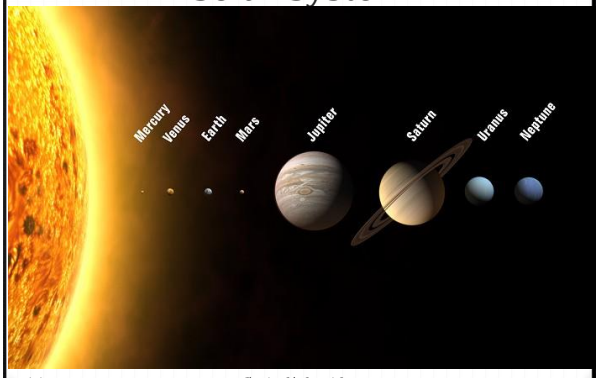
Question of the Day #1

Draw the best diagram of our solar system that you can in your notes. Make sure to include labels!

Solar System



Chapters 28 & 29 Objectives

1. **Describe early models of our solar system. This means I can:**
   a. Explain the geocentric model of the solar system and how **retrograde <u>motion</u>** brought change to that model.
   b. Describe the contributions and changes to solar system arrangement due to the following scientists: Nicolaus Copernicus, Kepler, Isaac Newton, Galileo.

2. **Examine the modern heliocentric model of our solar system. This means I can:**
   a. Explain Kepler's 1st Law and its relationship to the following terms **astronomical unit, focus, major axis, semi-major axis,** the Sun, and **eccentricity.**
   b. Determine the relative shape (elongated oval, oval, circle) of an orbit when given its eccentricity value.

3. **Relate gravity to the motions of celestial bodies. This means I can:**
   Describe how mass, center of mass, and distance between 2 objects affects their gravitational pull on each other.

4. **Summarize the properties of the solar system that support the theory of the solar system's formation. This means I can:**
   a. Describe how the planets formed from a disk surrounding the young Sun.
   b. Define & describe how the following terms are involved in the theory of the solar system's formation: **interstellar cloud, planetesimal.**
   c. Explain how the theory is supported by the types of elements and density differences of the inner terrestrial vs. outer gas giants.
   d. Using distance from the sun and resulting temperature differences throughout the solar system, explain why lightweight gases such as hydrogen and helium are rare in the terrestrial planets but common in the gas giants.

5. **Explore remnants of solar system formation. This means I can:**
   a. Define **asteroid.** Identify the location of the asteroid belt on a solar system diagram.
   b. Define and describe the composition of a comet.
   c. Discuss the location of the two main clusters of comets, including how far they are from the sun in astronomical units.

6. **Compare and contrast the properties of the inner/terrestrial vs. outer/gas planets. This means I can**
   a. Describe similarities and differences in composition, size, surface, composition (main elements), density, rings, number of moons.
   b. Explain why/how the inner and outer planets are composed of different substances.

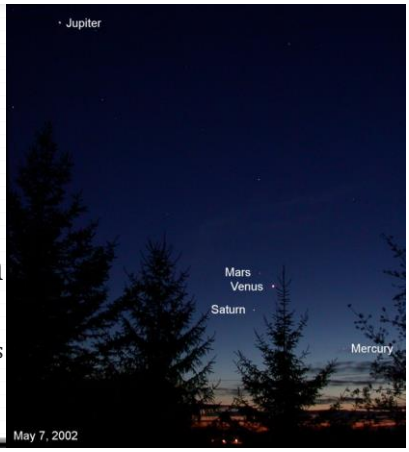
7. **Explain the Impact Theory about the Moon's formation, including evidence supporting the theory.**

8. **Identify features on the Moon. This means I can:**
   a. Define, draw and label the following surface features of the Moon on a diagram: highlands, maria, impact craters, regolith.
   b. Describe the history of the Moon's surface features; contrast the age and formation of maria vs. highlands.
   c. Determine the relative age of features on the moon using the principle of superposition.

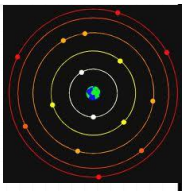
9. **Identify the relative positions and motions of Earth, Sun & Moon. This means I can:**
   a. Explain what causes earth's day and night, seasons.
   b. Compare and contrast summer solstice, winter solstice, autumnal and vernal equinoxes.
   c. Describe the following motions and their effects: rotation, revolution, tilt of axis, synchronous rotation.
   d. Compare and contrast high & low tides as well as spring & neap tides according to sun and moon alignment, tidal range, frequency and location.

Planets May Look Like Bright "Stars" from Earth

How can scientists tell planets and stars apart??



Sec 29.1 Early Astronomers

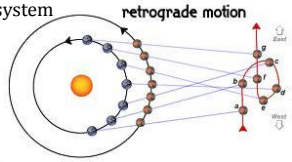


Research & Ideas

1. Ancient astronomers could recognize the difference between stars and planets
   A. Planets move, stars are stationary & do **NOT** move
2. **Geocentric** Model –1st model of solar system
   A. Geocentric = Earth is the center of the universe
      - Believed the Sun, planets, and stars orbited a stationary Earth

Geocentric Model of the Universe

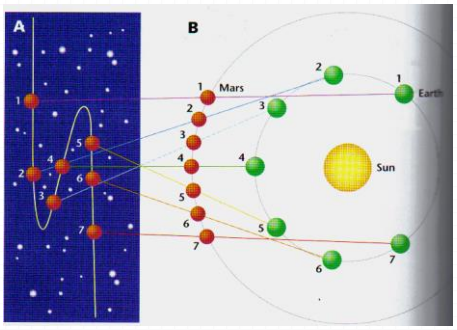
B. Problem: Didn't explain **retrograde motion**
   i. This is a sudden change in planetary motion when planets suddenly **appear** to move backwards
   ii. Very hard problem to solve
   iii. Scientists began looking for a better model of the universe/solar system



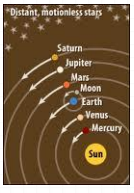
VIDEO
http://www.youtube.com/watch?v=ln1fHZvRr8o

Fig 29.1 Retrograde Motion, p.776

What is the REASON Mars APPEARS to move backwards below?



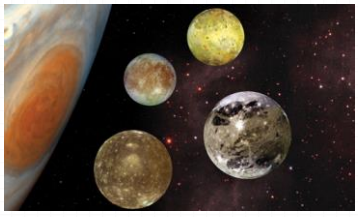
Heliocentric Model

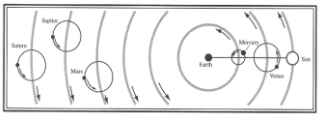


3. **Heliocentric Model** = Sun-centered
   A. Suggested by **Copernicus** in 1543
   B. Explained retrograde motion…So **WHY** do we see planets moving "backwards"?
      i. Inner planets move faster than outer planets around the sun
      ii. Earth will "pass" a slower moving planet
      iii. The slower planet temporarily appears to move backwards

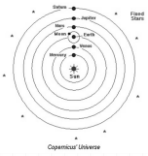
Heliocentric Model

C. Galileo's discoveries also support heliocentric
   i. 4 moons orbited Jupiter not the Earth
   ii. Therefore, Earth could not be the center of the solar system



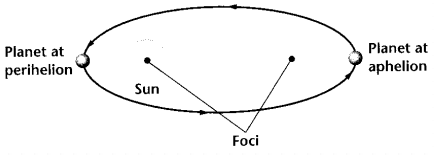


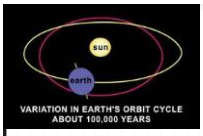
Cartoon



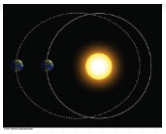
Kepler's First Law

1. **Kepler's 1st Law:** Most planets orbit the Sun in an ellipse, NOT a circle
   A. Ellipse = Oval that is centered on **TWO** points (foci), not 1 like a circle
      - (Focus – singular, foci – plural)

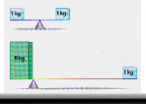


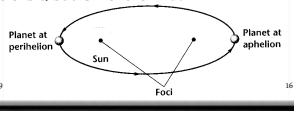


Kepler's First Law



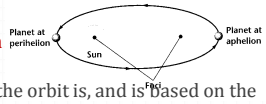
B. **Most planets orbit the Sun in an elliptical shape**
   i. Earth being the exception
      - Earth believed to move between an elliptical orbit and a circular orbit every 100,000 yrs or so.
      - http://www.youtube.com/watch?v=tw5MvHNw0Co
C. **Planets orbit while staying centered around 2 points.**
   i. The Sun is one point
D. **Orbit is around the "center of mass" of the 2 bodies (Sun & planet)**
   i. Sun is NOT the center of the orbit, but is 1 of the 2 foci





Kepler's First Law

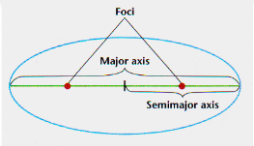
Eccentricity & Aphelion/Perihelion



Eccentricity = HOW oval-shaped the orbit is, and is based on the ratio of distance between the 2 foci to the major axis.

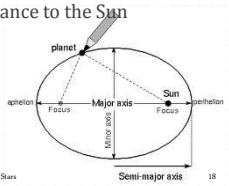
http://www.youtube.com/watch?v=BIBz_GQDga0

1. Planets vary in their distance from the Sun, therefore the distance between focus points is different for each planet.
2. A planet is NOT at a constant distance from the Sun
3. **1 Astronomical Unit (AU)** = the **average distance** between Sun & earth
   - Is the unit used for distances between the Sun and planets.



Kepler's First Law

4. **Major axis:** runs end to end through both foci.
   - Is the maximum diameter
5. **Semi-major axis:** ½ length of major axis.
   - Is the planet's average distance to the Sun

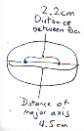


Eccentricity Mini Lab Instructions

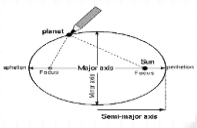
Procedure:

1. Tie a piece of string into a loop that fits on a piece of cardboard when it is laid out in a circle.
2. Place a sheet of paper on the cardboard.
3. Stick 2 pins through the paper close to the center but separated from each other by 2cm. (The yellow pin represents the Sun)
4. Loop the string over the pins and use a pencil to trace around them. Keep the string taut.
5. Record the following in the data table below:
   A. Measure the major axis and the distance between the pins.
   B. Calculate the eccentricity. (See the example calculation above.)
6. Repeat steps 3-5 with foci 9 cm and 0 cm apart.

Example: Eccentricity = Distance between the foci / Distance of major axis



Eccentricity = 2.2cm / 4.5cm = 0.48



Eccentricity: Mini Lab Questions

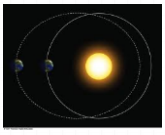
Distance foci are apart	Length of major axis in cm –Longest length (use 1 decimal)	Equation / Calculation (Show your work)	Eccentricity Value (Calculation answer)	Describe/Draw Relative Shape of Drawing
2cm				
9cm				
0cm (Just use 1 pin)				

Analyze and Conclude:

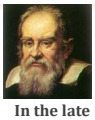
1. What do the 2 pins represent?
2. For planets orbiting in our solar system, what is always one of the foci?
3. How does the eccentricity number AND the shape change as:
   A. The distance between the foci (pins) gets larger?
   B. The distance between the foci (pins) gets smaller?
4. What is the eccentricity value of a perfect circle?_____
   How far apart are the foci of a circle?_____

Eccentricity Values:
What is the range?

6. **Eccentricity has a value between 0 to 1**
   - 0 = perfect circle (Distance between the 2 foci is 0)
   - 1 = very elongated oval



Gravity (& Galileo)



1. **In the late 16th century early 17th century Galileo was working with gravity.**
2. **Performed experiments dropping objects off the Tower of Pisa and rolling balls down inclines**

WHAT DID HE DISCOVER?? LET'S RECREATE GALILEO'S EXPERIMENTS:

Need: Timers, masking tape, bin of objects to drop

Experiment: Testing Gravity's Influence on Falling Objects

1. **Pick 4 objects of different weights from across the room. You can use anything safe to drop. If you want to use anything of the teacher's, please ask before you grab it.
2. **Record your object choices in the data table below:

Object	Trial #1	Trial #2	Trial #3
1.			
1.			
1.			
1.			

Gravity Activity Cont'd

Time for Predictions:

1. Out of all the objects you selected, what will fall to the ground most quickly?
2. Out of all the objects you selected, what will fall to the ground most slowly?

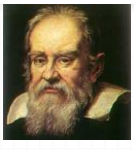
Procedure:

1. Time to test your predictions.
2. Go into the hallway and mark a height on the wall using masking tape. This is your start position from which each object will be dropped.
3. Pick the first 2 objects in your data table and hold them up to the start line.
4. Count to 3 to give the timer time to get the stop watch ready.
5. Drop the objects.
6. Repeat the above steps so both pairs of objects has a total of 3 trials.
7. Grab the next pair of objects, switch jobs, and repeat steps 3-6.

GRAVITY: Post Lab Questions:

1. Were your predictions accurate? Why or why not?
2. What relationship did you observe between the speed an object falls towards the Earth and the amount it weighs?
   - Did any object defy this relationship? If so, why do you think this happened?

Gravity (& Galileo)



Post-Lab Animation – Elephant vs. Feather Free-Fall

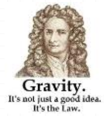
1. In the late 16th century early 17th century Galileo was working with gravity.
2. Performed experiments dropping objects off the Tower of Pisa and rolling balls down inclines
3. Gravity accelerates the fall of all objects at the same rate.
4. Air resistance causes lighter objects to fall more slowly.

Gravity (& Newton)

Sir Isaac Newton & Gravity

1. **1687 Newton published his theory of universal gravitation.**
   - Also called the inverse square law
2. **This theory helped discover Neptune.**
   - Watched Uranus's movements:
     - Gravity of something large was affecting the movements of the planet.
3. **Basics of the Inverse Square Law:**
   - Any two objects attract each other
   - Depends upon their masses AND the distance between them.

Inverse Square Law



This knowledge of gravity produced the law of universal gravitation.

(Don't need to know equation)

$$F = G\frac{m_1 m_2}{d^2}$$

G = Constant
6.6726 X 10^{-11}

The larger the objects (m) the stronger the force of gravity between them.

The farther apart the objects (d) the weaker the force of gravity.

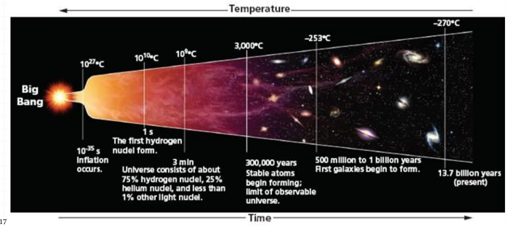
1. Distance squared weaker

How Do Scientists Determine Theories for How Our Solar System Formed?

1. **Scientists Examined**
   A. Why the planets are so different.
      - Especially Outer vs. Inner Planets
   B. Asteroids, Meteorites, and Comets.

Intro to Universe Formation

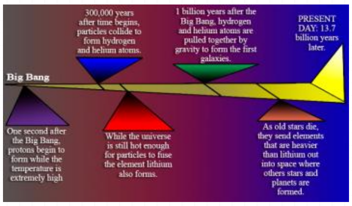
1. **Based on the following observation:**
   a) Galaxies are moving away from ours at great speed, in all directions, as if propelled by an explosive force – the "Big Bang".
2. **What was it like before the Big Bang?**
   a) All universe compressed into hot, dense mass, just a few millimeters across, that existed for just a fraction of the first second of time.


Temperature
Big Bang
10^{27}°C
10^{13}°C
10^{8}°C
3,000°C
-253°C
-270°C
10^{-35} s Inflation occurs.
1 s The first hydrogen nuclei form.
3 min Universe consists of about 75% hydrogen nuclei, 25% helium nuclei, and less than 1% other light nuclei.
300,000 years Stable atoms begin forming; limit of observable universe.
500 million to 1 billion years First galaxies begin to form.
13.7 billion years (present)
Time

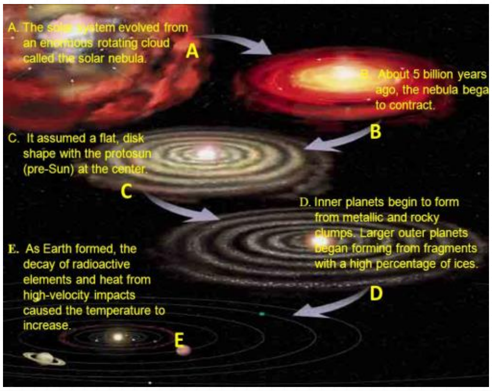
Universe Formation Timeline

3. **10 – 20 billion years ago → universe started to expand from a pebble-size to astronomical size.**
4. **Expansion continues, but much more slowly now billions of years later.**
5. **Over time, more diverse kinds of atoms began to form, and they eventually condensed into the stars and galaxies of our present universe**

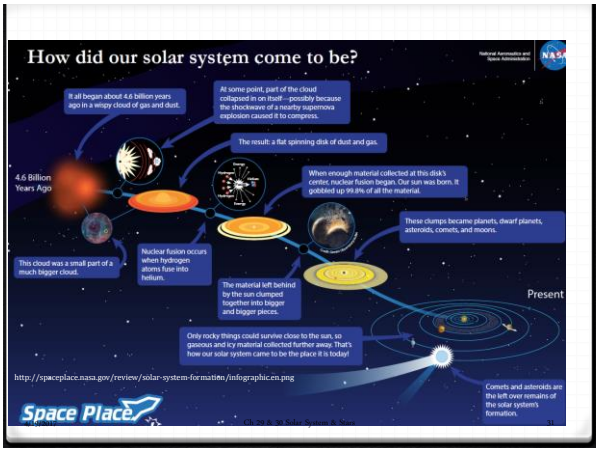
Video The Beginning of Everything The Big Bang: https://www.youtube.com/watch?v=wNDGgL73ihY


Big Bang
300,000 years after time begins, particles collide to form hydrogen and helium atoms.
1 billion years after the Big Bang, hydrogen and helium atoms are pulled together by gravity to form the first galaxies.
PRESENT DAY: 13.7 billion years later.
One second after the Big Bang, protons begin to form while the temperature is extremely high
While the universe is still hot enough for particles to fuse the element lithium also forms.
As old stars die, they send elements that are heavier than lithium out into space where others stars and planets are formed.

http://utahscience.oremjr.alpine.k12.ut.us/sciber08/9th/stand_1/images/BigBang.jpg


A. The solar system evolved from an enormous rotating cloud called the solar nebula.
A
B. About 5 billion years ago, the nebula bega to contract.
B
C. It assumed a flat, disk shape with the protosun (pre-Sun) at the center.
C
D. Inner planets begin to form from metallic and rocky clumps. Larger outer planets began forming from fragments with a high percentage of ices.
D
E. As Earth formed, the decay of radioactive elements and heat from high-velocity impacts caused the temperature to increase.
E

http://images.slideplayer.com/21/6269683/slides/slide_5.jpg



Formation of Our Solar System
Section 29.4

Collapsing Interstellar Cloud Theory- of Solar System Formation

Interstellar Clouds = Huge clouds of gas & dust in space

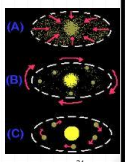
1. Made mainly of hydrogen (H_2) and Helium (He)
2. Forms stars and planets when the cloud condenses/collapses due to gravity

Formation of Our Solar System

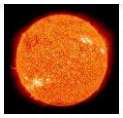
3. **These clouds usually look dark because the dust blocks light.**
   - Like Smog
   - Stars behind this cloud can't shine through it.
   - But….Sometimes the light from stars within the cloud causes these interstellar clouds to glow.
4. **Location**
   A. There are many interstellar clouds found within our Milky Way Galaxy.
   B. Astronomers look for high amounts of gas and dust


Formation of Our Solar System

5. **Collapsing Interstellar Cloud Theory**
   A. When enough gas and dust is present, scientists think these interstellar clouds condense because of gravity.
   B. Can form a star or planet
   C. Cloud begins collapsing slowly.
   D. The smaller it gets the faster it begins to collapse and spin
   E. This spinning motion with eventually form a flat rotating disk with a very dense center (core).



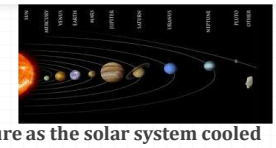
Formation of OUR Solar System



Solar Nebula

1. Scientist believe that one huge interstellar cloud called the solar nebula formed the Sun and all the planets.
2. The Sun formed first in the center of this cloud.
   - Fits with why our Sun is the brightest and most dense thing in our solar system.
3. In the center of the cloud it was the hottest
4. On the edges of the cloud it was the coldest

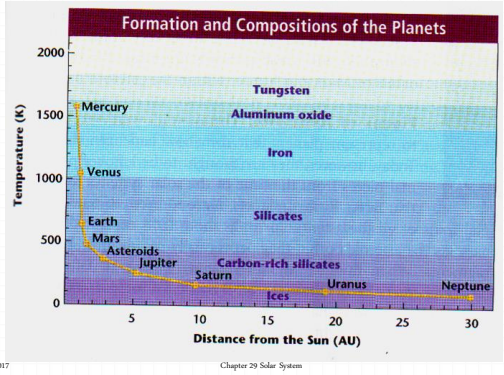
Formation of OUR Solar System



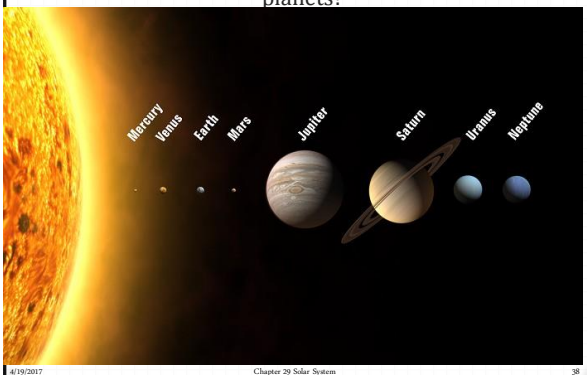
5. **This difference in temperature as the solar system cooled caused…**
   A. Heavy metals (iron, lead, etc.)
      i. condense at high temperatures and
      ii. became solids close to the Sun
   B. Lighter elements (hydrogen, helium, etc)
      i. don't condense until the temperature is very cold
      ii. remained gaseous
      iii. didn't become solid until they were further from the Sun

   C. **This is why** inner planets and outer planets have such different compositions

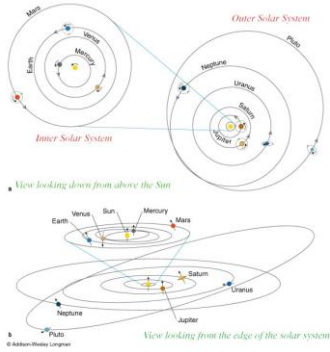
Fig 29-28 p.795 Element Composition of Planets

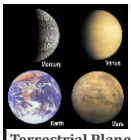


What are differences you can see between inner & outer planets?



Inner vs. Outer –Distance from Sun



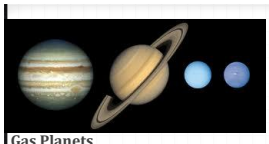


Terrestrial (Inner) Planets

Terrestrial Planets

****What does terrestrial mean? Composed of "land"**

1. **Inner Four Planets**
   A. Closest to the Sun
   B. Mercury, Venus, Earth, and Mars
2. **Small (Close to the size of Earth)**
   A. Smaller because the Sun's gravity captured the majority of materials found here
3. **Solid Surfaces**
   A. Made of Rocks and Metals. AKA "Heavy Metal" planets , because higher mass elements condensed at high temps close to the sun
4. **Few Moons**
   A. Sun's gravity took all the loose debris

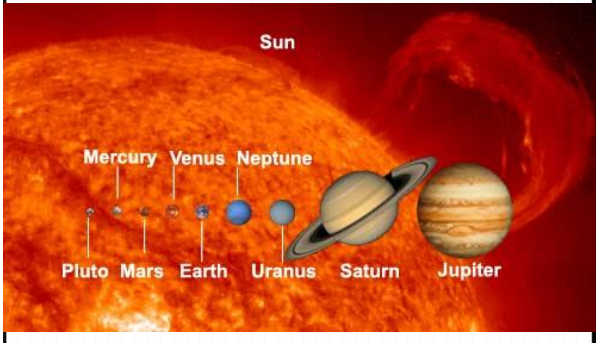


Gas Giant (Outer) Planets

Gas Planets

1. **Outer four Planets**
   A. Farthest from the Sun
   B. Jupiter, Saturn, Uranus, Neptune
2. **Larger in size & mass**
3. **Lack Solid Surfaces**
   A. Gaseous including hydrogen & helium
   B. Very little rock and metal
4. **Many moons (satellites)**
5. **Ring systems**
6. **Belts & Zones: Clouds stretched into bands by rapid rotation of the planet**
   A. Why look "striped"
   B. Clouds made of H, He, methane (blue) & ammonia (NOT water like on earth)

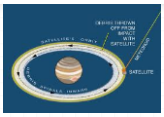
Approximate Size of Planets



Development of Inner Planets

Inner Planet Formation

1. As materials (rock, metal, ice) condense and become solid, they collide and stick together.
2. **Planetesimals** = Space objects (100's of km in diameter) made by colliding and sticking solid particles
3. **Inner Terrestrial Planets** formed by colliding and sticking planetesimals
   A. Made of very different things, more rock and metal
4. **Sun's gravity took all the gas and floating debris away from inner planets.**
   A. This is why they are rocky and dense
   B. This is why moons are rare for inner planets.



Development of Outer Planets

Outer Planet Formation

1. **The planets formed by a process in which dust and gas gravitationally attracted each other.**
   A. As size increases, gravity increases & pulls even more gas & dust in
   B. Over time this collected and formed larger and larger bodies.
2. **1st planet of the gas to form was Jupiter**
   A. This is why Jupiter is the largest.
   B. Had the most materials to build with
3. **Then Saturn, Uranus and Neptune (the rest of the gas giants) formed**
   A. Not as large because Jupiter had taken most of the materials; gas, dust, and ice to make itself.
4. **"Leftovers" became moons that form along equatorial planes of planets**

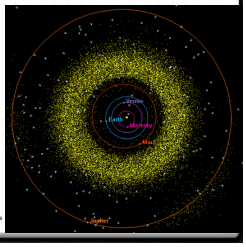
Cartoon

Space Rocks

Asteroids = Leftover pieces of planetesimals

1. Asteroids were never planets
2. Asteroids can collide and break apart.
3. Asteroid Belt = Planetesimals left behind in a band between Jupiter & Mars
   A. Jupiter's gravity prevented them from merging into a planet

Asteroid "Ida"
56 km (34 miles) wide
Has its own moon, "Dactyl"



Space Rocks

Meteroid
- When any space material enters Earth's atmosphere.

Meteor
- The streak of light produced when space material burns up in Earth's atmosphere.

Meteorite
- When a space object impacts Earth

These are all the same pieces of space rock, but the names change depending on location.

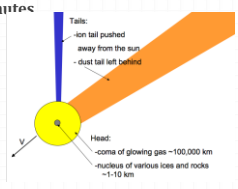
- Video: Huge Meteorites (downloaded), Meteorite Russia 2013- YouTube

Meteor Crater: Arizona
Gosses Bluff: Australia
6km (4miles) wide
200m (650ft) deep

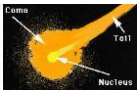
Space Rocks

Comet

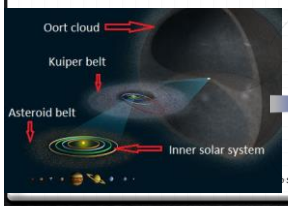
1. Small icy and rocky bodies with a highly eccentric orbit around the Sun.
2. **Meteor Shower**: Occurs when Earth passes through the **remains** of a comet's orbit
   - **Video: Comets (downloaded), 10 minutes**



Space Rocks



3. **Most found in 1 of 2 clusters**
   - A. Kuiper Belt – close to Pluto (30 – 50 AU) from the Sun
   - B. Oort cloud - >100,000 AU from the Sun
4. **Comet Structure (Parts of a comet)**
   - A. Icy nucleus = small, solid core
     - i. When it is heated, it releases gas & dust to form the coma & the tail
   - B. Coma = glowing gas surrounding nucleus
   - C. Tail – always points away from the Sun due to solar wind



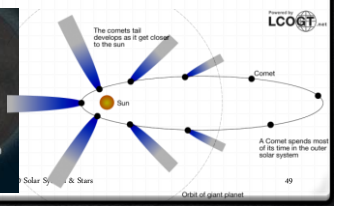
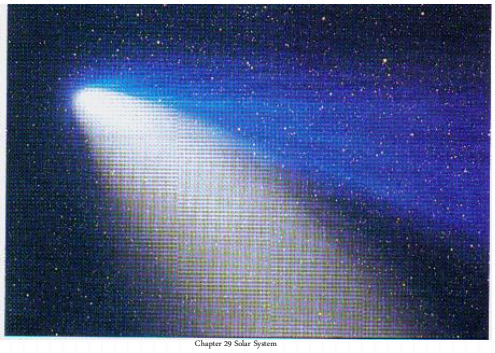


Fig 29-30 Photo of Comet Hale-Bopp in 1997

(Will not be seen again until the year 4397)



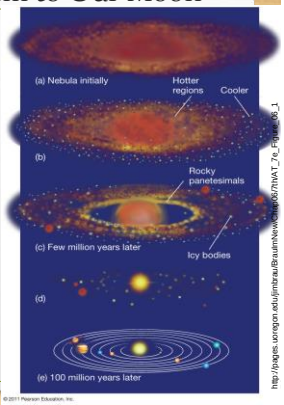
4/19/2017 Chapter 29 Solar System 50

Moving from Solar System to Our Moon

One last diagram of solar system formation.

Now that we've seen that the theories of how the universe and solar system involve lots of matter and debris flying around and collapsing:

We'll move on to theories of how our moon was formed.

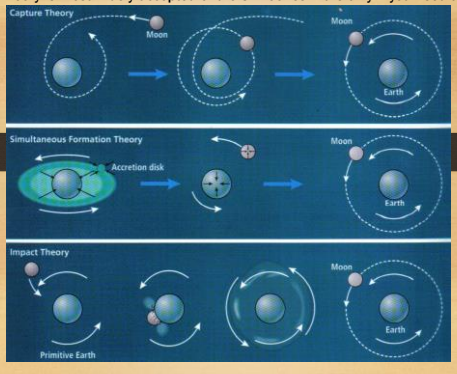


Ch 28 The Sun-Earth-Moon System 51 4/19/2017

TT #87 How Did the Moon Form?

Formation Theories – 3 main ones What does this diagram tell about them?

- Impact Theory is most widely accepted of the 3 Theories – the only 1 you need to explain



Impact Theory

1. Theory states that the Moon formed because of a huge collision between the Earth & a Mars-sized object
2. Collision expelled material/debris from both the Earth & the space object
3. The flying debris combines to form the Moon
4. Positives:
   - A. Explains why there are both similarities & differences in composition between the Earth & the Moon
   - B. Explains why there is no water on the moon – heat from the impact would have evaporated any water
5. Most commonly accepted theory
6. Possible cause of crater that became Pacific Ocean?

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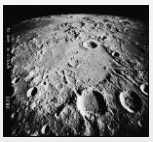
Impact Theory Videos

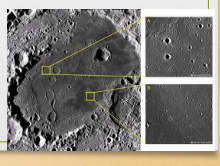
- Downloaded Video: Moon Origins by Apollo
- Video: Moon Origin, History Channel Clip
- Impact Animation
- Earth's Moon: Giant Impact Theory by Conceptual Academy
  - Watch from 3 minutes on
- Theory & Problems

Ch 28 The Sun-Earth-Moon System

Moon Topography

1. **Highlands**: Mountains, light in color, cratered (Light play-dough)
2. **Maria** ("seas"): Dark, smooth, low elevation, flat plains (Dark play-dough)

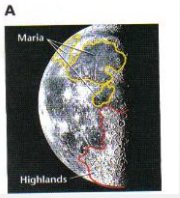


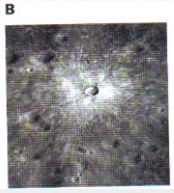



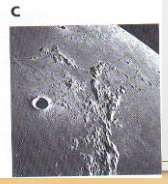
Moon Topography

3. **Impact craters**: Depressions formed by space object crashing onto the Moon's surface (Use various objects to make craters in highlands)
4. **Regolith:** Layers of loose, rocky matter caused by the impacts
   - A. Very fine regolith has a texture like snow
   - B. Thicker in highlands than in maria
5. No erosion
   - A. No atmosphere (no wind & no flowing water)
   - B. Impact craters remain unchanged


Fig 28-8 p. 754 Moon Topography

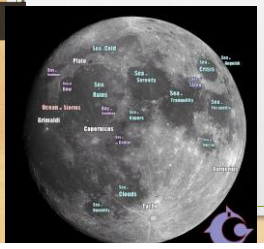


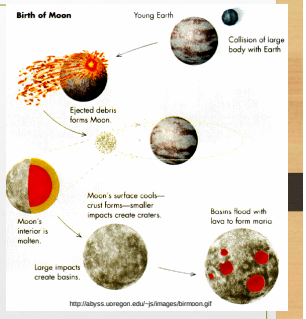




How old is the Moon?

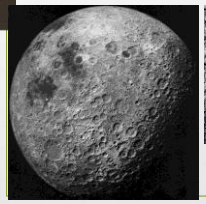
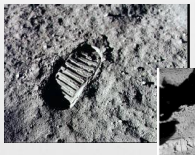
1. How do we know the age of various regions of the Moon?
   - ➢ Scientists dated rocks
2. Studies have shown that the Highlands formed before the Maria





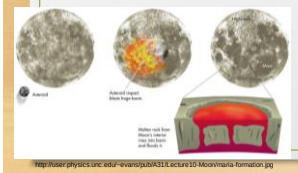
Moon History – Highland Age

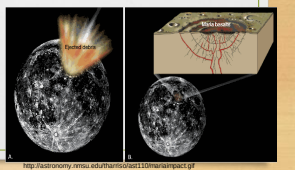
1. Highlands are 3.8 – 4.6 billion years old
   - A. Heavily bombarded during the first 800 million years by flying space objects
   - B. Caused surface to be covered with regolith,
     - I. Regolith = a layer of loose, ground-up rock caused by impacts
   - C. Regolith allows astronaut footprints to still be visible


Moon History – Maria Age

2. Maria are slightly younger, 3.1 – 3.8 billion years old
   - A. Formed by lava filling up huge impact crater holes
     - I. Very intense impacts by space objects caused cracks in the larger craters
     - II. Lava flowed up through the cracks & filled the bottom of deep craters
     - III. As the liquid lava cooled it created smooth, flat maria
   - B. Not many space objects have hit since the maria formed, so maria are smooth with few craters



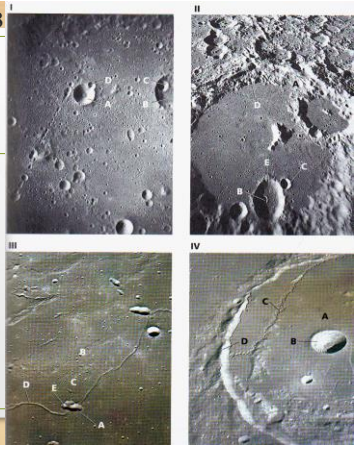


Moon History – Rilles, Far Side of Moon

3. Highlands remain high in elevation because lava did not completely fill the basins
4. Far Side of the Moon: NO Maria on the far side of the Moon
   A. The crust is thicker on the far side of the moon the impact cracks weren't deep enough to reach the lava

Mapping Geolab p. 768

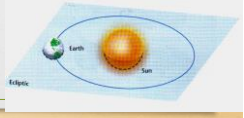
- Can you identify the labelled features?
- Can you determine their relative age? How?



Sec 28.3 The Sun-Earth-Moon System

Motions of the Earth

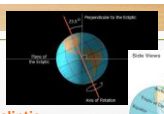
1. **Rotation**: Spinning of the earth around its axis
   A. Daily motion
   B. Causes day & night, and setting & rising of the sun
   C. Causes the "appearance" of the sun rising in the east & setting in the west
2. **Revolution**: Orbital motion around the Sun
   A. Annual Motion
   B. Year = the time to complete 1 revolution
   C. **Ecliptic**: Plane in which the Earth orbits the Sun



If the Earth's orbit around the Sun is the same, then how do we get seasons?

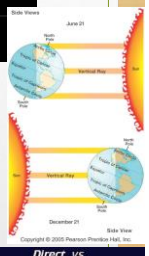
https://www.youtube.com/watch?v=p0wk4qG2mIg

Effects of Earth's tilt



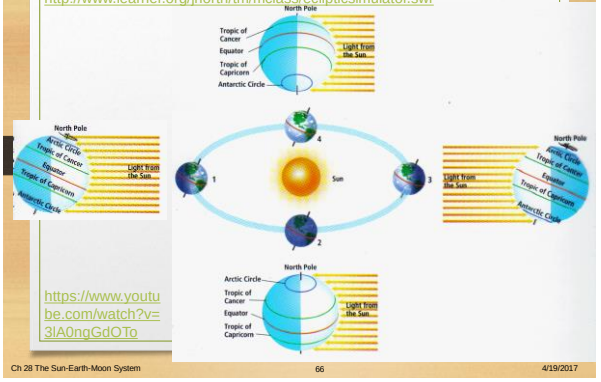
Effects of Earth's tilt; Seasons

1. Tilted at 23.5° compared to the ecliptic
2. Tilt AND revolution are both needed to cause seasons
3. Tilt causes the intensity of the Sun to vary with location
   A. Direct Light = Warmer (more intense)
   B. Indirect Light = Cooler
4. Hemisphere tilted TOWARDS the sun;
   A. Has longer daylight
   B. Is in the summer season
   C. The sun appears higher in the sky
5. NOTE: Seasons due to TILT (Not distance)



TT #88 Solstices & Equinoxes

Simulator – Seasons & Ecliptic:
http://www.learner.org/jnorth/tm/mclass/eclipticsimulator.swf

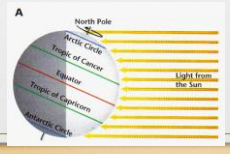


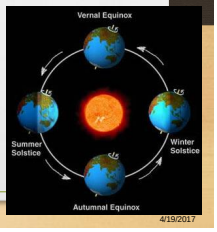
https://www.youtube.com/watch?v=3lA0ngGdOTo

Solstices

Solstice: Is the day when the sun reaches its greatest distance N or S of the equator

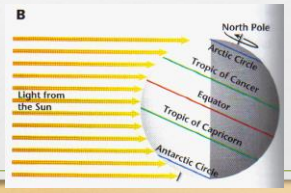
1. **Summer solstice** (for N. Hemisphere) is when the sun is the furthest north
   - A. Longest amount of daylight, shortest night
   - B. Most direct light is at 23.5°N – Tropic of Cancer
   - C. June 21
   - D. Arctic circle has constant daylight
   - E. Antarctic has constant darkness

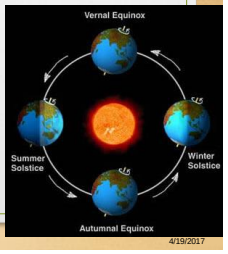




Winter Solstice

2. **Winter solstice** (for N. Hemisphere) is when the sun is the furthest south
   - A. Shortest amount of daylight, longest night
   - B. Most direct light is at 23.5°S – Tropic of Capricorn
   - C. December 21
   - D. Arctic circle has constant darkness
   - E. Antarctic has constant daylight

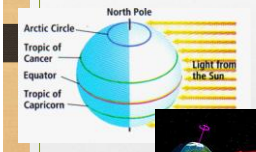


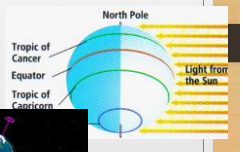


Equinox

Equinox: Sun is directly over the equator

1. Equal amount of daylight and night
2. Neither hemisphere is tilted towards the Sun
3. **Autumnal equinox:** Sept 21
4. **Vernal** (spring) **equinox:** March 21





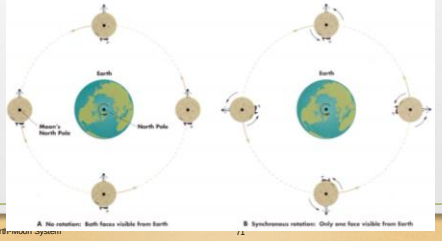
Chichen itza equinox

http://commons.wikimedia.org/wiki/File:ChichenItzaEquinox.jpg

Motions of the Moon – Synchronous Rotation

Do this slide IF TIME: Synchronous Rotation:

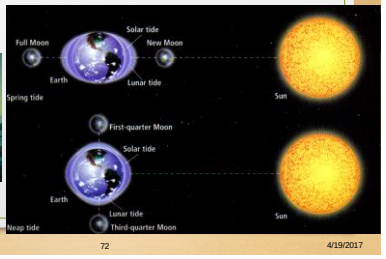
1. The Moon makes 1 revolution (orbit around earth) and 1 rotation (on axis) in the same amount of time
2. So the same side of the Moon always faces the Earth
3. We never saw the far side of the moon until space program
4. Video: Synchronous Rotation



Tides

Tides

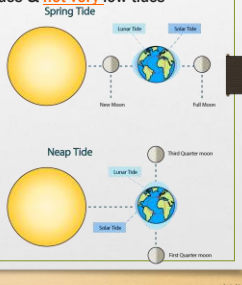
1. Moon's gravity has a bigger effect on the Earth's tides than the Sun's due to the moon's nearness
2. High tides occur on the sides of Earth towards & opposite of the moon
3. High tides occur every 12 hours. Low tides also occur every 12 hours



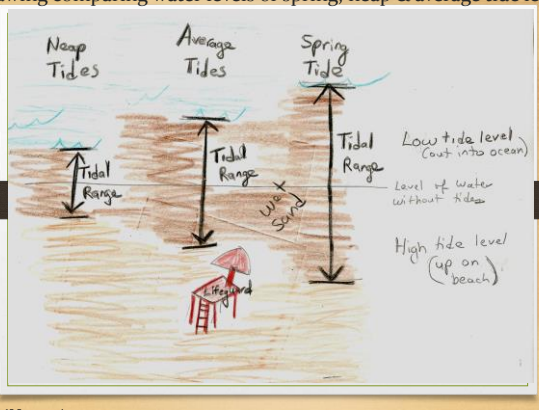
Tides

4. Spring tides occur when the earth, sun & moon are aligned
   A. Large tidal range: Very high tides & Very low tides
5. Neap tides occur when the moon is at right angles to the earth & sun line
   A. Small tidal range: not very high tides & not very low tides

- Video: Cause of Tides, 2 minutes
- Video: Time Lapse of High/Low Tides at Bay of Fundy Dock, 1 minute
- Animation: Spring & Neap Tides, 1 minutes
- Do you need to draw a diagram to remember?



Drawing comparing water levels of spring, neap & average tide level



Question of the Day #1

(Was also asked earlier in PowerPoint)

Draw the best diagram of our solar system that you can in your notes. Make sure to include labels!

Question of the Day #2

What was the problem with the geocentric theory?
How did we fix the problem?

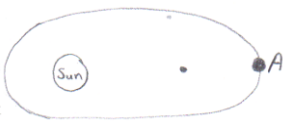
Question of the Day #3

Compare and Contrast Heliocentric and Geocentric Theory.

Question of the Day
You may want to use a Venn Diagram

Question of the Day #4

Review your knowledge of eccentricity using the diagram below.
A. Estimate the eccentricity value of the orbit.
B. Explain your estimate.



Question of the Day #5

What is retrograde motion?

Who fixed this problem?

Question of the Day #6

<u>Understanding Check</u>:
Write down as many facts as you can about interstellar clouds without peeking at your notes.

Question of the Day #7

1). What is an interstellar cloud?

2). What must happen to an interstellar cloud to produce a star or planet?

Question of the Day #8

Test your knowledge:
Describe what each planet is made of, gas, ice, rock or metal, and why that makes sense.

Question of the Day #9

Describe the process that produces terrestrial planets.

Please record your response in your notes outline.

Question of the Day #10

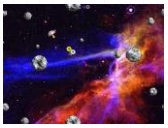
Describe the process that produces gas giant planets.

Please record your response in your notes outline.

Question of the Day #11

Use your notes to draw a diagram of a space rocks journey from being classified as an asteroid to a meteorite.

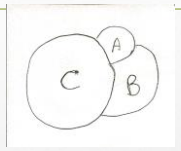
Please record your response in your note outline.



Miscellaneous Review Questions

1. List 3 characteristics common to all terrestial planets
2. List 3 characteristics common to all gas giants
3. Compare and contrast asteroids and comets
4. According to the solar nebular theory, what caused the inner planets to be dense and rocky and the outer planets to be light with H & He?
5. What does an eccentricity of 0.1 tell you?
6. What is retrograde motion?
7. Name the 4 terrestrials
8. What are 2 things that effect gravity?

Review #1: 28.2



1. In the diagram above, which crater is
   - A. Oldest? How do you know?
   - B. Youngest? How do you know?

Review #2 – Solstices & Equinoxes

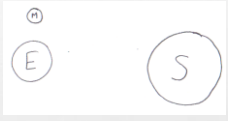
1. Describe an equinox
2. Describe the two solstices
3. Does the distance from the Sun cause the Earth's seasons? Why or why not?
4. How are the seasons in the northern & southern hemisphere related?
5. Why is the tilt of Earth on its axis important?
6. When the North Pole experiences 24 hours of daylight, what is happening at the South Pole?

Review #3 – Seasons & Phases

1. What are the causes of the seasons on Earth?
2. What would our seasons be like if Earth's axis were not tilted?
3. If Earth's axis were tilted 45 degrees, at what latitudes would the sun be directly overhead on the
   - A. summer and winter solstices
   - B. Vernal & autumnal equinoxes?
   - C. How would our seasons be different?

Review #4 - Miscellaneous

1. What causes day & night?
2. How long does earth's rotation take?
3. What type of tide is shown in the diagram below? What moon phase is occurring?



4. How often does low tide occur?