Astronomy Objectives

How to use this document: The student will be able to use the objective (DCI) with SEPs and CCCs to explain anchoring phenomena.

Barnes' notes: unit 1, unit 2, unit 3, unit 4.

Sky Observation and Measurement				
Objectives **Student will be able to:**	**Key Concepts**	**Sample Anchoring Phenomena**	**Suggested SEP's & CCC's**	**Text Pages**
1. Describe how astronomical theories have changed over time.	• Aristotle, Hipparchus, Ptolemy, Copernicus, Brahe & Kepler, Galileo, Newton • Geocentric vs Heliocentric Model • Retrograde motion, Epicycles • Universal Law of Gravity ($F_G=Gm_1m_2/d^2$)			
2. Recognize and apply tools and methods of observing and measuring the cosmos.	• Astrolabe, Telescopes (land/space, reflector/refractor, wavelengths), Spectroscopy, Space probes • Electromagnetic waves/spectrum • $c = \lambda * \nu$ • $E = h * \nu$ • Atomic spectra			
3. Identify common celestial objects and describe celestial motion & celestial orientation.	• Celestial Sphere, Horizon, Zenith, Meridian, NCP & SCP • Declination/Right Ascension, Altitude/Azimuth • Paths of celestial bodies, circumpolar, never-rise, rise/set • Constellations			
4. Compare common astronomical units of measure.	• Astronomical Unit, Lightyear, Parallax, Parsec • Magnitude (absolute & apparent), Luminosity, Brightness • $b=L/4\pi d^2$ • Kelvin			

Solar Systems				
Objectives **The student will be able to:**	**Key Concepts**	**Sample** **Anchoring Phenomena**	**Suggested** **SEP's & CCC's**	**Text Pages**
1. Illustrate the interactions within the Earth, Sun, and Moon system.	• Moon phases (waning/waxing, crescent, quarter, gibbous, full, new) • Divisions of time • Eclipses (solar/lunar, total vs partial vs annular, umbra, penumbra) • Tides • Seasons (equinox, solstice) • Solar vs Sidereal • Milankovich cycles			
2. Describe the structural organization of our solar system.	• Sun, planets (Terrestrial/Jovian), moons, dwarf planets, asteroid belt, comets, meteoroids, Kuiper belt, Oort Cloud			
3. Explain how our solar system was formed.	• Nebular theory • Nebula, protostar, star, protoplanetary disk, accretion, planetesimal, protoplanet • Exoplanets (implications upon NT)			
4. Illustrate motion of planetary bodies using Kepler's Laws, Newton's Universal Law of Gravitation, and Einstein's Theory of General Relativity.	• Law of Orbits, ellipse, eccentricity, foci, semi-major axis • Law of Areas, perihelion, aphelion • Law of Periods, $T^2=a^3$ • $F_G=Gm_1m_2/d^2$ • Spacetime			
5. Describe humanity's place in the solar system.	• Threats to humanity • Settlements • Other life in our solar system			
6. Explain how astronomers search for extraterrestrial life in other solar systems.	• Goldilocks zone • Organic chemistry & requirements for life • Drake equation & Fermi paradox			

Star Classification & Evolution				
Objectives **The student will be able to:**	**Key Concepts**	**Sample** **Anchoring Phenomena**	**Suggested** **SEP's & CCC's**	**Text Pages**
1. Compare and contrast the characteristics of various stars.	• Radius, mass, temperature, spectra, luminosity, composition. • Distance to stars • Wien's law ($\lambda_{peak}*T_K = 2.898x10^{-3}m*K$)			
2. Classify stars based upon the characteristics above.	• HR diagram • Luminosity classes & spectral classes • Main sequence, white dwarf, red giant, black dwarf, blue giant, supergiants, brown dwarf			
3. Describe/illustrate the forces and energy in a star during its lifetime.	• Nuclear fusion vs gravity • Energy production • $E=mc^2$ • Mass defect			
4. Explain how the mass of a star dictates its life cycle.	• Element formation • Solar masses			
5. Describe the various events at the end of a star's life which lead to different celestial objects.	• White dwarf, supernova, neutron stars, black holes, pulsar, gravity waves, wormholes, cosmic rays • Planetary nebula, cepheid variables			
6. Illustrate characteristics of the sun.	• Layers, sunspots, corona, solar wind, prominences			

Galaxies and Cosmology				
Objectives **The student will be able to:**	**Key Concepts**	**Sample** **Anchoring Phenomena**	**Suggested** **SEP's & CCC's**	**Text pages**
1. Illustrate the structure and scale of the Milky Way.	• Disk, spiral arms, central bulge, halo, globular clusters, open clusters			
2. Demonstrate knowledge of properties of galaxies and classification of these characteristics.	• Spiral, barred spiral, elliptical, irregular • Supermassive black holes, Active galaxies, Quasars • Dark matter (WIMPs and MACHOs)			
3. Illustrate the structure, organization, and scale of the universe.	• Planet, solar system, stellar neighborhood, galaxy, galactic group, superclusters, observable universe • Cepheid variables, Type 1a supernovae, Hubble's constant			
4. Explain the origin/birth of the universe as outlined by the Big Bang Theory and provide supporting evidence.	• Shape of space, galactic redshift, cosmic background radiation, composition of the universe • Fundamental forces, inflation • Edwin Hubble			
5. Explain the possible end of universe outcomes and provide supporting evidence for each.	• Open, closed, flat • Big crunch, big freeze, big rip • Dark energy			