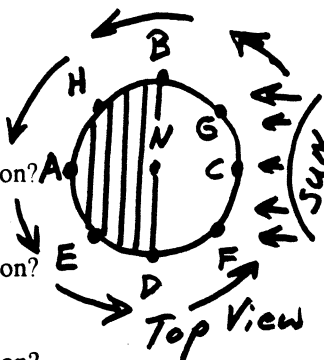
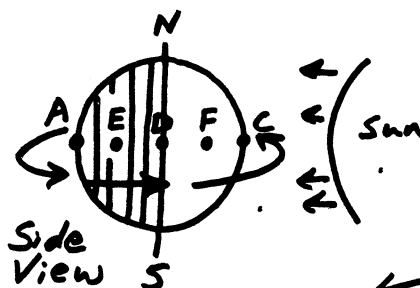
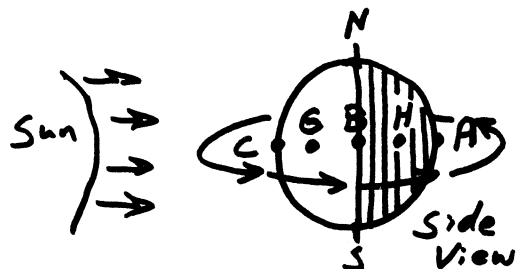


Unit: System of The Earth, Moon, and Sun

Earth Science Notes (Staplebn) Time Zones and The International Dateline (Earth's Rotation)

Name: _____

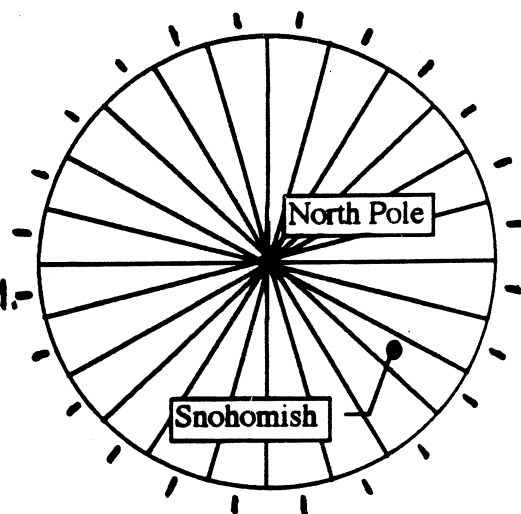


- How much of the Earth is always dark?
 - Is there ever an exception to this? If so, explain.
- Which side is dark? (the side facing the sun, or the side opposite the sun)
- In the pictures above, which point is entering darkness?
 - What's that time of day called?
 - Approximately what hour would it be according to a clock at this location?
- In the pictures above, at which point is the sun directly overhead?
 - What's that time of day called?
 - Approximately what hour would it be according to a clock at this location?
- In the pictures above, which point is entering daylight?
 - What's that time of day called?
 - Approximately what hour would it be according to a clock at this location?
- In the pictures above, which point is located opposite the sun, in complete darkness?
 - What's that time of day called?
 - Approximately what hour would it be according to a clock at this location?
- Estimate the time of day at each of the following points:
E = _____ F = _____ G = _____ H = _____
- If a person moves instantly from point D to point F, does the time of day get later or earlier?
- If a person moves instantly from point E to point A, does the time of day get later or earlier?
- When you travel east into a new time zone, should you add an hour or subtract an hour? _____
When you travel west into a new time zone, should you add or subtract an hour? _____
- Imagine that you take a one minute trip around the world, and you keep re-setting your watch every time you cross into a new time zone. Your watch says 8:00 AM as you leave. What time should it say when you return? _____ In order for this to happen, how many different time zones must there be? _____

12. The diagram on the right shows the Earth as you would see it if you were looking down from above the North Pole.

- Part of the Earth should be dark. On the Diagram lightly shade the correct part of the Earth.
- Draw the sun where it should be located.
- Use arrows to show which direction the Earth is rotating.
- On the diagram, label a place where the sun is "rising."
- Label places which are experiencing sunset, midnight, and noon.

Midnight Yesterday
12 A.M. =
Tomorrow Yesterday



- Label the equator.
 - Draw an arrow along the equator pointing East, and label it "East"
 - Draw an arrow along the equator pointing West, and label it "West"

14. The time in one of the time zones is labelled. Correctly label the times in the other 23 time zones.

15. Using the diagram on the first page, take a mental trip around the world. Start on the diagram in Snohomish. Imagine your starting date is April 20th. Keep heading east, and watch how the time changes. Also watch how the day changes. Remember that a new day begins at 12:00 A.M. (Midnight). What time is it when you arrive back in Snohomish? What is the date?
16. Repeat your mental trip going West instead of east. According to the diagram, do you return a day earlier or a day later?
17. If someone could leave an airport at noon and fly around the world in 30 minutes, they should return on the same day that they left. Your previous answers should have shown that the day would change. In order to fix things so that you get the correct date:
 - a) should you add a day or subtract a day when you travel around the world heading east?
 - b) should you add a day or subtract a day when you travel west?

Notes:

- There are _____ time zones on the Earth.
- When you cross into a new time zone heading east, you: _____
- When you cross into a new time zone heading west, you: _____
- The international dateline is at 180° longitude, in the middle of the _____ ocean.
- When you cross the international dateline heading west, you _____.
- When you cross the international dateline heading east, you _____.

Questions:

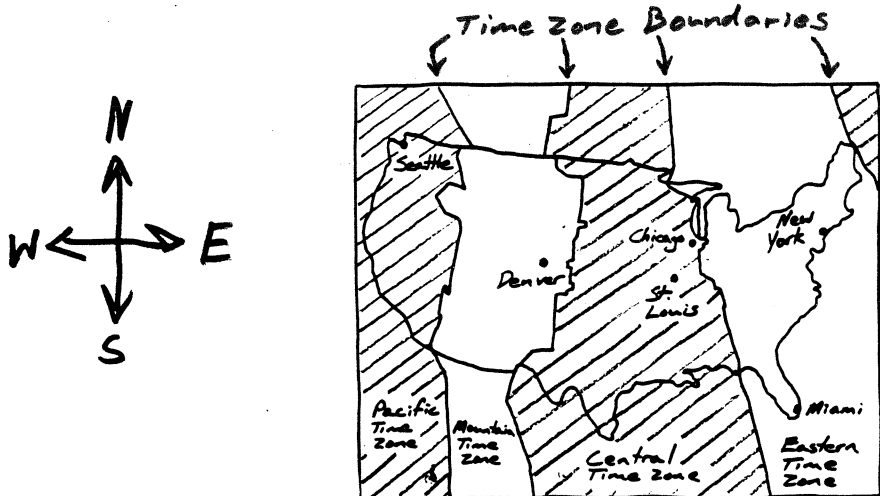
1. If it is 1:00 P.M. in Snohomish, what time is it in the next time zone to our east?
2. It is 5:30 P.M. in Seattle. What time is it in New York?
3. What time is it in Seattle when it is 4:20 A.M. in St. Louis?
4. If you fly west across the international dateline, and it was Monday when you left, what day will it be after you cross the dateline?

Challenging:

5. Why do you think the edges of the time zones are not always straight lines?
6. You are on the west side of the international dateline. Your time is 5:00 P.M., on Thursday. What is the time and day when you step to the east and cross the international dateline?
7. You fly from Denver to Miami. The flight lasts 3 hours. You left Denver at 7:15 A.M. Mountain Time. What time do the clocks in Miami show when you arrive in the Miami airport?
8. Why do we need an international dateline?

Most difficult

9. Judging by the diagram on the first page, how is it possible to travel around the world, through every time zone, in under 5 seconds -- without using any machinery?
10. If every location on the Earth has the same day and date, what time is it at the International Date Line?



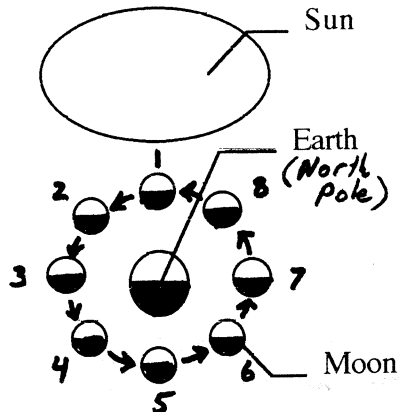
Earth Science Notes

Name: _____

Purpose: to understand why the shape of the moon appears to change over the course of a month.

Simulate The Moon Phases

Be like the diagram on the right. Your head is the Earth. Your tennis ball is the moon. Stretch out your arm and hold the tennis ball away from your head. Imagine that the sun is in the front of the room -- this means you will need to make sure the sunny side of the moon is facing the front of the room. Hold the moon in position 1, then move it to positions 2, 3,...



*Not To Scale!
Out Of Proportion!*

Draw the moon Phases

For each position on the diagram above, draw what you saw.

1.	2.	3.	4.
Name:	Name:	Name:	Name:
5.	6.	7.	8.
Name:	Name:	Name:	Name:

Name The Moon Phases

Use the terms below to come up with names for the moon phases you drew in the boxes above.

- Waxing: Becoming more full. (When the _____ side of the moon is lit, it is waxing.)
- Waning: Becoming less full. (When the _____ side of the moon is lit, it is waning.)
- Crescent Moon: A thin, curved moon.
- Gibbous Moon: A moon which is almost full, but it's not quite round.
- Quarter Moon: A moon which is half light and half dark.
- Full Moon: A complete, fully lit moon.
- New Moon: A completely dark, invisible moon.

9-16. A moon's name has two parts. Part 1: tells whether it is growing or shrinking. Part 2: describes the shape. For example, an almost full moon which is growing is a waxing gibbous. Full moons and new moons are neither waxing nor gibbous. Label the each of the boxes above with the full, correct name.

17. A solar eclipse occurs when the moon's shadow covers us. A lunar eclipse occurs when the Earth's shadow falls on the moon.
- a) During which moon phase can we have a solar eclipse?
 - b) During which moon phase can there be a lunar eclipse?

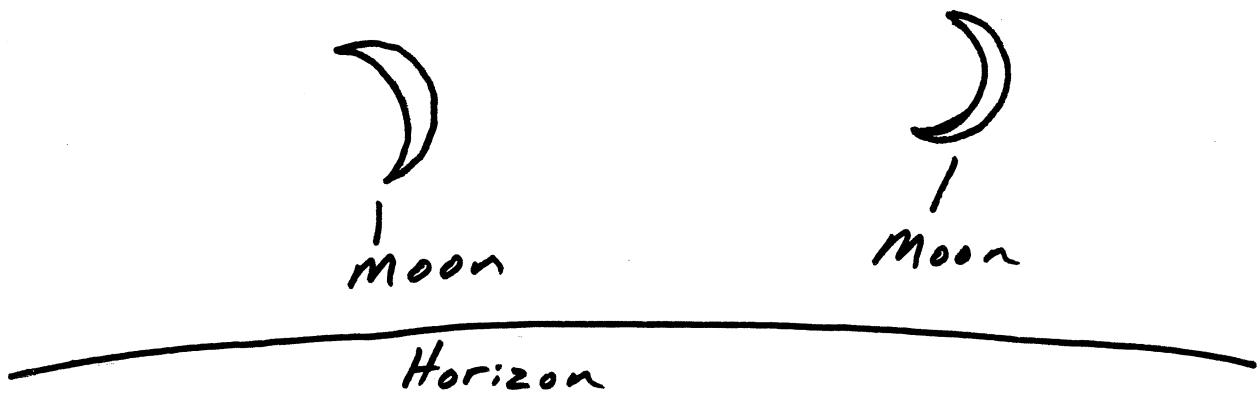
- 18. Can you see the dark part of the moon?
- 19. If you watch the moon at night, it appears to move across the sky. Why does it do that?
- 20. Approximately how long does it take the moon to orbit the Earth?

21

- 22. Challenging: According to the diagram, at what time ^{time} (of day -- on a clock) should a full moon be closest to overhead? What about a waxing gibbous?

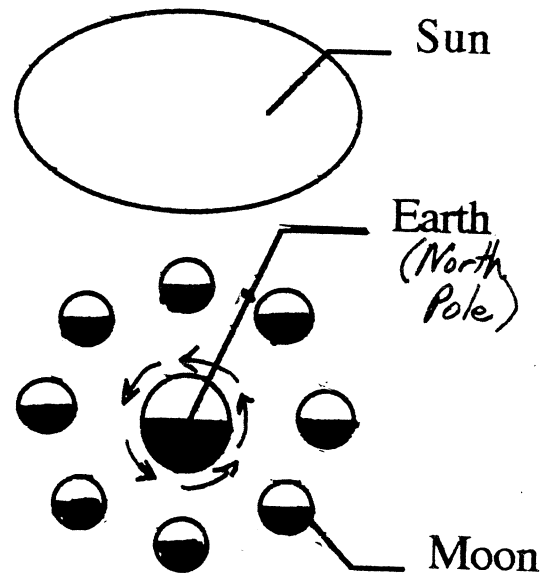
22.5 If you hold something at arm's length, and use it to cover up the full moon, how big should that thing be? Dime? Quarter? Nickel?

- 23. Challenging: The picture below shows what the night sky might look like on a planet with two moons. The planet orbits one star. Something is wrong with the diagram; what is it?



24. Challenging: Use your knowledge from the time zones notes to determine the approximate moonrise and moonset times below.

	Rise	Set
Full		
Waxing Gibbous		
Waning Crescent		
New		
1st Qtr (Waxing Quarter)		



Earth Science (More Moon Stuff)

* 92

Read pages 159-162, in the textbook, for a better understanding.

Useful Vocabulary:

Revolution: movement of something around something else in an elliptical or circular path.

Rotation: spinning of something on its axis.

Synodic Month: 29.5 earth days (very roughly, 4 weeks); the time it takes to go from one new moon to the next. $7\frac{1}{2}$ days \approx 1 week \approx $\frac{1}{4}$ moon cycle.

Sidereal Month: 27 $\frac{1}{3}$ days; the time it takes for the moon to make a complete revolution.

Lunar Eclipse: the earth's shadow falls on the moon.

Solar Eclipse: the moon's shadow falls on the earth.

Partial Eclipse: a person standing in the shadow can see some, but not all, of the sun.

Total Eclipse: a person standing in the shadow cannot see any of the sun.

Zenith: the point at which something is highest in the sky. For example, the sun is at its zenith at around noon.

Tides: the rise and fall of water's surface due to the gravitational pull of the moon and sun.

Spring Tide: An especially strong tide that is produced when the sun and moon are working together.

Neap Tide: An especially weak tide that is produced when the sun and moon are working against each other.

Earth to sun (average distance) = _____

Earth to moon (average distance) = _____

Diameter of Earth at equator = _____

Diameter of Moon at equator = _____

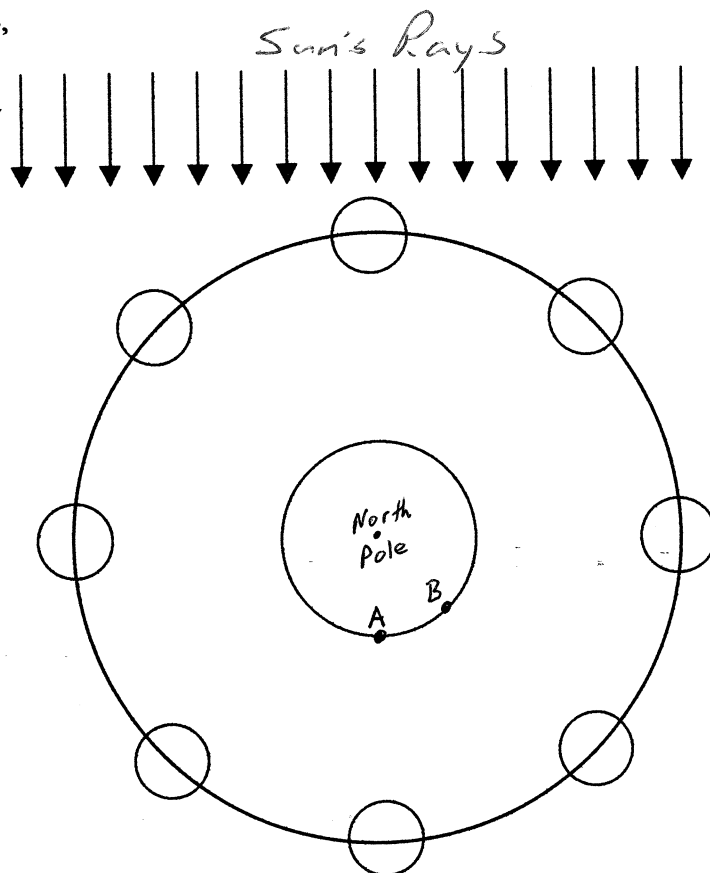
Mass of Earth = _____ Mass of Sun = _____ Mass of Moon = _____

Answer Choices (weeks): 0, $\frac{1}{2}$, 1, $1\frac{1}{2}$, 2, $2\frac{1}{2}$, 3, $3\frac{1}{2}$, 4

1. If today is a new moon, approximately how long will it be until there's another new moon?
2. How long does it take the moon to get through one quarter of it's cycle?
3. If today there is a waxing gibbous, how long will it be until there's a last quarter moon?
4. Today there is a first quarter moon. Sometime during the next synodic month there will be a solar eclipse and a lunar eclipse. In how many days will the solar eclipse occur?
In how many days will the lunar eclipse occur?

Answer choices (AM or PM): 12, 3, 6, 9

5. What time is it at point A?
6. What time is it at point B?
7. At what time does a new moon rise?
8. At what time does a waning gibbous set?
9. At what time is a waning crescent at it's zenith?
10. When is a waxing crescent at its zenith?
11. If you want to take one of those pictures of someone standing with the rising full moon behind him, at what time should you be ready to take your picture?



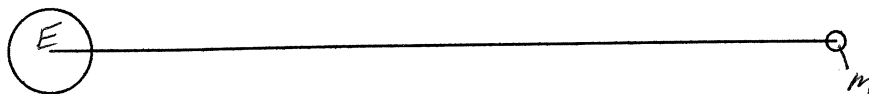
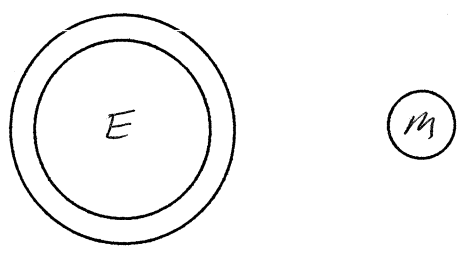
- ◆ Which has more gravity, the sun or the moon?
- ◆ Which is closer to the earth (sun or moon)?
- ◆ Which pulls on the oceans with more force (sun or moon)?
- ◆ Why is the tide high on the moon's side of the earth and the side opposite the moon?

What you'd expect →

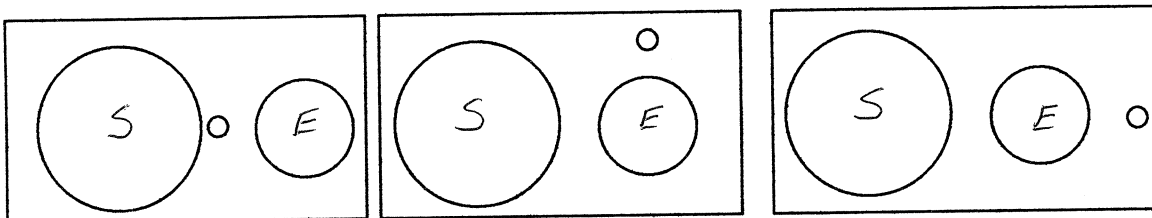


reality ↙

- Direction of gravity's force on the earth's oceans. It's most difficult for the moon to move the water on the moon side and opposite the moon side. The water on the "edges" of the earth is easy to pull. That water gets lower, the water on the far side doesn't change much, and the near side gets a little higher.
- Revolution of the earth and moon around their center of gravity (balance point) causes centrifugal force to pull opposite the moon

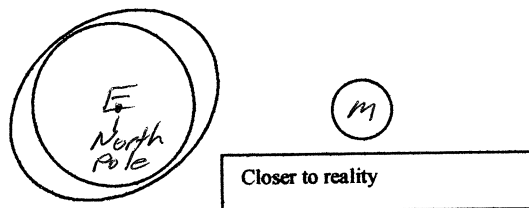
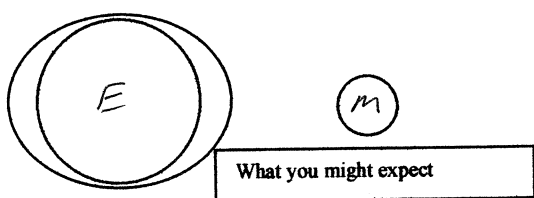


12. In each of the diagrams, write **H** where the moon makes high tides, and **L** where the moon makes low tides. Write **h** where the sun makes high tides, and **l** where the sun makes low tides.



13. Spring tides are especially high tides where the sun and moon work together. Label the diagrams that have spring tides.
14. Neap tides are especially high tides where the sun and moon work together. Label the diagrams that have neap tides.

- ◆ Why isn't the tide always highest when the moon is highest overhead?
 - Rotation of the earth pulls the high tide away from the moon

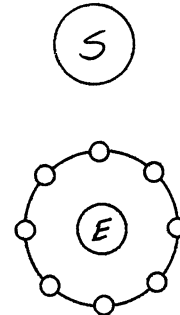


Earth Science (Moon Shift, continued)

- ◆ Why aren't tides easy to predict and understand?
 - Continents impede the progress of water.
 - Variations in ocean depth and coastline shape affect the movement of water in a complicated manner.
 - Winds and pressure can push water away or pull it nearer

Answer Choices (days): 0, 4, 7.5, 15, 19, 22.5, 26, 30

15. How many days are there between one set of spring tides and the next set of spring tides?
16. After you have a spring tide, how many days will it be before you have a neap tide?
17. During a solar eclipse, could you have a spring tide, a neap tide, or both?
18. During a lunar eclipse, could you have a spring tide, a neap tide, or both?



If the world had no weather, and if it were covered entirely with water of constant depth, ~~the~~ students in this class could easily predict the times of high and low tides anywhere on earth. All you would need to know is the moon phase. Reality, however, is more complicated. According to Seattle tide tables, Seattle high tides come about 4 or 5 hours after the moon is at its zenith and its nadir (its lowest point; when it's on the opposite side of the earth). In Everett, it's different. In La Conner it's different too. The shapes of ~~the~~ ^{the} bay and their distances from open ocean affect how fast the tides can change.

Assume that the tides lag behind the times you would expect by 4 ½ hours. In other words, when the moon is highest in the sky, it still won't be high tide for another 4 hours, 30 minutes.

19. When there's a full moon, at what times should there be high tides in Seattle? Will they be strong tides or weak tides?
20. When there's a last quarter moon, at what times will there be low tides? Will they be strong or weak?

The four terms below describe the Earths in the diagram.

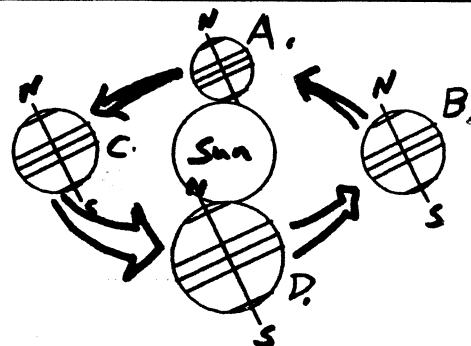
- Label each position of the Earth with the correct name and date.
- Shade the earths appropriately

Summer Solstice: The first day of summer. The most daylight hours of the year. (Around June 21 in the Northern Hemisphere)

Winter Solstice: The first day of winter. The fewest daylight hours of the year. (Around December 22 in the Northern Hemisphere)

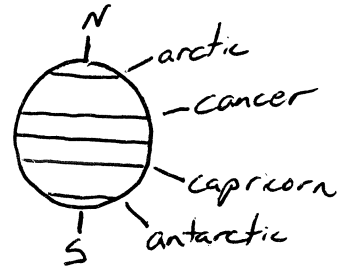
Vernal Equinox (Spring Equinox): The first day of spring. Equal hours of light and darkness. (Around March 23 in the Northern Hemisphere)

Autumnal Equinox (Fall Equinox): The first day of fall. Equal hours of light and darkness. (Around September 23 in the Northern Hemisphere)



Why is it hotter in the summer than in the winter?

- 1)
- 2)



Earth 1	Arctic Circle	Tropic of Cancer	Equator	Tropic of Capricorn	Antarctic Circle
Fraction in Sunlight (roughly)					
Hours of sunlight					
Angle of incidence of sunlight					
In the Northern Hemisphere, this is the first day of _____ (what season?)					
In the Southern Hemisphere, this is the first day of _____					
This picture goes with earth _____, in the diagram above.					

Earth 2	Arctic Circle	Tropic of Cancer	Equator	Tropic of Capricorn	Antarctic Circle
Fraction in Sunlight (roughly)					
Hours of sunlight					
Angle of incidence of sunlight					
In the Northern Hemisphere, this is the first day of _____ (what season?)					
In the Southern Hemisphere, this is the first day of _____					
This picture goes with earth _____, in the diagram above.					

Earth 3	Arctic Circle	Tropic of Cancer	Equator	Tropic of Capricorn	Antarctic Circle
Fraction in Sunlight (roughly)					
Hours of sunlight					
Angle of incidence of sunlight					
In the Northern Hemisphere, this is the first day of _____ OR _____					
In the Southern Hemisphere, this is the first day of _____ OR _____					
This picture goes with earth _____, in the diagram above.					

