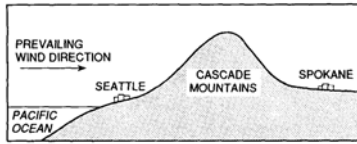


NAME: _____

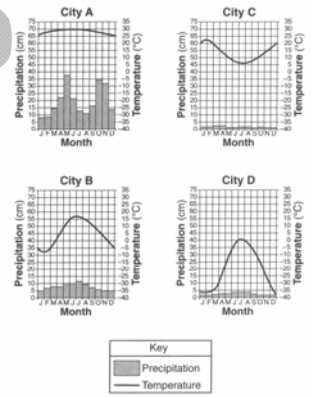
CLIMATE AND SEASONS NOTES

CLIMATE (Video 9.1 ESRT 4, 14b)

1. You must be able to determine what temperature range is and how latitude and nearness to large bodies of water affect it.
2. You must be able to explain the difference between the leeward and windward sides of a mountain and why those differences exist



Discuss the difference in climate between Seattle and Spokane and why difference exists.



Which city is closest to the North Pole?

Which city is closest to an ocean?

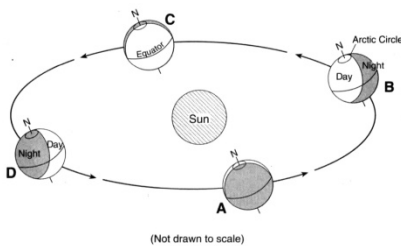
Which city has the highest temperature range?

ATMOSPHERIC CHANGES (Video 9.2)

1. You must be able to explain the causes and changes of global warming.
2. You must be able to explain the causes and changes of ozone depletion.
3. You must be able to explain the major steps in the greenhouse effect.

SEASONS (Video 9.3 & 9.4)

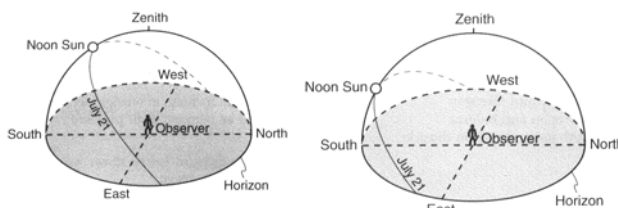
1. For the Vernal and Autumnal Equinoxes, and the Summer and Winter Solstices, you must be able to state:
 - a. The approximate noon time altitude of the sun
 - b. The date
 - c. The number of hours of daylight for the North and South Poles, the equator and New York
 - d. The point of sunrise and sunset
 - e. The location of the sun's vertical rays
2. Given a diagram showing the relative positions of the earth and sun, you must be able to determine the season.



What is the date at position C?

How can you tell?

3. You must be able to discuss the impact that the altitude of the sun has on shadow length and the intensity of sunlight.

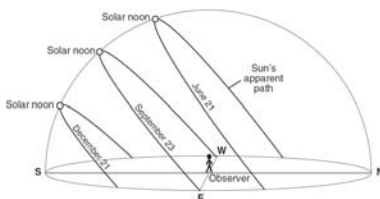


Which location would have the longest noontime shadow?

Which location would have the most intense sunlight?

Which location would have the longest duration of insolation?

4. Lines have to be drawn to show the apparent motion of the sun on a celestial sphere for different earth locations. The zenith point (Z) is the point in the sky directly over the observer.



What is the approximate location of this location?

How can you tell?


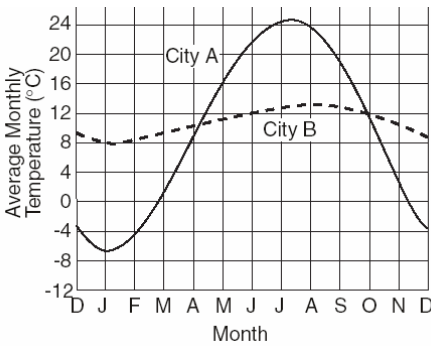
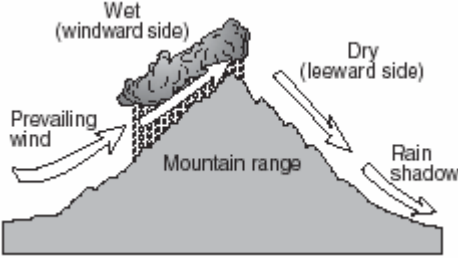

Climate and Season Facts

- Video 9.1 ESRT 4 & 14b
1. As latitude increases / temperature decreases (inversely related)
 2. The poles are cold because / they receive low angle, less direct sunlight (insolation)
 3. The equator is hot because / it receives high angle, more direct sunlight (insolation)
 4. As elevation increases / temperature decreases (inversely related)
 5. Marine climate has / cool summers and warm winter (smaller temp. range)
 6. Continental climate has / cold winter and hot summers (larger temp. range)
 7. Large bodies of water / moderate temperatures because water has a high specific heat
 8. Leeward side of a mountain is / dry and warm due to compression (high pressure)
 9. Windward side of a mountain is / cool and moist due to expansion (low pressure)
- Video 9.2
10. The ozone layer / filters or blocks harmful rays such as Ultra Violet radiation
 11. The earth absorbs mostly / short wavelength light energy (visible light, UV)
 12. The earth reradiates mostly / long wavelength heat energy (infrared, heat)
 13. The greenhouse gases are / carbon dioxide (CO₂), methane, and water vapor
 14. Humans add greenhouse gases (CO₂) to the air by / burning fossil fuels (oil/gas) from cars and factories
- Video 9.3 & 9.4
15. Insolation means / **IN**coming **SOL**ar **RADI**ation
 16. The seasons are caused by / the tilt of the earth's axis and the revolution around the sun
 17. If the earth was not tilted / there would be no seasons (more tilt / more extreme seasons)
 18. As the angle of insolation (sun in sky) increases / the temperature increases
 19. The sun is most intense at an angle of / 90°
 20. The sun rises in the / east and sets in the west due to earth's rotation
 21. In the US, at noon, to see the sun you have to face / south (shadow points north)
 22. The sun is never / overhead in NYS (sun only overhead between the tropics)
 23. The equator always receives / 12 hours of intense sunlight
 24. Shadows are longest when the sun is / low in the sky, shortest when the sun is / highest in the sky (noon)
 25. Duration of insolation is the / length of day; most in summer, less in winter
 26. Summer solstice / June 21 **
 - sun rises / north of east
 - sun sets / north of west
 - sun's altitude / highest of year
 - vertical ray hits / Tropic of Cancer (23.5°N)
 - NY gets / 16 hours of daylight
 - North Pole gets / 24 hours of daylight
 27. Winter solstice / December 21 **
 - sun rises / south of east
 - sun sets / south of west
 - sun's altitude / lowest of year
 - vertical ray hits / Tropic of Capricorn (23.5°S)
 - NY gets / 8 hours daylight
 - North Pole gets / 0 hours daylight
 28. Vernal Equinox / March 21 **
 - Autumnal Equinox / September 21 **
 - sun rises / due east
 - sun sets / due west
 - vertical ray hits / equator
 - whole earth gets / 12 hours

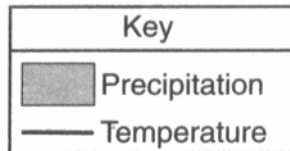
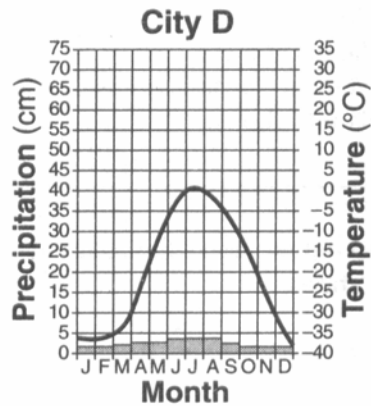
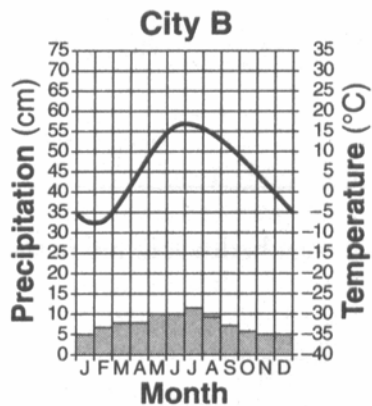
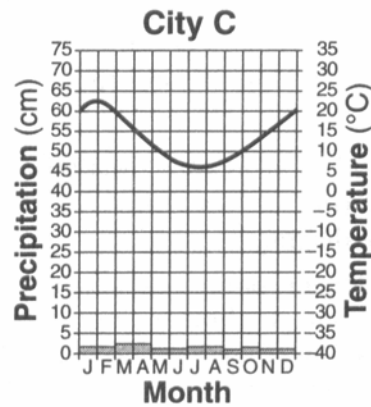
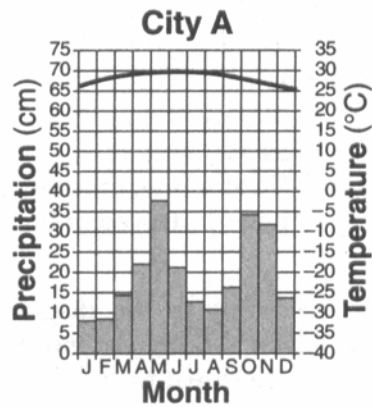
Key Concepts & Questions



Identify five factors that affect climate and explain how each affects climate.

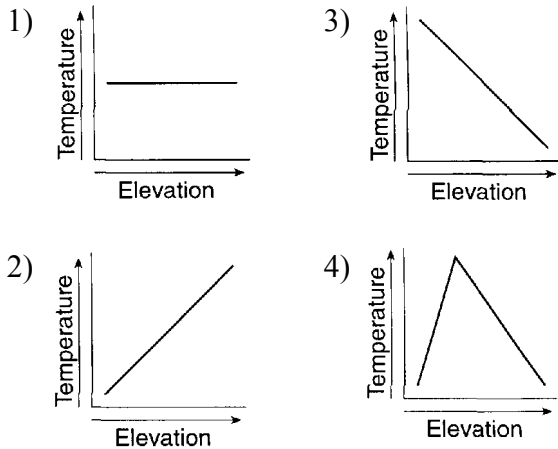
FACTOR	HOW CLIMATE IS AFFECTED
	
	<p style="text-align: center;">Cities A & B are located at the same latitude.</p> <div style="display: flex; justify-content: space-between;"> <div data-bbox="526 751 954 1094">  </div> <div data-bbox="1036 743 1442 926"> <p>Water _____ the temperature.</p> <p>_____ Summers</p> <p>_____ Winters</p> </div> </div>
	<div style="display: flex; justify-content: space-between;"> <div data-bbox="516 1146 971 1402">  </div> <div data-bbox="987 1163 1500 1276"> <p>Windward: _____</p> <p>Leeward: _____</p> </div> </div>
	

Base your answers to questions 1 through 3 on the climate graphs below, which show average monthly precipitation and temperatures at four cities, A, B, C, and D.



- It can be concluded that city C is located in the Southern Hemisphere because city C has
 - small amounts of precipitation throughout the year
 - large amounts of precipitation throughout the year
 - its warmest temperatures in January and February
 - its warmest temperatures in July and August
 - During which season does city B usually experience the month with the highest average precipitation?
 - spring
 - summer
 - fall
 - winter
 - City A has very little variation in temperature during the year because city A is located
 - on the dry side of a mountain
 - on the wet side of a mountain
 - near the center of a large landmass
 - near the equator
-
- Which ocean current transports warm water away from Earth's equatorial region?
 - Brazil Current
 - Guinea Current
 - Falkland Current
 - California Current

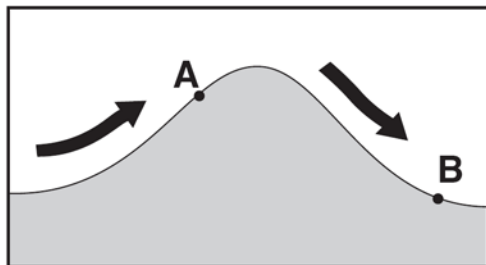
5. Which graph best shows the general effect that differences in elevation above sea level have on the average annual temperature?



6. Which ocean current carries cool water toward Earth's equator?

- 1) Alaska Current
- 2) East Australia Current
- 3) Peru Current
- 4) North Atlantic Current

7. The arrows on the cross section below show the prevailing wind that flows over a mountain. Points A and B represent locations on opposite sides of the mountain.



Which statement correctly describes the differences in the climates of locations A and B?

- 1) Location A is warmer and drier than location B.
- 2) Location A is cooler and wetter than location B.
- 3) Location B is warmer and wetter than location A.
- 4) Location B is cooler and drier than location A.

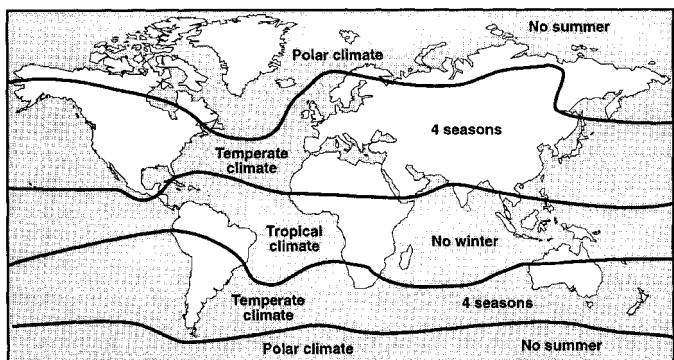
8. Which factor most likely causes two cities at the same elevation and latitude to have different yearly average temperature ranges?

- 1) rotation of Earth
- 2) duration of insolation
- 3) distance from a large body of water
- 4) direction of prevailing winds

9. Compared to the climate conditions of dry inland locations, the climate conditions of locations influenced by a nearby ocean generally result in

- 1) hotter summers and colder winters, with a larger annual range of temperatures
- 2) hotter summers and colder winters, with a smaller annual range of temperatures
- 3) cooler summers and warmer winters, with a larger annual range of temperatures
- 4) cooler summers and warmer winters, with a smaller annual range of temperatures

10. The map below shows the major climate zones on Earth.



The primary factor controlling these climate zones is

- 1) elevation
- 2) solar time
- 3) latitude
- 4) longitude

What Factors Affect the Climate of an Imaginary Continent?

Continent X

Climate involves an *average* of weather conditions for a large geographical region over a long period of time. It is described by averages, ranges, and daily and seasonal variations for factors such as rainfall, winds, and temperature. The great number of possible combinations of factors for different parts of the world makes the classification of climates very complicated.

Climate can be described in terms of average temperature (*hot, temperate, or cold*)

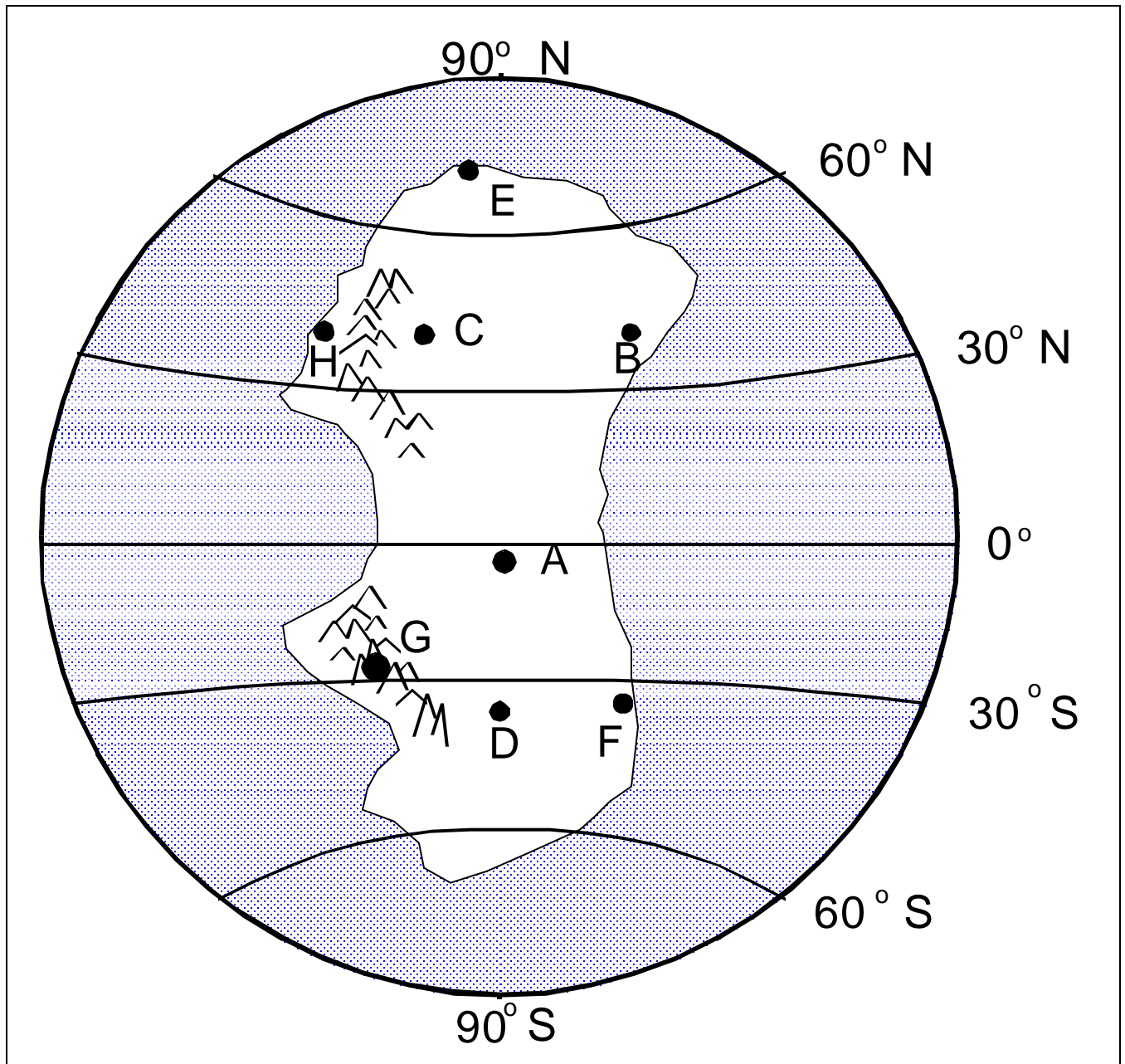


Figure 1: Continent “X.” Eight cities are labeled A through H. All cities lie at sea level, except for City G, which is high in a mountain range.

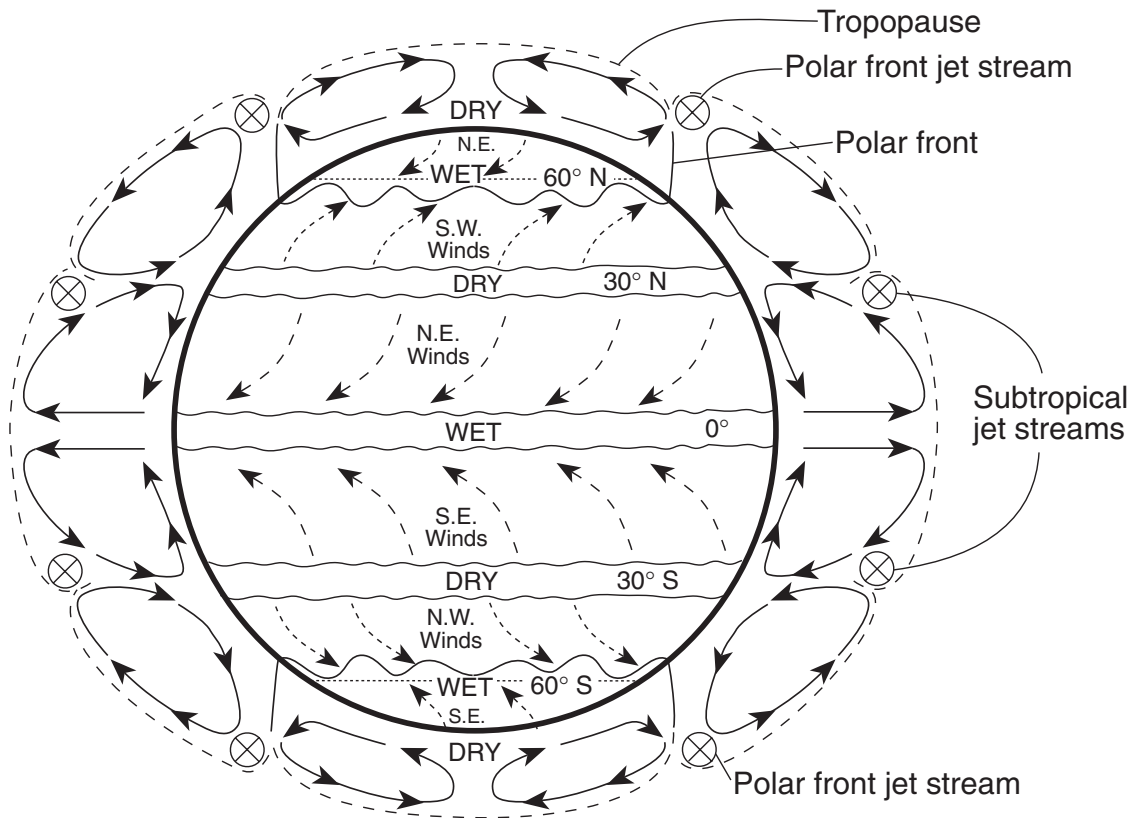
PLANETARY WIND AND MOISTURE BELTS IN THE TROPOSPHERE

by Charles Burrows

LATITUDE	AIR: RISING or SINKING	PRESSURE: HIGH or LOW	WET or DRY	CLOUDY or CLEAR	SURFACE WINDS: DIVERGING or CONVERGING	HIGH ALTITUDE WINDS: DIVERGING or CONVERGING	JET STREAM: NONE or POLAR FRONT or SUBTROPICAL	IS THIS THE LOCATION OF A POLAR FRONT? Y or N
0°								
30°N and 30°S								
60°N and 60°S								
90°N and 90°S								

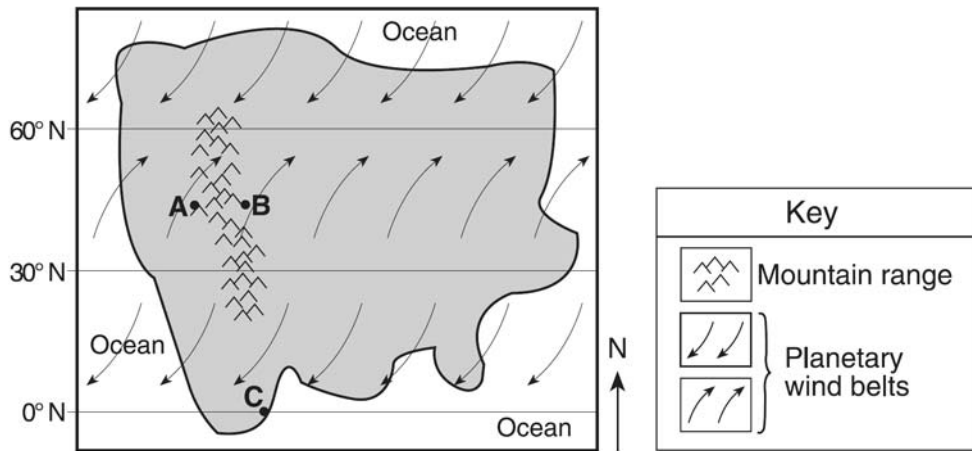
BETWEEN:	90°N and 60°N	60°N and 30°N	0° and 30°N	0° and 30°S	30°S and 60°S	60°S and 90°S
WIND DIRECTION (FROM)						

Base your answers to questions 1 through 3 on the map below, which shows Earth's planetary wind belts.

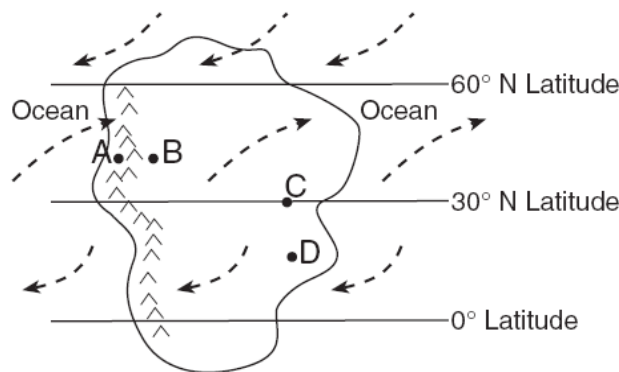


- The curving of these planetary winds is the result of
 - Earth's rotation on its axis
 - the unequal heating of Earth's atmosphere
 - the unequal heating of Earth's surface
 - Earth's gravitational pull on the Moon
 - Which wind belt has the greatest effect on the climate of New York State?
 - prevailing northwesterlies
 - prevailing southwesterlies
 - northeast trades
 - southeast trades
 - Which climatic conditions exist where the trade winds converge?
 - cool and wet
 - warm and wet
 - cool and dry
 - warm and dry
-
- Earth's entire equatorial climate zone is generally a belt around Earth that has
 - high air pressure and wet weather
 - high air pressure and dry weather
 - low air pressure and wet weather
 - low air pressure and dry weather

Base your answers to questions 5 and 6 on map below, which represents an imaginary continent. Locations *A* and *B* are on opposite sides of a mountain range on a planet similar to Earth. Location *C* is on the planet's equator.



5. Compared to the climate at location *A*, the climate at location *B* would most likely be
- 1) warmer and more humid
 - 2) warmer and less humid
 - 3) cooler and more humid
 - 4) cooler and less humid
6. Location *C* most likely experiences
- 1) low air pressure and low precipitation
 - 2) low air pressure and high precipitation
 - 3) high air pressure and low precipitation
 - 4) high air pressure and high precipitation

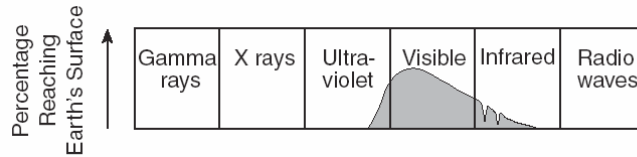


7. Over the course of a year, compared to location *B*, location *A* will have
- (1) less precipitation and a smaller temperature range
 - (2) less precipitation and a greater temperature range
 - (3) more precipitation and a smaller temperature range
 - (4) more precipitation and a greater temperature range
8. The climate at location *C* is much drier than at location *D*. This difference is best explained by the fact that location *C* is located
- (1) farther from any mountain range
 - (2) closer to a large body of water
 - (3) at a latitude that experiences longer average annual daylight
 - (4) at a latitude where air is sinking and surface winds diverge
9. Compared to the observations made at location *D*, the observed altitude of *Polaris* at location *B* is
- (1) always less
 - (2) only less from March 21 to September 22
 - (3) only greater from March 21 to September 22
 - (4) always greater

Sun's Energy



According to the graph below, what wavelength of energy does the Earth receive in the greatest intensity?



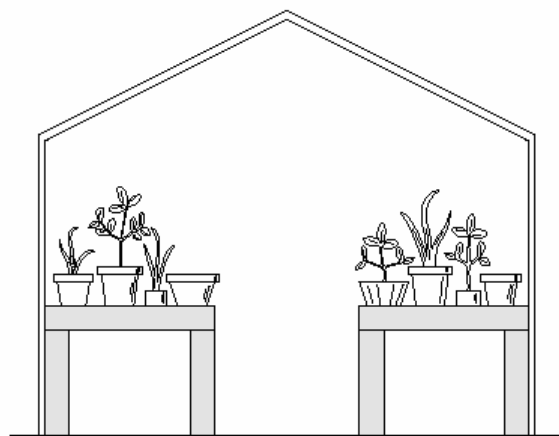
Name the primary gas which absorbs ultraviolet energy (UV) from the sun. _____

Why is the ozone layer important?

What are the three primary gases which absorb infrared radiation (IR = heat)?

Why is it warmer on a cloudy night than on a clear night?

Explain the greenhouse effect. Include a diagram which shows the change in wavelength.

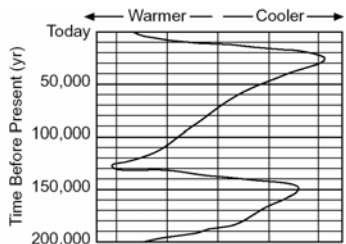


Greenhouse

Global Climate Change



1. Ice Ages



2. Global Warming

3. El Niño and La Niña

|

El Niño

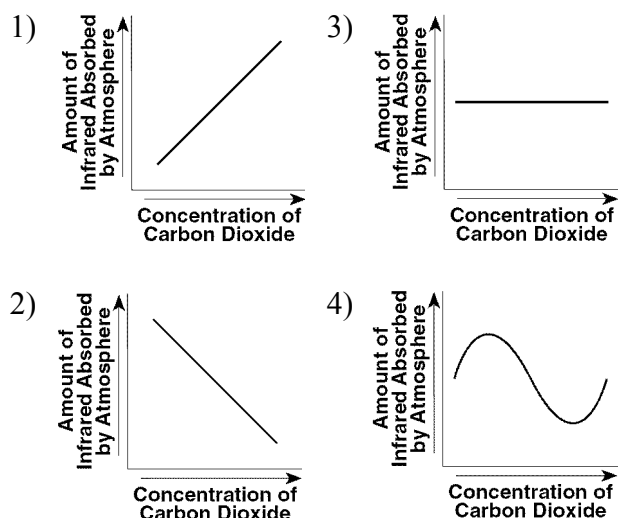
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La Niña

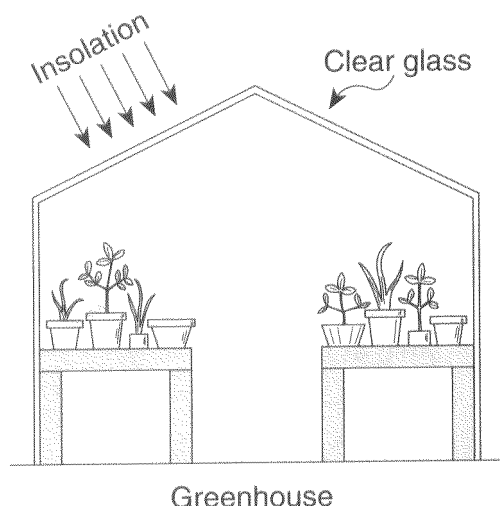
1. Which two gases have been added to Earth's atmosphere in large amounts and are believed to have increased global warming by absorbing infrared radiation?

- 1) neon and argon
- 2) chlorine and nitrogen
- 3) hydrogen and helium
- 4) methane and carbon dioxide

2. Which graph best shows the relationship between the concentration of carbon dioxide in Earth's atmosphere and the amount of infrared radiation absorbed by the atmosphere.



3. The diagram below shows a greenhouse.



What is the primary function of the clear glass of the greenhouse?

- 1) The glass reduces the amount of insolation entering the greenhouse.
- 2) The glass allows all wavelengths of radiation to enter and all wavelengths of radiation to escape.
- 3) The glass allows short wavelengths of radiation to enter, but reduces the amount of longwavelength radiation that escapes.
- 4) The glass allows long wavelengths of radiation to enter, but reduces the amount of shortwavelength radiation that escapes.

Base your answers to questions 4 and 5 on the passage below.

Ozone in Earth's Atmosphere

Ozone is a special form of oxygen. Unlike the oxygen we breathe, which is composed of two atoms of oxygen, ozone is composed of three atoms of oxygen. A concentrated ozone layer between 10 and 30 miles above Earth's surface absorbs some of the harmful ultraviolet radiation coming from the Sun. The amount of ultraviolet light reaching Earth's surface is directly related to the angle of incoming solar radiation. The greater the Sun's angle of insolation, the greater the amount of ultraviolet light that reaches Earth's surface. If the ozone layer were completely destroyed, the ultraviolet light reaching Earth's surface would most likely increase human health problems, such as skin cancer and eye damage.

4. Explain how the concentrated ozone layer above Earth's surface is beneficial to humans.
5. State the name of the temperature zone of Earth's atmosphere where the concentrated layer of ozone gas exists.

Reasons for the Seasons

Fact(s) to memorize: 15 - 25



Tilt of Earth's axis

Insolation

Revolution around the Sun

Earth's Tilt Increases ?

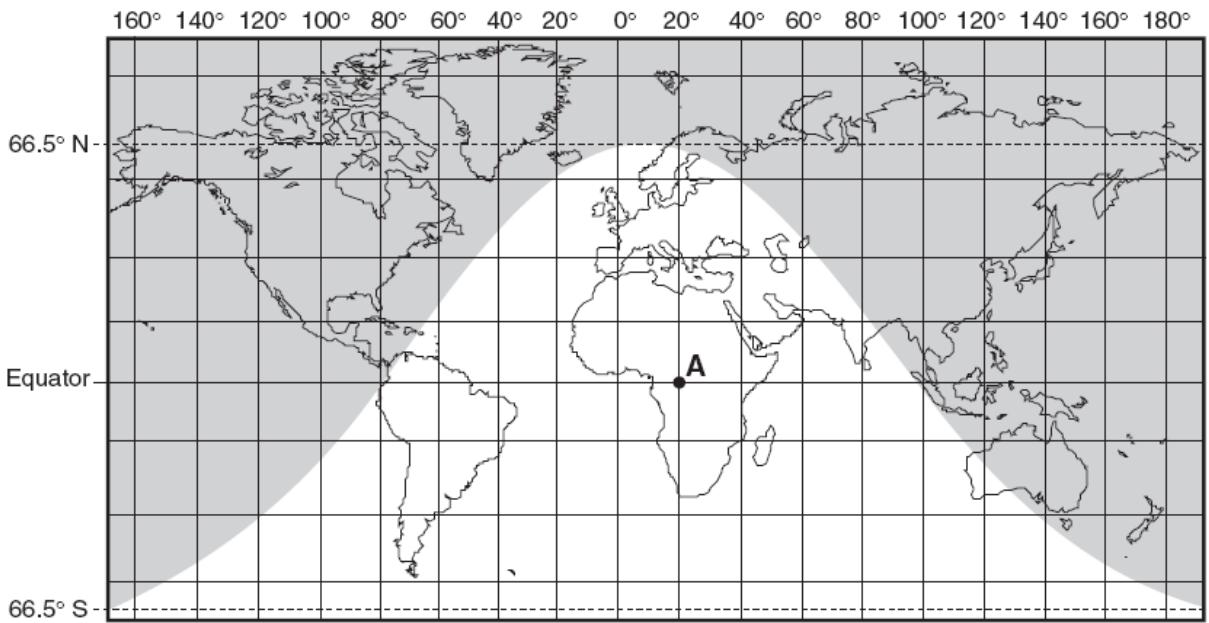
Altitude of the Noon Sun & Path through the Sky

solar noon

Shadow

What is meant by "within the tropics"?

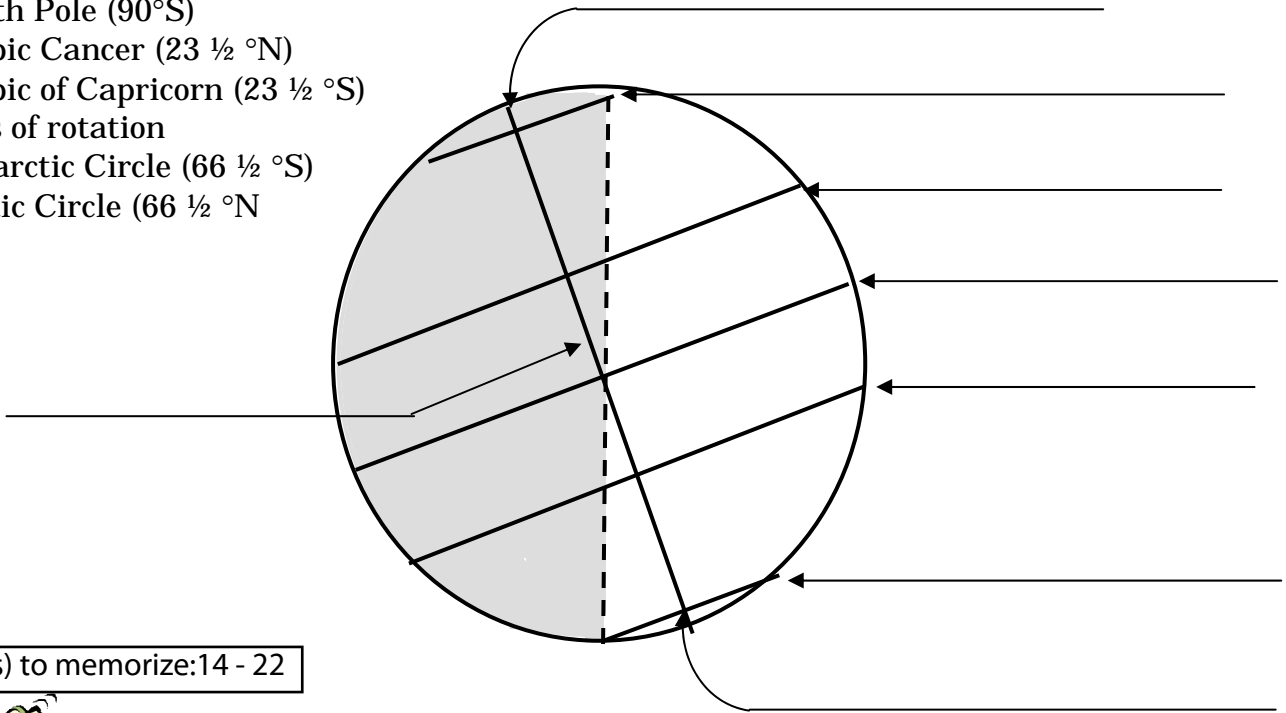
What determined where the Tropic of Cancer and the Tropic of Capricorn would be located on Earth's surface?



Direct ray of the sun

Locations on Earth: Label the diagram below using the following locations.

- Equator (0°)
- North Pole (90°N)
- South Pole (90°S)
- Tropic Cancer (23 ½ °N)
- Tropic of Capricorn (23 ½ °S)
- Axis of rotation
- Antarctic Circle (66 ½ °S)
- Arctic Circle (66 ½ °N)



Fact(s) to memorize: 14 - 22



Fact(s) to memorize: 26 - 28



Name	Date	# of hours of daylight N.Y.	<i># of hours of daylight North Pole</i>	<i># of hours of daylight South Pole</i>	Point of Sunrise	Point of Sunset	Altitude of Noon Sun (high-med-low)	Latitude of Vertical Rays
Summer Solstice								
Autumnal Equinox								
Winter Solstice								
Vernal Equinox								

The sun rises in the _____ and sets in the _____. Therefore, at sunrise, one's shadow will point _____
 At sunset, one's shadow will point _____

At Solar Noon at our location, one's shadow will always point _____.

When will the sun be directly overhead at Solar Noon at our location? _____
 Why?

On what day of the year is the Sun lowest in the sky at Solar Noon?	03/21	06/21	09/21	12/21
On what day of the year is the Sun highest in the sky at Solar Noon?	03/21	06/21	09/21	12/21
On what day of the year is the angle of insolation greatest at our location?	03/21	06/21	09/21	12/21
On what day of the year is the angle of insolation least at our location?	03/21	06/21	09/21	12/21
On what day of the year is the duration of insolation greatest at our location?	03/21	06/21	09/21	12/21
On what day of the year is the duration of insolation least at our location?	03/21	06/21	09/21	12/21
On what day of the year will one have their longest shadow at Solar Noon in NY?	03/21	06/21	09/21	12/21
On what day of the year will one have their shortest shadow at Solar Noon in NY?	03/21	06/21	09/21	12/21

When is the earth closest to the Sun?	03/21	06/21	09/21	12/21
When is the earth furthest from the Sun?	03/21	06/21	09/21	12/21

Why is it colder then during the winter?

What are the reasons for the seasons?

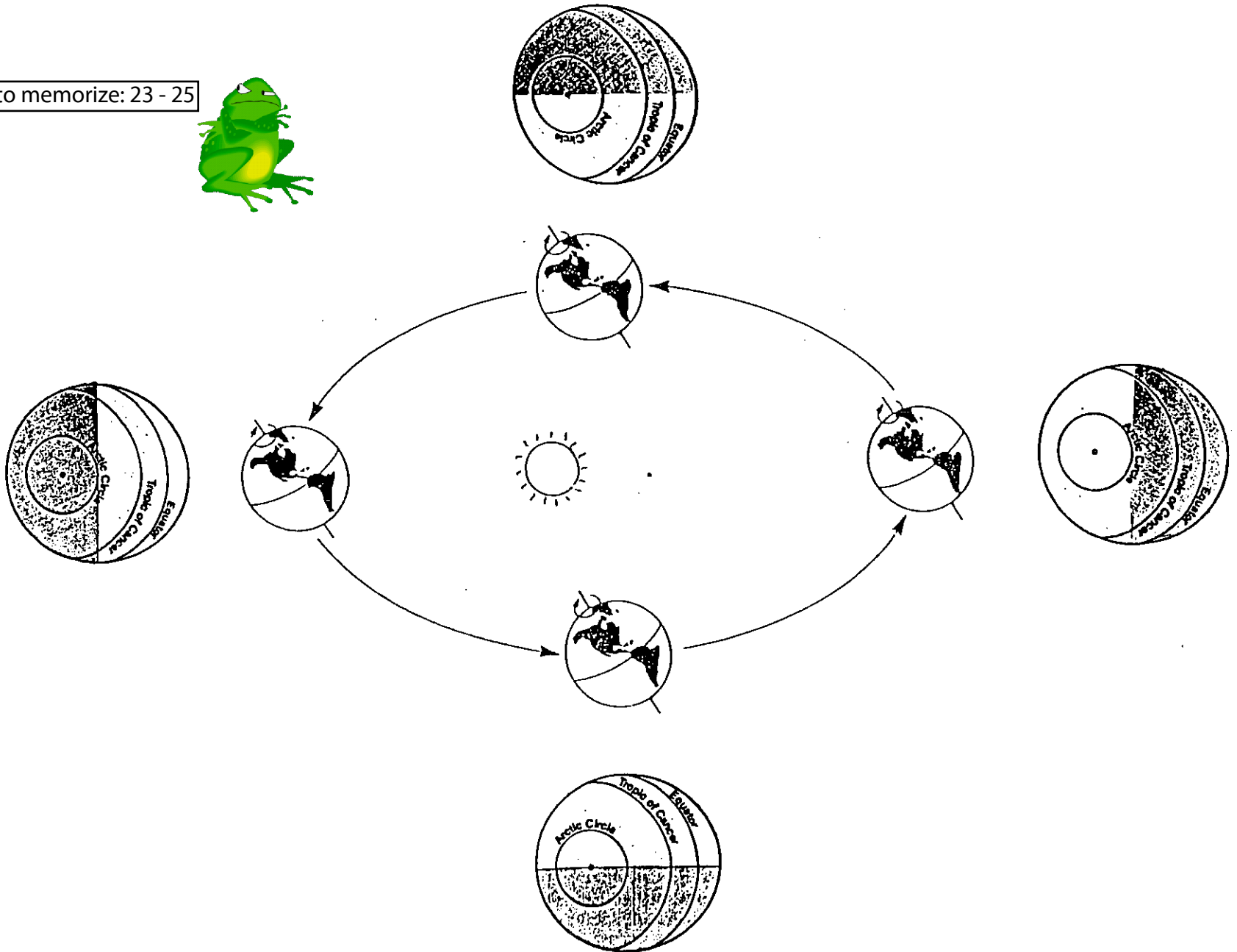
Fact(s) to memorize: 23 - 25



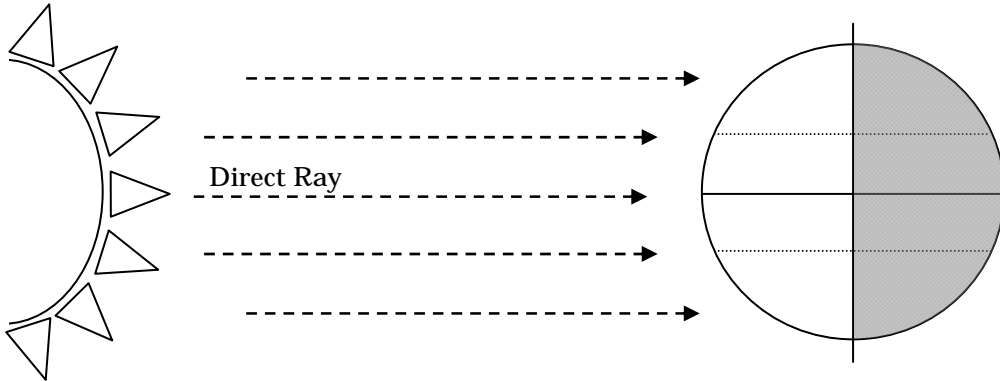
Earth revolves around the Sun in a yearly cycle of _____ days.

As Earth revolves, its axis always points in the same direction.

Fact(s) to memorize: 23 - 25

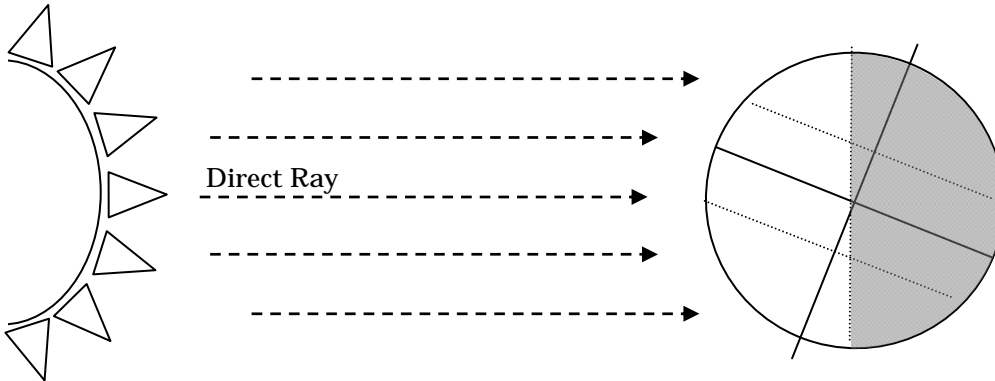


Angle of Insolation / Angle of Incidence



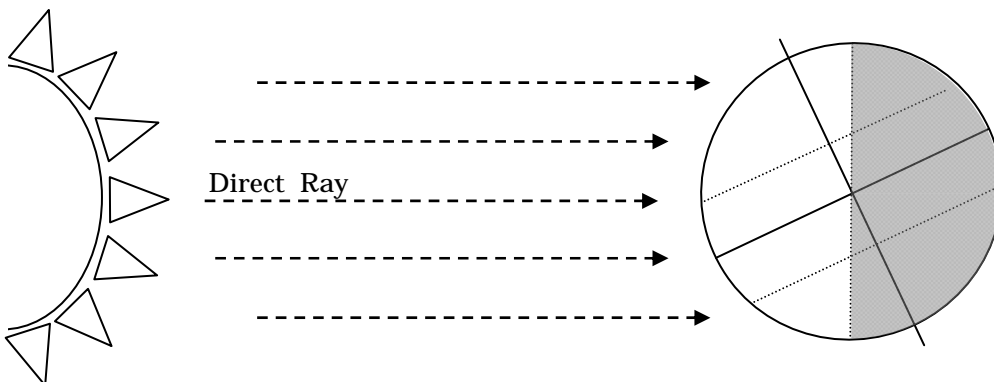
At what location is the direct ray of the sun? _____

What seasons could this be? _____ or _____



At what location is the direct ray of the sun? _____

What season would this be? _____

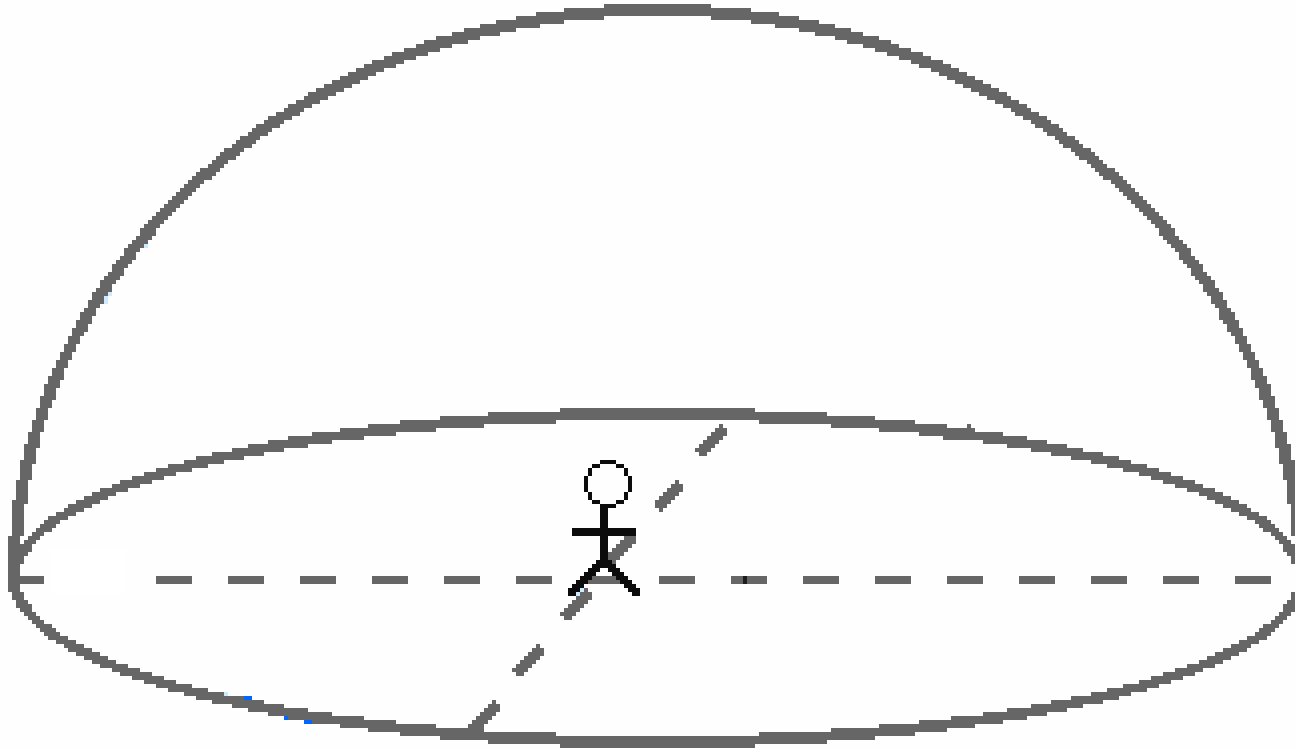


At what location is the direct ray of the sun? _____

What season would this be? _____

Draw the path of the Sun across the sky for each of the dates of the equinoxes and solstices for NY State.

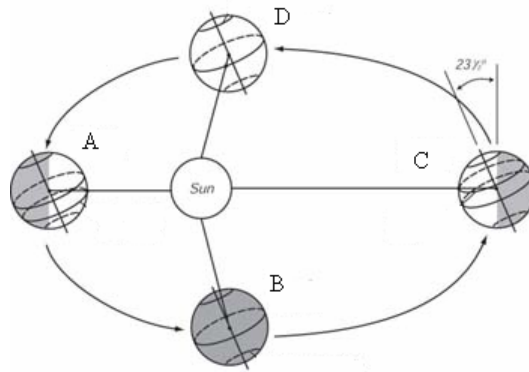
Fact(s) to memorize: 15 - 28



Fact(s) to memorize: 14 - 25



Fact(s) to memorize: 15 - 28



	Date	Where the Sun is directly overhead	Altitude of Sun at Solar Noon at our location	Duration of Insolation at our location	Duration of Insolation at the North Pole	Duration of Insolation at the South Pole
A						
B						
C						
D						

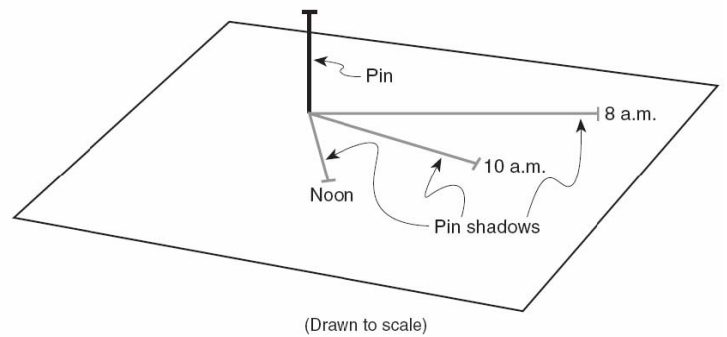
WORLDWIDE PATHS OF SUN

Equator 3/21	North Pole 6/21	South Pole 12/21	Southern Hemisphere 40S 6/21

Seasons Review

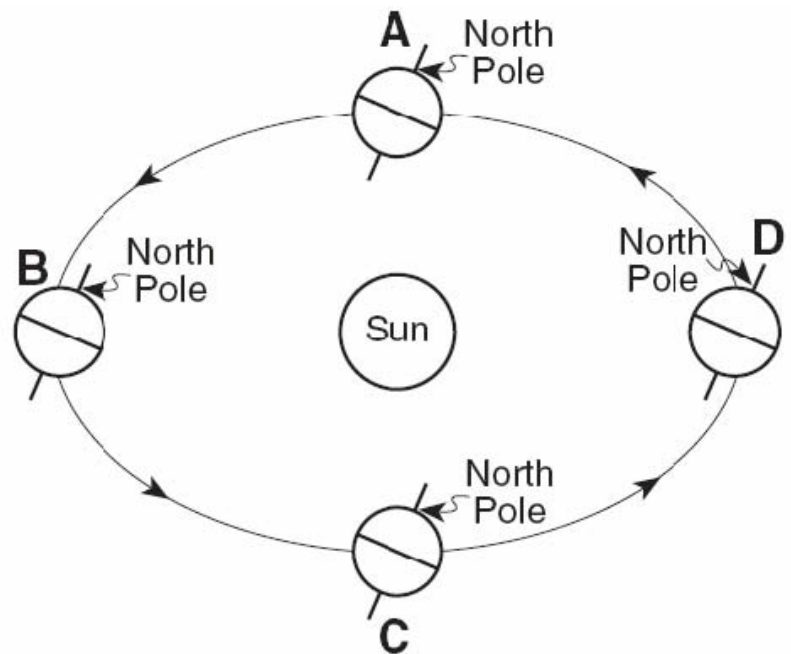
Use the picture below to answer questions 1-3

1. Why does the shadow change its length?
2. Draw in the shadow for 11 am.
3. Draw the shadow for 2 pm.



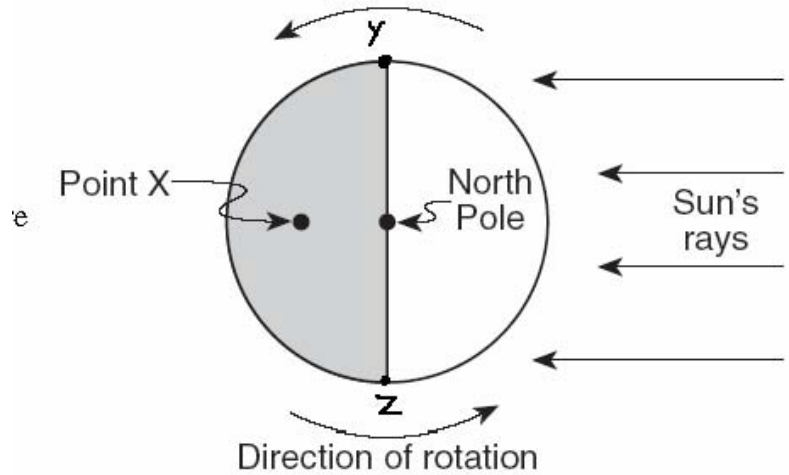
Use the picture below to answer questions 4-11

4. Which position is the summer season in the northern hemisphere?
5. Shade the night portion of position B and position D in the diagram.
6. Describe what happens to the orbital velocity as the planet moves from C to A.
7. Which latitude receives the direct rays of the sun in position D?
8. Which latitude receives the direct rays of the sun in position B?
9. Which latitude receives the direct rays of the sun in positions A and C?
10. Which position gives NY the longest amount of daylight hours?
11. What is the date for position D?

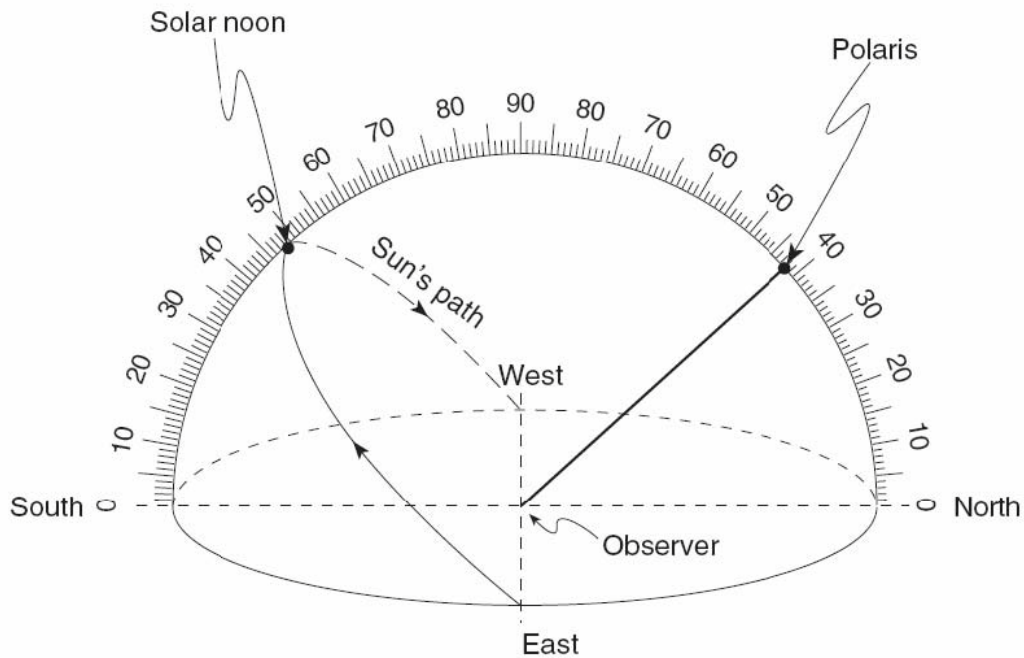


Use the picture below to answer questions 12-16

12. What time is it at point X?
13. What time is it at point Y?
14. What time is it at point Z?
15. What two days of the year could this picture have been taken?
16. The motion in this diagram causes wind and ocean currents to curve. What is the name of that force and which way do they curve in the Northern Hemisphere?

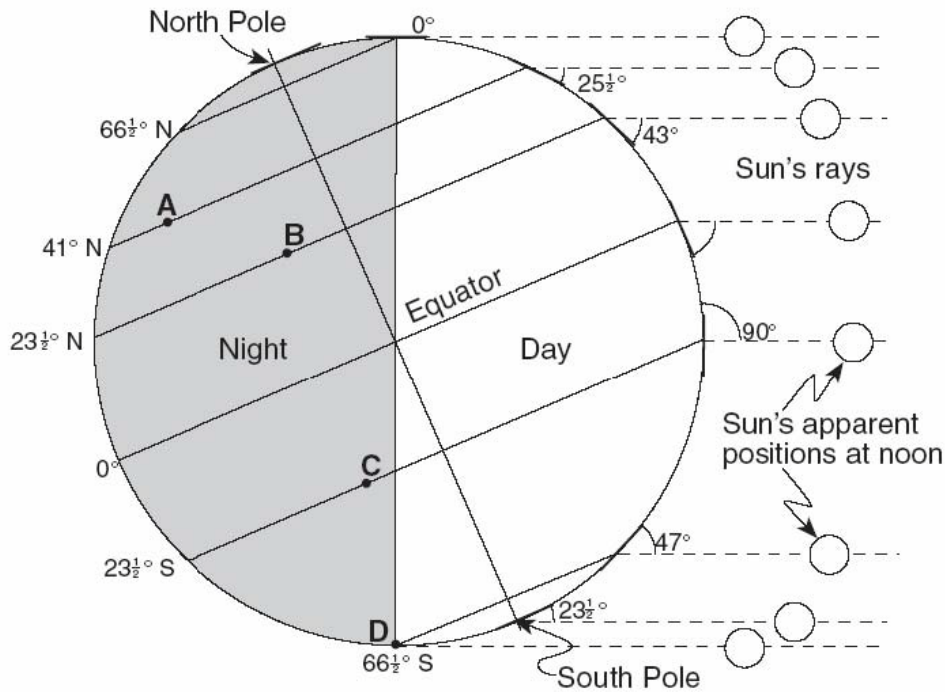


Use the picture below to answer questions 17-21



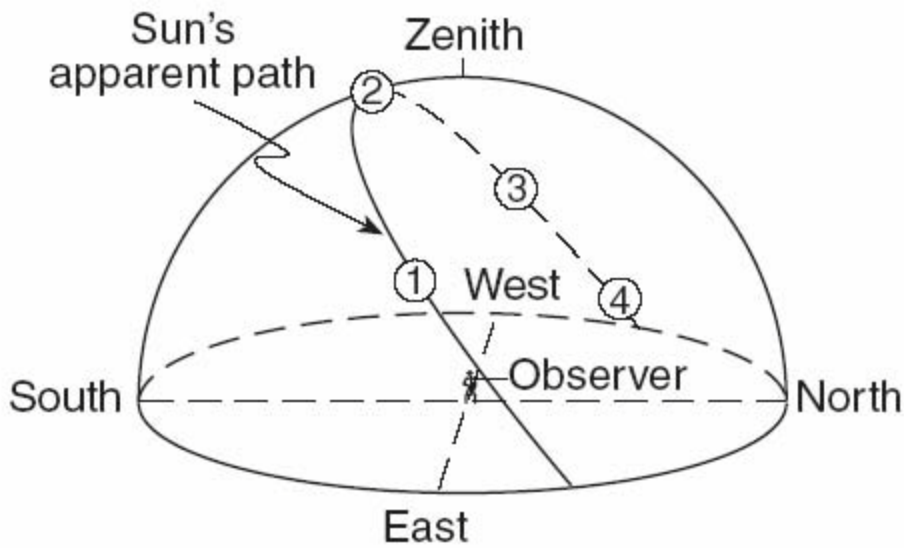
17. Which city in NYS is this location probably located?
18. What are the two possible dates this picture could be on?
19. Draw the sun's path on June 21st reaching an altitude of 73°.
20. Label the zenith point.
21. What happens to the altitude of Polaris as you travel from New York to the North Pole?

Use the picture below to answer questions 22-26



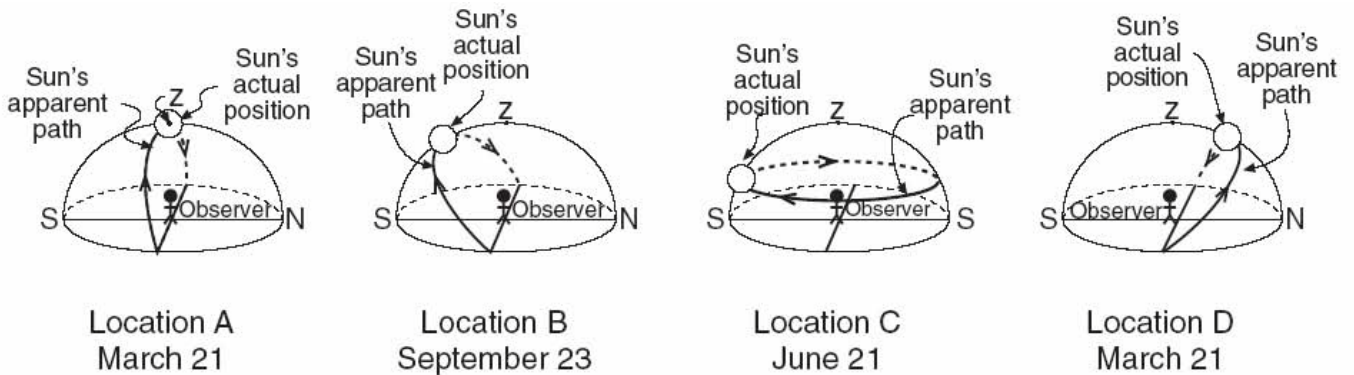
(Not drawn to scale)

22. What is the date of this picture?
23. What letter is receiving the direct rays of the sun on this date?
24. Which letter could be in New York State?
25. How many hours of sunlight does the South Pole receive on this date?
26. What happens to the amount of daylight hours



27. What is the date of this diagram?
28. Which number represents the time of day with the shortest shadow?
29. Which number represents the time of day with the longest shadow?
30. If this location was in New York State, label the approximate position of Polaris.

Use the following picture to answer questions 31-34.



31. Which location could be in New York? _____ because..
32. Which location is in the Southern hemisphere? _____ because..
33. Which location is at the North Pole? _____ because..
34. Which location is at the Equator? _____ because..