WEEK 1  THE NIGHT SKY—"Finding Your Way"

USING The Edmund Scientific Star and Planet Locator The instructor will present a brief overview.

See image below and your “Locator” as you study and answer the following:

1. **BECOMING FAMILIAR** with The Parts of the “Star and Planet Locator in order to use it as a star computer. Observe the “dial” (rotating part) which contains markings for:

   1. **Stars** which are white dots with brightness of stars being indicated by the size of the dots. Some bright stars have their names imprinted on the dial. **Star names start with a capital letter followed with lower case.**

   TASK: **Rotate** the dial (SEE IMAGE) and find five bright stars and list their names here.

   ____________________________________________

   What famous star do you think is within the central brass pin( or grommet) that the sky rotates about? (SEE NOTE NEXT TO WEST mark on locator)

   (If you do not know this answer see Fig 2.13 of the “BENNETT” textbook you have for your lecture.

2. **Constellations**: Groups of stars known as constellations (for example the famous zodiacal group like LEO and VIRGO) and imprinted on the dial with all CAPITAL letters and have the key stars of the group connected with lines to get a sense of the constellation boundaries.
**TASK** Find and Name any prominent five constellation on the dial:

_______________________________________________________________________________________
_______________________________________________________________________________________

Set up the “star finder” with the NORTH Horizon Corner vertically up as in the image above.

WHAT FAMOUS WORD IS MADE UP OF THE INITIALS OF THE CARDINAL POINTS (N,S,W,E)?

**IMPORTANT: CARRY OUT THE FOLLOWING TASK TO FAMILIARIZE YOURSELF WITH THE STAR FINDER**

3: LABEL the IMAGE ABOVE with ARROWS POINTING to the feature as described AS YOU FIND THEM. A to E in this section

   A. Date Markings: Find these on the outer part of the dial a tick for each day of the year and month words..

   B: Hourly Time marks: Find these on the fixed face of the star finder.
   Label MIDNIGHT, 1 AM, 6 AM, 11 PM, 6 PM

   C: Label WEST and EAST and South: The edge of the inner image of stars (Oval window) near these cardinal points represents the horizon in these directions. Celestial objects on the dial below these horizon boundaries (hidden from view by the grey area) are below the respective horizons and cannot be seen.

   D: PUT arrows where you think the NORTH, SOUTH, EAST and WEST horizons are near the movable inner part of the dial. (note: the E and W near the oval window showing appropriate horizons)

   E: MERIDIAN: Note that just above the brass pin is the label string hole (MERIDIAN) and just below the word SOUTH is another place for the string hole. You will tape a piece of string below connecting these markers later in this exercise and thus create a projection our our LONGITUDE position on earth into the sky. This line divides the sky exactly in half and is called the MERIDIAN. It goes from North to South and over our head (a point called the ZENITH) Label the line in the schematic figure.

   QUESTION: What time is it when the Sun rising in the East “hits” the Meridian?

4: ASTERISMS are patterns of stars that look like something we recognize. The asterism “BIG DIPPER” (looks like a soup dipper with three stars in the “handle” and four stars in the “cup” portion) can be found near the pole(brass pin). Find it and note that capital letters are used to identify an asterism but the letters are not as bold in white as constellation names. The font is also a bit different. Explore the dial and find three other asterisms and list them here.

II: Observing with the star locator: Instructor will demonstrate how the finder is used in the field!

A: STAR MOTIONS: Gentle rotate the dial going from the dates and days increasing appropriately at the midnight point just like our calender (Counter clock wise rotation around brass pin). Though we are rotating around the CELESTIAL POLE (brass pin) stars have different motions near the four cardinal horizons. Describe the motion of stars (like rising; setting; arcs; circles; etc) for each of the horizons as you rotate the dial and sketch a brief path of a typical stars motion near the respective horizon.

   EAST (note motion near “E” mark near oval opening)

   WEST(NOTE motion near “W” as above)
Motions continued:

SOUTH

NORTH

B: REFERENCE CIRCLES:

ECLIPTIC CIRCLE: This is the daily path of the sun (due to the earth going around the sun) through the constellations known as the band of animals or Zodiac. The Planets and our Moon are also found in the constellations along this path. The ECLIPTIC is indicated by a dashed circle on the dial. Find the ECLIPTIC (The dash path on the dial) and list four constellations that it goes through. The names should be familiar!

Celestial EQUATOR: Since the sky appears as a great sphere above us we can use a great circle to divide it up just like we do the earth. The earth has poles since it rotates hence we divide the earth in half with the Equator. Since the sky rotates it also has poles(Celestial poles..the brass pin is the North Celestial Pole or NCP for short) and we can imagine a great circle called the Celestial EQUATOR that divides the celestial sphere in half.

Find the Celestial EQUATOR indicated by a drawn solid circle and name four constellations that it goes through.

C: Celestial REFERENCE POINTS:

EQUINOX: The ecliptic path crosses the Celestial Equator in two places. Examine both circles and find both points. These points are the position that the Sun takes when the earth experiences equal day and nights(i.e. all parts of the earth have 12 hrs day and 12 hrs night) known as the Equinoxes. What two constellations is the Sun in when it reaches theses points?

Remember: Sun moves in Zodiac!

SOLSTICE: When the sun reaches the point on its path (ecliptic) that is furthest from the equator we reach a point called a solstice. There are two points that this happens. One above the equator the other below.

The constellation the sun is in when it is furthest below(LOCATOR is held with NORTH up!) the equator is_______________. This is the first day of Winter and is known as the WINTER SOLSTICE!

The SUMMER SOLSTICE is the point furthest above the equator and the sun is in the constellation?_____________________

SPRING and FALL Equinox a thinking exercise!

Turn the dial till you see one of the intersections of the Ecliptic path and Celestial Equator. Since the sun advances on the ecliptic day by day clockwise (Right to Left on your dial). This latter motion is opposite the daily counter rotation of the sky. Since the sun is below the equator for winter then the situation implies that the first day of Spring known as the SPRING OR VERNAL EQUINOX occurs when the sun is in the constellation? ____________

HINT: The Sun goes from below the equator to above the equator.

Hence the FALL or AUTUMNAL EQUINOX the first day of autumn occurs when the sun is in the constellation?_____________________

The Sun is dropping below the equator.

As an aside; the ancient civilization which started the Zodiac thought the sun traveled the circle called the ecliptic fully around in 360 days ..Thus, we divide to this day, circles up into 360 degrees. Actually a year is _______ days and we can say the sun approximately travels on the ecliptic ______ degree(s) per day!

MOTION SUMMARY: Facing the Star Finder with the North Horizon UP the sky rotates in counter clockwise manner. The stars will make a complete rotation in 24 hrs due to the earths rotation (hence, hourly marks on the
fixed face of the Locator). The stars will also shift each day about 1 degree due to the Earth going around the sun resulting in another complete rotation in a year (Hence monthly day marks on the dial). This rotational aspect of the stars daily and yearly permits us to use the locator for any day or hour of the year.

D: CIRCUMPOLAR CONSTELLATIONS: Rotate the dial and note the constellations near the pole(brass pin) just go in circles about the pole and some never disappear (or set behind a horizon ie. Never set!). This dial is designed for our position on earth (Latitude 40 degrees) List four Major Constellations that will rotate around Polaris and never set in their daily journey about the celestial pole for our position. They are called the Circumpolar Group. Name four of these circumpolar constellations?

Note: Two stars in the cup of the asterism the BIG DIPPER are called (and labeled) “POINTERS” since a line connecting them goes almost directly to the NORTH Celestial POLE or the pole star “Polaris”

III: THE SKY DURING THE SEASONS:
Since the entire sky rotates through the day if you stayed up all night you would see almost all the constellations. We speak of seasonal stars as those seen before Midnight since most humans are asleep after Midnight. We will explore the prominent stars and constellations during the Winter-Spring and Summer-Fall Seasons.

Winter-Spring Skies:
Rotate the dial so that midnight is on December 21. We have set the sky for this night. Be sure to keep this setting for what follows and change it when prompted.

A: Northern Horizon-Winter-Spring Skies:
The circumpolar group is always prominent: The constellation closest to the pole is called URSA MINOR and resembles the asterism called the “BIG DIPPER” and the asterism is called the________________________
Looking at the circumpolar constellations CASSIOPEIA AND CEPHEUS one can say they also look like something we are familiar with. 
What do you think the asterism formed by the prominent stars of CASSIOPEIA is called?_________ (HINT A LETTER of the alphabet)
Likewise for CEPHEUS?____________________________________ (Hint..people live in them)

B: Near the southern horizon and above are prominent (contain bright stars) fall-winter constellations. Name five prominent constellations above the southern horizon and at least five bright stars they contain or are near.

Five constellations________________________________________________________________________

Five bright stars are________________________________________________________________________

C: Name one prominent constellation and it’s bright star near the Eastern Horizon.

________________________________________________________________________

D: Are their any prominent constellations and bright stars near the Western Horizon..if so name them.

________________________________________________________________________

E: What Zodiac constellation on this date (Dec 21 12 AM) within the hour has risen in the East and what Zodiac constellation is about to set in the West?

________________________________________________________________________

F: Finding your way around the stars after you know a few is easy since all you have to do is to imagine lines and arcs pointing other stars or constellations. The POINTERS that show the way to the North Celestial Pole are an example of this geometrical technique of finding your way around.

TRY THIS! If we follow the “POINTERS” opposite the direction to the pole we reach the zodiac constellation called?________________________ Hint: Do you see the mane? see, it’s easy!
**Summer-Fall Skies:**
Rotate the dial and set the locator to June 21 at Midnight:

**Northern Horizon:**

What did you notice about the orientation of the circumpolar constellations going about Polaris in comparison to the Winter-Spring sky above?____________________________________________

Using the Geometrical Technique mentioned above we now explore the prominent groups in the Summer-Fall sky.
Find the Big Dipper Asterism and note the three stars of the handle (The middle star is shown as a double whose visibility was used by the ancient Egyptians as an “eye” exam for civil service). Image follow the arc of the handle away from the four stars of the cup portion of the Big Dipper. The arc sweep to the star Arcturus.

Arcturus is in the constellation________________.

The constellation next to this one looks like the letter U and is called________________ which means “northern Crown”.

Next to the crown (to the left) is a group of stars containing a famous cluster (globular cluster M13) and named after a Greek demi-god and is called _________________. The star patterns of the group are connected with lines that look like a fancy “H”.

Next to these to the left is a constellation named after the ancient Instrument played by the demi-god and contains one of the brightest stars in the sky(note the size of the white dot). Name this constellation and the very bright star?____________________________________

Next on the left is the constellation that means “Swan” containing a famous asterism whose top has a bright star. Name this constellation and the bright star?____________________________________

The two previous bright stars form a “Triangle” with another bright star known as the “Summer Triangle”. This third star of the triangle is located below the two previous bright stars.

Name this star and the constellation it is in. The constellations name means EAGLE”._________________________.

**Note the Southern Horizon**
Very prominent in the southern view is the ecliptic low in the sky.

**QUESTION:** Name four Zodiac constellations crossing the heavens in this view?

**RISE; SET; TRANSIT TIMES:**
When we observe the heavens we are very interested in knowing when an object rises, when it sets and when it reaches the highest point in the sky for us. The latter is known as a transit and happens when the celestial object reaches the meridian and is the usually the best time to observe the object. Tape the string across the string holes so that you have a Meridian Line.

An example: Note for the last date set June 21 at Midnight that the constellation Aquarius is rising in the East, Virgo is setting in the west and very close to transit is the tail of SCORPIUS, The eastern part of HERCULES and star Vega.

**Exercise 1.** Set the dial for 4 a.m. on October 16
a. What zodiac constellation just rose in the East. ___________________________

b. What zodiac constellation is about to Set?_______________________________

C. What bright star(s) is at or near Transit?_______________________________

D. Assuming the center of the Meridian is at your Zenith(over head) then what constellation and bright star are at your zenith at this time?____________________________________
Exercise 2. FIND RISE, SET and TRANSIT times of planets for today! Set the dial for midnight tonight. On the other side of the dial is Table 1 which identifies the constellation a planet is in for the given year and month.

**READ THE INFORMATION BEFORE THE TABLE TO UNDERSTAND THE NOTATION.** Assume the planet is in the middle of the constellation specified for today’s month and year (see table 2 for the name of the constellation). Then by rotating the dial and keeping mind today’s date. Fill in the following table for the time of the event? HINT: Approximate when the middle of the planet’s constellation reaches the East, West and Transit points then check out the position of today’s date marker for the time of the event. Assume the Sun is up when between 6 a.m. and 6 p.m. to figure out about how many hours a planet is visible in the night sky. 6p.m. to 6 a.m. We assume the planet is not visible when the sun is up. The latter is not true since planets are visible at twilight and even in the day for the brighter ones. This last calculation of HOURS VISIBLE is a bit involved and you may need time at home to figure it out! If the planet is not visible then state the reason why in the CONSTELLATION column! Figure this out if you want a good grade.

**Event table:**

<table>
<thead>
<tr>
<th>PLANET</th>
<th>CONSTELLATION(s)</th>
<th>RISE TIME</th>
<th>TRANSIT TIME</th>
<th>SET TIME</th>
<th>HOURS VISIBLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Venus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mars</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jupiter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Saturn</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
GENERAL TIME CONSIDERATIONS: The big dipper asterism is the key to finding many star patterns which you will learn latter. TASK: Sketch below around Polaris the orientation of the big dipper for the start of each of the four Seasons (at midnight) around Polaris. The Summer position at midnight is indicated to start you off? (This is Summer SOLSTICE..set your dial for June 21 midnight with the Northern Horizon below (or hold locator on North end..South pointing up) to see big dipper in this position with respect to Polaris)

*  
*  
*  
*  
*  
  * Polaris
SUMMER  
* <----pointers (point to Polaris!)

_____________________________ NOTE: Northern Horizon Here (hold locator as above)________________________

Scouts learn that the big dippers position can tell us what the date is. As above with the Northern sky below at 9:00 pm. Use your star finder to determine the approximate dates and label each of the two figures below by looking at the pattern of the pointer stars only. HINT: Try to picture or sketch the rest of the big dipper!

*Polaris  
*  
  * <--Pointers

FIG 1 Sky at 9 p.m. DATE?________________
________________________Northern Horizon _________________________

Pointers---->*  
*  

*Polaris'

FIG 2 Sky at 9 p.m. DATE?____________
________________________Northern Horizon _________________________
Identify the following Patterns by writing the **names** of the **constellations** as well as **bright stars** and groups you find using your Locator. Set the dial to the **Winter** for these groups below observed in urban areas:

**BE DETAILED FOR FULL CREDIT!**

**EACH BRIGHT STAR SHOULD BE NAMED AS WELL AS EACH PATTERN.**
Identify the following Patterns by writing the names of the constellations as well as bright stars, AS ABOVE, you find using your Locator. Set the dial to Summer for these groups observed in urban areas: