Tuesday, April 3, 2018

Pick up: none

Today you will:

- Learn about Newton's Laws and Kepler's Laws

HOMEWORK:

Complete WB Ch. 26

Study!

Motion in Space

Review – What is Scientific Law?

- What is a Scientific Law?

A. An observation

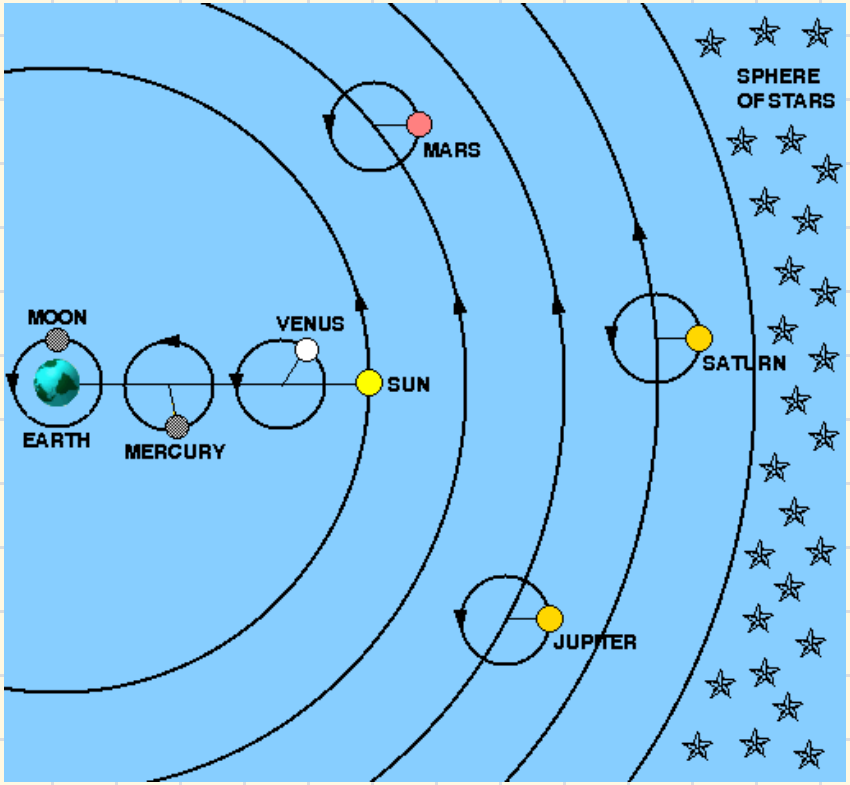
B. A description of an observed phenomenon

C. An explanation of an observed phenomenon

D. A hypothesis

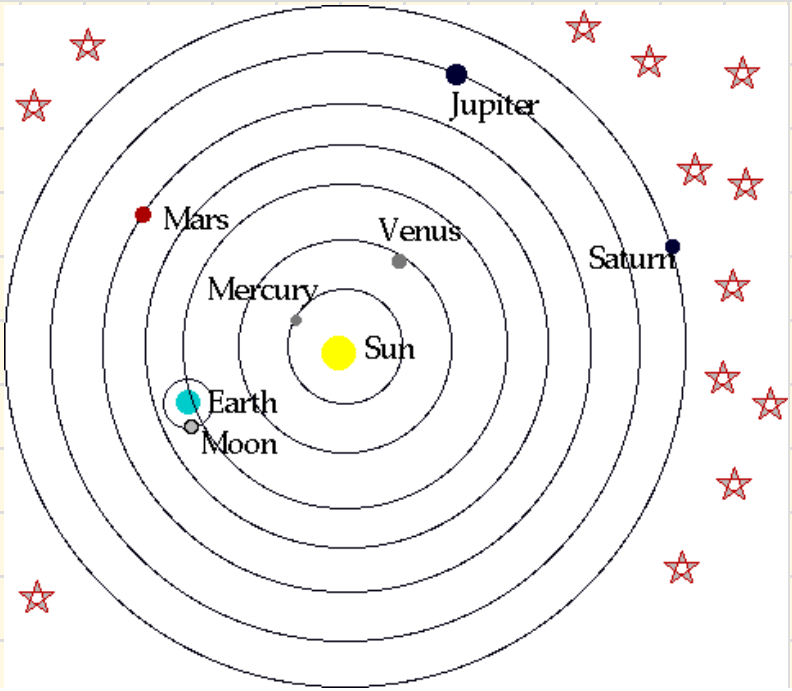
Review – Models of the Solar System

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



Review – 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

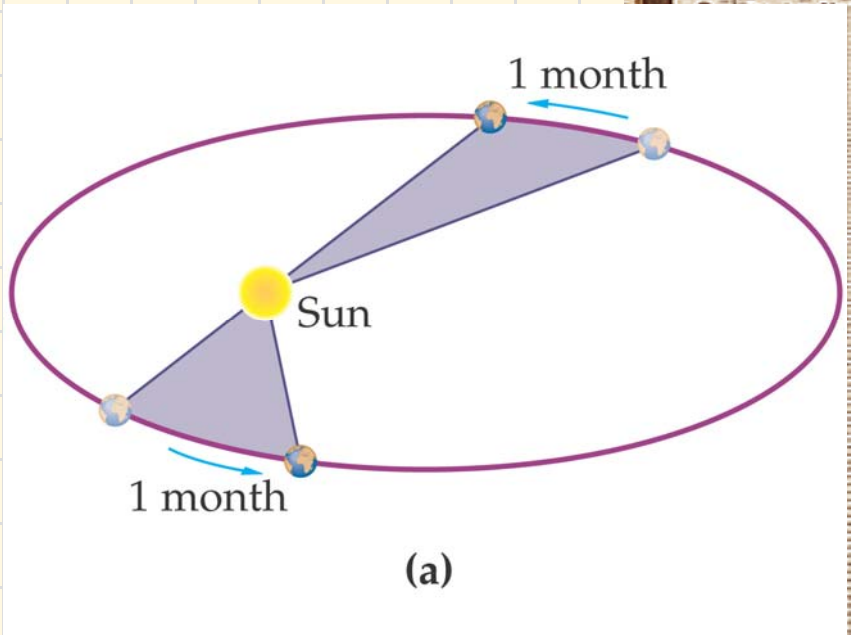
- Kepler studied **Tycho Brahe's** notes and observations
  - Lead to development of **three** laws
- Very **accurate**
  - Still used **today**

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

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



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

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

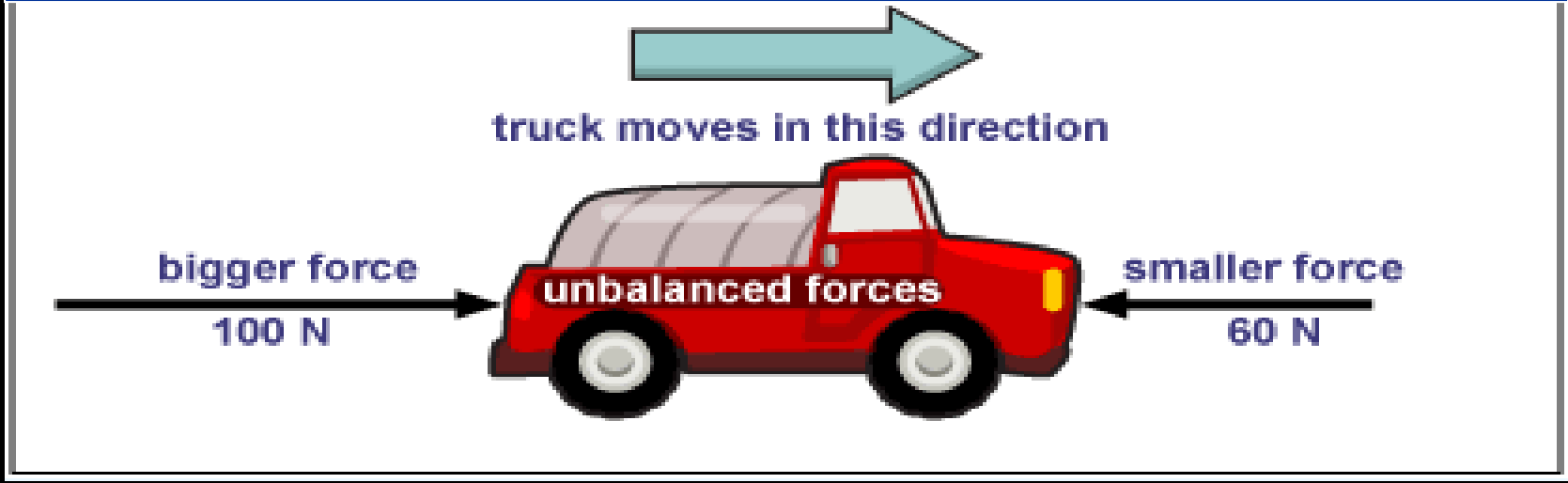
- 1st Law:
  - An object in motion **stays** in motion until an outside **force** acts on it
  - **Resistance** to change in motion
    - AKA **Inertia**
  - Objects travel in **straight** lines in space
    - Planets' orbits **curve** due to **gravity** (outside force)

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?

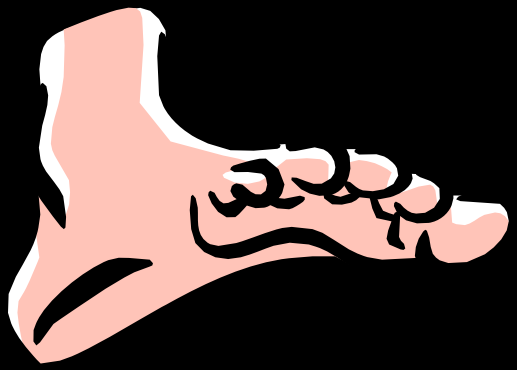
Ten times as much

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).