NAME(S)_____ SECTION DAY/TIME_____
ASTRONOMY 20/25 S. V. LLOYD

Stellarium Activity #4
SUNRISE AND SUNSET: ANCHORAGE

Overview The seasonal variation in temperature is due to two changes in the Sun's path over the course of the year:

1) the Sun's height (altitude) in the sky at noon
2) the number of hours the Sun is above the horizon

Software This activity uses **Stellarium** version **0.16.0**.

Configuration For this activity, it makes the times clearer if you turn **off** daylight saving time. To do this, go to the **Location** window [F6] and make sure that **Enable Daylight Saving Time** is *not* selected. Check the box above (**Use custom time zone**). From the **Time Zone** drop-down menu, scroll all the way to the bottom and select **Local Mean Solar Time.** Set the location to **Anchorage**, **United States** (longitude 149° W, latitude 61° N).

Turn on the **meridian** if it isn't on already (press the semicolon [;] key). The meridian is the green line that goes from the north point on the horizon thru the zenith to the south point on the horizon, dividing the sky into its eastern and western halves. The Sun is highest in the sky when it is on the meridian. This defines **true solar noon**.

Open the **Configuration** windown [F2]. Click on the **Information** tab. In **Displayed Fields,** select Altitude/Azimuth from the 2nd column of options. Click on the **Navigation** tab. Under **Display formats of date and time** select time: **24-hour format.** Close the window.

The Sun Stop the clock [7]. Set the time to **12:00:00**. Select the Sun by clicking on it. Press the space bar to lock the Sun in position. In the upper left you will see some information about the Sun:

Magnitude is the apparent brightness of the Sun expressed in the peculiar system astronomers use for measuring the brightness of a star. In this system, a negative numbers are bright stars; positive numbers are faint stars. Polares has a magnitude of +2. Sirius has a magnitude of –1.5. What is the Sun's magnitude?

RA/DE are **right ascension** and **declination.** These are the co-ordinates of the Sun on the celestial sphere. Right ascension is like longitude (how far east the Sun is); declination is like latitude (how far north or south of the equator the Sun is).

Az/Alt are **azimuth** and **altitude.**
Azimuth is the direction of the Sun around the horizon.

0° = north
270° = west 90° = east
180° = south

Altitude is how many degrees above the horizon the Sun is.

90° = at the zenith
0° = on the horizon

Sunrise & Sunset

Set the date to **March 20**. Set the time to **6:00:00**. That's 6 a.m.
Use the arrow keys to face the Sun rising in the east. Fill in the table below.

Sunrise is when the Sun is just on the horizon (altitude = 0° 0'). Use the J, K, & L keys to go forward or backward in time until the Sun is right on the horizon. Record the time of sunrise and the azimuth of the Sun. Round of the time to the **nearest minute**. Round off the azimuth to the **nearest degree**. (If the number of minutes is more than 30, round up to the next degree.)

True Noon is when the Sun crosses the meridian. Advance time until that happens (tap the J, K, L keys). Record the altitude of the Sun and the time. Round off the azimuth and altitude to the nearest degree. Round off the time to the nearest minute.

Sunset is when the Sun is just on the horizon (altitude = 0° 0'). Record the time of sunset and the azimuth of the Sun. Round off the time to the nearest minute. Round off the azimuth to the nearest degree.

Repeat for June 21, Sept. 22, & Dec. 21.

DATE	SUNRISE TIME	SUNRISE AZIMUTH	MERIDIAN TIME	MERIDIAN ALTITUDE	SUNSET TIME	SUNSET AZIMUTH
Mar 20						
June 21						
Sept 22						
Dec 21						

Calculations

Calculate the length of time the Sun is above the horizon. The time above horizon is the sunset time minus the sunrise time. Report the result in **hours and minutes**.

When subtracting the times, remember that there are 60 minutes in an hour, not 10. If you have to borrow an hour when subtracting, remember that you are borrowing 60, not 10.

Example: sunrise time 7:45, sunset time 17:25. Since 45 is greater than 25, you need to borrow an hour; change 17 to 16 and add 60 minutes to 25 to make 85, then subtract:

$$\begin{array}{r} 1\,\not{7}{}^{6}:\not{2}{}^{8}\,5 \\ -\ \ 7{:}4\ \ 5 \\ \hline 9{:}4\ \ 0 \end{array}$$

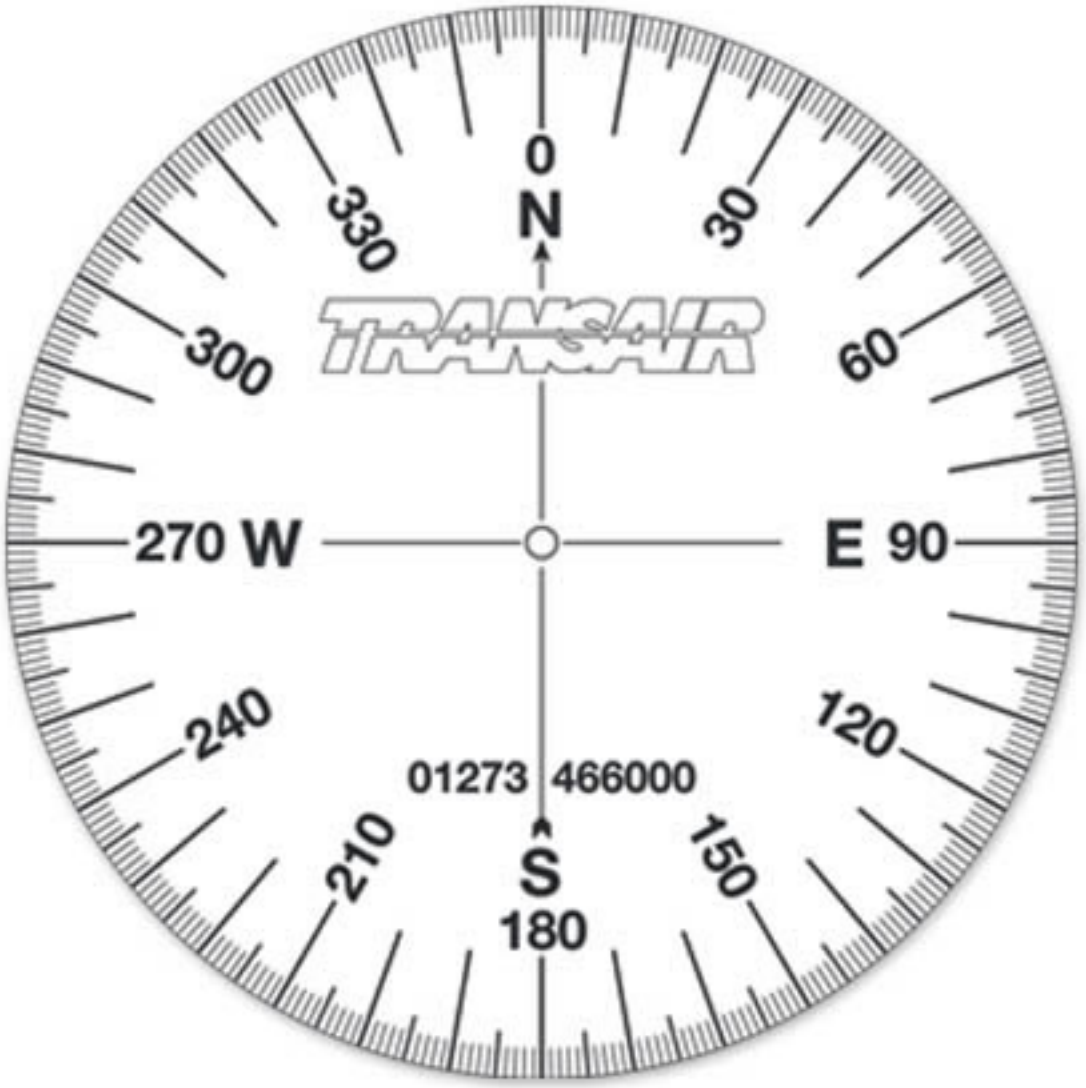
If you are using 12-hour time, you will have to add 12 hours to the sunset times.

Example

The sunset time is 5:30 PM. Add 12 hours to make it **17:30**.

DATE	Mar 20	Jun 21	Sept 22	Dec 21
Sunset time				
Sunrise time				
Hr/min above horizon				

Graph Plot the azimuth of sunrise and sunset for each date in the circle.



Analysis Answer the following questions.

1. a) On what days of the year does the Sun rise due east and set due west? ("Due east" means exactly east--azimuth 90°. "Due west" means exactly west--azimuth 270°.)

   b) When does the Sun rise farthest north and set farthest north?

   c) When does the Sun rise farthest south and set farthest south?

   d) How many degrees does the sunset point move between June & December?

2. a) On what day of the year was the Sun at the highest altitude at noon?

   b) On what day was it at the lowest altitude at noon?

3. Compare the number of hours of daylight in Anchorage with the hours in Los Angeles. Consider both the equinoxes and the solstices.