**Quizlet Set By Chris**

The major weakness of the currently definition of a planet is that it only applies to our solar system

An Asteroid is not a planet because its orbit is not clear and it is not spherical

The moon is not a planet because it does not orbit the sun

The moon is a satellite

Pluto is no longer a planet because Pluto does not dominate its orbit; it doesn’t have enough gravitational pull

Definition of planet: Must orbit the sun, must be spherical, must dominate its orbital pathway and not intersect with other entities

The Kuiper Belt is located beyond Neptune

A KBO is a Kuiper Belt Object

Order of the planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune

Neptune and Uranus are blue because of the various compounds that reflect light in the blue wavelength

Jupiter has the most satellites

Saturn’s rings are thin, mostly comprised of ice and rock, bright sections of rings that have lots of debris, and gaps between rings

Jupiter’s four largest moons: Lo, Europa, Ganymede, Callisto

Jupiter’s surface is gaseous, has turbulent clouds due to winds, a giant red spot; this is a storm

Mar’s surface is old and rocky with some frozen water. It is geologically dead

Mars has a thin atmosphere

Earth’s surface is comprised of land and water. It has a range of temperatures and is geologically active

Earth’s atmosphere has layers and weather

The moon is rocky, has no atmosphere, is geologically dead, and has large temperature ranges

1 AU is the average distance between the earth and the sun

The sun makes up 99.8% of the mass in the solar system

1 AU is about 150 million Km

The sun has a lifespan of 10 billion years

The sun is 4.5 billion years old

The sun has another 5.5 billion years left and then it will die

During the end of the sun’s life it will become larger, brighter, and hotter. It will kill life on Earth when this happens

The sun revolves 225-250 million years around the Milky Way

Interstellar is the area in between stars outside of our solar system

Interstellar medium is the vacant space that fills the interstellar space. It consists of gas and dust

The parallax effect is the displacement of an object due to various viewing angles. It is used to measure distances of far objects

The further the star, the smaller the parallax, and the distance is less precise

The smallest parallax angle is 0.01 arcsec

The closer the star, the larger the parallax

1 parsec is about 3.3 light years

1 mega-parsec is 1 million parsecs

Light year: The distance light can travel in a year

Galaxy: A system of millions or billions of stars, together with gas and dust, held together by gravitational attraction

Stars are found within galaxies and clusters

The Milky Way is NOT in a galaxy cluster

Lookback Time: Age of light being emitted from an object. Applies to far away objects because the light is very old. This means that when you look at far away objects, you are seeing that object as it was X years ago

The Milky Way is a spiral galaxy

The Milk Way is 100,000 light years across

We cannot image the Milky Way because we are in the Milky Way. We need to leave it in order to image it

The sun is about 2/3 outward from the centre of the Milky Way

A spiral galaxy is defined by a central bulge and pinwheel like arm in a flat rotating pattern with stars, gas, and dust

An elliptical galaxy has an ellipsoidal shape

Stars in an elliptical galaxy move in random patterns

Elliptical galaxies have red hues because majority of the stars are old and dying, which are often red and orange

Galaxies groups and clusters are formed by galaxies moving toward each other and rotating around one another

Galaxy clusters are the largest bound system in the universe

Elliptical galaxies are primarily present in galaxy clusters

Black holes do not suck, they have a regular gravitational pull. If it an object gets too close it can be destroyed by the gravity

Edwin Hubble determined that the universe is expanding

Hubble discovered the universe was expanding because the distances between galaxies and rate of motion is increasing

Parallax cannot be used to measure distance between galaxies because the shift is to small

Standard candle method is used measure distance between galaxies

A Standard candle is an object that emits the same brightness at all times. Using this you can measure the change in brightness to determine if an object is moving away or towards

A supernova is an example of a standard candle

The Standard candle method requires a bright object

The Doppler shift is used to measure the motion of a galaxy

Blue shift: Galaxy is moving closer to you

Red shift: Galaxy is moving away from you

Hubble’s Law: Speed and distance are directly proportional to each other.

The further away a galaxy is, the faster it is moving away from us

Hubble’s Law equation: V = Hd

V = Speed; measured using standard candle

H = Hubble’s constant

D = Distance; measured from Doppler effect

The Hubble constant is constantly changing

The universe is expanding uniformly

Hubble’s Law implies that galaxies must have been closer together and overlapped causing greater galactic density.

Galaxies were merging more often in the past

The universe is approximately 13 billion years old

The universe has no center point, and expansion happens in all directions

Galaxies within clusters and groups are not moving away from each other because they are bound by gravity

Visible light is the part of electromagnetic spectrum we can see with our eyes

Longer wavelengths have low frequency and energy

Shorter wavelengths have high frequency and energy

The atmosphere blocks out shorter wavelengths like gamma and x-rays

Red, blue, and green filters are applied to images from the Hubble telescope

It is better to study space objects from space because there is no atmosphere to block signals

Hawaii is an ideal place for astronomy because it is elevated and further from light pollution

Standard units for:

Distance = meters (m)

Time = seconds (s)

Mass = Kg

Speed = m/s

Gravity is a force of attraction between objects

Gravity depends on mass and distance

The greater the mass the stronger the force of attraction

The closer the objects, the stronger the force of gravity

Gravity works in infinite ranges

Electromagnetic force works in infinite ranges

Strong Nuclear force works in extremely short distances

Weak Nuclear force works in short distances

Forces from strongest to weakest: Strong nuclear, electromagnetic, weak nuclear, gravity

Special relativity only applies to light

In special relativity, the speed of light is always the same

Classical relativity assumes you add the speed of all moving items

Time dilation: The time it takes for light to reach a moving person depends on the distance the light needs to travel

It takes longer for light to reach a moving person than a stationary one, and clocks run more slowly

The gamma value tells us the factor by which moving clocks run more slowly

The smaller the gamma value, the faster the time

The larger the gamma value, the slower the time

In order to experience time dilation, an object must travel at least half the speed of light

Length contraction: Objects appear shorter along the direction they are moving if they are moving at relativistic speeds. In the other direction, the object remains the same size

Special relativity in used in GPS algorithms

Heavy metals have faster moving electrons which alter the molecular shape and its interactions with light create specific colors, like gold

Einstein’s equation is E=mc2

Mass increases if you are moving faster and thus you need more energy to move faster

Mass is not constant at all speeds. There is rest mass and moving mass which is determined by the speed of the object

Moving Mass = Gamma X Resting Mass

The faster you move, the bigger the difference between moving and resting mass

Combining two speeds less than the speed of light results in a speed less than (<) `c`

The speed of light is constant no matter the movement or observer

An object with mass cannot accelerate to the speed of light because it would take an infinite amount of energy

On a space time diagram, the x-axis is distance in meters

On a space time diagram the y-axis is time, usually ct

It is not possible to have a line lower than 45 degrees on a space time diagram

All lines below the x-axis on a space time diagram represent light from the past because you are seeing light come towards you from a difference distance

All lines above the x-axis on a space time diagram represent light from the future

Time travel to the past is possible if you can move faster than the speed of light and overcome special relativity

Speed of light equation: c = f λ

If the wavelength is long, the frequency and energy is low

If the wavelength is short, the frequency and energy is high

Black body radiation is when something glows based off its temperature, not material

Black body radiation is from Max Planck

Max Planck proposed that light is small energy bundles quanta

Equation for momentum: p = mv

Equation for gravitational force: F = G[(m1 x m2)/r2]

Einstein discovered the photoelectric effect

When light is shined onto metal, the electrons are knocked out of their orbits. Thus, light has momentum and is likely a particle

A particle has no mass and no momentum. But light is a particle and has momentum

Einstein discovered that light is a wave-particle duality

Energy of a photon: E = hf

If a star is moving away from us the frequency decreases, meaning they have less star light

De Broglie came up with the theory of quantum tunnelling

Quantum tunnelling is when something does not have the energy to pass a barrier but does it anyway

Smaller objects have a greater frequency and act more like waves

Larger objects have a lower frequency and act more like particles

Quantum objects are waves and particles

Particles shot at double slits create two lines with respect to the slits

Waves shot at double slits create an interference pattern where the middle is concentrated

Quantum particles shot at double slits have an interference pattern like waves

Quantum particles behave like particles in a double slit when observed by bouncing light waves off them

The double slit experiment led to the uncertainty principle

The uncertainty principle was developed by Heisenberg

The uncertainty principle states that you cannot measure both location and movement at the same time. You will always be uncertain about one

An antiparticle has the same mass and size as a particle but opposite charge

Space is not truly empty, it has particles and antiparticles merging together at a fast rate

The absorption spectrum is caused by electrons moving up energy levels by absorbing the exact quanta of light energy between levels

The emission spectrum is caused by electrons moving down energy levels by release exact quanta of light energy between levels

A Cepheid variable is a luminous star that makes an excellent standard candle. We can determine its properties from the luminosity

Luminosity is the absolute measure of radiated light from an object or body

Brightness refers to the apparent magnitude of a star; how it appears to an observer far away

Electrons do not orbit atoms, there are orbital areas where electrons are likely to be found

Wavelength is the distance of one wave interval

Frequency is the rate at which the wave oscillates

Speed is Frequency X Wavelength

Light does not have mass it is energy. But it does have momentum