

The Motion of Planets

History of Astronomy

Scientific Method

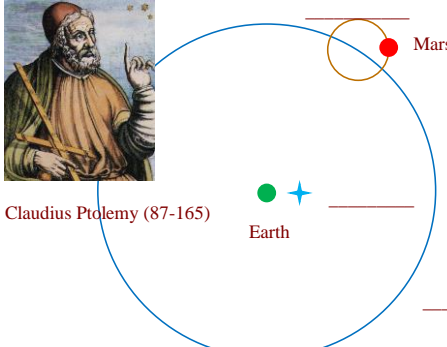
Scientific Methods

1. _____
2. _____
3. _____
4. _____

_____ = Why something happens
 _____ = How something happens

Assumptions of Early Models

- _____ - Earth in the middle
- Everything orbits the Earth
- Stars are located on the Celestial Sphere
- Everything moves in _____ motions



Claudius Ptolemy (87-165)

Earth



Mars

The Dark Ages

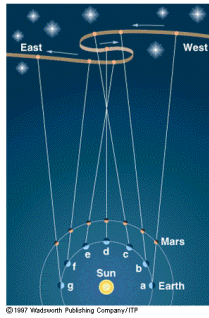



Nicolaus Copernicus (1473-1543)

Errors building up
 Must be a better way!
 Let's try a _____ system!
 Not any better though

Retrograde Motion in the Copernican Model



Tycho Brahe (1546-1601)

Naked eye observations of planets
 Accuracy through _____
 Best observations of planetary positions
 Hired "nerd" to help calculate model
 Died....

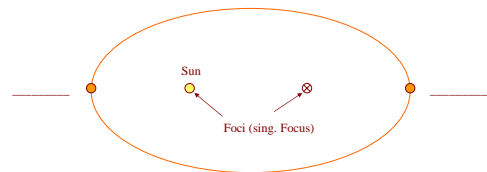


Johannes Kepler (1571-1630)

Worked for Brahe
 Took data after his death
 Spent years figuring out the motions of the planets
 Came up with...

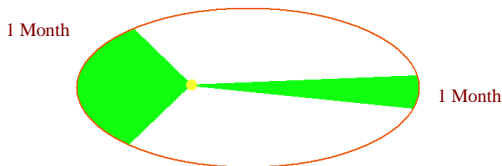
Three Laws of _____

1. Planets move in _____ orbits with the Sun at one foci



Average distance from the Sun = 1 _____

2. Planets move _____ at perihelion than at aphelion.



3. Period is related to average distance

P = period of the orbit
 a = average distance

$$\text{_____} = \text{_____}$$

Longer orbits - greater average distance
 Need the value of *k* to use the formula
k depends upon the situation
 Can be used for anything orbiting anything else

Special version of Kepler's third Law –
 If the object is orbiting the Sun
 P – measured in years,
 a – measured in A. U., then....

$$P^2 = a^3$$

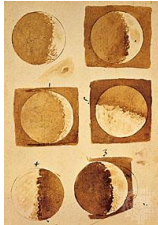
Galileo Galilei (1564-1642)



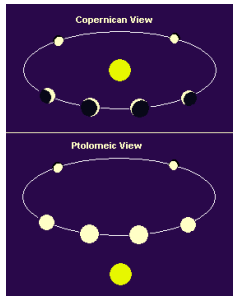
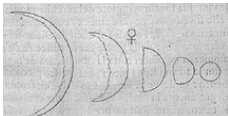
Knew of Copernicus's & Kepler's work
 Used a telescope to look at the sky
 What did he see?



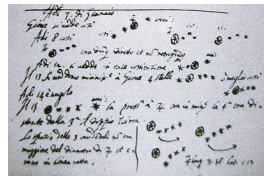
The Moon was an _____ object



Venus has _____



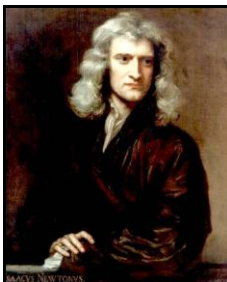
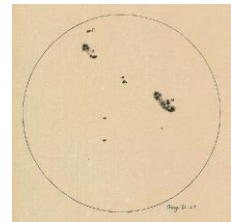
Jupiter has objects around it



Saturn is imperfect



The Sun is imperfect



Isaac Newton (1642-1727)

The ultimate "nerd"
 Able to explain Kepler's laws
 Had to start with the basics -

The Three Laws of _____

1. Law of _____ - Objects do whatever they are currently doing unless something messes around with them.

2. Force defined

$$F=ma$$

F=force

m=_____

a=_____ = change in
motion

3. For every action there is an

_____.

The three laws of motion form the basis for the most important law of all (astronomically speaking)

Newton's Universal Law of Gravitation

$$F = \frac{GM_1M_2}{R^2}$$

F=force of gravity

G=constant

M_1, M_2 = masses

R=distance from "centers"

Gravity is the most important force in the Universe

Planetary Configurations

Superior Planets (beyond Earth's orbit)

Planetary Configurations

Inferior Planets (inside Earth's orbit)