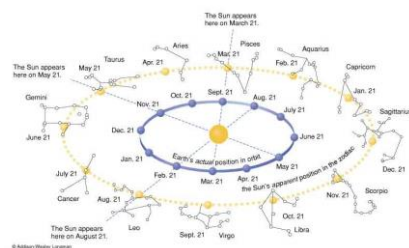


Name: \_\_\_\_\_  
 Partner(s): \_\_\_\_\_  
 1101 or 3310: \_\_\_\_\_  
 Desk # \_\_\_\_\_  
 Date: \_\_\_\_\_



## The Zodiac

### Purpose:

- Learn the basic features of the Starry Night College software by exploring the properties of the Zodiac
- Explain what the Zodiac is and describe how the constellations change with observing location
- Describe the motion of the Sun, planets and Moon in relation to the Zodiac

### Equipment:

- |   |                      |
|---|----------------------|
| • Starry Night College software         | • Flashlight         |
| • Plastic celestial sphere and markers  | • Small rubber Earth |
| • Zodiac taped on the walls of the room | • Star wheels        |

**Preconceptions:** What does “the Zodiac” mean to you, from your current knowledge?

**Question 1:** On the desktop click on the magnifying glass in the lower left of the screen and type “Starry Night College” to launch the software. It may take a minute or two indicate that the software is loading. If you are prompted to set a Home Location, search for Vancouver and save it as your home location. You can always change your home location in the File menu. Once the software has started you should see a view of the sky and horizon from Vancouver. There are 3 panels (SkyGuide, Graph, Search Results) which may be useful throughout these labs. You can toggle them in and out with the 3 buttons in the top right corner next to the search field. You don’t need them on your screen for now.

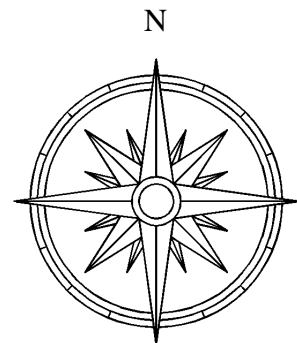
In the table on the next page, give the names of the astrological signs shown (You can Google this.), and compare them to the names of the actual constellations labels as shown in Starry Night College. Point out the names that are different. Click: View > Constellations > Zodiac and play with the labels, boundaries and illustrations. (Hint: Toggling the Horizon and Daylight in the View menu may help you to see all the constellations in the Zodiac.)



**Question 2:** Turn the Horizon back on. Travel to 2 different cities. Choose one of your cities in Europe and the other in the southern hemisphere. State which cities you chose and describe how the sky is different than in Vancouver. (Options > Viewing Location...)

**Compass points:** Travel back to Vancouver (using the Home button). Look around the horizon using the , and notice the compass points.

**Question 3:** Complete the diagram on the right with E, S, W, NE, SE, NW, SW, and SSW.



**Daylight and other objects:** Switch daylight on and off. Set the time to midnight (12:00:00 AM). Play with the “View” and “Labels” menus. Magnify some objects you might by zooming in and out (Use - + on the bottom left). Find M31 using the search bar and double click the picture of the Top Hit.

**Question 4:** Explore the sky. What types of objects are you finding? When you mouse over objects the type of objects are listed under “Object type”.

**Question 5:** What planets are in the sky tonight? (Hint: Labels > Planets-Moons will make them easier to spot.)


**Question 6:** Use the search bar to find the Moon. If the Moon is not currently visible from your location, click Hide Horizon. Right click on the Moon and select “Show Info”. What is the phase of the Moon today? Name it and draw it.

**Question 7:** Go to View > Constellations. Define the following terms.

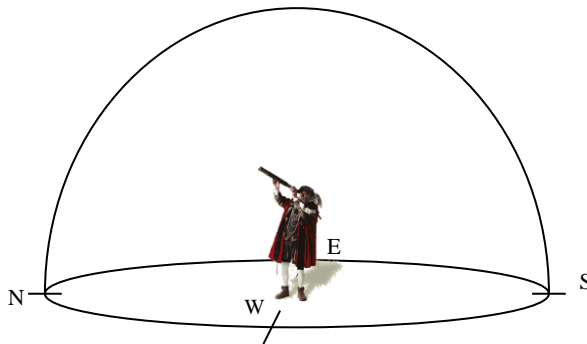
- Constellation label
  
- Constellation boundary
  
- Constellation illustration
  
- Asterism

**Polaris:** Find the North Star (Polaris) in the Little Dipper (Ursa Minor). Find the Big Dipper (Ursa Major).


**Question 8:** Imagine that you are in your backyard with a friend. Describe (in words) a method to find Polaris, starting from Merak and Dubhe, two stars of the Big Dipper. Draw a diagram to explain your method.

**Zenith:** The automatic field of view is set to 150°. Change the FoV to 180° by the slider at File > Preferences > Maximum field of view. Now when you zoom out with the scroll wheel it will go to 180°. Consider the following when answering Question 9: Spin the ground with the  while looking straight up – you should see a red circle made up of two arrows at the Zenith. What does the Zenith do? Stand up in the room and spin while looking at the ceiling. What is the point that does not appear to move?

**Question 9:** Propose a definition for the zenith. Draw the zenith on the diagram to the right representing the sky in Vancouver.



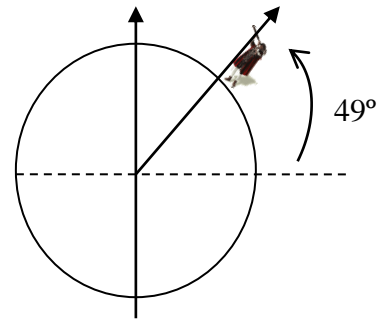
Hereafter, Z will be the label for the zenith.

**North Celestial Pole:** The time is automatically set to flow at the same speed as “normal” time, but you can let time flow faster or slower, forwards or backwards or in discrete steps. Open the time flow controls to the left of the search bar and set the time step to 3 min. Make the Earth spin by clicking on the  button. Play with the time buttons to get used to them.



**Question 11:** The diagram to the right represents the Earth. The dashed line is the equator of the Earth.

- Indicate the direction to Z and to Polaris (P) for an astronomer standing in Vancouver, at a latitude of  $49^\circ$  N.
- What should be the angle between the direction of Z and the direction of P according to this diagram?
- To measure the angular distance between Z and P, click on the hand icon and change it to the Angular Separation tool. Round off this numerical value to the nearest degree.
- Is your answer consistent with the previous one?



**The Zodiac as seen from Vancouver:** The zodiac is a band of stars in the sky that circles a full  $360^\circ$ , but only part of the zodiac is visible at any particular time of the year.

**Question 12:** Explain why backyard astronomers need a star wheel. What is actually happening in the sky? Draw a diagram. (Help: have one of you play the part of the Sun by holding a flashlight, and another one playing the part of the Earth orbiting the Sun, and look at the Zodiac constellations on the walls of the room.)



**Dialog:**



Jimmy: Why isn't the Zodiac a band parallel to the horizon?

Janis: Because the latitude of Vancouver is 49° N.

Jimmy: Then at the North Pole it must be parallel to the horizon. Let's go there and check!



**The Zodiac as seen from the Pole:** Find a way to travel to the North Pole (latitude 90°N). Watch the Zodiac on September 1<sup>st</sup>, December 1<sup>st</sup>, March 1<sup>st</sup> and June 1<sup>st</sup>. (Hint: View > Alt/Az Guides > Grid. Get rid of daylight.)

**Question 13:** For each of the following dates, select the bright star of the Zodiac that has the highest elevation and complete the table. The elevation is also called **altitude**, i.e. the angular distance above the horizon. (Hint: Select a flat horizon in Options > Other Options > Local Horizon > Flat.)

Date	Highest constellation of the zodiac	Selected star	Angular distance to horizon
Sept 1 <sup>st</sup> 2006	Gemini	Castor	31°52'
Dec 1 <sup>st</sup> 2006	Gemini		
March 1 <sup>st</sup> 2006			31°52'
June 1 <sup>st</sup> 2006		Castor	

Conclude. Do the constellations change with the seasons at the North Pole, like in Vancouver? Why?

**Stay at the North Pole:** To see the changes happening in the sky in the course of a day, play time with a step of **1 minute**. The observed motion is due to the rotation of the Earth about its axis.

To see the changes happening in the sky in the course of a year, play time with a step of one **sidereal day**. The observed motion of the sky is due to the revolution of the Earth about the Sun.

**Question 14:** How many constellations of the Zodiac can the people at the North Pole see in the course of a year? Name them.

**Question 15:** Which Zodiac constellations do people standing at the South Pole see? (Guess or travel there.)

**Question 16:** Propose an explanation for the apparent tilt of the Zodiac as seen from the Poles. Draw a picture to help with your explanation.





d) Propose a thorough definition of the Zodiac based on your answers from (a) – (c).

**The 13<sup>th</sup> constellation in the Zodiac:** Remove any coordinate grid and the horizon. View the boundaries of the Zodiac constellations. Carefully follow the yearly motion of the Sun. Notice that the Sun leaves the boundaries of the Zodiac constellations once a year.

**Question 19:** Harvey was born on Dec 12th, 1987. What constellation was the Sun in on his birthday?

**Conclusion:** Write a conclusion to this lab. What did you learn? What is the use of what you have learnt? How could you use that knowledge in your backyard? What interested you the most?