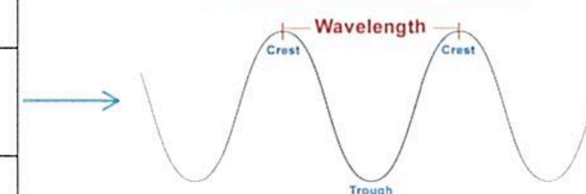
Topic: Astronomy

Big Bang	The Bing Bang Theory is the dominant scientific theory about the origin of the universe. The Big Bang took place approximately 13.7 billion years ago. All the mass and energy was concentrated into a very small and dense "primeval atom". This atom exploded/expanded with tremendous force causing all of the matter in space to expand. The expanding and cooling universe formed subatomic particles (protons, neutrons and electrons) and then small atoms of hydrogen and helium. Within 1 billion years, matter organized itself into celestial bodies (stars and galaxies).
Singularity	A very small and dense "primeval atom".
Red Shift	Spectral lines with longer wavelengths. This indicates that a universe is moving away from us.
Blue Shift	Occurs when light rays speeding toward us get squeezed into shorter wavelengths. This indicates that's a universe is contracting.
Doppler Effect	Apparent change in wavelength of light as an object moves towards or away from an observer. -if an object moves toward us, the object is blue-shifted (shorter wavelength) -if an object moves away from us, the object us red shifted (longer wavelength)
Hubble's Law	The relationship between distance and recessional velocities of galaxies. Simply Stated: the farther away the galaxy, the faster it is moving from us.
Wavelength	Distance from crest to crest (peak to peak) in a wave.
Frequency	The number of wavelengths in a given unit of time (cycles/second).

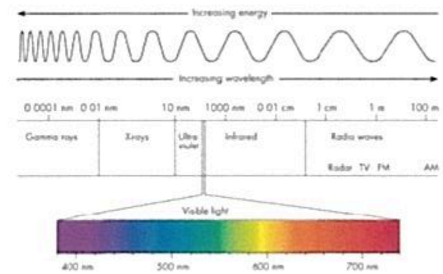
Big Bang Diagram

Wavelength Diagram

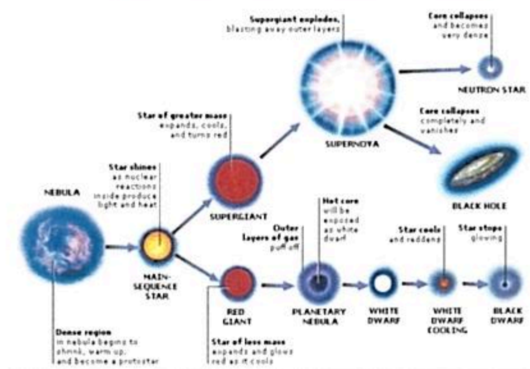


Radial Velocity	The component of the motion of a star away from or toward the earth along its line of sight expressed in miles or kilometers per second and determined by the shift in the wavelength of light emitted by the star.
Electromagnetic Energy	A form of energy that is reflected or emitted from objects in the form of electrical and magnetic waves that can travel through space.
Star Formation	A star will start out as Nebula (a cloud of gas and dust). Later, the star will form a protostar (not a true star). The protostar will eventually become a Main Sequence star. Depending on whether the star is massive or small will determine its path for its future life.
Life Cycle of Stars (small/massive)	**Small stars** - Nebula ↓ -Protostar ↓ -Main Sequence ↓ -Red Giant ↓ -Planetary Nebula ↓ -White Dwarf (will cool and redden) ↓ -Black Dwarf (stops glowing) **Massive stars** -Nebula ↓ -Protostar ↓ -Main Sequence ↓ -Super Giant ↓ -Super Nova ↓ -Black Hole or Neutron Star
Nebula	A cloud of gas and dust -nebula contract and condense under the influence of gravity -contraction causes temperatures and pressures to rise -Eventually forms a protostar
Nova	A nova is an explosion from the surface of a white-dwarf star in a binary star system. A nova occurs when the white dwarf, which is the dense core of a once-normal star, “steals” gas from its nearby companion star.

Electromagnetic Energy Diagram

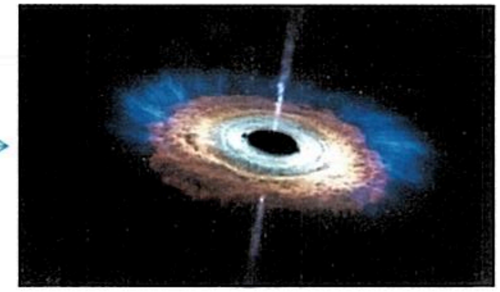


Life Cycle of Stars Diagram

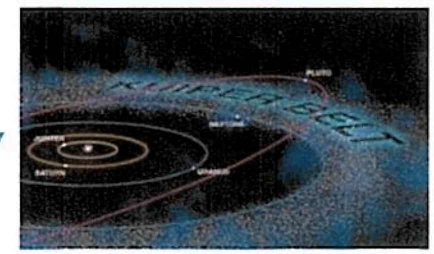


Life Cycle of Our Sun	Our sun is an average yellow star. Currently our sun is a Main Sequence (early stage) star. Our sun is not a massive star so its next stage will be a Red Giant. After our sun becomes a Red Giant (intermediate stage), it will become a White Dwarf (late stage).
Pulsar	One of several hundred known celestial objects generally believed to be rapidly rotating neutron stars that emit pulses of radiation, especially radio waves, with a high degree of regularity.
Supernova	The "death" of a massive star by explosion.
Nuclear Fusion	A process in which two or more atoms combine (fuse) to create one larger atom.
Neutron Star	An extremely dense star that remains after a Supernova
Black Hole	A region of space having a gravitational field so intense that no matter or radiation can escape.
Terrestrial Planets	Mercury, Venus, Earth and Mars are all Terrestrial planets. These types of planets are small, rocky, dense, close to the sun, and they all have few to no moons.
Jovian Planets	Jupiter, Saturn, Uranus and Neptune are all Jovian planets. Jovian planets are mostly made of gas, large in size, have low densities, far from the sun, have many moons, and have rings.
Planetary Nebula	When Red Giants expel their outer layers of gas and leave behind their exposed hot, small core.
Oort Cloud	A vast region of the solar system occupied by billions of comets. Location of Oort Cloud, beyond Neptune and Pluto.
Kuiper Belt	Around Pluto, where some asteroids form.
Asteroid Belt	Between Mars and Jupiter, where most asteroids form.

Black Hole Diagram

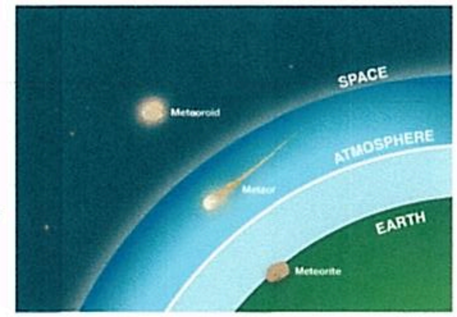


Kuiper Belt Diagram

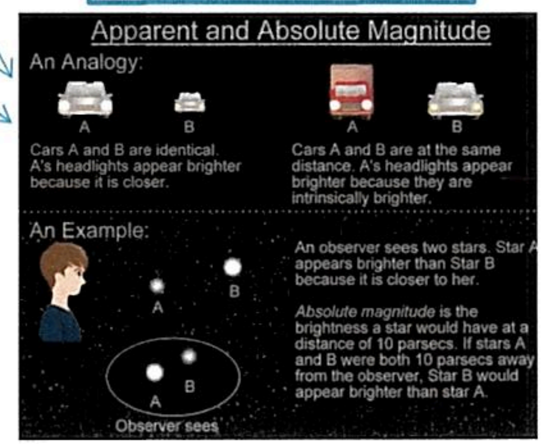


Light Year	The distance light can travel in one year. A single light year is 6,000,000,000,000 kilometers.
Astronomical Unit	One astronomical unit is the distance from the sun to the earth (149,597,870 kilometers).
Meteorite	Any objects that are large enough to survive the fall through an atmosphere and land on a surface. Upon impact, they create impact craters.
Meteoroid	Small pieces of rock and/or iron that are moving through space. Often small pieces of asteroids and comets tails that get caught in the gravity of other larger solar objects.
Meteor	Meteoroids that have entered a planet's atmosphere and are being burned up as they encounter friction within the atmosphere. The heat and friction give off a great amount of light (often called shooting stars).
Comets	Masses of ice and rock hurtling through space. Can be up to 50km wide (typically 1-10km wide). Move in highly eccentric orbits. Most comets originate in the Oort Cloud. They develop distinctive tails in this area due to sublimation.
Absolute Magnitude	How bright a star appears from a standard distance of 32.6 light years or 10 parsecs.
Apparent Magnitude	How bright a star appears from Earth.
Luminosity	The total amount of energy radiated by a star or other celestial object per second.

Meteoroid/Meteor/Meteorite Diagram



Apparent/Absolute Diagram



Earth Science Regents Review Sheet: ASTRONOMY

Big Bang - a cosmic theory about the beginning of the universe

- A scientific theory on how the universe was formed; the idea that the origin of the universe was marked by a fast expansion of matter
- Basically, the world started out as one single atom and continued to expand, forming galaxies; it still continues to expand
- At first, it expanded rapidly and then slowed down till what we have today
- Proves the idea that the world is continuously expanding [Red Shift] – the inflation theory
- We know this because of the weak cosmic background radiation ["a uniform microwave radiation remaining from the Big Bang"] still observed till today

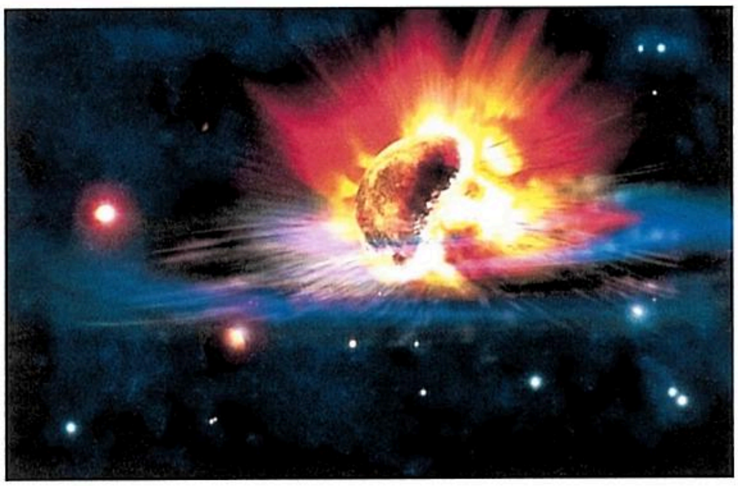


Diagram 1: Big Bang Expansion

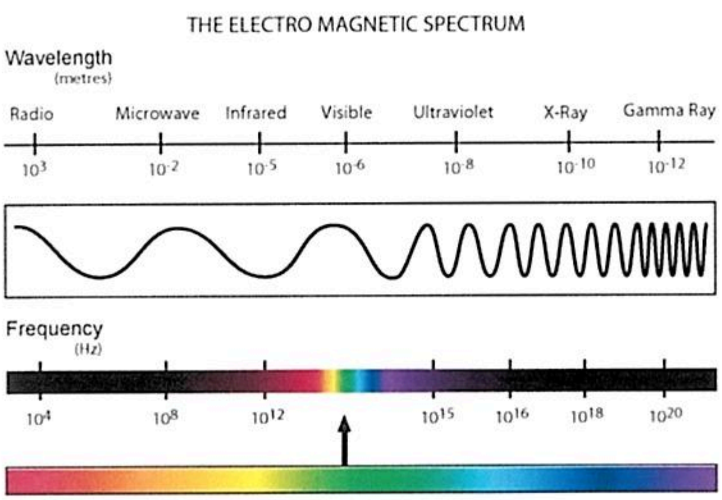


Diagram 2(above): Wavelength/Frequency Demonstration

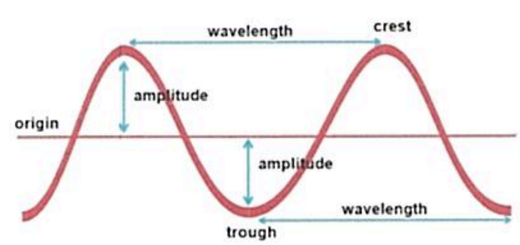
Diagram 3(right): Parts of a Wavelength

Singularity – a point where some property is infinite; like at the center of a black hole (the idea that a lot of mass is compressed in zero space)

Doppler's Effect – the change in wavelength (and frequency) of energy that occurs when the source emitting the energy is moving away from or towards an observer; understood with light and sound

- Basically the higher the frequency, the shorter the wavelength observed
- Measured using light to understand the relative movements of the galaxies and stars (to us)
- **Blue Shift – demonstrated by galaxies as they move towards us; shorter wavelength (λ)**
- **Red Shift – demonstrated by galaxies as they move away from us; longer wavelength (λ)**
- Remember, objects don't change color, only wavelength
- Red-shift is proof of the BBT because objects are moving away (therefore, universe is expanding)
- The faster and further an object is traveling, the more extreme the red shift

Wavelength – the distance between the two crests (peaks) of two waves
Frequency – how fast waves show up in a certain amount of time (the speed of the waves)



Earth Science Regents Review Sheet: ASTRONOMY

Hubble's Law – explains the relationship between distance and speed to measure the distance to distant stars and galaxies

- **Vexp = HoD**
- Vexp: recession velocity(expansion)
  Ho: Hubble constant*(like π) is highly sought after number as it is equal of the slope of the line in the next figure (relationship can be found ignoring this symbol)
  D: Distance to the object
- Proves that the velocity of galaxies is proportional to the distance from the Earth
- The universe is expanding at the speed of light

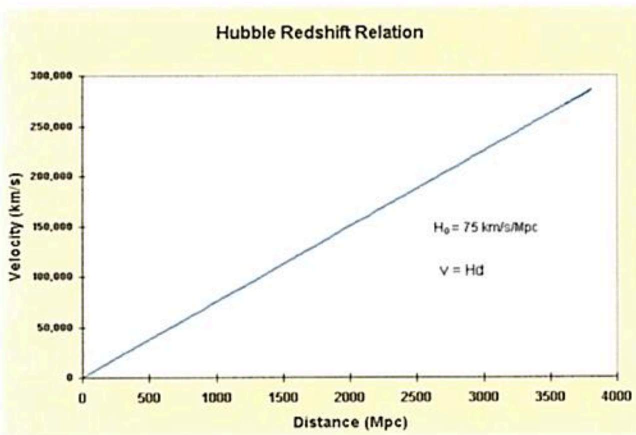


Diagram 4: Direct Relationship between Velocity (Speed with direction) and Distance to the Object

Diagram 5: A telescope in La Silla, Chile used to measure the radial velocity of exoplanets till present date

Radial Velocity – most effective method for locating exoplanets

- This method "relies on the fact that a star does not remain completely stationary when orbited by a planet" (from, "Radical Velocity, the First Method that Worked)
- It has small alterations (like an ellipse) because of the gravity of its orbiting partner
- This changes its spectrum to display the red or blue shift being observed, helping us derive the spectrograph for that particular planet.

Electromagnetic Energy – a form of energy that is reflected off of objects traveling in space in the form of different kind of waves (ex. Gamma rays, x-rays, ultraviolet radiation, visible light, infrared radiation, microwaves, and radio waves) each kind of wave with the different wavelength on the spectrum to differentiate them

- The Aurora Borealis are an example of electromagnetic energy seen from space

Earth Science Regents Review Sheet: ASTRONOMY

Diagram 7: The Aurora Borealis [Northern Lights] are in the form of Electromagnetic Energy

Star Formation – how stars [large masses of gases far off in space that produce energy by nuclear fusion] form

- Nuclear Fusion: the process where energy is created in stars; four hydrogen atoms are fused together to form one helium atom and extra energy; lighter elements form heavier elements
- 4 Hydrogen = 1 Helium + energy

Life Cycle of Stars:

- Stars form in the **nebulae**, which are huge masses of dust and gas (mainly hydrogen) that are condensing (or contracting) in space
- As mass collapses due to gravity, an increase in density leads to higher temperatures and nuclear fusion eventually begins; this converts lighter elements into heavier unstable elements and energy
- From the nebulae, the **main sequence star** forms which is how 90% of all stars spend most of their lives here as average size; as temperature increases, so does luminosity (how bright it is); THE SUN IS A MAIN-SEQUENCE STAR
- **Depending on the mass of the star, it will either transform into a Red Giant or a Super Giant (only if more mass has accumulated)**
- The very high mass star (like a Super Giant) will explode as a **Supernova** and become a **Black Hole** or another **planetary nebula** (the gas cloud from which stars form)
- A high mass star (a Red Giant) will explode as a **Supernova** and become a **Neutron Star**
- An Average or Low-Mass Star (A Main-Sequence) will undergo a gravitational weakness and then a **Nova Outburst** to become a **Red Giant** and then slowly burn out into **White Dwarfs**, and when they completely burn out, they will become **Black Dwarfs**

The Fate of a Star is ultimately decided by its mass:

- Large stars die violently rather fast – SUPERNOVAS (humongous explosions); small Stars fade away (fade out) over long periods of time. They will initially ho through a NOVA outburst and then fade away

Earth Science Regents Review Sheet: ASTRONOMY

Black Hole – objects with such enormous gravity that nothing can escape their grasp, even light [$E = mc^2$]
Neutron Stars – extremely dense, small, hot stars
Pulsar Stars – neutron stars that spin rapidly there by releasing pulses of energy

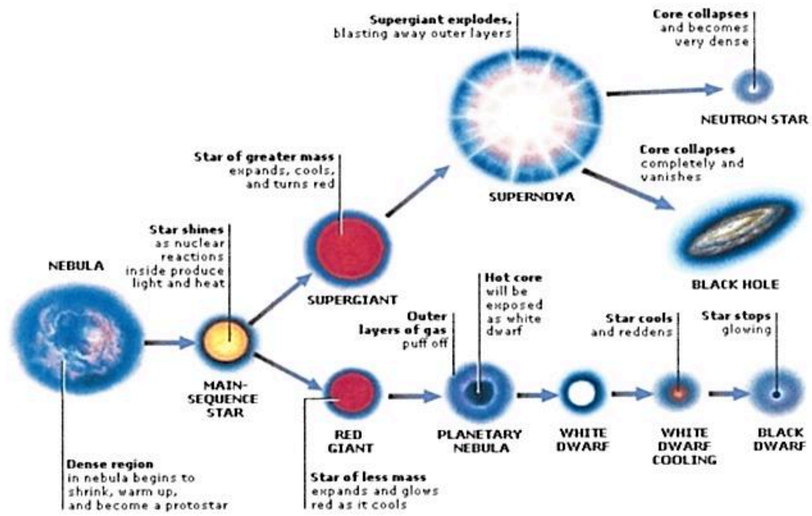


Diagram 6: Life Cycle of Stars

Life Cycle of Our Sun:

- The Sun is currently a Main Sequence Star, a low to average mass star and about 5 billion years' old
- It started as a proto-star as the "solar" nebula collapsed
- It is expected to expand to a giant through a NOVA outburst
- Then it will shed its outer layers and become a white dwarf
- Lastly, the white dwarf will slowly cool and become a black dwarf (a dead star)
- The Sun is the only star in our solar system and average in every manner

Absolute Magnitude – the measure of the brightness of a celestial object
Apparent Magnitude – the brightness of a celestial object as it looks from Earth
Luminosity – the rate at which a star emits energy relative to the Sun (Sun's luminosity is 1)

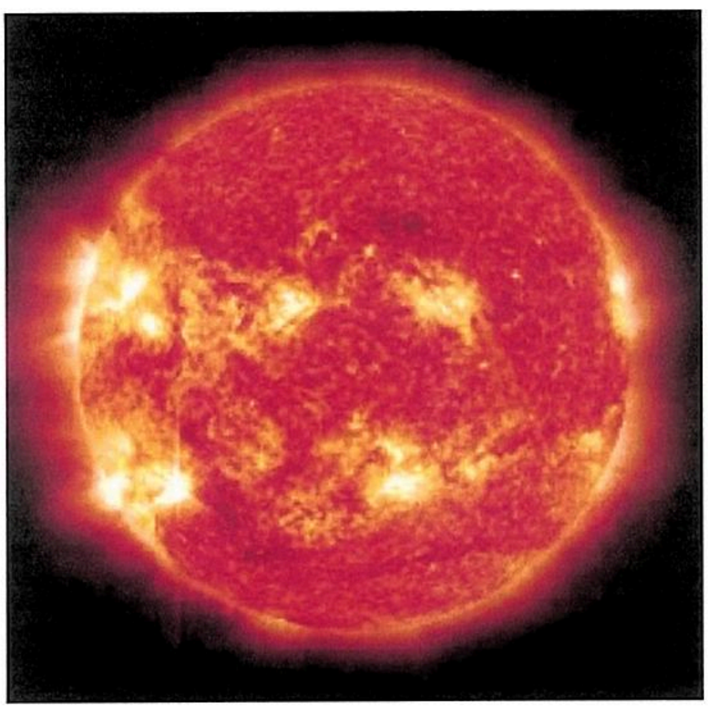


Diagram 8: The Sun

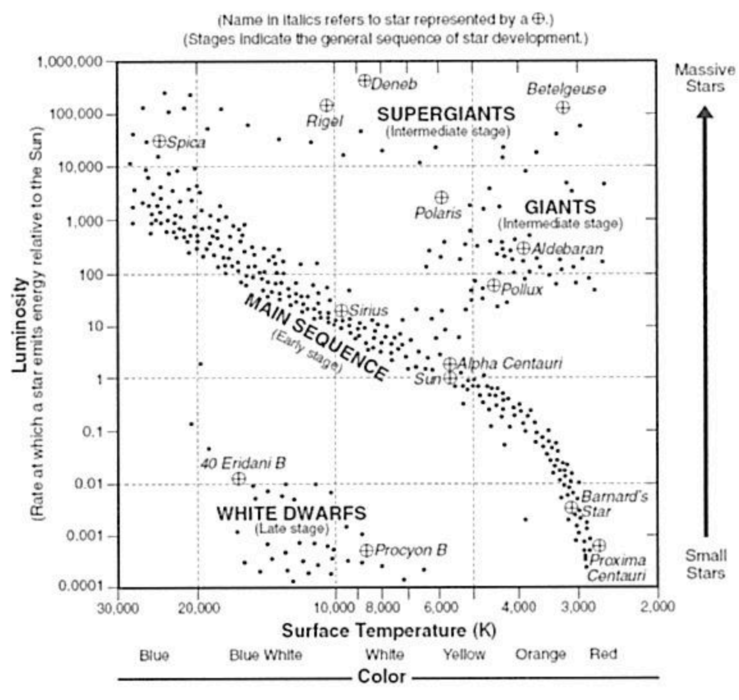


Diagram 9: Characteristics of Stars ESRT's

Earth Science Regents Review Sheet: ASTRONOMY

Terrestrial Planets – the four inner planets before the Main Asteroid Belt [Mercury, Venus, Earth, and Mars]

- Mercury: the smallest, has no atmosphere, closest to the Sun; because it has no atmosphere, it is impacted by a lot of craters, so it looks like the Moon
- Venus: hottest (thick CO_2 atmosphere – causes the runaway greenhouse effect [the atmosphere allows energy to come in and holds onto the energy]); it's similar size to Earth, rotates backward, its day is longer than its year; the surface is volcanic (sulfuric acid rain), yellow and keeps getting even hotter, once considered a twin to Earth because of size, but Venus is the "bad twin" – not a happy place
- Earth: the "Blue Planet" – 70% surface is liquid water, only one habitable to LIFE (temperature and atmosphere)
- Mars: the "Red Planet" – iron oxide (has oxygen that causes elements to change like iron) , had water and has ice, Mons Olympus (very large volcano, largest in the Solar System[30 miles high], Mt. Everest is 6 miles high); 2/3th the size of Earth, once had a lot of water

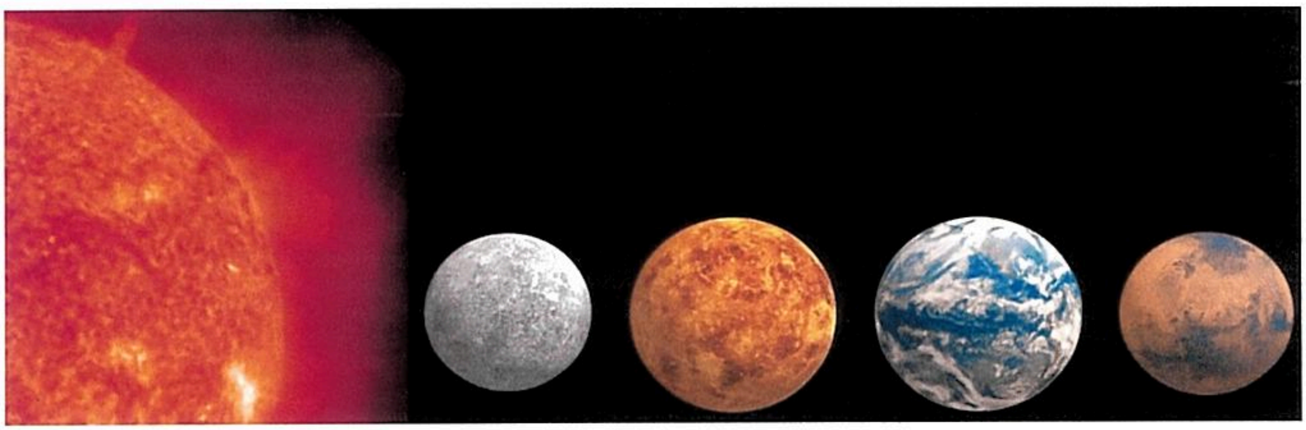


Diagram 10: The Terrestrial Planets

Jovian Planets – the four outer planets after the Main Asteroid Belt [Jupiter, Saturn, Uranus, Neptune]

- "Jov" in latin is based on Jupiter
- All of these planets have rings and moons and are known as the "Gas Giants"
- Jupiter: the largest in the Solar System, The Great Red Spot (hurricane like storm), many moons (57)
- Saturn: known for its many rings, also has moons (68), a bit smaller than Jupiter
- Uranus: rotates on its <u>side</u> (ancient impact), cold and icy; like a tumbleweed (45 degrees), look like cold
- Neptune: coldest, very windy (over 700 mph), ice (methane ice) surface with a saline water body below

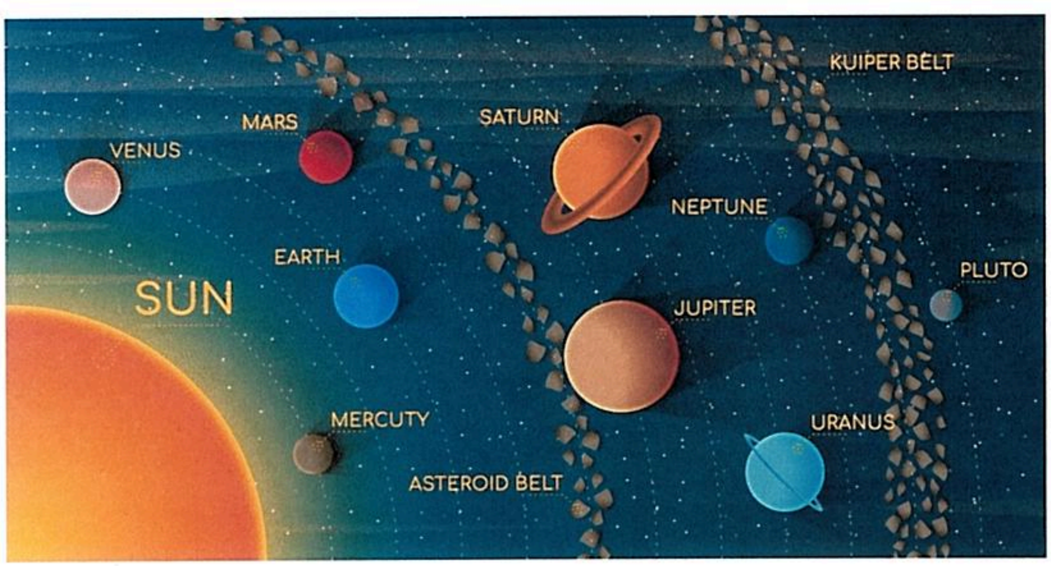
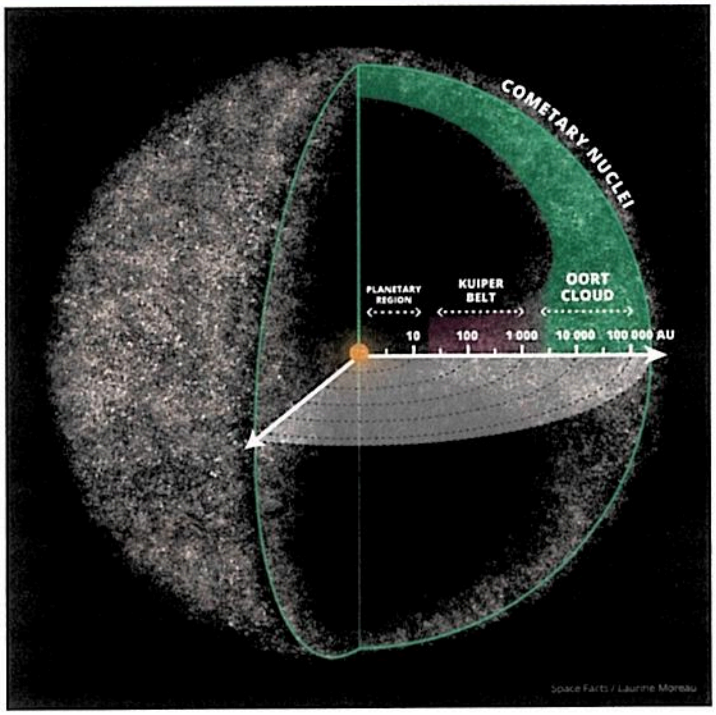


Diagram 11 (left): Representation of Entire Solar System with Asteroid and Kuipter Belts

Earth Science Regents Review Sheet: ASTRONOMY

Oort Cloud – a vast region of the solar system occupied by billions of comets, beyond the Kuipter Belt



Asteroid Belt – the MAB (main asteroid belt) between Mars and Jupiter [the INNER and the OUTER planets]
Kuipter Belt – after Neptune, and Pluto (now a dwarf planet) is within the belt

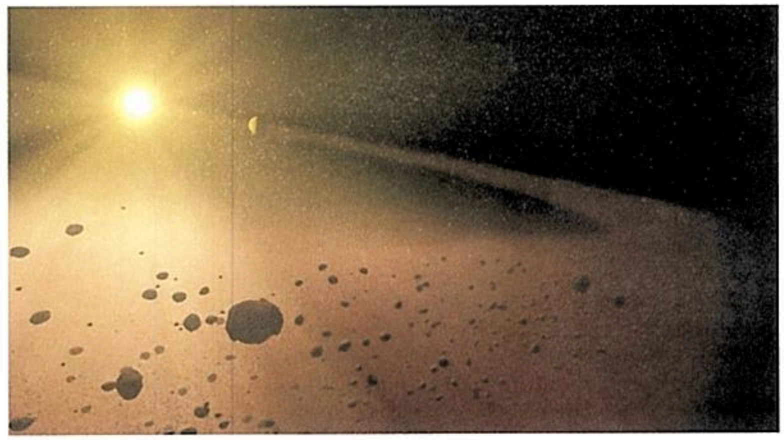


Diagram 13(above): Image of the Main Asteroid Belt

Diagram 12(left): The Oort Cloud is beyond the Kuipter Belt

Small Celestial (Solar) Objects:

- Comets – generally 10-50 km diameter, biggest of all small objects; like really long ellipses, masses of ice and rock that are hurdling through space; move in highly eccentric (stretched ellipses) orbits that come from random directions (do not follow the plane of orbit of the planets); most originate from the Oort Cloud (between Neptune and Pluto); move faster in the inner Solar System due to the Sun's gravity, they develop distinctive tails in this area due to sublimation, they illuminate (light up, heat up); has a nucleus (a dark snowball composed of ice, dirt, rock, and gas), a coma (the halo of gas, ice, and rock bursting forth from the nucleus), and the tail (the dust tail and ion tail), the tail always points away from the sun
- Asteroids – irregularly shaped pieces of rock that are moving through space in the same direction as the planets; smaller than comets
- Meteorite, Meteoroids, and Meteors are sand to boulder size objects (small pieces of rock and /or iron that are moving through space); they are all the same, but they change names depending on where they are found
- Meteoroids are often smaller pieces of asteroids and comets tails that get caught in gravity of other larger solar objects
- Meteors – meteoroids that have entered a planet's atmosphere; we have in Earth called "shooting stars", not in Mercury because there is no atmosphere
- Meteorites – meteors that survive the atmosphere and hit the surface of a planet or another solar body (make it to the surface, found on land)

Light Year – the distance that light travels in a year; used to determine age of celestial objects such as stars
Astronomical Unit (A.U.) – the average distance from the center of the Earth to the center of the Sun, used to measure other enormous distances in space

Seasonal Dates (1st date of each season)

- Summer Solstice- June 21st
- Autumnal (fall) Equinox- September 23rd
- Winter Solstice- December 21st
- Vernal (spring) Equinox- March 21st
- These dates tend to vary

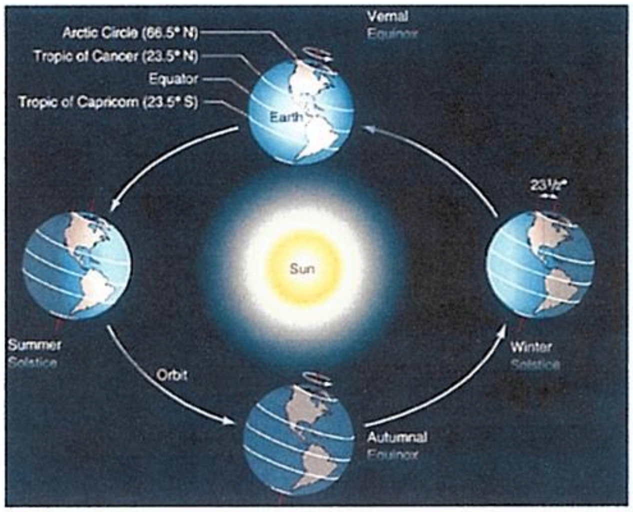


Diagram 3: Seasonal Dates

Solar Noon

- When the Sun passes a location's meridian and reaches the highest position that it can in the sky for that specific for location

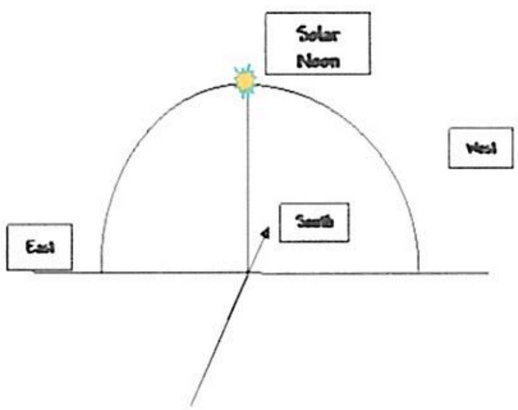


Diagram 4: Solar Noon

Season Names

- Winter Solstice
- Vernal (spring) Equinox
- Summer Solstice
- Autumnal (fall) Equinox

Directions of Sunrise and Sunset

- The sun rises in the east and sets in the west
- Equinoxes- Rises due east, Sets due west
- Summer Solstice- Rises north of east and sets north of west
- Winter Solstice- Rises south of east and sets south of west

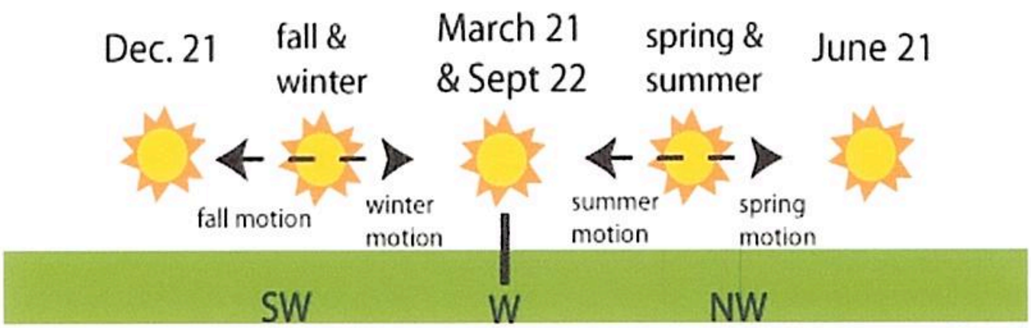


Diagram 5: Directions of Sunrise and Sunset

Location of Direct Rays

- June 21st- 23.5 degrees N
- September 23rd- 0 degrees
- December 21st- 23.5 degrees S
- March 21st- 0 degrees

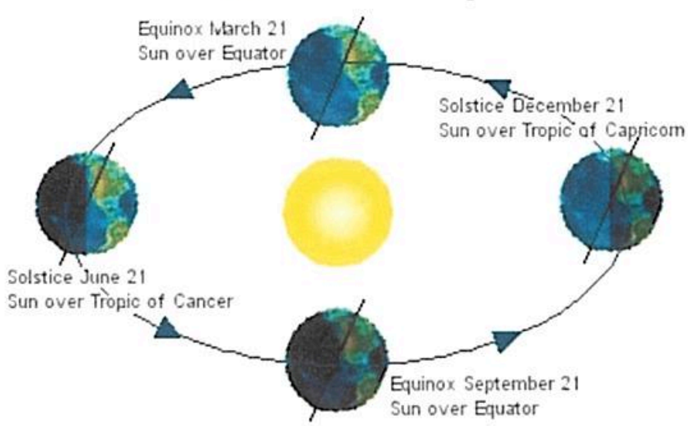


Diagram 6: Location of Direct Rays

Zenith

- The point directly above an observer's position (90 degrees above the horizon)

Horizon

- Where land meets sky, the lowest altitude a person is able to see (0 degrees)

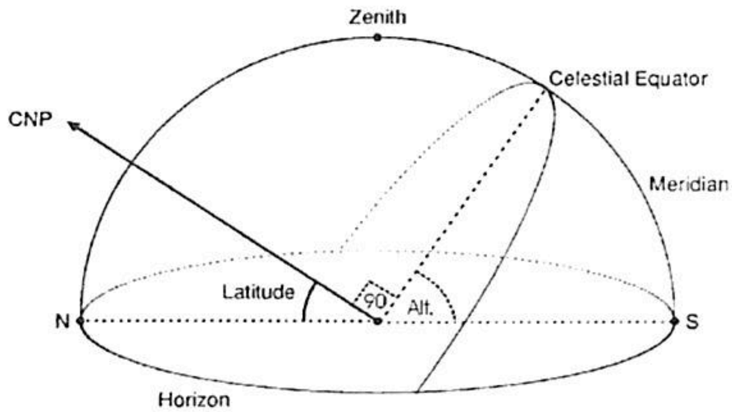


Diagram 7: Zenith and Horizon

Sun's Path Diagram

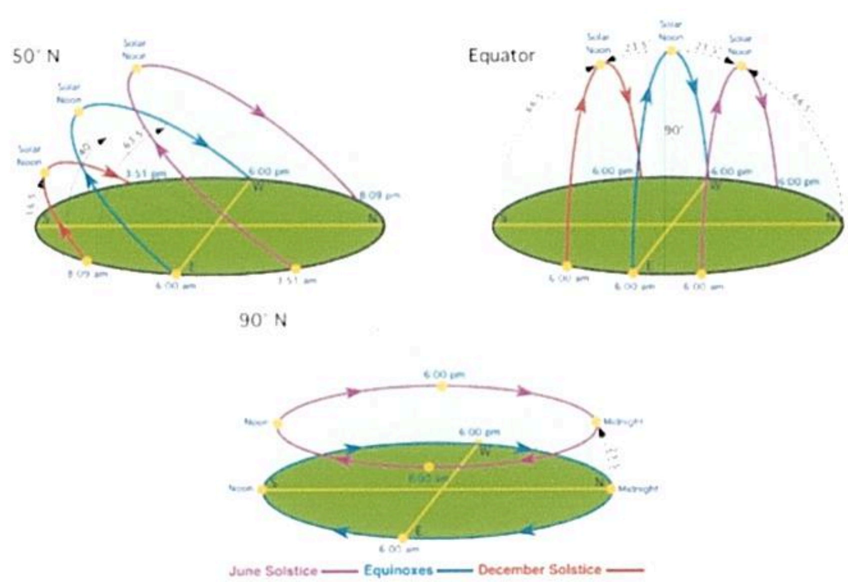


Diagram 8: Sun's Path

Time

- Time is the measured period during which an action process continues.
- Earth's estimated time can be measured by using the position of the Sun in the sky relative to a point on Earth's surface.

Diagram 9: Time

Rotation

- This is a circular movement of an object about a point in space
- Earth turns on its axis.

Revolution

- Refers to the movement of any celestial object around any other celestial object. For example, the orbit of Earth around the Sun.

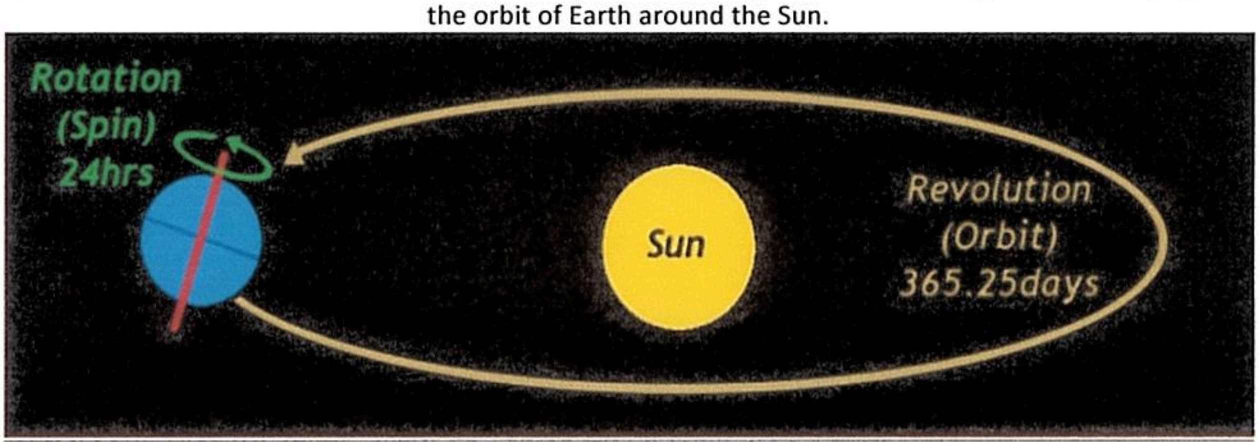


Diagram 10: Rotation and Revolution

Evidence of Rotation

- Foucault Pendulum- A pendulum will swing in the same direction while earth rotates beneath it

- The Coriolis Effect- Because of Earth rotation, there is a spin on objects in motion, which causes a deflection in the travel direction. In the Northern Hemisphere the turn is towards the objects right. In the Southern Hemisphere the turn is towards the left.

- Earths Rotational Speed- 23 hours, 56 minutes and 4 seconds

- The daily apparent movement of stars- When the Earth moves, stars stay in place. Long exposure photographs show the continuous path created by stars.

Evidence of Revolution

- Changing Constellations- With each season, the viewer on earth is exposed to different constellations

- The change in the apparent diameter of the sun in a heliocentric model

- The change in seasons- each season has different temperatures, weather conditions and amount of daylight due to Earths distance to the Sun.

Period of Rotation

- 23 hours, 56 minutes and 4 seconds
- How long it takes earth to spin exactly 360º

Period of Revolution

- 365.26 days
- How long it takes earth to revolve around the sun

Coriolis Effect

- There is a spin on objects in motion, which causes a deflection in the travel direction due to Earth's rotation.
- In the Northern Hemisphere the turn is towards the objects right.
- In the Southern Hemisphere the turn is towards the left.

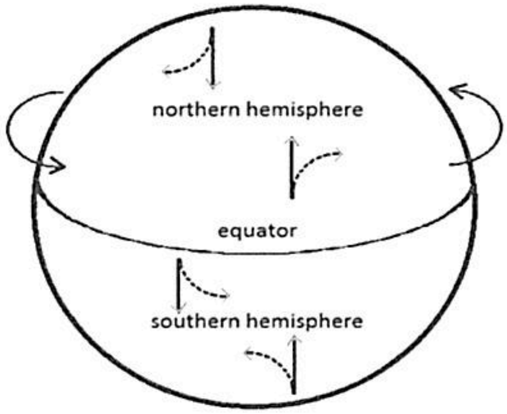


Diagram 11: Coriolis Effect

Foucault's Pendulum

- A pendulum will swing in the same direction while earth rotates beneath it
  - Evidence of Rotation

Diagram 12: Foucault's Pendulum

Axial Tilt

- Earth's axis is tilted by 23.5 degrees vertical to the plane of its orbit

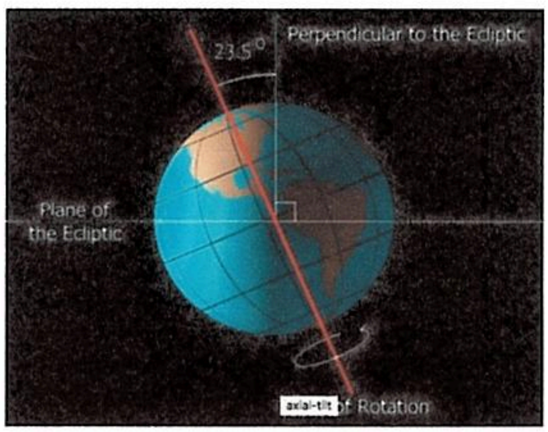


Diagram 13: Earth's Axial Tilt

Polaris

- The degrees of latitude always be equal to the degrees of altitude for Polaris (only in the Northern Hemisphere)
- Polaris is known as the North Star and doesn't move while the rest of the northern sky does around it.
  - The altitude of Polaris is equal to an observer's latitude on Earth.

Parallelism

- The result that Earth's tilt is parallel to its last position through its orbit of the sun.
  - Earth's axis is always pointed in the same direction.

Apparent Solar Day

- The period of time between two successive passages of the sun's center across the same meridian.

Mean Solar Day

- The period of time between two successive passages of the mean sun across the meridian at noon.

Apparent Diameter

- Objects in space, such as the Sun, look to be getting larger or smaller. This is because there is either an increase or decrease in the distance between Earth and the object due to elliptical orbit.

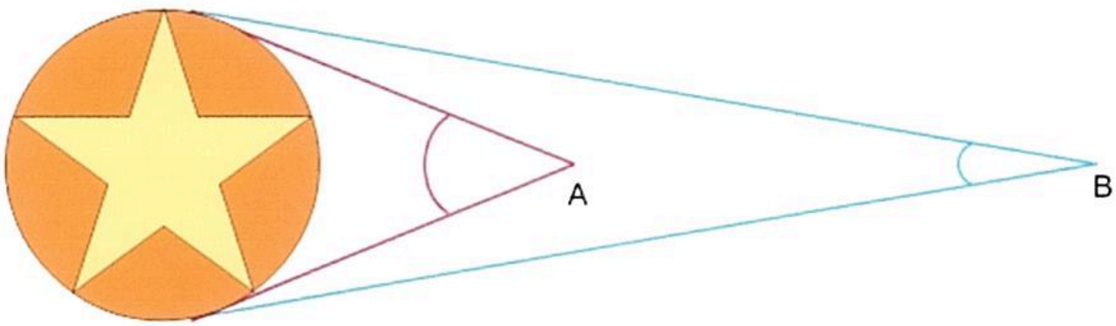


Diagram 14: Apparent Diameter

Star Trails

- Continuous paths created by stars, produced during long exposure photographs.

Diagram 15: Star Trails

Greenwich Mean Time

- The clock time at the Royal Observatory in Greenwich, London.
- The hours of Daylight and Nighttime remain constant throughout the year
- When the sun is at its highest point, exactly above the Prime Meridian, it is noon at Greenwich

Energy

Energy

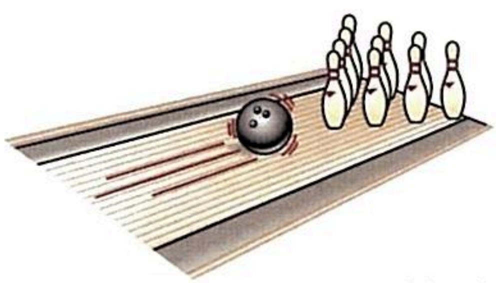
- The capacity for doing work.

Kinetic Energy

- Kinetic energy is the energy of motion
- KInetic energy depends on mass and speed
- The formula for kinetic energy is:

KE=0.5 x m x v^2

- Kinetic energy has to do with the work an object must accelerate and do to move and have motion.



Elizabeth Morales **Diagram 1**

Potential Energy

- The stored energy of an object at a certain position
- There are two types of potential energy; Gravitational potential energy and elastic potential energy
- Gravitational potential energy is energy stored relative to the vertical height.
- The formula for gravitational potential energy is:
  PE_{grav}= mass x g x height
- Elastic potential energy is energy stored in an object by stretching or compressing
- The more an object is stretched, the more energy stored.

- Potential energy is the energy needed to release the kinetic energy. The roller coaster shows that potential energy is being used as the cart goes up. When it hits the steep drop kinetic energy is released and used as the kart goes down.

Diagram 2

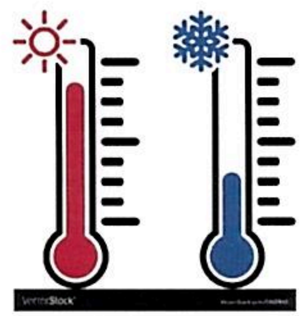
Heat Energy

- A form of energy that is transferred by a difference in temperature.

Temperature

- The measure of the amount of kinetic energy in an object
- Temperature is measured in degrees celcius or farenheit depending on where you live, using a thermometer
- Temperature can affect how we dress, farming, going to work, and travel.
- Temperature can also indicate long term changes like global warming and climate change

Diagram 3



Frequency

- The number of times a point on a wave passes a fixed reference point in a certain time interval
- Frequency deals with different types of waves like: light, sound, and radio
- The unit for frequency is Hertz
- Frequency tells you the color of different lights.
- If something has a high frequency than it is on the blue side of the light electromagnetic spectrum.
- If something has a low frequency it is on the red end of the electromagnetic spectrum

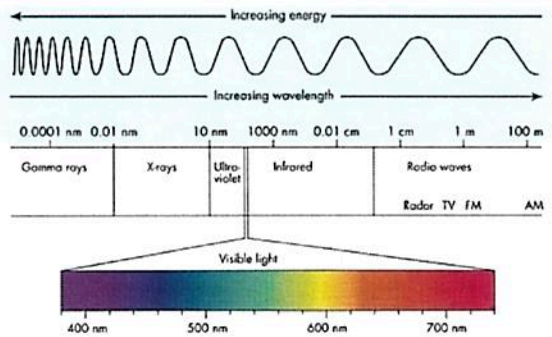


Diagram 4

Latent Heat Energy

- Energy absorbed or released by a substance during a change in its physical state that happens without changing temperature.

Joules

- The SI unit of work or energy, equal to the work done by a force of one newton.

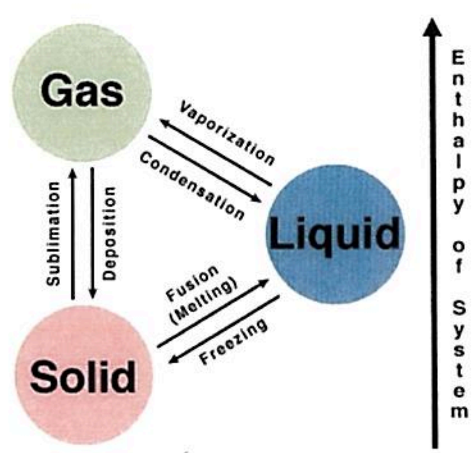
Phase Changes

- A change in a distinctive form of a substance
- The types of phase changes are:

-Liquid to Solid (Freezing)
-Solid to liquid (Melting)
-Liquid to gas (Evaporation)
-Gas to liquid (Condensation)
-Gas to solid (Sublimation)
-Solid to gas (Deposition)

- For a phase change to occur there must great change in temperature

Diagram 5



Specific Heat

- The amount of energy (in joules) required to raise one gram of a substance one degree Celsius.
- The higher the density of the substance, the higher the specific heat
- If a substance has a high specific heat that means it takes a long time to heat up and cool down
- If a substance has a low specific heat that means it takes a short time to heat up and cool down. For example lead and copper.
- Water has a very high specific heat. If you live by water you will have cooler summers because it takes longer for the water to heat and warmer winter than an inland location because it takes longer to cool down.

Specific Heats of Common Materials

MATERIAL	SPECIFIC HEAT (Joules/gram • °C)
Liquid water	4.18
Solid water (ice)	2.11
Water vapor	2.00
Dry air	1.01
Basalt	0.84
Granite	0.79
Iron	0.45
Copper	0.38
Lead	0.13

Diagram 6

Conduction

- The transfer of energy caused by particle to particle collisions
- Some examples of conduction are; Putting your hand on a hot surface and your hand becoming hot, hot food on your plate will cause your plate to become hot, and walking on hot sand will make your feet heat up.

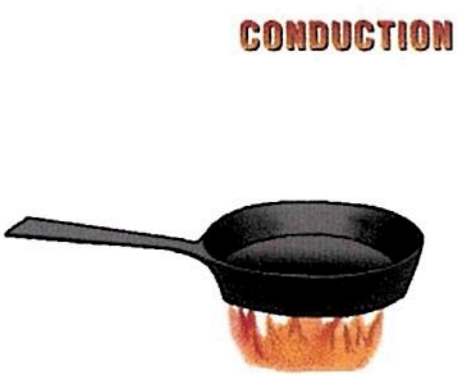


Diagram 7

Convection

- The transfer of energy due to differences in fluid densities\

- Some examples of convection are; a steaming cup of tea and the steam shows the heat being transferred, ice melting because the heat moves from the air to the ice causing it to melt, and a pot on a stove, the fire from the stove moves to the pot calling the pot and whatever is inside it to heat up.

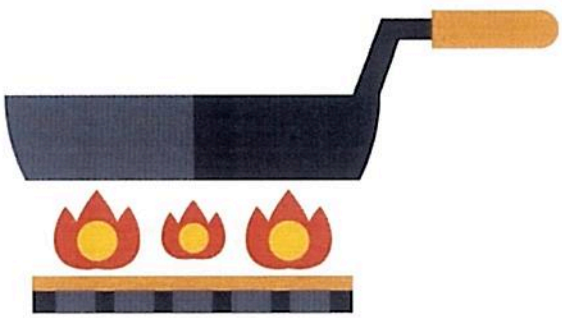


Diagram 8

Convection Cells

- A self contained zone in which warmer air in the center is pushed upward and is balanced by the downward motion of cooler air.

Transverse Waves

- A wave in which the direction of displacement is perpendicular, to the direction of propagation, as a surface wave of water.

Energy Source

- A region of high temperature heat flow

Energy Sink

- A region of lower temperature heat flow.
- Heat flows from source to sink (Hotter to cooler).

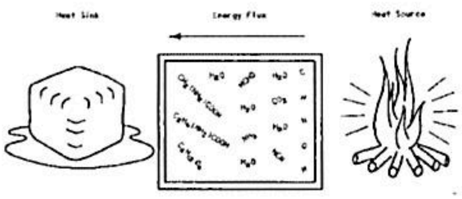


Diagram 9

Conversion of Energy

- Energy is neither created or destroyed-it is converted from one form to another
- The total energy always remains the same

Radiation

- The transfer of energy in waves
- The sun gives of heat by radiation
- Terrestrial radiation is energy that is absorbed by Earth, will be re-radiated as infrared heat

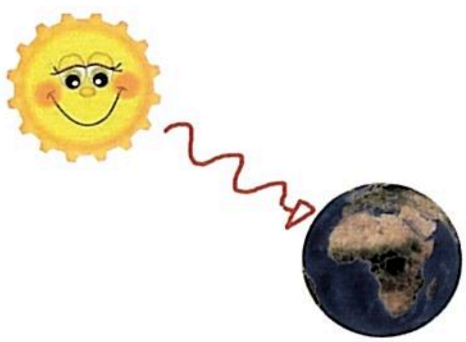


Diagram 10

Reflect

- The redirection of waves as they encounter a material's surface

Absorb

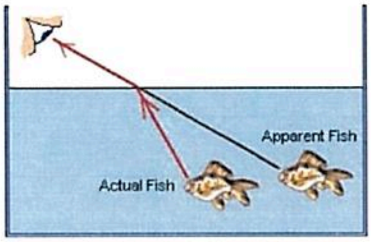
- The energy taken in by a material, this will cause it to heat up

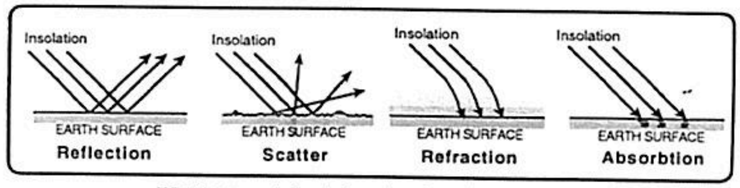
Scatter

- Waves that are both reflected and refracted on an uneven surface

- **Refract**

- The bending of waves as the cross an interface of two materials with different densities due to density passing between another





What happens to insolation when it reaches the Earth.

Diagram 11 **Diagram 12**

Surface Types That Absorb Energy well

- Rough, dark surfaces absorb energy well
- For example blacktop on a playground
- A good absorber is also a good radiator

Surface Types That Reflect Energy well

- Smooth, light surfaces reflect energy well
- For example a calm lake or snow on the ground

Absolute Zero

- The lowest possible temperature, where nothing can be colder and no heat energy remains in the substance

Sea Breeze vs. Land Breeze

- The wind will blow from higher pressure over the water to lower pressure over the land causing sea breeze. The sea breeze strength will vary depending on the temperature
- difference between the land an ocean. At night, the roles reverse. The air over the ocean is now warmer than the air over land.

Diagram 13