

Science Olympiad Coaches Clinic 2002 – B Division

1. Students need to be able to locate these stars, constellations, and deep sky objects either in a planetarium, star lab, or on paper charts. Make sure they find images of the deep sky objects and know what they look like. They also need to know the location of the planets on the night of the competition.... This can be found in the Sky and Telescope magazine for that month. Also, the Sky Gazers Almanac (also available from the Sky and Telescope people at skypub.org) will tell every single event taking place in the sky for every night of the year.
2. This is a projection map centered on the North Celestial Pole (similar to the same projection centered on the terrestrial north pole.) Students need to be able to locate objects using the celestial coordinate system of Right Ascension (RA – similar to longitude on Earth but measured in hours, minutes, and seconds of time with 15 degrees between lines of Right Ascension.) and Declination (Dec – similar to latitude on Earth and also measured in degrees, minutes, and seconds.)
3. This chart is a projection located along the Celestial Equator (0 degrees declination) and with lines of RA from time to bottom measured in hours. Note the ecliptic (apparent path of the sun) which is a reflection of the orbit of the Earth around the Sun and along which all planets are located with the exception of Pluto which is highly eccentric in orbit.
4. Don't let the students be fooled by a slightly different projection – this is still the celestial sky with lines of RA and Declination.
5. Know the position of the Earth, Sun, and Moon for all types of eclipses and tides. Make sure they also look at images of the different types of eclipse of phenomena.
6. Go to the photoplanet journal on the JPL site (URL listed on slide 18) and get images of the surface of different planets and moons (Moon, Mars, Mercury, Callisto are excellent ones to use) and have students practice sequencing the features as to the oldest (happened first) to youngest (happened last) – this will also help them learn the types of features and what the different planets/moons look like.
7. Students need to know that stars are either solitary (like our Sun), in a binary or multiple star system, part of an open cluster (Hyades, Pleiades) which are in the plane of the Milky Way Galaxy, or in globular clusters which are above and below the plane of the galaxy and very old.
8. Students must be familiar with the Hertzsprung-Russell Diagram (HR Diagram). The vertical axis can be labeled either Absolute Magnitude (how bright the stars actually are if they were all at the same distance from Earth), and the horizontal axis can be labeled with temperature, color, or the spectral classification of OBAFGKM (they all mean the same thing). Remember, this is very similar to the Periodic Table of the Elements – and the location of a star on the HR Diagram tells you how bright it is, it's temperature, age, mass, composition, and evolutionary stage (living stars on Main Sequence, dying stars on Red Giant and Super Red Giant branches, and end product of Sun-sized stars on White Dwarf branch.)

9. Remember – the most important thing about spectra is that hot stars do not have very many emission lines (too hot for electrons to be held to the nuclei so not many electrons to jump up and fall back down in their energy levels to emit photons) and the coolest stars have a lot of emission lines because they are so cool that even compounds can exist.
10. This is a sample of how spectra are related to Main Sequence stars – few lines for the hottest and brightest stars at the upper left of the HR Diagram, and many lines for the coolest and dimmest stars at the lower right of the HR Diagram.
- 11 – 14. This is the image set that is available on the classroom ready education page on the Chandra.Harvard.edu website. The website contains the instructions and several different answer keys. It is a fun way for students to study the sequence of events for Sun-sized and massive stars from birth to death.
15. Students should be able to locate the stars and deep sky objects they are responsible for knowing on the HR Diagram. They should know where hot bright stars like the Pleiades belong, the Sun, red giants such as Betelgeuse, and white dwarfs.
16. You may want to access the Wright Center website and go through the Cosmic Evolution section for your own information if you have questions about the stars. The CD that I produced and gave everyone is also on the site and will be helpful to quickly locate images of planetary surfaces (use the 2001 Space Explorations section of the CD-ROM.) IGNORE the Hands-On-Astrophysics icon on this slide.
17. The Wright Center homepage
18. Good URL's and resources for your students.