1 Discussion: The sky

1. Make a list of things that can be seen in the sky.
2. Categorize your items as Terrestrial/Atmospheric, Orbiting the Earth, Orbiting the Sun, Outside the Solar System, or Other.
3. How long does it take for the things you see in each category to move or change noticeably relative to things on the ground (you can give a range)?
4. For non-terrestrial objects: How long does it take for the things you see in each category to move or change noticeably relative to the "background" of distant stars (or galaxies)?

Example: *Airplane – T/A – seconds to minutes.*

2 Discussion: The solar system

1. Make a list of kinds of things in the solar system and list the planets
2. Put everything in order of distance from the Sun, where applicable
3. Draw a schematic of the solar system showing where you might find each planet or kind of object (don't worry about scale for now).

3 On paper: The sidereal day

Materials

optional: globe or celestial globe

Instructions

The sidereal day is the (average) time it takes for the Earth to make exactly one full rotation (360 degrees). The solar day is the (average) time it takes the Earth to rotate far enough for the Sun to be over the same longitude on the Earth (i.e. the time between two successive local noons). This exercise will help you to figure our why these time periods are slightly different, and by how much.

Quick reminder about angles: there are 360°(degrees) in a circle, each degree is divided into 60′(arc minutes), and each arc minute is divided into 60"(arc seconds).

Do the following in your lab notebook. Make sure your answers are clear. Don't worry, this should not be to scale.

Draw the Earth's orbit around the Sun looking down from the North Celestial Pole. Which direction does the Earth rotate on its axis? Which direction does the Earth orbit the sun? (Draw arrows!)

Draw a circle to represent the Earth at a certain point in its orbit. Draw another circle representing the Earth's location 24 hours later (you can exaggerate how far it would have moved).

Let's say you are standing on the Earth at noon on the first day. Indicate where on the surface of the Earth you would be standing and draw an arrow toward the Sun. Do the same for the next day's position.

No let's say you have a friend on the opposite side of the Earth looking up into the night sky when it is noon your time. Draw your friend and an arrow indicating the direction they are looking when they look straight up. Do the same for the next day. If your friend sees a star directly overhead when it is noon your

time on the first day, will she see the same star in exactly the same position 24 hours later? Does the star appear overhead before or after 24 hours have elapsed?

Now let's do a little math:

- How many degrees does the Earth move in its orbit around the sun in 24 hours?
- How many degrees does the Earth rotate in 24 hours?
- What is the angular speed of the Earth's rotation in degrees per hour, in arc minutes per minute, in arc seconds per second?
- How long does it take the Earth to rotate 360°?
- What is the difference between the length of the solar and sidereal day and which is shorter?
- How long is the sidereal day (hours, minutes, and seconds)?

4 Indoor: visualizing the sky

Materials

seasonal sky chart or planisphere

Instructions

Orient a planisphere or sky chart for the current season with the real cardinal directions (roughly). Pick out a few of the brightest constellations and visualize being outside and looking up to see them in the sky. What direction would you face? How high up in the sky would the constellation appear?

Actually practice this indoors: face in the appropriate direction and point up at the angle above the horizon where you expect the constellation to appear. Now swing your arm to indicate the path of the constellation through the sky over the course of the night.

5 Computer: using planetarium software

Materials

computer with planetarium software, "Seasonal Objects: Winter" (p.38-39, *Turn Left At Orion* 2nd Edition: 1998, Consolmagno and David, Cambridge University Press)

Instructions

Make sure each person understands how to do the following:

1. Figure out how to set the time and viewing location. View the sky as it looks right now from our current location.
2. Find the current seasonal "guideposts" from the *Turn Left at Orion* book.
3. **Find out what planets will be up tonight and where they are in the sky and record this in your lab notebook.** Think about going out on the roof at 9pm: **what direction would you face to see each planet that is up then, and how high up in the sky will it be?** Answer the same questions for April 25, the date of our last lab.