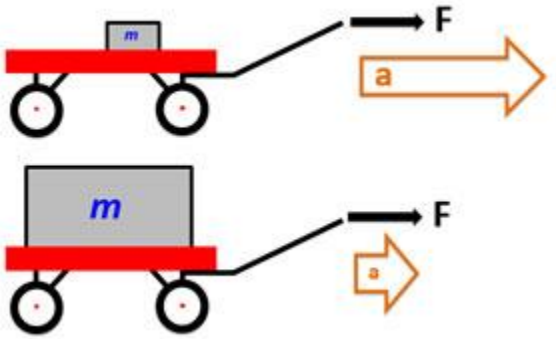
- Momentum – measure of an object's _____
  - Momentum = _____[x] _____
  - Ex: paperclip and bowling ball
    - Tossing the paperclip = low mass and low velocity
      - Easy to _____!
    - Firing a paperclip out of a firing machine= low mass but high velocity
      - … _____ even try to catch it
    - Tossing a bowling ball = low velocity but high mass
      - Tougher to catch than a _____

VS.

Galileo and Newton

Newton and the Laws of Motion

- 2nd Law of Motion – *The _____ of a body is inversely _____ to its mass, _____ proportional to the force, and in the same direction as the force*
  - F = ma F (_____) m (_____) a (_____)
- Acceleration – change in _____
- Velocity – speed with a specific direction
  - Speed – rate of motion without a _____
  - Ex: driving in a circle at 60 mph is a constant speed but changing velocity due to changing directions
- All about cause and _____!



Galileo and Newton

Newton and the Laws of Motion

- 3rd Law of Motion – *To every action, there is an _____ and _____ reaction*
  - AKA: forces need to occur in pairs directed in opposite directions
  - Ex: if you stand on a skate board and jump _____, the skateboard will shoot _____