**8th Grade Unit 2: The Universe**

*lesson 1: What makes up the universe?*

smallest to largest (doodle in your IAN)

planet- a spherical body that orbits a sun/star

* terrestrial planet- rocky solid surface (Mercury, Venus, Earth, Mars)
* gas giant- very small rocky core with large gas atmosphere or thick ice (Jupiter, Saturn, Uranus, Neptune)

star- a large celestial body that is composed of gas and emits light

* most are composed of hydrogen and helium
* nuclear fusion occurs at the core

solar system- a collection of large and small bodies in space with a central star(s)

galaxy- a large collection of stars (solar systems), gas, and dust held together by gravity

* spiral galaxy (Milky way)- arms/bands surrounding a central point or bulge
* elliptical galaxy- sphere or oval shaped (no arms)
* irregular galaxy- splotchy blobby shape (very active places for star formation; young galaxies)

universe- all of the matter and energy, as well as, the space between

Measuring distance in the universe

light year- distance light can travel in one-year (travels at 300,000 km/s) 9.5 trillion km

* closest star to us is Proxima Centauri at 4.3 light years
* it would take us, at current space traveling speeds (58,000 km/h), 75,000 year to get there

*lesson 2: What are some properties of stars?*

*Vocab: apparent magnitude, luminosity, absolute magnitude*

a star is a lg. celestial body composed of gas (plasma) and emits light; light is created during fusion of atoms in it’s core; star’s job is to create new and more complex atoms from simpler ones

sun=star

Our Sun

* average in size and temp.
* composed of mostly hydrogen (helium, oxygen, nitrogen, and neon)
* core temp. 15 million degrees c
* surface is called photosphere almost 6000 degrees c
* energy escapes the Sun as light, heat, and wind
* it is a white star

Properties of stars:

* brightness:
  + apparent magnitude- the measure of a star’s brightness as seen from Earth
* brightest stars -2; our sun -26.8
* dimmest stars +30
* Sirius is the brightest star visible to the naked eye -1.46
* absolute magnitude (luminosity)- the measure of a stars brightness from a standard distance
  + same scale brightest are – numbers
  + Our sun 4.8 (8.3 light min. away)
  + Sirius 1.4 (8.6 light years away)
  + Betelgeuse apparent mag. .45; absolute mag. -5.6 (640 light years away)
* temperature
  + hottest stars 25,000 C at the surface
  + coolest stars 3,500 C at the surface

hottest to coldest

BLUE WHITE YELLOW ORANGE RED

* size
  + using solar radii
    - use the radius of our sun to compare/measure the size of others
    - Our sun= 1 solar radius
    - Rigel (blue) 78 solar radii
    - Antares (red) 776 solar radii
    - solar radius= 695,000 km or 109xEarth
* White dwarfs (approx. the size of Earth) 0.01 solar radius
* Giants 10-100 solar radii
* Supergiants up to 1000 solar radii

*lesson 3: How do stars change over time?*

*vocab: nebula, white dwarf, supernova, neutron star, H-R diagram, main sequence*

(add in the life cycle diagram here)

nebula- clouds of gas and dust in the universe

* gravity pulls the gas and dust together
* stars form in the most dense parts of the nebula (center)
* least dense material (hydrogen, helium, etc.) pulled to the center the

easiest

* the remaining more dense material will later make planets, moons, asteroids

collisions of atoms in the gas and dust create heat (energy) jump start the sun

* the stars are powered by nuclear fusion
* the nucleus of the atoms are fused together to create new atoms
* the start of nuclear fusion is the “birth” of the star

main sequence­- a star that is actively fusing hydrogen into helium

* the largest portion of a star’s “life”

fusion in the core stops as the hydrogen runs out

* the core contracts raising the temp of the core
* the energy causes the outer layers of the star to expand

\*the last steps depend on the size of the star

A low mass star:

* during the fusion stage the inward & outward forces were equal
* when fusion stops it expands into a larger star called giant
* giants are red b/c the surface temp. cools as it expands
* gases drift away from the star forming a cloud around the star (planetary nebula)
* remaining matter collapse into the core creating a white dwarf ( a very dense very hot

core of matter created by a “dying” star)

* size of Earth
* burn for billions of years as they cool and dim (black dwarf)

A high mass star:

* when hydrogen fusion ends the star fuses other larger atoms (ex. carbon)
* much shorter life; more energy=faster burn out
* as it expands and cools it becomes a red supergiant
* when all fusion stops the supergiant collapses
* supernova- a gigantic explosion where a supergiant throws it’s outer layers into space

(core remains)

* can become a neutron star (a small very dense ball of tightly packed neutrons)
* can become a black hole (only the most massive) all the mass of the star

collapses into a single point; can be seen w/ x-rays

Hertzsprung-Russell diagram (H-R diagram)- organizes stars by surface temp. and luminosity

(add H-R diagram booklet to IAN)