HOW DO I FIND THAT STAR?

Suppose a friend told you about a wonderful constellation she saw last night and insisted that you see. What information would you need to find the constellation yourself?

As you might expect, you will need a map that gives you the positions of sky objects. Astronomers have devised such a map and call it a **star chart**.

Do you think that all celestial objects are on the star chart? Why or why not?

Can you use the same star chart in the summer and winter? Why or why not?

**ACTIVITY 1: Using a Star Chart**

**Setting a Star Chart**

When acquiring a practical star chart you need to consider the following:

*latitude - the chart should be designed to cover your latitude; you can ignore longitude

*date and time settings - the chart should be movable to fix the date and time or it should tell you the date and time it is printed for.

1. Locate a start chart. On the stationary portion of the chart, locate the time of night you will be observing. Turn the sky dial until your date lines up with the observing time.

2. Hold the chart so that the point labeled “north” points to the north. Without looking at the chart, determine which direction is east. Now, look at the star chart. Is the word “east” pointing toward the east? Why or why not?

What can you do so that “north” is still pointing north but east is in the correct position?
3. A **constellation** is a section of the celestial sphere which contains a recognized pattern of stars. Each constellation is named after a person, animal, object or creature from ancient mythology. You will be able to see any constellation that is visible in the center ellipse of the star chart. Any other constellation is below the horizon and is not visible at the specified time.

4. Before you start you need to note a few more points.

* Constellation names are generally written in capital letters.
* Star names and other objects are usually written in lower case.
* Some objects will be identified by Messier codes like M13 or M87. These can include star clusters, galaxies, and nebulae.
* The size of the points representing stars indicates how bright they are. The larger the point on the star chart, the brighter the star. Only stars that you can see with the naked eye are printed on the star chart.

**Now you are ready to use the star chart.**

1. Set the star chart for September 15 at 11:00 PM. Use this setting to answer the following questions.

   a. Find the constellation Pegasus. In which direction in the sky would you look to find it?

   b. In which constellation is the star Alderbaran?

   c. Locate and name a constellation that is rising. (hint: where does the Sun rise?).

   d. The **zenith** is the highest point in the sky for you, the observer. Where is the zenith on the star chart? What constellation is at the zenith?

   If you answered URSA MINOR you are incorrect. Many people guess this because the sky circle rotates around a star in this constellation. The zenith will be at the intersection of the east-west and north-south lines.
2. Set the star chart for 9:00 PM on December 25.
   a. What constellation is at the zenith?
   b. Locate one rising and one setting constellation. Are they the same ones as you identified in the fall?
   c. Find the constellation ORION. What are the two brightest stars in the constellation?
   d. What are the main (most prominent) constellations besides Orion?
   e. Turn the sky wheel until Orion has just vanished below the western horizon. Locate the date (December 25) and look at the time at that date. Record the time below. This time is considered the setting time of the constellation.

3. Now set the chart for midnight on July 20.
   a. Locate a constellation that is just rising and one that is just setting. This means that the constellations are partially above and partially below the horizon.
   b. What are the main summer constellations?
All fixed objects are included on the charts. These objects include stars, star clusters, galaxies, and nebulae. Since the Sun and planets change their positions with respect to the fixed objects it would be pointless to include them on the chart.

When you are locating a point on Earth you can use the same map any time of year since the points are all fixed with respect to you. However, since the Earth rotates the celestial objects change their orientation with respect to you all the time. Any star chart you use must take this into account. As you have discovered, the chart is designed to be held over your head. If you don't hold it up be sure to compensate for the east-west reversal.

As you have seen, star charts are simple to use but do have some limitations. Is the sky map or chart exactly like the sky? Why or why not?

The sky is spherical but the sky map you are using is flat. There will be some distortion in where the objects will appear and their exact shapes. This problem also exists with maps of the Earth that portray three dimensional land surfaces in two dimensions. As long as you are aware of it you can compensate as needed.

Now let's get back to the star chart.

4. a. Find the stars Altair, Deneb, and Vega. What pattern do they make? Do they form a traditional constellation?

These stars form the "Summer Triangle". Would it be a small or a large triangle in the night sky?

b. Slowly turn the sky wheel. As you do, notice which constellations are always visible above the horizon. Record their names here.

What can you say about when you will be able to see these constellations (time, month)?
The constellations you listed are called **circumpolar constellations** and are visible all the time (assuming it is dark enough.).

**Activity 2: Charting the Heavens Using a Planetarium Program**

You have had the opportunity to use a tool to display the night sky, the star chart. You are now acquainted with constellations and non-planetary celestial object motion over time. Wouldn’t it be great if you could chart the night sky on a given date and time for a particular location and watch the changes in an animated time sequence? Or wouldn’t it be interesting to see how the sky appeared to our ancestors or how it will look to our descendants? This is possible with a planetarium where a projector can be set to display celestial objects for a given date and time on a domed surface and show motion of stars and planets.

Although we do not have a planetarium, we can generate a “virtual sky” by simulating celestial displays and motion using a computer program such as The Sky™ or Red Shift™. These programs will allow you to select a location, date, and time for sky viewing. They also permit you to select the objects to be seen along with constellation and sky coordinate lines. You can set the sky in motion to see how the celestial display will change with time as the Earth rotates and revolves around the Sun.

**Starting TheSky™**

To begin the program TheSky™ go to Start, then Programs. Locate TheSky and select TheSky Level II CD-ROM. When the program finishes loading you should see a display similar to the one below. If these instructions do not work for your computer, ask your instructor for alternate directions.
The top of the screen contains controls that change the screen display. This section is gray with a variety of menus and button icons. The lower section of the screen is the sky display. This is usually black with sky objects plotted in white or color. A red or green dotted line toward the bottom of the display represents the horizon. The direction you are looking toward (SW, NE, E) on the display is printed under the horizon line. The ecliptic is displayed as a yellow dotted line and the meridian for the location selected is displayed as a blue dotted line (visible in north and south looking views).

**Using the Cursor**

When you place the cursor, controlled by the mouse, on a screen display object and click you will see a box appear like the one here. It will provide the object name (if it has one), any astronomical catalog identification number, and information about the object. Sometimes object files needed to identify an object are not loaded on the computer you are using and the CD-ROM with the files is not available. The white object list box will indicate that file is not available.

The mouse controlled cursor is used to change the screen display using options on the toolbar or in pull-down menus.

**TheSky™ Toolbars and Menus**

TheSky™ has a series of toolbars that make it easy for you to control what you see on the screen. The toolbars are located at the top of the screen and consist of small icons in buttons. When a button appears to be depressed, it means that this function or option is active. You can turn an option on or off by pressing on the icon with the left button of the mouse. Below is a brief description of the various options. Please note that your display may not have all the buttons in the same order as seen above. Feel free to play with these options as you read below.

**Scrolling the Sky**

These arrow buttons allow you to change your view left to right and up and down. If you push the up arrow, the screen view will shift so the center of the display is a point higher in the night sky.
Zooming In and Out

The magnifying glasses permit you to look more closely at the current sky display or to see more objects in the display. To magnify (see less of the sky or look closer), select the + button. Doing the same thing with the - button will zoom out (show more of the sky). If the button becomes entirely gray, you have reached the limit of the zoom.

Look Commands

If you want to change your view so that you are looking in a specific direction (north, south, east, west or up (zenith)) you can do it with these buttons. Selecting Z will change the screen display and show what you would see if you were looking straight up toward the zenith.

Moving in Time (Time Skip)

You can change the time of the display easily with these buttons. The pull-down window allows you select the amount of time that you want to skip (second, minute, hour, day). The single left or right arrow points move you one time unit. The double arrow points begin a sequence that continually changes the display by the time unit. It generates an animation of the sky over time. You stop the motion with the square. The up arrow point resets the date and time to the initial conditions.

Displaying Objects

Sometimes you want to control the number of objects that are displayed on your screen. You can do that easily with this set of buttons. When the button is selected, the objects are displayed. From left to right, these buttons control:
STARS DOUBLE STARS VARIABLE STARS GALAXIES CLUSTERS NEBULAE

Labeling Objects on the Screen

You can label the objects on the screen with these buttons. Because they add a lot of information to the screen it is best to leaves these unselected unless you are searching for a particular object.

Displaying Grids and Patterns

Sometimes it is convenient to have a reference grid placed on the sky display. The left (blue) grid marks coordinates of the celestial sphere, right ascension and declination. The right (red) button shows coordinates with respect to the local horizon, altitude and azimuth.
If you want to display the classical constellation patterns, you can select the left button of the two shown here. The right button will display the boundaries of each constellation.

**Orienting Yourself**

The Sky™ can simulate your view from different perspectives. If you select Z (zenith up) the display is referenced to the horizon. This is the orientation you want when you are trying to simulate the actual view from your observing site. You will see a horizon line drawn near the bottom of the sky display. The P (pole up) view uses equatorial referencing and is better when you are just looking at celestial objects and are not concerned about the horizon or zenith location. The ? allows you to rotate the display to any angle using a curves arrow key to the left of it (not shown here but can be seen on the toolbar graphic on page 2).

**Leaving Tracks**

Sometimes it is convenient to monitor the path of an object like the planet Mars by having the object leave a trail. The buttons shown here will allow you to do that. The yellow button (right one) will allow you to select the objects that will leave a trail and the type of trail. Selecting the red dot button will turn on the tracking feature. The trails will show when the time skip feature is used to put the sky in motion.

**Setting Your Site, Date, and Time**

To set the location, date, and time for your sky view you will use one of the “Data” menu items. Click on Data and you will see a selection called “Site Information” as shown below.

When you click on “Site Information” it will provide the screen shown here:

In the “Location” folder you can select the site. If the Description box does not display Washington, D.C. you can change it with the pull down menu. You will note that the longitude and latitude for
Washington are also displayed. This menu has many US cities preprogrammed. You can also select a site by typing its longitude and latitude in the appropriate boxes.

If you click “Date and Time” folder, you can select the time for the sky display. The default is to use the computer clock. This will happen when the “Use computer’s clock” is checked. You can set the date to be any value from 4712 B.C. (-4712) to 10,000 A.D. The time is expressed in a way that avoids the use of AM and PM. For example, 10 PM is 22 hours. Be sure to check “Apply” and “OK” before returning to the display or the display will not reflect the changes you make.

The Nightly Motion of Stars

To look at the motion of the stars over a period of time we can set a site and time and put the sky in motion

* Set the date for today using the Data menu
* Set the orientation on the tool bar for Zenith Up.
* Turn off ALL objects except the stars. Turn on the constellation boundaries.
* Go to the Time Skip icons and be sure the time interval is set for 1 day. Click on the double arrow pointing right to start the sky motion to the future. You can stop the motion with the square or reverse the motion with the left arrows.

1. Observe the night sky in motion looking south. Describe the motion.

What is the path taken by the stars when viewing to the south? ________(Hint: watch one object for a while.)

A          B
\[ \]
C          D

2. Now change your view to north, and start the motion after resetting the time to your initial conditions.
Observe the night sky in motion looking north.
Describe the motion.

Illustrate the path taken by the stars when viewing to the north.

Is there any star that is not following the path above? If so, identify it.

Does the Big Dipper (part of Ursa Major) go below the horizon? Explain.

3. Now go back to the “Date and Time” folder and change the year to 5000. Click on “Apply” and then “Close.”

Observe the night sky again looking north as you did just above.
Describe the motion.

What is different in the year 5000? Describe it.

**Observing Planetary Motion**

- Set the date for today
- Set the orientation on the tool bar for **Pole Up**. This will keep the stars in the same position on the screen all the time.
- Use the **Scroll arrows** to position the blue ecliptic line centrally on the screen. Zoom out to get a more encompassing sky view
- Turn off ALL objects except the stars. Turn off all grids, boundaries, and labels.
• Go to the **Time Skip** icons and be sure the time interval is set for 1 day. Click on the double arrow pointing right to start the sky motion to the future. You can stop the motion with the square or reverse the motion with the left arrows.

1. Observe the motion of the planets.
   What is changing?

   What is not changing?

2. Now turn the stars off and turn the tracking on with the red dot button. Start the motion again and let it run awhile. If the tracking marks become too numerous, turn the tracking button off and then on again to clear the marks and restart motion. What do you notice about the planets’ motion? Describe or illustrate it.