



Lexington High School

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Science Department

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June 1, 2009

Dear Incoming Advanced Earth System Science Student,

Attached you will find your summer assignment for your Advanced Earth Systems Science course next year. It consists of three parts: a summer reading book and two assignments in observational astronomy.

1. **The Weather Makers, by Tim Flannery:** All advanced students are asked to read the book The Weather Makers. This provides an overview of the very complex system that creates Earth's climate, and some insight into how human activity is affecting that system. A study of Earth's climate will be a yearlong theme in the Earth Science class. A reading guide is provided, to help you identify the important information. When you return to school, you will be assigned an essay the content of the book.
2. **Star Watch:** You will make observations of a series of different constellations. Attached, there are directions for finding your constellations and a star map to assist you. There is also a rubric showing how this assignment will be assessed. You should make your observations on **no less than two different nights**. Each constellation should be observed twice. When you return to school, your teacher will collect your data sheet with your observations on it. Go with a friend or a parent! Also, there are two meteor showers over the summer and a total solar eclipse that you might want to try and catch. They are not required, but they are usually a lot of fun.
 - **July 28 and 29 - Southern Delta Aquarids Meteor Shower.** The Delta Aquarids usually produce about 20 meteors per hour at their peak. The shower will peak this year on July 28 & 29, but meteors can usually be seen from July 18 - August 18. The near first quarter moon will set early, providing an excellent viewing experience after midnight. The radiant point for this shower will be in the constellation Aquarius. Best viewing is usually to the east after midnight.
 - **July 21 and 22 – Total solar eclipse –** Should you be traveling in the vicinity of India or China on these days, check out the total solar eclipse!
 - **August 12 and 13 - Perseids Meteor Shower.** The Perseids is one of the best meteor showers to observe, producing up to 60 meteors per hour at their peak. This year's peak occurs on August 13 & 14, but you may be able to see some meteors any time from July 23 - August 22. The waxing gibbous moon will provide some interference in the evening, but after it sets, the morning hours should provide some spectacular viewing opportunities. The radiant point for this shower will be in the constellation Perseus. Look to the northeast after midnight.

3. **Sun Journal:** Find a spot in your yard, near your house or in your neighborhood where you will be able to make a series of observations of the setting sun. You will begin these observations over the summer and continue on – possibly as long as the spring equinox – so pick a spot that will be accessible for the next 10 months. Consider snowdrifts in your site selection. Many students have found that the playing field near their local elementary school is a good spot. You will need to be able to return to that **exact spot** each time you make an observation.

- Start by taking a photograph of the western horizon and printing it out on a 8.5x11 sheet of paper (plain paper is fine – it does not have to be photo paper).
- Using a compass or another method, determine the location of West and label it on your photograph. Also indicate with arrows in which direction North and South are. Note: we are not looking for a compass rose. We are looking for you to indicate where you would look if you wanted to look due west (or north or south).
- On two different days, separated by at least 4 weeks, stand in the same spot from which you took the photograph and draw the location of the setting sun on your photograph. Draw both observations on the **SAME PHOTOGRAPH**, labeling them with the date and time of your observation. Should the sun move off the side of your photograph, take another picture and tape the two images together to make a panorama view of the horizon. An example is provided below.

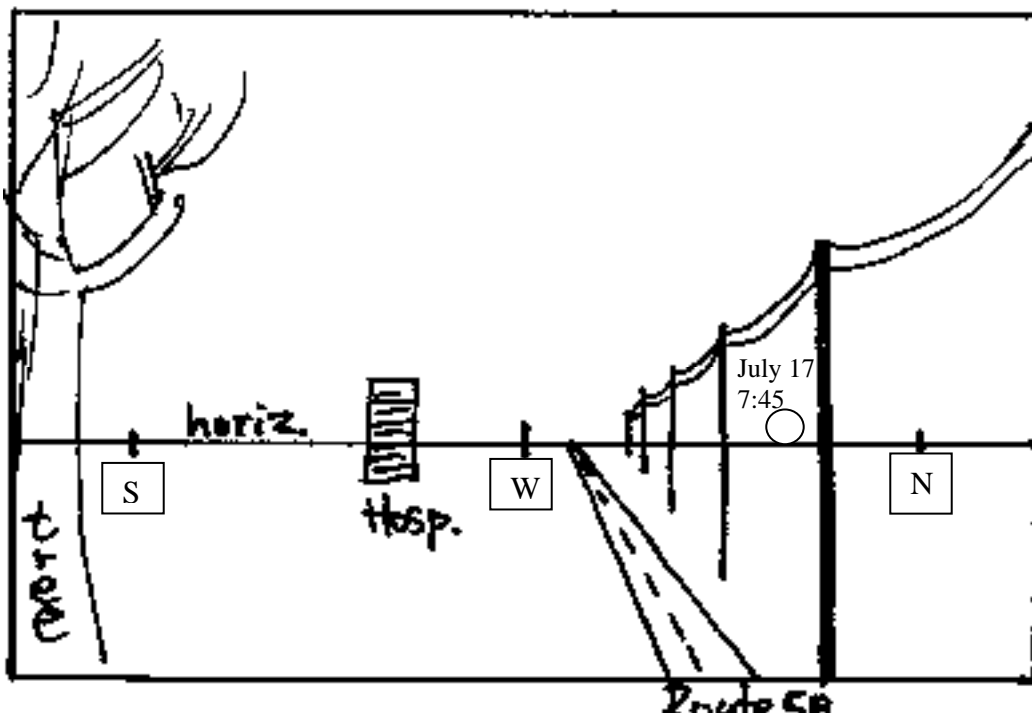
Tip: Record your observations the moment it touches the horizon. Do not round times to the nearest 5 minutes or have the sun “float” above the horizon.

Tip: Label the date and time directly over, under or inside the sun. You will be making a lot of observations on this diagram so keep your notations small.

When you return to school, your teacher will collect your photograph with your observations on it. Attached you will find the rubric that will be used to assess your sunset observations.

Have a great summer and we will see you in the fall!

The 9th Grade Earth Science teachers



ADVANCED EARTH SYSTEMS SCIENCE SUMMER READING ASSIGNMENT

For Advanced Earth Systems Science, the summer reading book is The Weather Makers, by Tim Flannery. As you read, consider the questions in the study guide that relate to each chapter. (Note: the question numbers correspond to the chapters in the book. Important terms are in *italics*.) When you begin ninth grade in September, you will be asked to write an essay based on the content of the book. We will provide a rubric for the format and content of your essay. Much of the science content in the book will be part of the curriculum for the coming year, as well as an excellent foundation for your research project (more information will be available when you get to LHS).

Part 1. Gaia's Tools

1. What is the *Gaia* hypothesis?
2. What are *greenhouse gases*? List the four layers of Earth's atmosphere. On what basis is the atmosphere divided into these layers? What is the composition of the atmosphere?
3. What is the *Keeling Curve*? What does it show? What are the implications of the data shown in the curve?
4. How is carbon dioxide measured? What is a *carbon sink*? What are the implications of increasing atmospheric carbon dioxide for the oceans?
5. What are *Milankovitch cycles*?
6. What does the author mean by "time's gateways"? What are the three agents of change he considers to be powerful enough to drive evolution on a global scale?
7. What can tree growth rings tell us about past climates? How do ocean currents affect climate?
8. What is the *Anthropocene*?
9. What are *fossil fuels*? How do they form? What does the author predict about our future use of these fuels?

Part 2. One in Ten Thousand

10. Describe the *El Nino—La Nina* cycle.
11. How is global warming affecting life in the Polar Regions? Specifically, consider krill, seals, caribou and polar bears.
12. How is global warming affecting coral reefs?
13. What happened to the golden toads in the rain forests of Costa Rica?
14. How are rainfall patterns expected to change in the next century? Which countries are expected to experience negative impacts as a result of these changes?
15. How will global warming influence the development of storms such as *hurricanes*?
16. As the polar ice sheets melt, *sea level* will rise. By how much is global sea level expected to rise?

Part 3. The Science of Prediction

17. Describe the "*hockey stick*" graph. What does it show?
18. Can global warming be stopped (avoided) in the 21st century? Explain.
19. Describe some of the impacts of global warming on mountainous regions and on the plants and animals that live at high altitudes.

20. How have species in the past survived changes in climate (warming or cooling)? What is different about climate change in the 21st century?
21. How will global warming impact the ability of marine organisms to make their shells?
22. There is strong geological evidence that three “tipping points” for Earth’s climate have occurred in the past. What are these, and how would each impact Earth’s future climate?
23. “Could climate change threaten the resources required by cities to survive?” (p. 205) In what ways are large cities vulnerable to changes induced by global warming?

Part 4. People in Greenhouses

24. What was the purpose of the *Montreal Protocol*? Has it been successful?
25. What is the *Kyoto Protocol*? Has it been successful?
26. Why have the governments of the United States and Australia refused to ratify the Kyoto Protocol?
27. What is the *IPCC*?
28. Discuss three engineering solutions which have been proposed to counteract global warming.
29. What are the prospects for a hydrogen-based economy?

Part 5. The Solution

30. What are the pros and cons of wind power? –of solar power?
31. What are the pros and cons of nuclear energy? –of geothermal energy?
32. What are some of the possibilities for *decarbonizing* our transport systems?
33. In the opening sentence of this chapter (see just under the title), an Act of God is defined by A. P. Herbert as “something which no reasonable man could have expected.” In the future, how will the consequences of global warming change this definition?
34. What three possible outcomes does the author see for our future?
35. What is Aubrey Meyer’s proposal for Contraction and Convergence (C &C) as a way to regulate carbon emissions? What, in the author’s opinion, is the *worst* thing that citizens of the developed world can do?
36. What are three steps you can take to help reduce global warming--*now*?

Advanced Earth Science--Summer Assignment Observations in Astronomy ("Star Watch")

Beginning this summer, and over the course of the next school year, you will be asked to do a series of observations of the night sky. Whenever you are asked to make one of these observations, we suggest you and a friend (or parent) find a safe open area, where there are as few lights as possible, and where you have an unobstructed view of the horizon. Allow your eyes to adjust to the darkness for about 15 minutes before actually making your observations. (A suggestion--although most students can find very good viewing right here in Lexington, a short drive to Concord or Sudbury will eliminate enough light pollution to make a difference. The open fields in farming areas provide excellent viewing!) The attached star map will help you find your way! To use the star map, you hold it over your head and then line it up with geographic north. You may find a flashlight that is tinted dark red to be helpful.

The first few observations of the night sky can be a bit frustrating. Don't give up--it takes some patience and perseverance. Ask a friend or parent to help you. Once you can spot the familiar star patterns, you will wonder how you ever missed them, and you will establish an important connection with the ancient peoples of our planet, for whom the night sky was so significant.

1. POLARIS (the NORTH STAR), URSA MAJOR (the BIG DIPPER) and URSA MINOR (the LITTLE DIPPER)

1. Select a convenient time after dark.
2. Obtain a diagram of the "blank" sky, provided with this assignment. This is the sheet with two semi-circular "sky" areas).
3. Record the time, date and planned constellations on the diagram.
4. Face North to locate Ursa Major, Polaris and Ursa Minor (its stars will be faint). Ursa Major is a large constellation that spreads across a good portion of the sky. (It reaches across the sky more than your outstretched hand at arm's length.) To find Polaris, use the two westernmost stars in the "bowl" of the dipper--these are known as the "pointer stars," because an imaginary line drawn through them (extending upward above the bowl) will just about reach Polaris.
5. Label the direction in the center of the diagram North, the one to the left as West and the one to the right as East.
6. Using dots connected by lines, record the pattern made by Ursa Major, Ursa Minor and Polaris on your sky diagram. Label these.
7. Ask your parent to sign the line on the diagram indicating that you have completed the assignment as described above.

2. The SUMMER TRIANGLE and the NORTHERN CROSS

Your next observation will be of the group of constellations containing three stars known as the SUMMER TRIANGLE, and CYGNUS, the NORTHERN CROSS. These constellations will set in the Fall, and we will not see them again until late next spring. The Summer Triangle consists of three bright stars embedded in three constellations. The star DENEK is found in the constellation CYGNUS (the swan), ALTAIR is in AQUILA (the eagle) and VEGA is in LYRA (the lyre). These three stars make a distinctive triangle in the summer sky, and will be nearly overhead at this time of year.

The NORTHERN CROSS is a fainter grouping that can be seen as a cross or sword slicing into the Summer Triangle. In fact, it is simply another name for the constellation CYGNUS.

1. Face North. Find Ursa Major and Polaris in the sky and record these on your data sheet so that you can locate the Summer Triangle with respect to Ursa Major.
2. Now turn 180° and face South. Look high in the Southwestern sky and pick out the three relatively bright stars arranged in the tall triangle.
3. Now, as your eyes adjust to the darkness, find what appears to be a cross or sword cutting across the middle of the triangle.
4. Using your “blank” sky chart, fill in this pattern with dots and lines. Fill in the rest of the information on the chart. (This time you are facing south!)
5. Label the key stars and constellations.
6. Obtain parent signature.

3. CASSIOPEIA (the celestial “W” or “M”)

Once again we suggest finding an area where there are as few lights as possible, and where you have an unobstructed, safe view of the horizon. Allow your eyes to adjust to the darkness for about 15 minutes before actually making your observations. Now you have some experience at this, so this time around you should feel a little more at home with the night sky. Take the opportunity to relax and enjoy the night air!

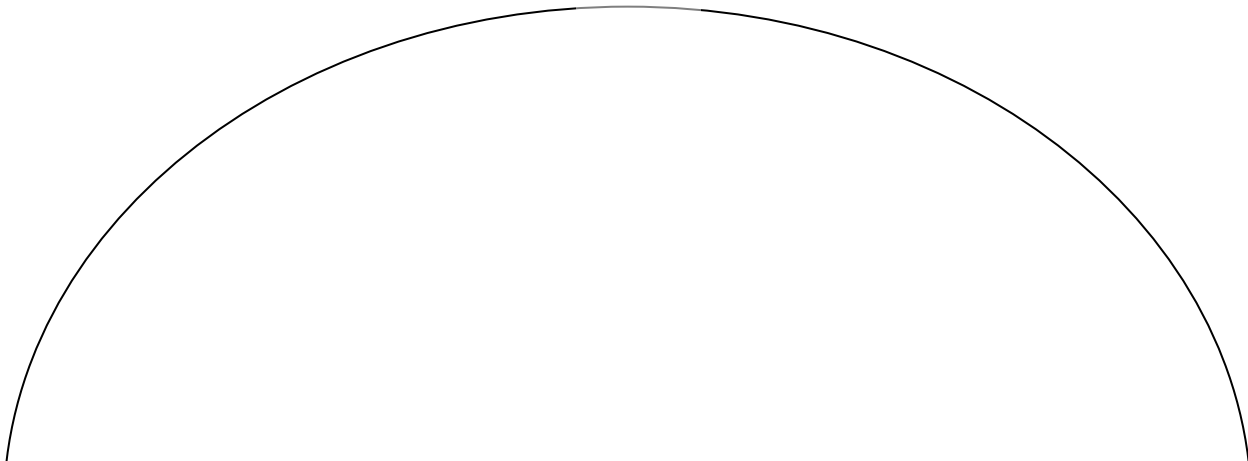
1. Once more, find your diagram of the “blank” sky.
2. Select a convenient time after dark. Record the time and date of your observation.
3. Once again, find Ursa Major and use the pointer stars to bring you to Polaris. Record these on your data sheet; again, for orientation.
4. Continue along this line beyond Polaris and look for the pattern of a large “W” in the sky. You have found Cassiopeia!
5. Using dots and lines, record the pattern made by Ursa Major, Polaris and Cassiopeia on your diagram. Label these.
6. Obtain parent signature after showing them the pattern.

4. BOOTES and ARCTURUS

As a final observation of the summer sky, try to find the constellation Bootes. Don't rush through these observations. Start with the part of the sky you know, and “walk your way through it,” using stars and constellations that you already know.

1. As before, find Ursa Major and record its position in the sky. Follow the curve of the dipper's handle toward the Southeast, where you'll find a bright yellow-orange star. This is ARCTURUS, the brightest star in the constellation BOOTES (the herdsman, or shepherd). Bootes has a large and distinct diamond-shaped pattern made from fainter stars.
2. Record your observations and obtain parent signature.

Zenith



Direction

Name: _____ Date and Time _____

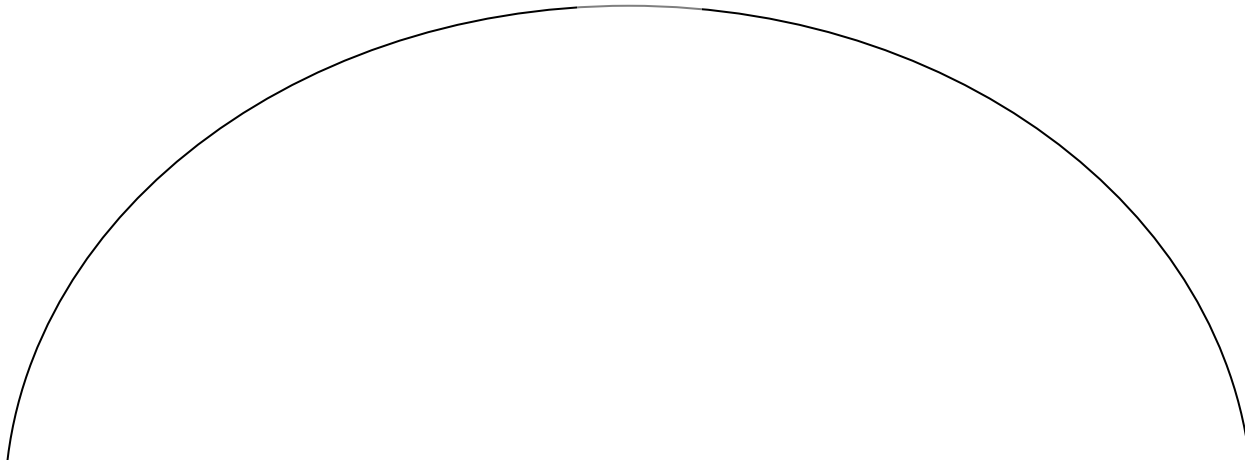
Constellations observed: _____

Observing conditions: _____

Notes: _____

Parent signature: _____

Zenith



Direction

Name: _____ Date and Time _____

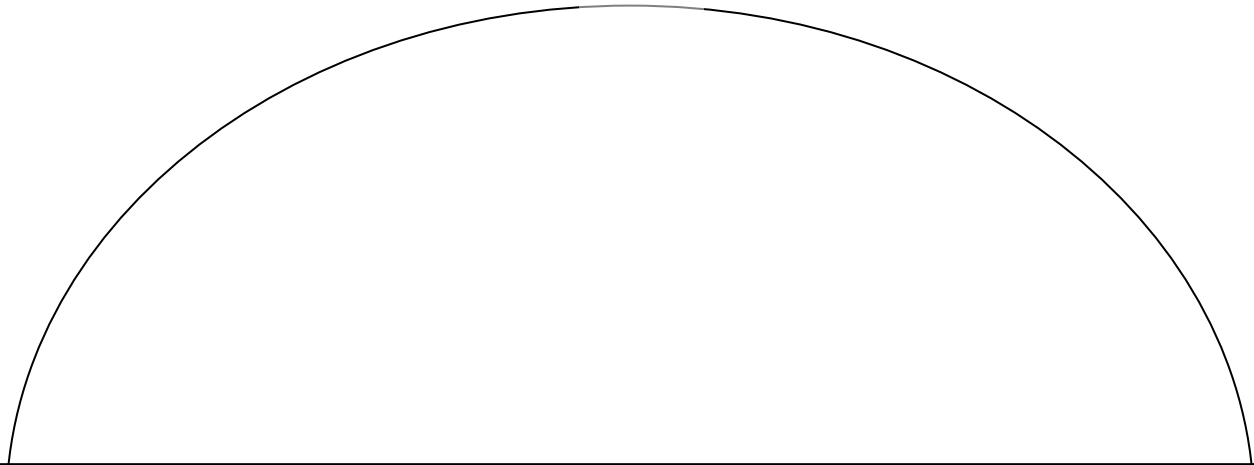
Constellations observed: _____

Observing conditions: _____

Notes: _____

Parent signature: _____

Zenith



Direction

Name: _____ Date and Time _____

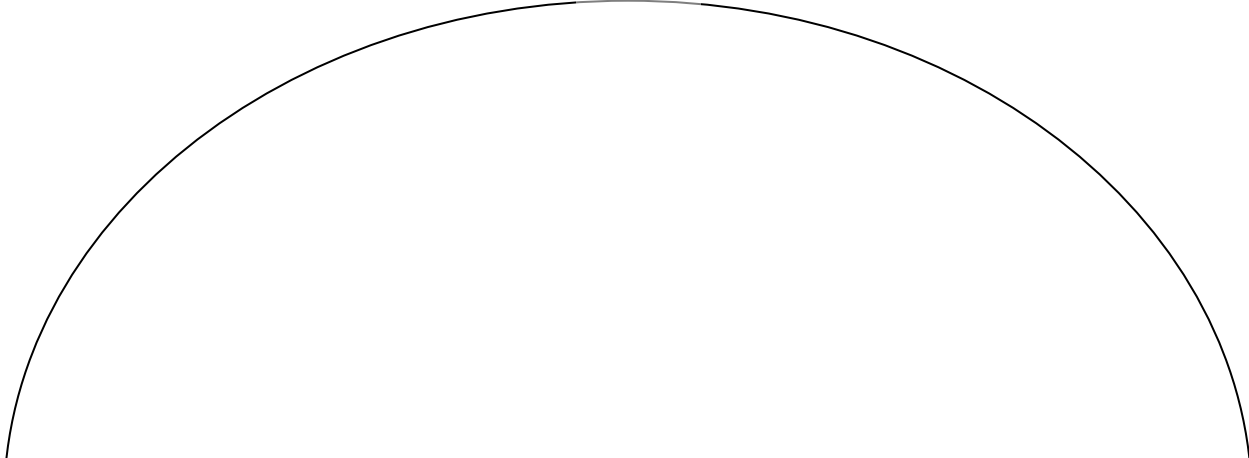
Constellations observed: _____

Observing conditions: _____

Notes: _____

Parent signature: _____

Zenith



Direction

Name: _____ Date and Time _____

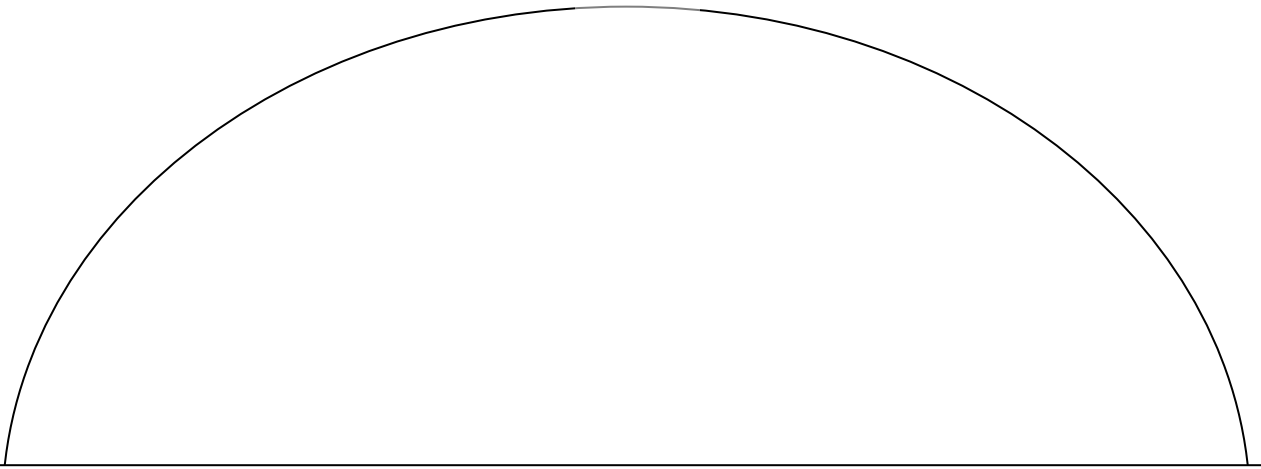
Constellations observed: _____

Observing conditions: _____

Notes: _____

Parent signature: _____

Zenith



Direction

Name: _____ Date and Time _____

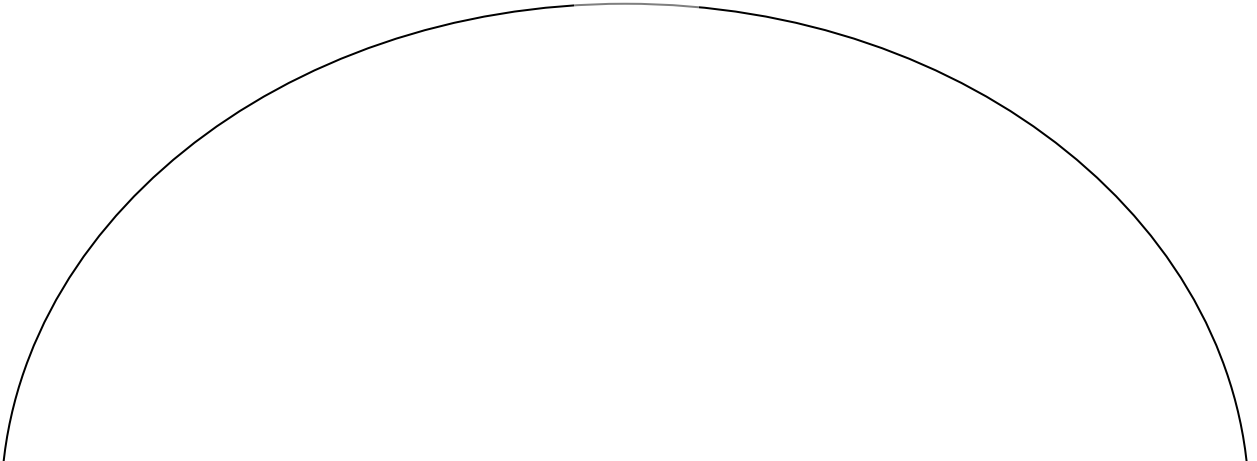
Constellations observed: _____

Observing conditions: _____

Notes: _____

Parent signature: _____

Zenith



Direction

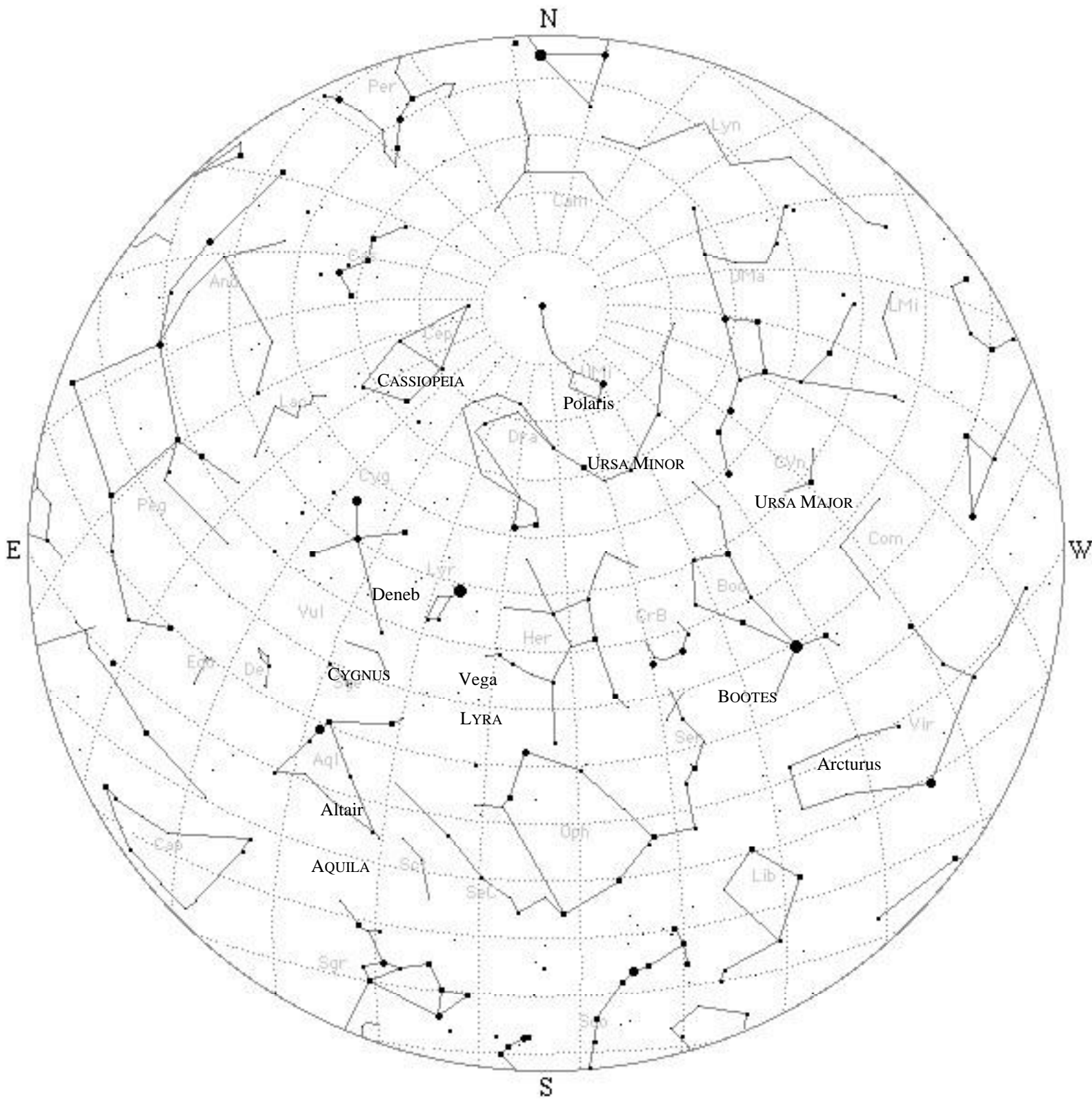
Name: _____ Date and Time _____

Constellations observed: _____

Observing conditions: _____

Notes: _____

Parent signature: _____



Advanced Earth System Science Summer Star Watch Rubric

URSA MAJOR, URSA MINOR, POLARIS	0 points	1 point	2 points	3 points
Constellations	Constellations are missing	Drawings inaccurate, key star (Polaris) incorrectly labeled or not labeled	Drawings are accurate, but key star (Polaris) incorrectly labeled or not labeled	Constellations are accurately drawn, key star (Polaris) is correctly labeled
Dates, times		Dates, times not recorded		Dates, times recorded on the diagram
Connecting the “dots”		Stars not connected by lines	Some stars connected by lines	All stars are connected by lines
Number of observations		Observations made only on one date		Observations made on at least two dates
Parent signature		Signature is missing		Signature present on the diagram

SUMMER TRIANGLE, NORTHERN CROSS, ALTAIR, DENEK, VEGA, URSA MAJOR, POLARIS	0 points	1 point	2 points	3 points
Constellations	Constellations are missing	Drawings inaccurate, Ursa Major not recorded, key stars (Altair, Deneb, Vega, Polaris) not labeled	Drawings accurate, Ursa Major recorded, but key stars (Altair, Deneb, Vega, Polaris) not labeled	Constellations are accurately drawn, Ursa Major recorded, key stars (Altair, Deneb, Vega, Polaris) labeled
Dates, times		Dates, times not recorded		Dates, times recorded the diagram
Connecting the “dots”		Stars not connected by lines	Some stars not connected by lines	Stars are connected by lines
Number of observations		Observations made only on one date		Observations made on at least two dates
Parent signature		Signature is missing		Signature present on the diagram

CASSIOPEIA, URSA MAJOR, POLARIS	0 points	1 point	2 points	3 points
Constellations	Constellations are missing	Drawings inaccurate, Ursa Major not recorded, key star (Polaris) not labeled	Drawings accurate, Ursa Major recorded, but key star (Polaris) not labeled	Constellations are accurately drawn, Ursa Major recorded, key star (Polaris) correctly labeled
Dates, times		Dates, times not recorded		Dates, times recorded the diagram
Connecting the “dots”		Stars not connected by lines	Some stars connected by lines	All stars are connected by lines
Number of observations		Observations made only on one date		Observations made on at least two dates
Parent signature		Signature is missing		Signature present on the diagram

BOOTES, ARCTURUS URSA MAJOR, POLARIS	0 points	1 point	2 points	3 points
Constellations	Constellations are missing	Drawings inaccurate, Ursa Major not recorded, key stars (Polaris, Arcturus) not labeled	Drawings accurate, Ursa Major recorded, but key stars (Polaris, Arcturus) not labeled	Constellations are accurately drawn, Ursa Major recorded, key stars (Polaris, Arcturus) correctly labeled
Dates, times		Dates, times not recorded		Dates, times recorded the diagram
Connecting the “dots”		Stars not connected by lines	Some stars connected by lines	All stars are connected by lines
Number of observations		Observations made only on one date		Observations made on at least two dates
Parent signature		Signature is missing		Signature present on the diagram

SUMMER STAR WATCH TOTAL ____/60

RUBRIC FOR SUN JOURNAL ASSIGNMENT

NAME: _____ CLASS: _____

	0 points	1 point	2 points	3 points
Suns' position relative to the horizon	Suns not indicated	Suns appear to "float" above the horizon	Suns appear to "touch" buildings but not horizon	Suns appear to "touch" the horizon
Dates and times of observations	Dates/times are missing	Either dates or times missing	Both dates and times indicated, but away from Suns	Both dates and times clearly indicated and on/near Suns
Compass directions	Compass directions are missing		West indicated, but not N or S	All compass directions clearly labeled
Clarity of horizon	Horizon is missing	Horizon carelessly drawn, heavily obscured by land features	Horizon slightly obscured by land features	Horizon clearly drawn, unobscured by land features
Time between observations; # of observations	Only one observation recorded	2 observations, less than 2 weeks apart	2 observations, 3-4 weeks apart	2 observations, at least 4 weeks apart
Recording observations	Observations on 2 diagrams			Observations on the same diagram

Sun Journal: _____/30