Name: ___________________________
Partner(s): ________________________
1101 or 3310: ______
Desk # ____________
Date: _____________

The Sun, Michelangelo, Sistine Chapel

The Apparent Motion of the Sun in Vancouver

Purpose

- Explain how you can find your latitude by looking up at the night sky
- Explain the local coordinate system and what altitude and azimuth are
- Describe the path of the Sun as seen from Vancouver on the solstices and equinoxes
- Explain the trace of the analemma

Equipment

- Starry Night College
- Plastic hemispheres
- Non-permanent markers

Preconceptions

- Where does the Sun rise?

- Where does the Sun set?

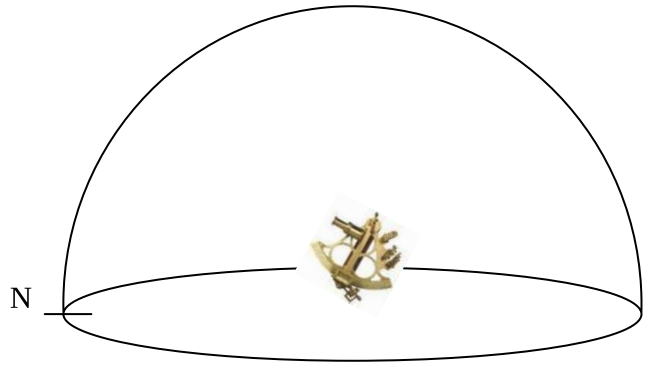
Latitude of a location: Before we start looking at the Sun, let's learn how to find the latitude of your location by looking at the night sky. Historically, sailors used a sextant, as shown on the right.

Question 1:

a) Travel to the following locations and measure the angular distance between Polaris (P) and North (N) on the horizon using the Angular Separation tool (Right-click on the hand in the upper left corner).

Location	Angular distance between P and N	Latitude of the place
Vancouver		
Quito		
Reykjavik		
Mexico City		

b) On a local view of the celestial sphere, draw and explain how to find the latitude of a place:



c) Now travel to Santiago, in Chile. Find Polaris. What do you notice?

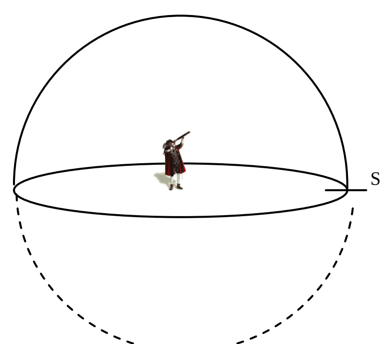
d) Display the celestial grid (View > Celestial Guides > Grid) and find a bright star (magnitude less than 6) that could define the South Celestial Pole.

e) In which constellation is the South Celestial Pole?

f) For the following locations, find the altitude of the SCP.

Location	Altitude of the South Celestial Pole	Latitude of the place
Santiago		
Pretoria		
Sydney, Austr.		
Sao Paolo		

g) In the diagram to the right, you're an observer in the Southern Hemisphere. Draw the two celestial poles.



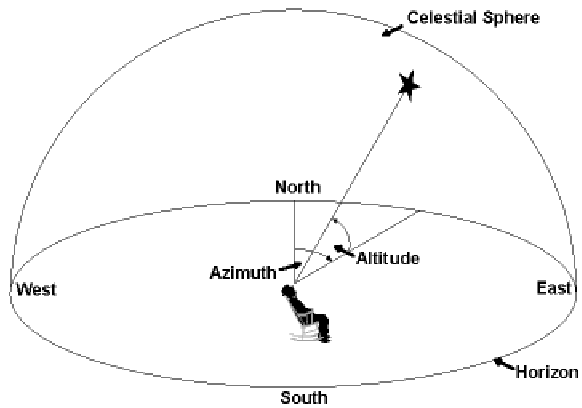
h) On a local view of the celestial sphere, draw and explain how to find the latitude of a place in the Southern Hemisphere.

The Local Coordinate System: Go back to Vancouver. Display the local coordinate system (View > Alt/Az Guides > Grid).

The **altitude** of a celestial object is the angle measured upwards from the observer's horizon. Thus, an object on the horizon has an altitude of 0° and one directly overhead has an altitude of 90°. Negative values for the altitude mean that the object is below the horizon. Altitude is also frequently referred to as elevation.

The **azimuth** of a celestial object is angle measured clockwise around the observer's horizon from north. So an object due north has an azimuth of 0°, one due east 90°, south 180° and west 270°.

In this activity, round off azimuth and altitude to the nearest degree.



Question 3: Find the azimuth of the following compass points.

N	E	S	W	NE
ESE	SE	SW	NW	WNW

Motion of the Sun as seen from Vancouver: Use a plastic hemisphere to represent the sky in Vancouver, i.e. what you can see from your backyard. Draw N, S, E, W, Z (zenith), P (Polaris) and the local meridian joining N, Z and S.

Set the date to March 21. Switch off daylight savings (Click on the 3 horizontal bars to the left of the month. Click off "Auto-manage DST". Click "Turn Daylight Saving Time Off". Right click on the Sun and select "Local Path". Then play time from sunrise to sunset. Note the position of the Sun at sunrise, culmination and sunset. Draw the daily path of the Sun on the plastic hemisphere. (Hint: Culmination is the highest altitude that a celestial object attains above the horizon. An object culminates as it crosses the local meridian.)

Draw the daily path of the Sun on the same plastic hemisphere on June 21, Dec 21 and Sept 21.

Ask your instructor to check your work:

Instructor's initials: _________

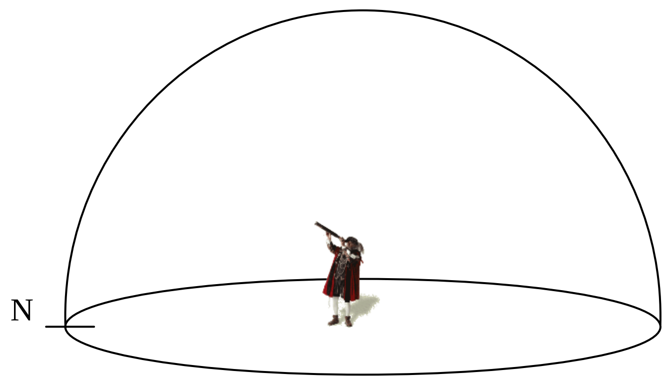
Question 4:

a) What is the date of the summer solstice (longest daylight)? _____________

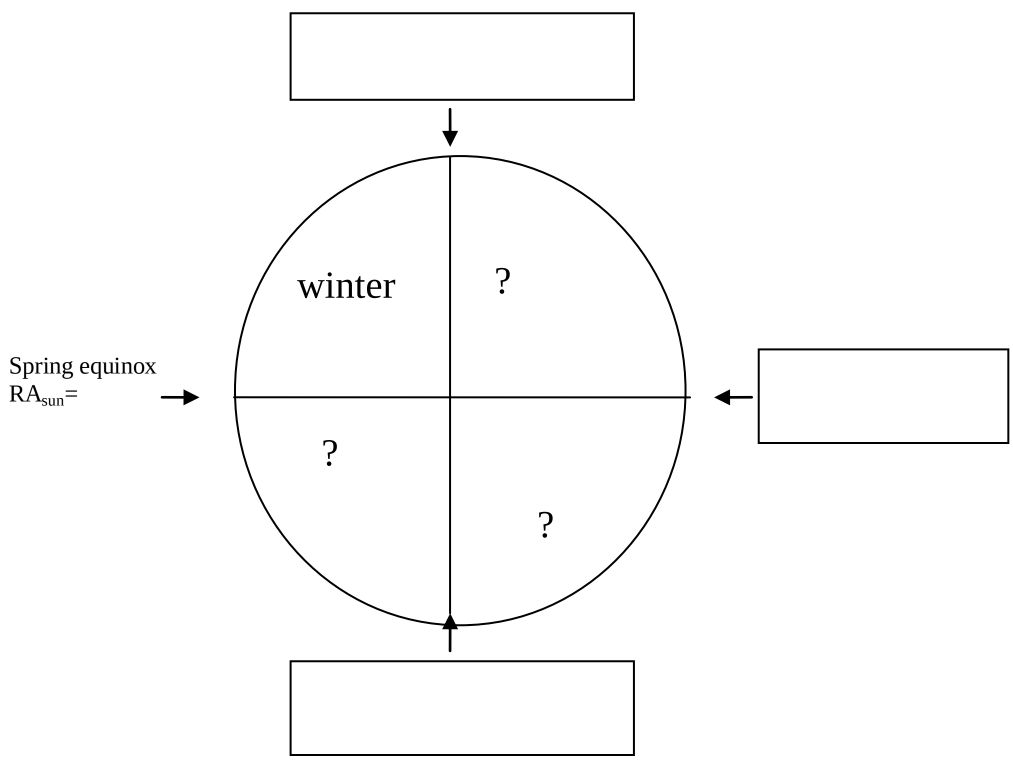
b) What is the date of the winter solstice (shortest daylight)? _____________

c) When is the length of day equal to the length of night (equinox)? _____________

d) Draw Z and P (Polaris) on the following diagram representing the sky in Vancouver. Draw and label the path of the Sun on each equinox and each solstice.



e) Complete the ecliptic wheel below with the name of the equinox/solstice and the RA of the Sun on these days. Replace each ? by the name of a season.



f) What is the right ascension of the sun on the fall equinox? _____________

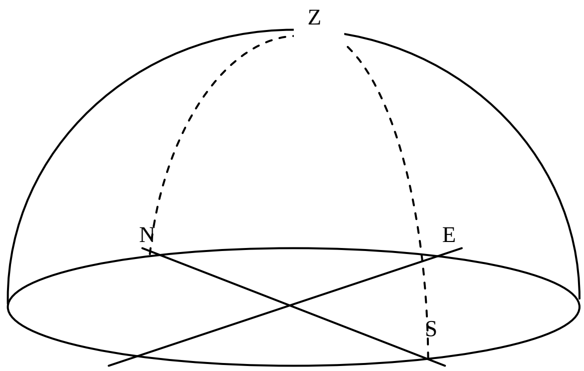
g) What is the declination of the sun on the fall equinox? _______________

h) Does the Sun ever reach the Zenith in Vancouver? ________________

i) Why the weather is warmer in Vancouver in June than in December? (Give two reasons).

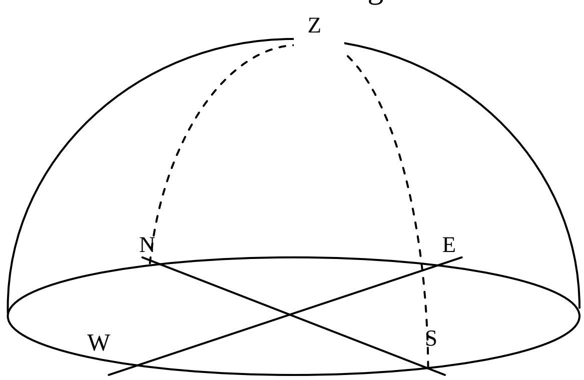
Question 5: Analemma. Say you record the position of the Sun every day at noon in Vancouver.

a) On the following diagram, draw the change in the positions of the Sun that you expect to record. It might help to draw it on the plastic hemisphere too.



Since the orbit of the Earth is not a perfect circle, the Sun follows an 8 figure. Click Favorites > Local View > Analemmas > Analemma Daylight, set the location to Vancouver at noon. With a time step of 1 day, watch the changes of the Sun's position at noon in the course of a year.

b) Draw the analemma. Indicate the date of the highest and lowest positions of the Sun.



Conclusion: Write a 3 to 5-line conclusion about this lab.

Clean and return your hemisphere.