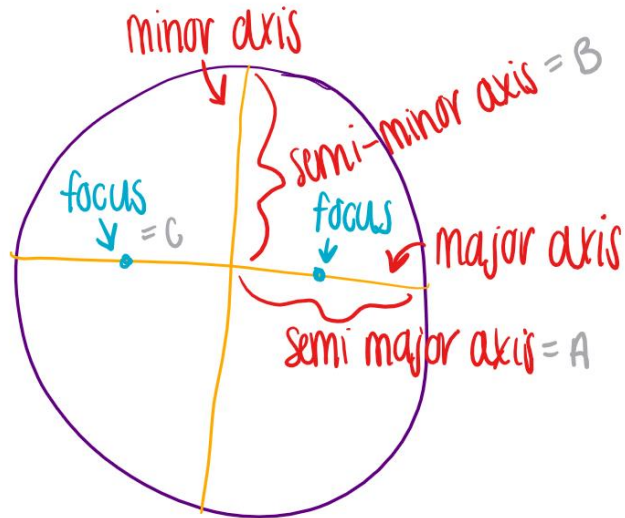


- Tycho Brahe
 - Danish nobility - well funded
 - Saw a new star in 1572
 - He saw a supernova
 - This wasn't a new star because the heavens are perfect
- Made very precise measurements of the sun, moon and planets
- Brahe hired Johannes Kepler
- Johannes Kepler
 - Nose was cut off and was very vain
 - He sat down, drank a lot and did not get up to use the restroom and his bladder bursts
- Eclipse
 - Some of the distance between the foci is constant
 - It's a flattened circle
- Eccentricity - tells you how flattened a circle is
- circles, $e=0$ but as the circle gets flattened, the e number gets closer to 1 because the circle is becoming flattened
- As the planet moves away from the sun, it slows down but as it moves towards the sun, it speeds up
- He said that 1^2 is equal to 1^3
- $p^2 = a^3$
 - P = how long it takes to orbit once
 - A = semi-major axis
- People thought that as things move in the sky, it made music
- Galileo Galilei
 - Pisa, Italy
 - Experimentalist, called the Father of Modern Science
 - All objects fall at the same speed as they fall
 - He did not invent the telescope
- You must get rid of the air, and then they will fall at the same time
- Galilei pointed the telescope up to look at the sky
- He saw that the milky way was made of stars
 - The sun has sunspots
 - The moon had mountains and craters
 - Jupiter has moons and Saturn has rings
- He showed that Aristotle was wrong for thinking they were in a celestial sphere.
- Put under house arrest, 70 years old and blind from looking at the sun.
- His friends came to visit, and the pope was his friend but a cardinal complained about him.
- His daughters were nuns and he was buried by one of his daughters
- Sir Isaac Newton
 - He was too busy to go to his own wedding
 - Discovered the universal law of gravitation
 - An apple hit him on the head, and he discovered gravity
 - Invented calculus, the other one was a German
 - Came up with three laws of motion
- Gravity is an attractive force; it's always pulling never pushing
- A force - push or pull
- Weight - pull of gravity
- Weight is a force
- Force's units are newton
- Only four shapes gravity can be:
 - Ellipses and circles will come back, but hyperbola and parabola will not come back.

- Oval - have two flat sides and two round sides
 - Not a shape an orbit can be

focus plural is foci



Preview from Notesale.co.uk
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$$F_g = G \frac{m_1 m_2}{r^2}$$
 (Note: 'Kilograms' is written above m_1, m_2 and 'meter' is written below r^2)

Unit Two - Astronomy Notes

Light spectrum: Raul's mother visited uncle Xavier's Garden

Order of the Planets: My very earnest mother just served us nine pizzas.

9/25/18

- Light is electromagnetic radiation

- X-rays travel through soft tissue but not bone
 - Blocked by the atmosphere
 - They kill
- Ultraviolet
 - Causes sunburns and skin cancer
 - Most is blocked by atmosphere, the ozone layer blocks the rays
 - Kills living cells
- Visible
 - 400-700 nanometers that's visible
 - What the human eyes detect
 - The colors of the spectrum Roy g biV
 - RED, ORANGE, YELLOW, GREEN, BLUE, INDIGO, VIOLET
 - Violet is the shortest
 - Red is the longest - violet is the shortest so it's the most energetic per photon
- Infrared
 - We feel the heat
 - Infrared light bulbs got hot and they are inefficient for light.
 - Humans radiate infrared

9/27/18

- Purple is the pigment and violet are the light that it's reflecting because the human eye cannot see violet.
- Microwave
 - Very easily absorbed by water
 - Light is energy
- Radio
 - Longest wavelength
 - Used for communications because our atmosphere is transparent to radio waves
 - They have the least amount of energy
 - Longer than 1 m
- Things emit light and it depends on their temperatures
- 3 temperature scales in common use
 - F, Celsius and kelvin
- Kelvin is an absolute scale, there is not negative numbers
- Absolute zero is no available energy -- no energy out, only energy in
- Kelvin temperatures do not use the degree symbol
- Temperature is a measure of how fast the particles are moving
- Hotter substances- faster the particles are moving
- Black body - an object that does not reflect light from outside sources
- Something is a color because it is not absorbing a color because it's reflecting it
- Black bodies absorb everything
 - They emit light based on temperature
- A hot star is blue, cool star is red
 - In between star is white
- Lambda means wavelength
- Energy / area x time = flux how much brighter something is
- We get a spectrum from reflection, refraction and dispersion

10/2/18

- The liquid metal in Jupiter is hydrogen.
 - Strongest magnetic field.
- Earth's magnetic field protects us from the solar wind, a stream of charged particles that flow outward from the sun.
- Aurora happens when the solar wind is tunneled down to hit the Earth's poles.
- Earth's crust is broken into plates and 3 different rocks.
- Hot spot volcanism
 - Plates move over hot spots and that's how we get mountains and islands.
- Hawaii is a bunch of volcanoes.
- Alfred Wegener introduced PT and then nobody believed him.
 - It was not accepted at the time.
 - He could not explain why it was happening.
 - 1950's, 40 years later, we discovered the Mid Atlantic ridge.
 - The seafloor was moving away from each other.
 - Proposed Pangea.
- What's the evidence?
 - There are fossils on the coast of South America and Africa that are the same species.
 - They must have been connected in the past for them to be there.
- How did it split/?
 - First, north south. Then east west.
 - Himalayan mountains are from PT ramming each other and pushing each other up.
 - Rift is when PT move away from each other
- Subduction zone, creating trenches when PT's go above each other and the other goes below.
- Heat moves from hot to cold
- 3 ways to move heat conduction, convection and radiation.
 - Depend on the material
- Conduction
 - Through contacts and bonds
 - Best with solids
- Convection
 - Liquids and gases
 - Circulation, moving the warm material around
- Radiation
 - Electromagnetic radiation
 - Losing energy by emitting photons
- If the Atlantic ocean is growing, the pacific is shrinking
- The ring of fire - a lot of geological activity around that place, the pacific plate.
- 4 layers in the interior and 4 layers in the atmosphere
 - Inner core - solid iron

- Earth has a greenhouse effect
- How the atmosphere was made → formation of the atmosphere
 - We used to not have an atmosphere, the gases are trapped rocks, early volcanism, out gasses some gases. All the terr. That have atmospheres have volcanoes and volcanoes bake the gases out. Water fell out of the clouds, water dissolve some of the gases in the oceans. CO₂ and sulfur d and water make sedimentary rocks. Plants convert CO₂ to oxygen and then plants put N₂ back into the atmosphere
- Weather - short term atmosphere changes, the conditions that we have right now.
- Climate - long term average.
- They average 30 years to get the average temperature.
- greenhouse effect
 - Sunlight hits the earth, strikes and heats the surface. Some of the sunlight gets bounces back up, ground heats and radiated infrared, need the same input and output of sunlight to get balance, some infrared gets trapped, water and clouds trap infrared, CO₂ traps and methane traps infrared and that's what's causing the greenhouse effect.
- This is called the greenhouse effect, bc this is what happens
 - Causing global warming
- Evidence for GW

10/30/18

- Fossil fuels are stored solar energy
- The moon orbits the earth in 27.3 days. The cycle of phases is 29.5
- We see 59% of the earth
- The moon wobbles, the wobbles are called librations
- Going around the ecliptic, not the equator.
- Orbit's elliptical so the orbital speed varies.
- Dark side- far side of the moon.
- Common ices - water, methane and ammonia.
 - Vaporize at low temperatures.
- The moon is lacking in the volatiles
- Volatiles - material that vaporize at low temperatures.
- Lacking in iron and has no atmosphere.
- Mercury and the moon do not have atmosphere.
- Moons has a low gravitational pull.
- No oxygen, no magnetic field.
- Apollo, one had an explosion.
 - Gus grison, roger chafy and ed white were the 3 astronauts that killed in the explosion.
- Apollo 2-7 were not manned #8 orbited the moon and came back.
- Apollo 9 did not leave earth's orbit. It checked to make sure everything docked.

- Jupiter has the longest lived storm
- Has the most moons.
- Strongest magnetic field produced by liquid metallic hydrogen.
- Uranus is tilted sideways, most extreme seasons.
 - Water with dissolved ammonia.
- They're not aligned with their spin axis and not centered.
- Uranus does not have an internal energy source.
- Helium falling as rain in saturn. - how it gets gravity.
- Neptune has gravity by contracting.
- ammonia , reds and browns, methane creates blue clouds
- Jupiter - galileo
- Saturn - cassini
- Saturn is not spherical. - has the biggest bulge - oblateness - how non spherical something is.
 - Determines how much mass is in the core of the planet.
- Things that are spinning have a bulge.
- Saturn has more of it's mass in it's core than jupiter.
 - Thin atmosphere
 - Lower gravity
 - Expands outwards.
- Uranus was discovered in 1781.
- If it moves against the background of stars it's a planet
- Herschel saw it orbit and realized it was a planet
- Uranus - the roman god of heaven.
- Uranus was an accidental discovery.
- Neptune was predicted to exist.
- Uranus had a wobble, not staying in it's path.
 - Something was pulling on it.
 - Two people using how much deviation, what mass object was needed to produce the wobble and where it would be located.
- There was argument over the planet of Neptune.
- Today, we give both the people that found it credit.
- Neptune - the god of the sea.
- It shows that gravity works long distance and it works the same no matter how far away the object is.
- This was good for science in general .
- Neptune was predicted.
- All four jovian planets have moons and rings.
- The moons are also icy as well as rocky.
- The ices contain carbon compounds, methane, ethane, alcohols, dirty dark stuff.
 - The older the ices, the darker it is.
 - The younger it is, the whiter it is.

- Asteroids that have never gotten hot enough to melt are the oldest objects in the solar system.
- Asteroids are from the terr. And comets are from the jovian planets.
- Asteroids have very few volatile.
- Comets are mostly ice, some metal.
- Comets come from the ort cloud or by jupiter.
- Asteroids have nearly circular orbits near the plane of the ecliptic.
- Largest and first Asteroid was Ceres
 - Called a planet for 50 years.
 - It's now a dwarf planet.
- Asteroids was not coined until 1850.
 - Means 'star like'
 - It looks like a star in a photo.
- The asteroid belt runs from 2-3.5 au from the sun.
 - Ceres is 2.8 au.
- The mass of all the Asteroids in the belt, you wouldn't get pluto, no material in the Asteroids.
- How do we find Asteroids?
 - They move against a background of stars
 - We take pictures at diff. Times and compare to see what moved.
- Max wolf found nearly 200 Asteroids from pictures (1800's)
- Asteroids come in different types of material composition
 - Most of them are rocky
 - The old ones have iron in goup on the crust.
 - Newer ones have stone
 - Metallics can happen with large Asteroids by differentiate.
- Stoney's - rocky mantel
 - Irons - core (easy to find)
 - Stony irons - Asteroids that have not differentiated.
- Meteorites - must survive thru the atmosphere, no ice can be on that rock.
 - Once it's hit a ground.
- Meteoroid - in space, small dust grain bits, no status as major object
- Meteor - flashes thru the sky, when it hits the atmosphere, compresses the air in the atmosphere and the air heats and it causes it to streak.
- The Asteroid Ida has a moon, Dactyl.
 - They can also have rings & ring systems.
- Asteroids are too small for gravity to pull them into spheres.
- It is believing that an collision into the earth caused the extinction of the dinosaurs.
 - The entire content burned because of the planets and the oxygen in the atmosphere.
 - Sunlight was lost for years.

- Galileo studies how things accelerate.
 - Accelerate - the way objects change their speed or direction of motion.
 - telescopes were called spy glasses
 - Lippershey discovered spy glasses but Galileo put the spy glasses together and edited the spyglass to make it more powerful, thus becoming a telescope
 - He turned the telescope to the heavens (the sky) and saw stars and other details of things that nobody knew was there.
- Ch 3 S 3.1 The Laws of Planetary Motion
 - Orbit - the path of an object in space
 - Kepler found that the path of a planet was like ellipse
 - Ellipse - the simplest kind of closed curve, belonging to the conic sections.
 - Major axis - the widest diameter in the ellipse
 - Semi-major axis - half the distance from the center to the end
 - Eccentricity of the ellipse - the ratio of the distance between the foci to the length of the major axis
 - Orbital speed - the speed with which each planet moves along its ellipse
 - Kepler came up with orbital period, how long it would take something to reach the sun.
 - $p^2 = a^3$
 - P is the orbital period and a is the AU
 - Kepler's first law: Each planet moves around the Sun in an orbit that is an ellipse, with the Sun at one focus of the ellipse.
 - Kepler's second law: The straight line joining a planet and the Sun sweeps out equal areas in space in equal intervals of time.
 - Kepler's third law: The square of a planet's orbital period is directly proportional to the cube of the semimajor axis of its orbit.
- Ch 3 S 3.2 Newton's Greatest Synthesis
 - Newton's first law: Every object will continue to be in a state of rest or move at a constant speed in a straight line unless it is compelled to change by an outside force.
 - Newton's second law: The change of motion of a body is proportional to and in the direction of the force acting on it.
 - Newton's third law: For every action there is an equal and opposite reaction (or: the mutual actions of two bodies upon each other are always equal and act in opposite directions).
 - Momentum - The law states that in the absence of any outside influence, there is a measure of a body's motion

- Ch 3 S 3.3

9-13-18 Ch 3 S 3.4-3.6 & Ch 4 S 4.6

- Ch 3 S 3.4
- Ch 3 S 3.5
- Ch 3 S 3.6

9-18-18 Ch 4 S 4.6

- Ch 4 S 4.6 Ocean Tides and the Moon
 - Twice daily rising and falling of the tides
 - Tides must be related to the moon
 - The moon attracted different parts of the Earth
 - Called differential forces
 - Differential forces make the Earth a prolate spheroid
 - prolate spheroid - a football shape
 - The Earth's long diameter is towards the moon
 - Earth distorts from the moon's forces but only enough to affect the water and oceans.
 - tide - raising forces make bulges in the ocean