EARTH SCIENCE

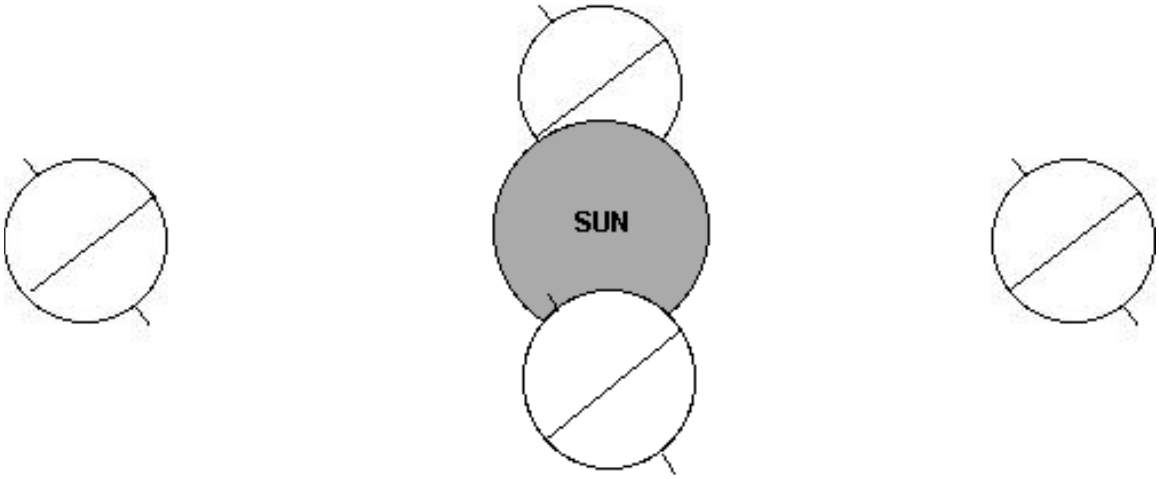
Lab Exercise

<u>Earth-Sun Relationship</u>
(worth 10 points)

Fill in the following dates and terms on the diagram below. Remember that this diagram may be from a different vantage point than what is in the lecture. Take a look at when the north pole is tilted most towards the sun and think about what month that would be. Label the month accordingly on the diagram.

March 20-23	September 20-23
June 20-23	December 20-23

solstice	equinox
solstice	equinox



Also: Label the declination of the sun for the four positions of the earth above. If you are unclear about what the declination of the sun is, don't just guess. Look it up and then ask questions.

DO NOT LABEL SEASONS ON THIS DIAGRAM.

The seasons only apply to half of the planet. Just call the solstices and equinoxes by the month that they occur.

Solar Azimuth and Elevation

Using the Solar Position Calculator, determine the azimuth and elevation of the sun for the following dates and times. You will first need to change the calculator settings to the following. These are coordinates for a location on the SC4 campus (CEM Building). The first date and time has already been completed for you. Plug in the latitude and longitude below and make sure that you come up with the same answer (precisely). This will ensure that you have the calculator set up properly. Stick with the year 2020 for all dates. Include all decimals in your answers.

City: Scroll to the top of this list and set it to "Enter Lat/Long"

Latitude: 42^{O} 58' 44" NORTH

Longitude: 82^{O} 25' 41" WEST

Time Zone Offset: = 5

Daylight Savings Time: = YES

Set the date to June 21 of this year (assume zero seconds for each)

Military time is shown below. Enter military time into the calculator and avoid using A.M. or P.M. (the caluclator periodically gives bad answers when this is done). Be sure click on the 24-hour option for each time.

	Azimuth	**Elevation**
A. 06:00	57.69 degrees	0.97 degrees
B. 07:30	_____ degrees	_____ degrees
C. 09:00	_____ degrees	_____ degrees
D. 10:30	_____ degrees	_____ degrees
E. 12:00	_____ degrees	_____ degrees
F. 13:30	_____ degrees	_____ degrees
G. 15:00	_____ degrees	_____ degrees
H. 16:30	_____ degrees	_____ degrees
I. 18:00	_____ degrees	_____ degrees

	Azimuth	**Elevation**
J. 19:30	_____ degrees	_____ degrees
K. 21:00	_____ degrees	_____ degrees

Daylight Savings Time: = NO

Set the date to December 21 of this year (assume zero seconds for each). Beware that the time for letter R is not a nice rounded number. Enter the time precisely as shown. If you enter 17:00, the sun wil have set (very depressing).

	Azimuth	**Elevation**
L. 08:00	_____ degrees	_____ degrees
M. 09:30	_____ degrees	_____ degrees
N. 11:00	_____ degrees	_____ degrees
O. 12:30	_____ degrees	_____ degrees
P. 14:00	_____ degrees	_____ degrees
Q. 15:30	_____ degrees	_____ degrees
R. 16:56	_____ degrees	_____ degrees

Daylight Savings Time: = NO

Set the date to March 21 of this year (assume zero seconds for each). Beware that the time for letter Y is not a nice rounded number. Enter the time precisely as shown.

	Azimuth	**Elevation**
S. 7:00	_____ degrees	_____ degrees
T. 9:00	_____ degrees	_____ degrees
U. 11:00	_____ degrees	_____ degrees
V. 13:00	_____ degrees	_____ degrees

	Azimuth	Elevation
W. 15:00	_____ degrees	_____ degrees
X. 17:00	_____ degrees	_____ degrees
Y. 18:35	_____ degrees	_____ degrees

Local Noon Time

Using the same Solar Position Calculator, determine the exact local noon time for the following dates. Remember, local noon time is when the azimuth is equal to exactly 180 degrees (not 180.1 or 179.9). This means that the sun is shining from exactly south. Change the time of day (down to the exact second) to get the azimuth equal to 180. This involves some trial and error. Plug in the time and change the minutes and seconds until you come up with the correct time (to the second). Once you find the exact right time, also record the elevation of the sun (include all decimals). The first date has already been completed for you. Plug in the latitude and longitude below and make sure that you come up with the same answer (precisely). This will ensure that you have the calculator set up properly. If you haven't already done so, you will first need to change the calculator settings to the following:

City: Scroll to the top of this list and set it to "Enter Lat/Long"
Latitude: Degrees = 42 Minutes = 58 Seconds = 44 NORTH
Longitude: Degrees = 82 Minutes = 25 Seconds = 41 WEST
Time Zone Offset: = 5
Daylight Savings Time: = YES

	Azimuth	Time (hh:mm:ss)	Elevation of the sun
October 14	180 degrees	13 : 15 : 33	38.54
June 21	180 degrees	___ : ___ : ___	_____
April 14	180 degrees	___ : ___ : ___	_____
July 30	180 degrees	___ : ___ : ___	_____
August 25	180 degrees	___ : ___ : ___	_____
September 21	180 degrees	___ : ___ : ___	_____

Now change Daylight Savings Time to NO and determine the following:

	Azimuth	**Time (hh:mm:ss)**	**Elevation of the sun**
November 30	180 degrees	___ : ___ : ___	_____
December 21	180 degrees	___ : ___ : ___	_____
January 21	180 degrees	___ : ___ : ___	_____
March 1	180 degrees	___ : ___ : ___	_____
February 14	180 degrees	___ : ___ : ___	_____
March 21	180 degrees	___ : ___ : ___	_____

On which of these dates is the noon time sun highest in the sky? Take a look at the solar elevation for all 12 dates above and choose the highest value.

_____

On which of these dates is the noon time sun lowest in the sky? Take a look at the solar elevation for all 12 dates above and choose the lowest value.

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