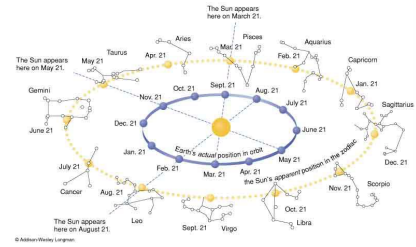Name: _____

Partner(s): _____

1101 or 3310: _____

Desk # _____

Date: _____

The Zodiac

Purpose

- Learn the basic features of the Starry Night 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
- Plastic celestial sphere and markers
- Zodiac taped on the walls of the room

- Flashlight
- Small rubber Earth
- Star wheels

Preconceptions: Define the Zodiac from any previous knowledge.

Question 1: Launch Starry Night College. Provide the names of the astrological signs shown and compare them to the names of the actual constellations. Circle the names that are different. (SKYGUIDE > Unit E: Star Finding > E3: Seasonal Constellations > The Zodiac)


Setting Home, Time and Date: Explore the menus and find a way to travel to Vancouver (Hint: "Look up"). Make sure that Vancouver is defined as "home". Set the date and time to view tonight's sky (Hint: 🕐).

Question 2: On a given day, at a given time, is the night sky the same all over the world? Check the night sky in various cities (e.g. Vancouver, Hong Kong or London) around the world at the same local time. Describe what you notice.

Compass points: Travel back to Vancouver. Look around the horizon using the ✋, notice the compass points.

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

N
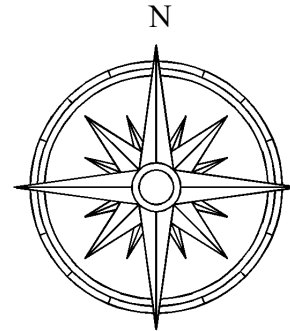
Daylight and other objects: Switch daylight on and off (SETTINGS ⚙ > LOCAL HORIZON > Show Daylight). Set the time to midnight (12:00:00 AM). Magnify some beautiful objects you might want to look at by zooming in and out (+/- button at the right bottom corner). Find M31 using Search ⚲ . Remove the stars (SETTINGS ⚙ > STARS > Show Stars). Show the planets (SETTINGS ⚙ > SOLAR SYSTEM > Show Planets).

Question 4: Explore the sky. What types of objects can you find?

Question 5: What planets are in the sky tonight?

Question 6: Find the Moon. Right click on the Moon and open the Info Window or click on the ⓘ button. What is the phase of the Moon today? Name it and draw it.

**Question 7:** Go to GLOSSARY or use Google. 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. Create a method to find Polaris starting from Merak and Dubhe, two stars of the Big Dipper. Draw a diagram to explain your method.

Zenith: Go to SETTINGS > GUIDES AND LINES and choose "Horizon Coordinates" under Grid Coordinate System. And click on SHOW GRID to display the **lo**cal coordinate system. Zoom out of the sky until the field of view (FOV, bottom left on horizontal toolbar) is equal to 180 degrees. Consider the following when answering Question 9. Spin the ground with the ✋ while looking 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.
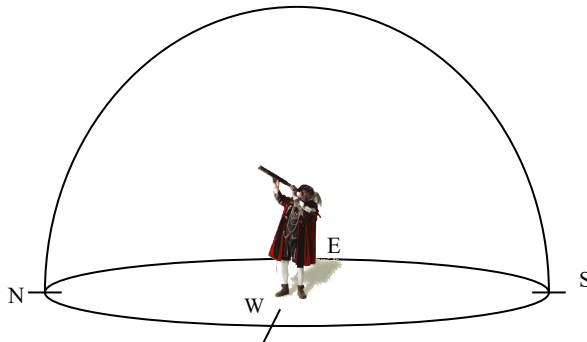
Hereafter, Z will be the label for the zenith.

North Celestial Pole: Open the time step ⟨⟩. Set the time step to 15 min. Make the Earth spin by clicking on the ▶ button. Play with the time buttons to get used to them.

Question 10: One point does not move in the sky while the Earth is spinning about its axis. (Go to SETTINGS > GUIDES AND LINES and choose "Equatorial Coordinates" under Grid Coordinate System. And click on SHOW GRID to display the **eq**uatorial coordinate system).
a) What is the name of the bright star close to that point?

b) Why isn't the sky rotating around Z? (Help: you can use the rubber earth and the plastic hemisphere, or the plastic celestial sphere).

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

   a) Indicate the direction to Z and to Polaris (P) for an astronomer standing in Vancouver, at a latitude of 49° N.

   b) What should be the angle between the direction of Z and the direction of P according to this diagram?

   c) Use the ruler button in the upper horizontal toolbar to measure the angular distance between Z and P at Vancouver. Round off this numerical value to the nearest degree. (Hint: Use the 180° field of view).

   d) Is your answer in (c) consistent with the previous one?
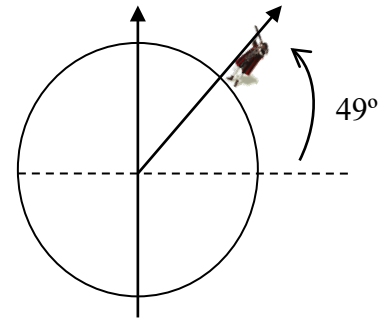
The Zodiac as seen from Vancouver: The zodiac is a band of stars in the sky that circles a full 360°, but only part of the zodiac is visible at any particular time of the year.

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 90ºN). Watch the Zodiac on September 1st, December 1st, March 1st and June 1st.

(Hint: Display the **lo**cal coordinate system [Horizon Coordinates]. Get rid of daylight.)

(Go to SETTINGS > CONSTELLATIONS, select Show Boundaries and Show Names.)

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. Altitude (Alt) of a sky object is indicated at the left bottom of the tool bar.

Date	Highest constellation of the zodiac	Selected star	Angular distance to horizon (at 12:00am)
Sept 1st 2006	Gemini	Castor	31º52'
Dec 1st 2006	Gemini		
March 1st 2006			31º52'
June 1st 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, change the time step to **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: What do people standing at the South Pole see of the Zodiac? (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.

Astrology: In Western (sidereal) astrology, your astrological sign is more or less the constellation in which the Sun was rising on the day you where born.

Question 17:
    a) Use the software to find your astrological sign.
       (Hint: remove the horizon. Go to SETTINGS > LOCAL HORIZON, uncheck Show Horizon.)

    b) Find your sign if you were born in 1 AD.

    c) Find your sign if you were born in 6000 AD.

    d) Conclude.

Motion of the Sun, planets and Moon: Travel to Vancouver. Remove the horizon. Select a time step of 1 day then play time. Keep looking at the Zodiac. When you are looking at planets keep in mind that the sizes of planets on the screen indicate how bright they are, not their actual size. This is why Venus appears larger than Jupiter.

Question 18:
    a) Describe the motion of the **Sun** with respect to the Zodiac.

b) Describe the motion of the **planets** with respect to the Zodiac.

c) Describe the motion of the **Moon** with respect to the Zodiac.

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

The 13ᵗʰ constellation in the Zodiac: Remove any coordinate grid and the horizon. View the boundaries of the Zodiac constellations. Follow carefully 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?

Food for thought: If you were an instructor, what questions would you ask on a test?