



Thursday, April 11, 2019

Pick up: none

Today you will:

- Learn about Telescopes, Kepler's Laws and Newton's Laws ISN pg 153

HOMEWORK:

Study!



Motion in Space

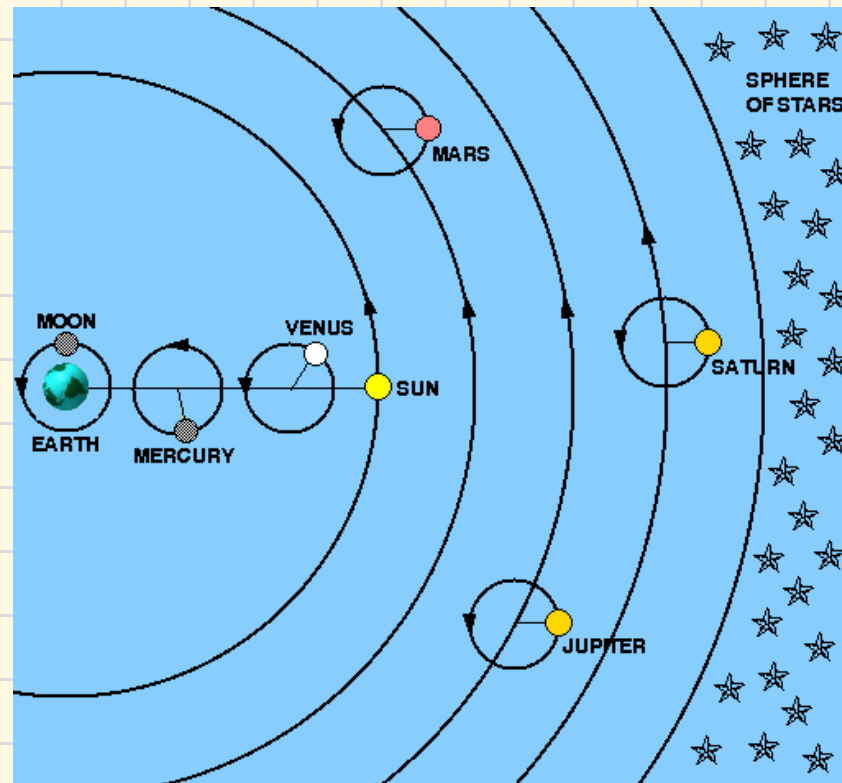
Review – What is Scientific Law?

- What is a Scientific Law?
 - A. An observation
 - B. A description of an observed phenomenon
 - C. An explanation of an observed phenomenon
 - D. A hypothesis



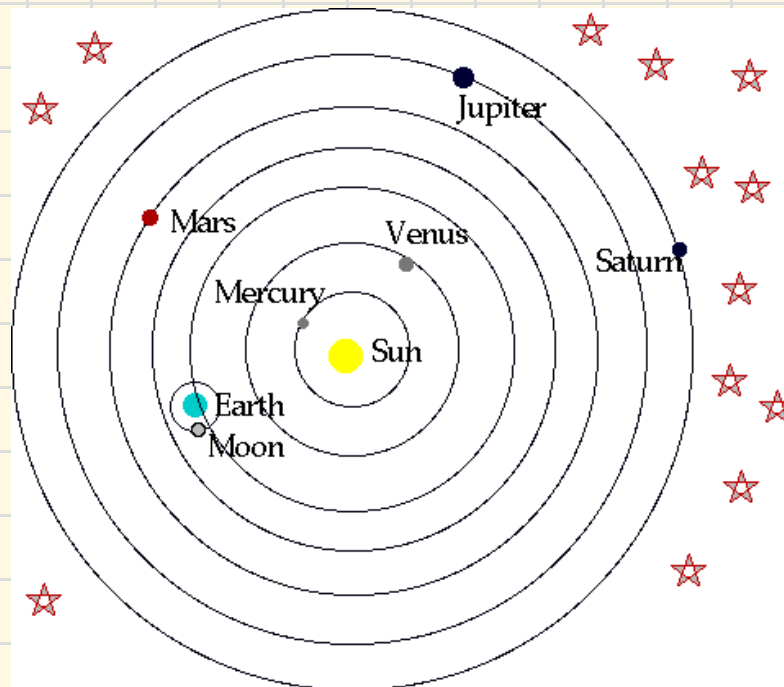
Models of the Solar System

- Ptolemy's Model:
 - Geocentric model
 - Earth is the center of the solar system



Models of the Solar System

- Copernicus's Model:
 - Heliocentric model
 - The Sun is the center of the solar system



Kepler's Laws of Planetary Motion

- Kepler studied Tycho Brahe's notes and observations
 - Lead to development of three laws
- Very accurate
 - Still used today



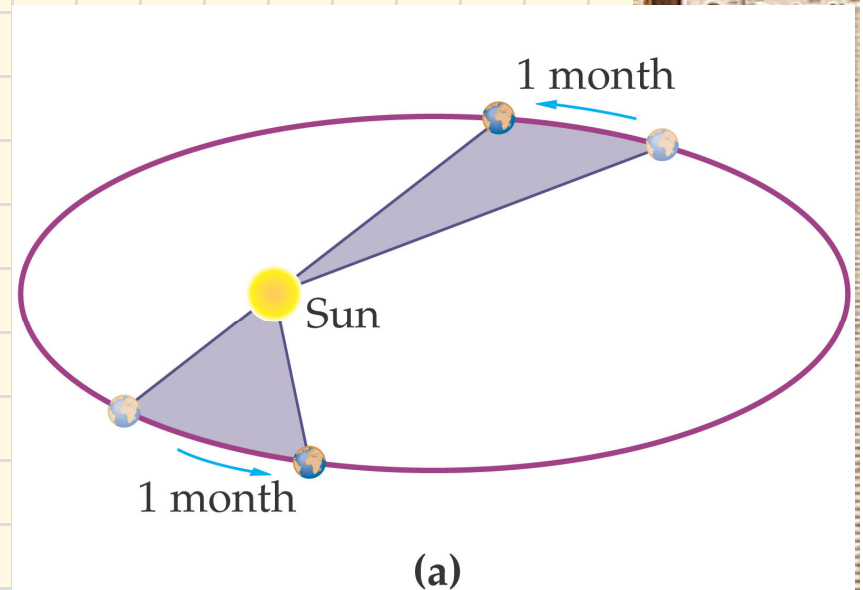
#1: Law of Ellipses

- What is an ellipse?
- Each planet orbits the sun along a path called an ellipse
 - AKA oval
- Some are more circular looking than others
- Eccentricity:
 - A number value that describes how far off (eccentric) a planet's orbit is
 - Perfect circle: Eccentricity = 0.00



#2: Law of Equal Areas

- Describes the speed of objects at different points in their orbits
- Object is nearer to the sun = moves faster
- Object is further away from the sun = moves slower
 - Still covers the same exact area in both places



#3: Law of Periods

- Orbital period:
 - The time it takes for a planet or other body to complete one orbit
- $K \times a^3 = p^2$
 - $K = 1$ (constant)
 - a = average distance of a planet from the sun
 - p = planet's orbital period
- Describes how a planet's distance to the sun is related to orbital period



Newton's Laws



Newton's Contributions



- Calculus
- Light is composed of rainbow colors
- Reflecting Telescope
- Laws of Motion
- Theory of Gravitation

SIR ISAAC NEWTON WOULD HAVE
DISCOVERED GRAVITY YEARS EARLIER HAD
WILLIAM TELL NOT WANDERED BY

Newton's Laws of Motion

- Newton wanted to explain why planets moved the way Kepler had observed
- Lead to development of three laws
 - Describes the motion of objects on Earth and the motion of objects in space



Newton's 1st Law of Motion

- 1st Law:
 - An object in motion stays in motion until an outside force acts on it
 - Resistance to change in motion
 - AKA Inertia
 - Objects travel in straight lines in space
 - Planets' orbits curve due to gravity (outside force)



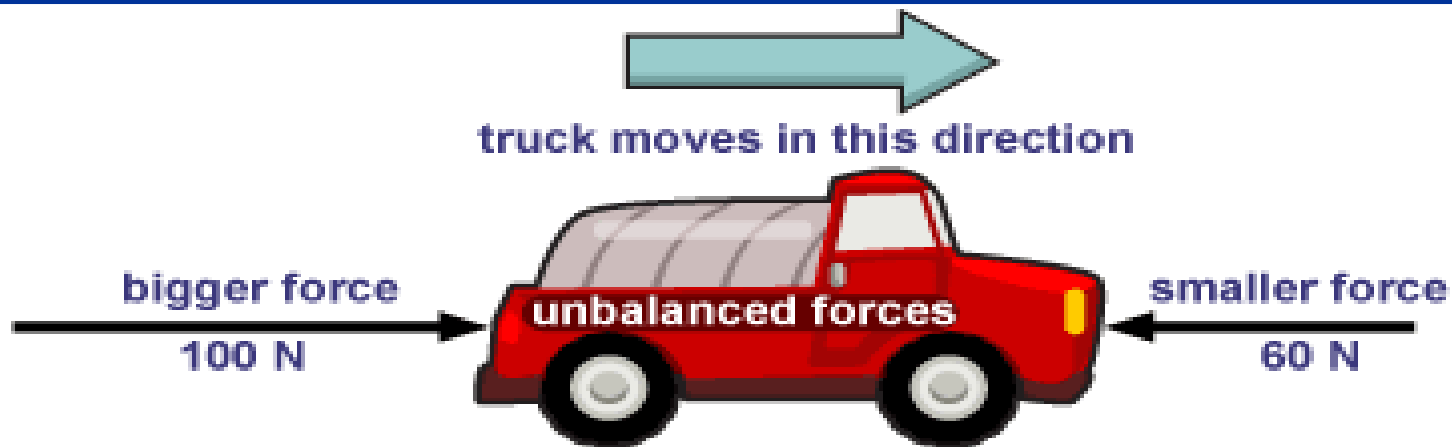
Balanced Force



Equal forces in opposite directions produce no motion

Unbalanced Forces

Unequal opposing forces produce an unbalanced force causing motion



1st Law



- Unless acted upon by an unbalanced force, this golf ball would sit on the tee forever.

What is this unbalanced force that acts on an object in motion?

Friction!

- There are four main types of friction:
 - Sliding friction: **ice skating**
 - Rolling friction: **bowling**
 - Fluid friction (air or liquid): **air or water resistance**
 - Static friction: **initial friction when moving an object**

1st Law

- Once airborne, unless acted on by an unbalanced force (gravity and air – fluid friction) it would never stop!



Newton's 2nd Law of Motion

- 2nd Law:
 - The relationship between mass (m), acceleration (a), and force (F)
 - Simply put:
 - $F = m \times a$



Newton's Second Law

One rock weighs 5 Newtons. The other rock weighs 0.5 Newtons. How much more force will be required to accelerate the first rock at the same rate as the second rock?

Ten times as much



Newton's 3rd Law of Motion

- 3rd Law:
 - For every **action**, there is an **equal** and **opposite** reaction
 - For example:
 - Stepping off a **boat** onto a dock or the **shore** of a lake
 - We go toward the shore/dock
 - The boat goes away from you



Think about it . . .

What happens if you are standing on a skateboard or a slippery floor and push against a wall? You slide in the opposite direction (away from the wall), because you pushed on the wall but the wall pushed back on you with equal and opposite force.



Why does it hurt so much when you stub your toe? When your toe exerts a force on a rock, the rock exerts an equal force back on your toe. The harder you hit your toe against it, the more force the rock exerts back on your toe (and the more your toe hurts).