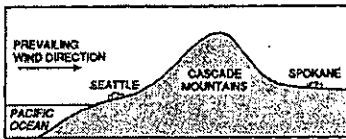


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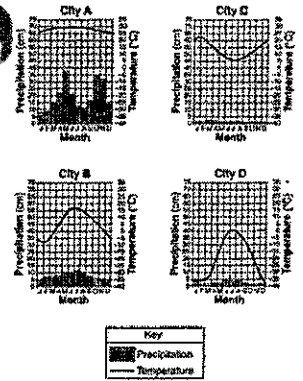
CLIMATE AND SEASONS NOTES

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?

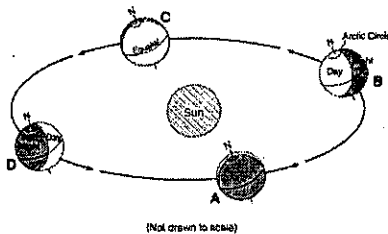
Which city has the highest temperature range?

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)

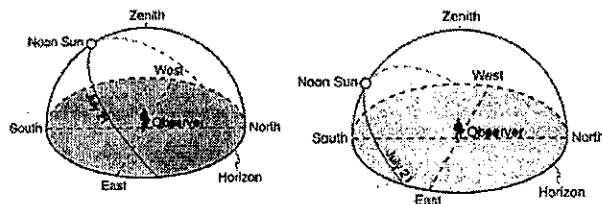
1. For the Vernal and Autumnal Equinoxes, and the Summer and Winter Solstices, you must be able to state:
 - a. The approximate noon time altitude of the sun
 - b. The date
 - c. The number of hours of daylight for the North and South Poles, the equator and New York
 - d. The point of sunrise and sunset
 - 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.

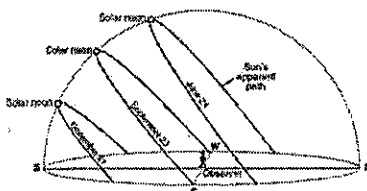


Which location would have the longest noontime shadow?

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?

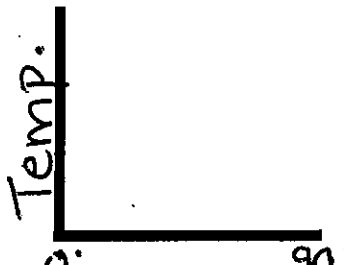
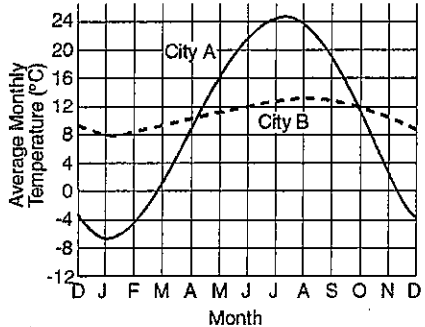
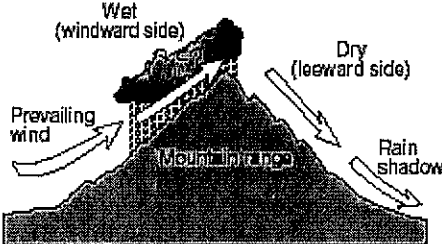
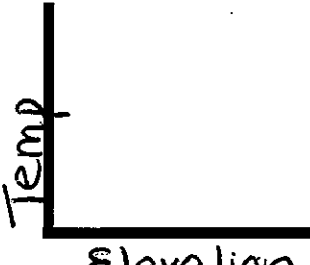
Climate and Season Facts

- 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 **SOLAR** 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

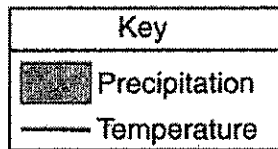
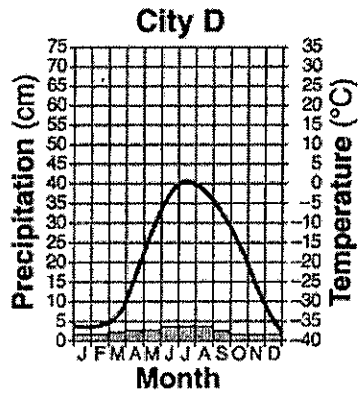
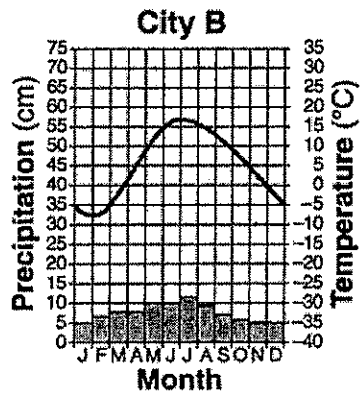
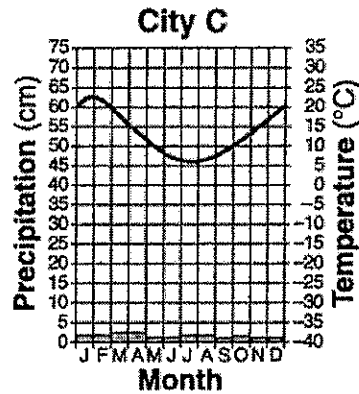
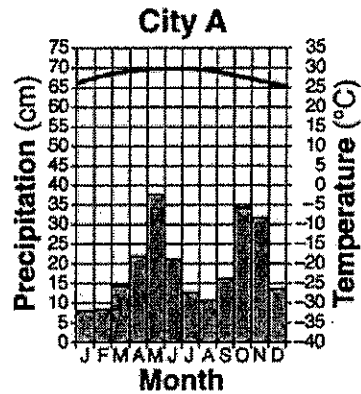
Key Concepts & Questions



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

FACTOR	HOW CLIMATE IS AFFECTED
<p>① Latitude</p>	<p>Temp. As latitude increases, the temp. _____.</p> 
<p>② Closeness to a large body of water.</p>	<p>Cities A & B are located at the same latitude.</p>  <p>Water <u>moderates</u> the temperature.</p> <p>_____ Summers _____ Winters</p> <p>City B is closer to large body of water. The line is _____ (small temp. range)</p>
<p>③ Orographic Effect</p>	 <p>Windward: _____ Leeward: _____</p>
<p>④ Elevation</p>	<p>Temp. As elevation increases, the temp. _____.</p> 
<p>⑤ Ocean Currents</p>	<p>Warm currents = _____ climate Cold currents = _____ climate</p>

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*.



1. It can be concluded that city *C* is located in the Southern Hemisphere because city *C* has

1) small amounts of precipitation throughout the year	3) its warmest temperatures in January and February
2) large amounts of precipitation throughout the year	4) its warmest temperatures in July and August

 2. During which season does city *B* usually experience the month with the highest average precipitation?

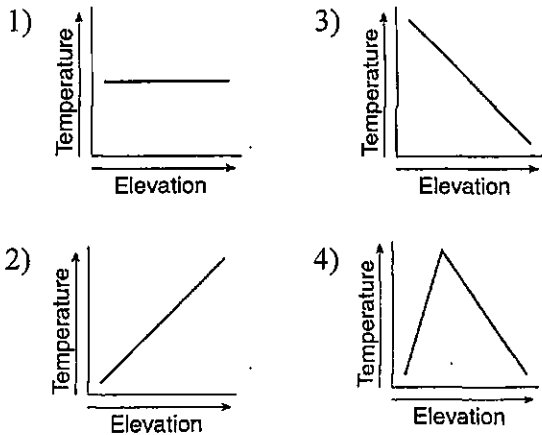
1) spring	2) summer	3) fall	4) winter
-----------	-----------	---------	-----------

 3. City *A* has very little variation in temperature during the year because city *A* is located

1) on the dry side of a mountain	3) near the center of a large landmass
2) on the wet side of a mountain	4) near the equator
-
4. Which ocean current transports warm water away from Earth's equatorial region?

1) Brazil Current	3) Falkland Current
2) Guinea Current	4) California Current

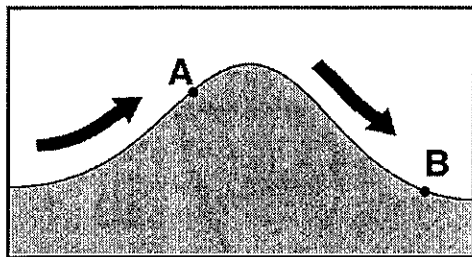
5. Which graph best shows the general effect that differences in elevation above sea level have on the average annual temperature?



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*.

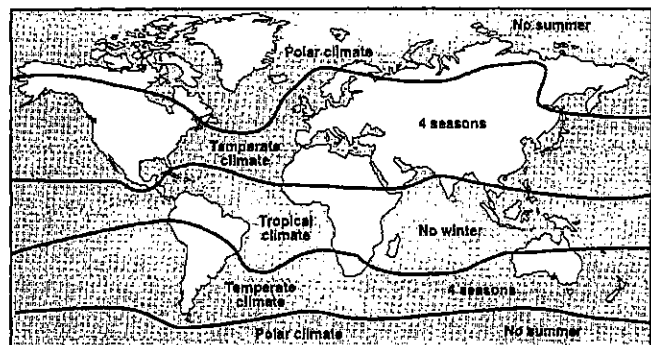
8. Which factor most likely causes two cities at the same elevation and latitude to have different yearly average temperature ranges?

- 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*)

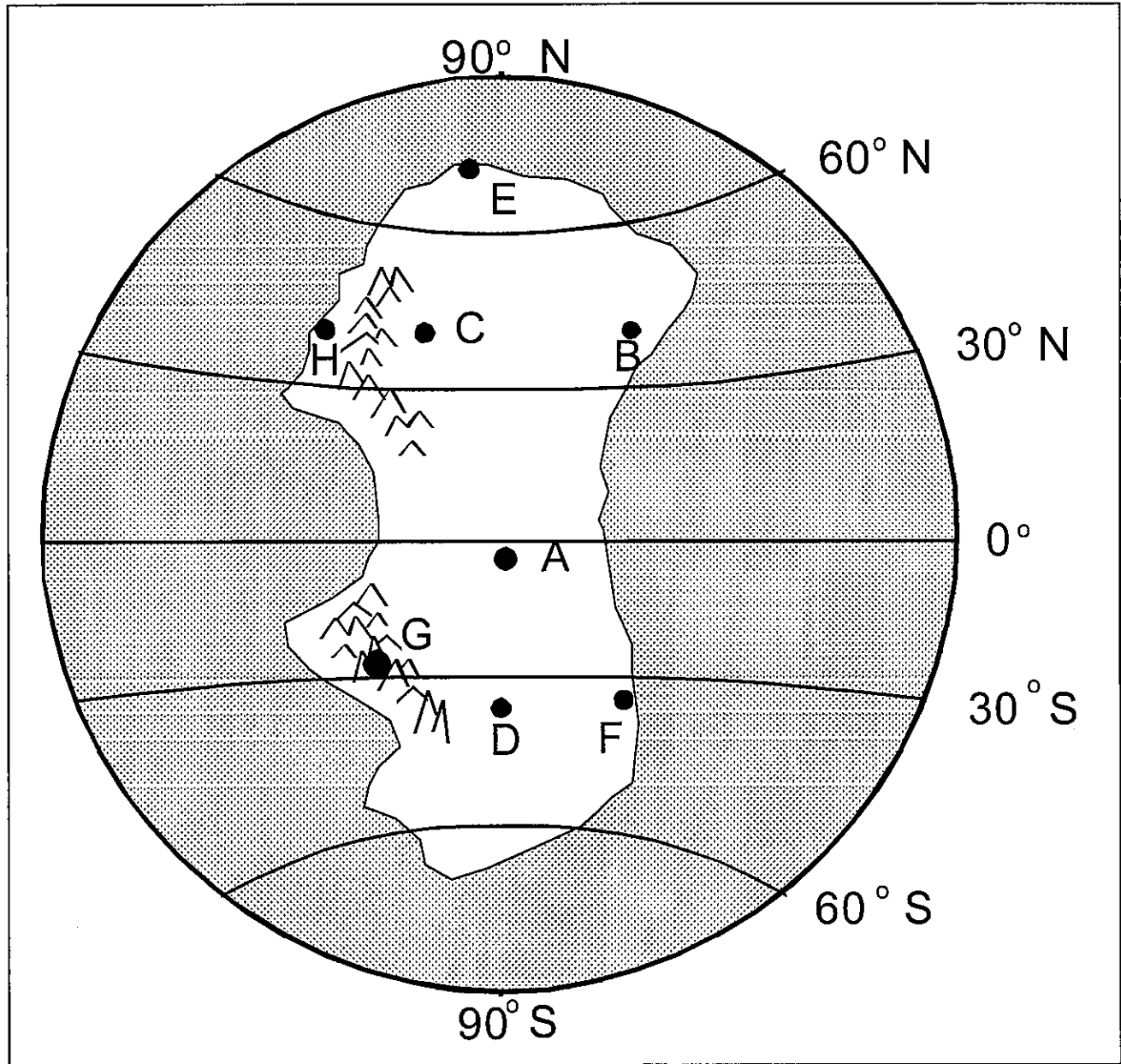


Figure 1: Continent "X." Eight cities are labeled A through H. All cities lie at sea level, except for City G, which is high in a mountain range.

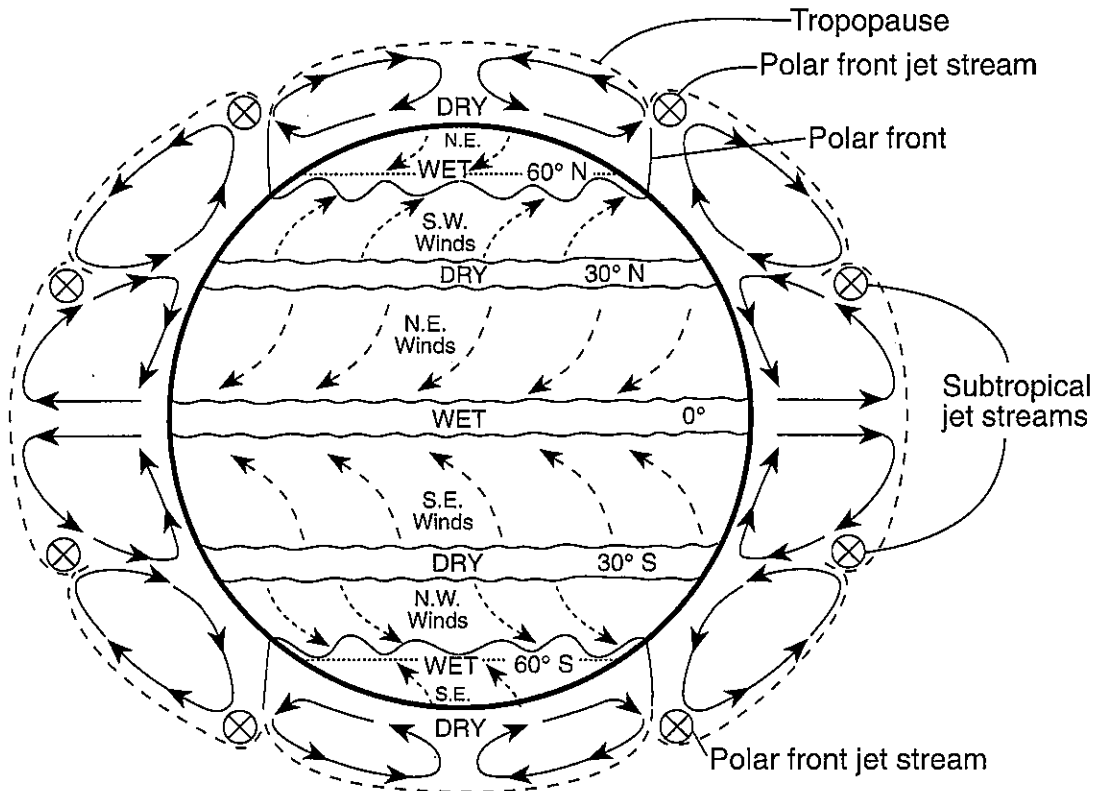
PLANETARY WIND AND MOISTURE BELTS IN THE TROPOSPHERE

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.

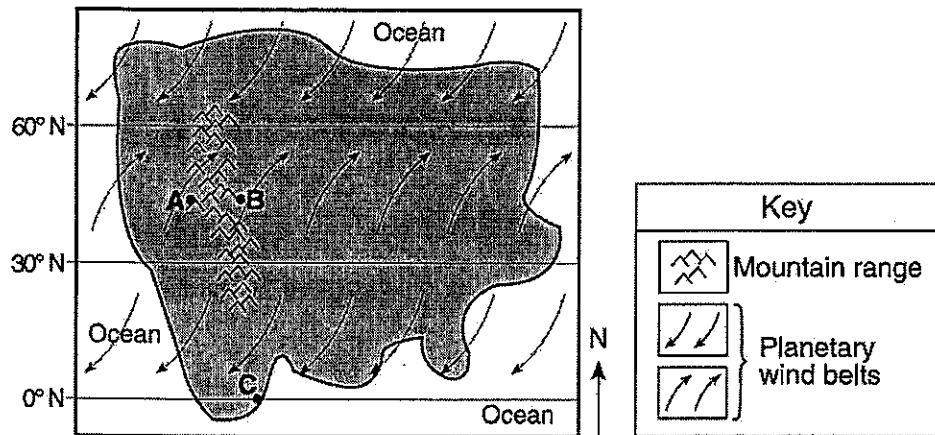


- The curving of these planetary winds is the result of
 - Earth's rotation on its axis
 - the unequal heating of Earth's atmosphere
 - the unequal heating of Earth's surface
 - Earth's gravitational pull on the Moon
 - Which wind belt has the greatest effect on the climate of New York State?

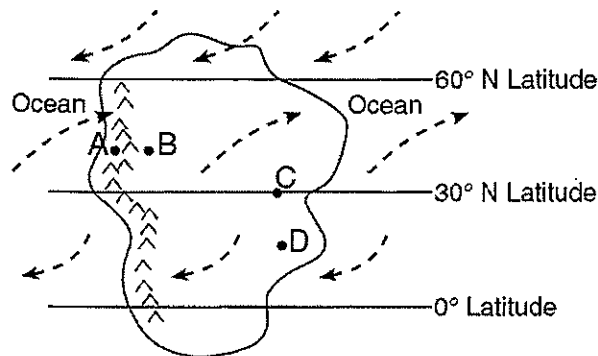
(1) prevailing northwesterlies	(3) northeast trades
(2) prevailing southwesterlies	(4) southeast trades
 - Which climatic conditions exist where the trade winds converge?

(1) cool and wet	(2) warm and wet	(3) cool and dry	(4) 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

NAME: _____ PERIOD: _____ DATE: _____

LAB PARTNERS: _____ LAB #37

FACTORS AFFECTING WORLDWIDE CLIMATE

INTRODUCTION

Climate involves an average of weather conditions over a large geographic region over a long period of time. It is affected by many factors such as:

1. Nearness to bodies of water
2. Latitude
3. Mountain ranges
4. Elevation
5. Prevailing winds
6. Ocean currents

Because of the great number of possible combinations of factors for different parts of the world, classification of climates is very complicated.

OBJECTIVES

You will be able to determine the climate of an imaginary landmass based on an analysis of several climatic factors.

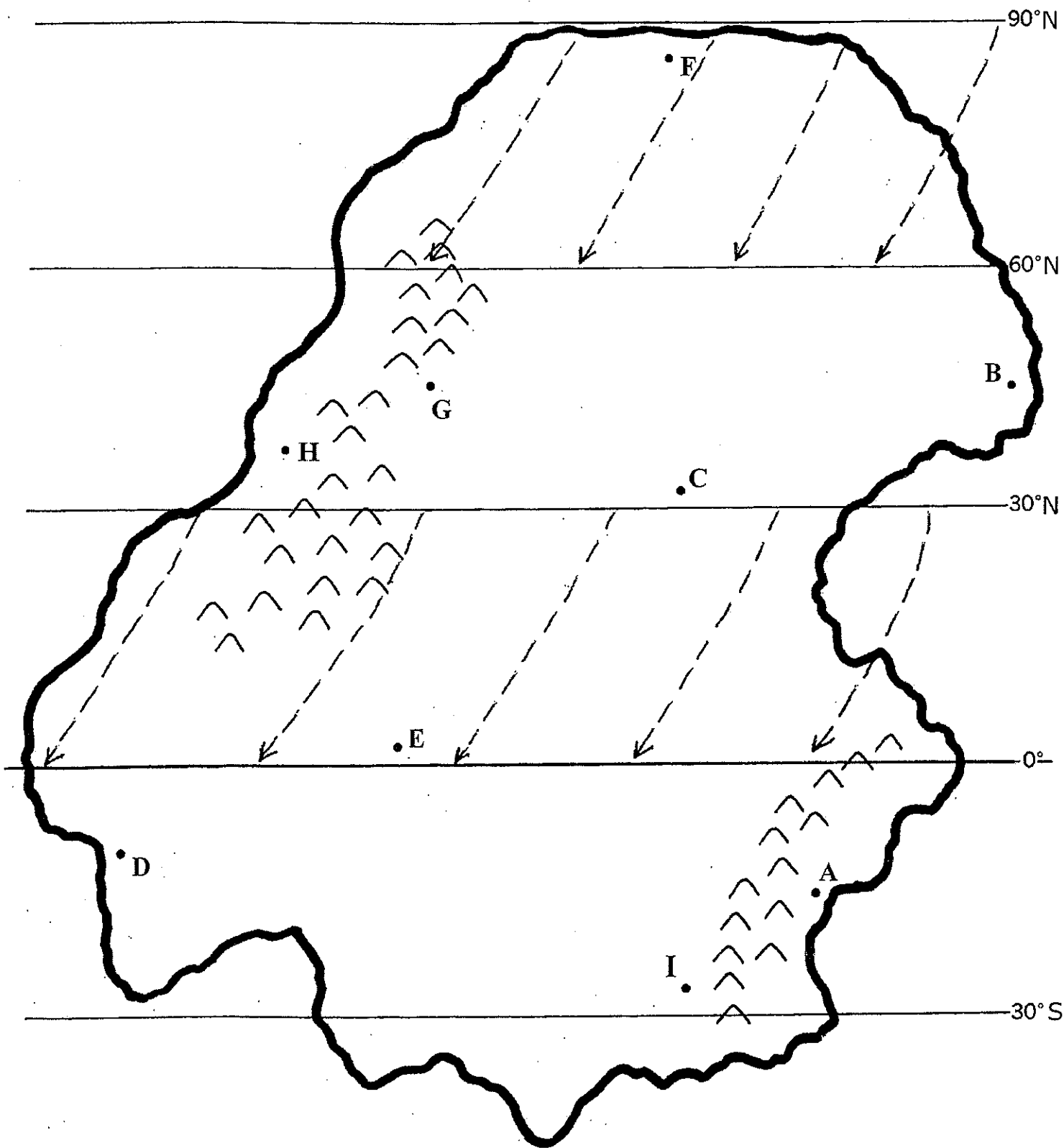
MATERIALS

Planetary Wind Chart pg. 14 ESRT
Red, Blue, and Black colored pencils

APPROXIMATE TIME 2 periods

PROCEDURES

1. On the diagram of the continent provided, the wind pattern for the Northeasterlies (N.E.) has been drawn in for you. Using the Planetary Wind chart on pg. 14 of the ESRT complete the diagram by adding the following wind belts, use black pencil.
 - A. Southwesterlies (S.W.)
 - B. Southeasterlies (S.E.)
 - C. Northwesterlies (N.W.)
2. Warm ocean currents move along the east coast continents away from the equator toward the Polar Regions. Cold ocean currents move along the west coast of continents away from the poles and toward the equator. Using the Surface Ocean Currents Chart on pg. 4 of the ESRT draw in the warm ocean currents (using red pencil) and cold ocean currents (using blue pencil) on the diagram of the continent provided.
3. Answer laboratory questions 1 through 13.



LABORATORY QUESTIONS

1. How does temperature vary with latitude? _____

2. Define "Average Annual Temperature." _____

3. Define Temperature Range. _____

4. How does elevation affect the climate of a location? _____

5. How does the presence of a mountain range affect the climate of a region? _____

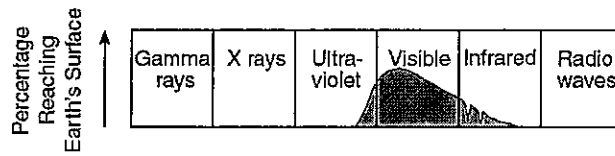
6. How does the temperature of ocean currents affect climate? _____

7. Which lettered location(s) :
 - a. has no winter _____
 - b. has a temperate (mid-latitude) climate _____
 - c. has a climate influenced by altitude _____
 - d. is located on the windward side of a mountain _____
 - e. is located on the leeward side of a mountain _____
 - f. would be located in a desert _____
 - g. is influenced by a warm ocean current _____
 - h. is influenced by a cold ocean current _____
 - i. has cool summers and long cold winters _____
 - j. has a marine climate _____
 - k. has a continental climate _____
 - l. has a S.E. wind _____

Sun's Energy



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



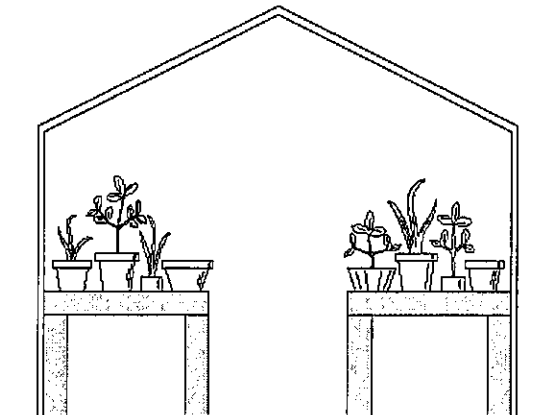
Name the primary gas which absorbs ultraviolet energy (UV) from the sun. _____

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

Reasons for the Seasons

Fact(s) to memorize: 15 - 25

Tilt of Earth's axis

Different latitudes receive different intensities () from the sun



Insolation

Greatest angle of insolation =

Revolution around the Sun

Earth's orbit around the sun

Earth's Tilt Increases ?

Earth's direction of tilt changes as earth around the sun.

North Pole tilted towards the sun
= in the Northern hemisphere.

Altitude of the Noon Sun & Path through the Sky

solar noon

When the sun is highest point in the sky directly overhead in NY
Sun is in the sky in the North hemisphere

Shadow

When sun is lower in the sky.

What is meant by "within the tropics"?

and Any location between of the equator.

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

Last place north or south of the equator where the sun is directly. (23.5°N + 23.5°S)



Fact(s) to memorize: 23 - 25

Name	Date	# of hours of daylight N.Y.	# of hours of daylight North Pole	# of hours of daylight South Pole	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								

NAME: _____ PERIOD: _____ DATE: _____

LAB PARTNERS: _____ LAB #40

INVESTIGATING THE SUN'S APPARENT MOTION

INTRODUCTION

Every day you can see the sun rise on the eastern horizon, move steadily in a giant arc across the sky, and set on the western horizon. The ancients believed that the sun takes a daily trip around the earth while the earth remains at rest. However, we now know that the earth rotates on its axis from west to east. This rotation makes it appear that the sun is moving east to west. The daily motion of the sun therefore is not real but an apparent motion. Since seasonal changes in the intensity and duration of sunshine regulate growing seasons and since life is so organized around the behavior of the sun, man came to realize the regularity and predictability of the sun's actions.

OBJECTIVES

When you finish this investigation you should be able to:

1. Construct a graph from given data on the sun's altitude and date.
2. Determine from the graph the periods of maximum and minimum hours of daylight.
3. Identify from the graph the appropriate seasons and the sun's altitude on the solstices and equinoxes.
4. Use celestial sphere and hemisphere diagrams to determine Earth's seasons
5. Determine clock time using Earth's longitude system
6. Draw the relative length of the noon shadow for locations in New York State for each season

MATERIALS

Graph Paper
Pencil
Protractor

APPROXIMATE TIME 2 Periods

PROCEDURES

1. Graph the data for date of the year versus maximum altitude on the graph paper. Connect all points with a smooth curved line.
2. On your graph label the points representing the Vernal and Autumnal Equinoxes and the Summer and Winter Solstices.
3. Answer the laboratory summary questions for Part I.

LAB DATA TABLE

Observations of the sun were made each week for one year. Measurements of the maximum altitude of the sun were taken. The time of day at which the maximum altitude occurred was also noted.

The table contains the observation as recorded on these days. Each point represents where the sun was at "High Noon" on that particular day.

DATE/ MONTH	MAXIMU M ALTITUDE (Degrees)	TIME OF MAXIMU M ALTITUDE
J 1	25	12:03
A 8	26	12:06
N 15	27	12:09
22	28	12:11
29	32	12:13
F 5	33	12:14
E 12	34	12:14
B 19	36	12:14
26	39	12:13
M 4	42	12:12
A 11	44	12:10
R 18	47	12:08
25	50	12:06
A 1	52	12:04
P 8	55	12:02
R 15	58	12:00
22	60	11:58
29	62	11:57
M 6	65	11:56
A 13	66	11:56
Y 20	68	11:56
27	69	11:57
J 3	70	11:58
U 10	71	11:59
N 17	71	12:01
E 24	71	12:02

DATE/ MONTH	MAXIMU M ALTITUDE (Degrees)	TIME OF MAXIMU M ALTITUDE
J 1	71	12:04
U 8	70	12:05
L 15	69	12:06
Y 22	68	12:06
A 5	65	12:06
U 12	63	12:05
G 19	61	12:03
26	58	12:02
S 2	56	12:00
E 9	53	11:57
P 16	51	11:55
T 23	48	11:52
O 7	43	11:48
C 14	40	11:46
T 21	37	11:45
28	36	11:44
N 4	33	11:44
O 11	31	11:44
V 18	29	11:45
25	27	11:47
D 2	26	11:50
E 9	25	11:52
C 16	25	11:56

Max Altitude

72
69
66
63
60
57
54
51
48
45
42
39
36
33
30
27
24
21
18
15
12
9
6
3
0

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
Jan	8	15	22	29	5	12	19	26	9	11	18	25																				
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May																																
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July																																
Aug																																
Sept																																
Oct																																
Nov																																
Dec																																

Date / Month

LABORATORY QUESTIONS (PART 1)

1. In degrees what was the **MAXIMUM** altitude observed? _____

What date(s) did the **MAXIMUM** occur? _____

2. In degrees what was the **MINIMUM** altitude observed? _____

What date(s) did the **MINIMUM** occur? _____

3. How does the clock time noon compare with solar time noon for the entire year?

4. How does the length of the sun's path and number of daylight hours vary with the seasons?

Summer _____

Winter _____

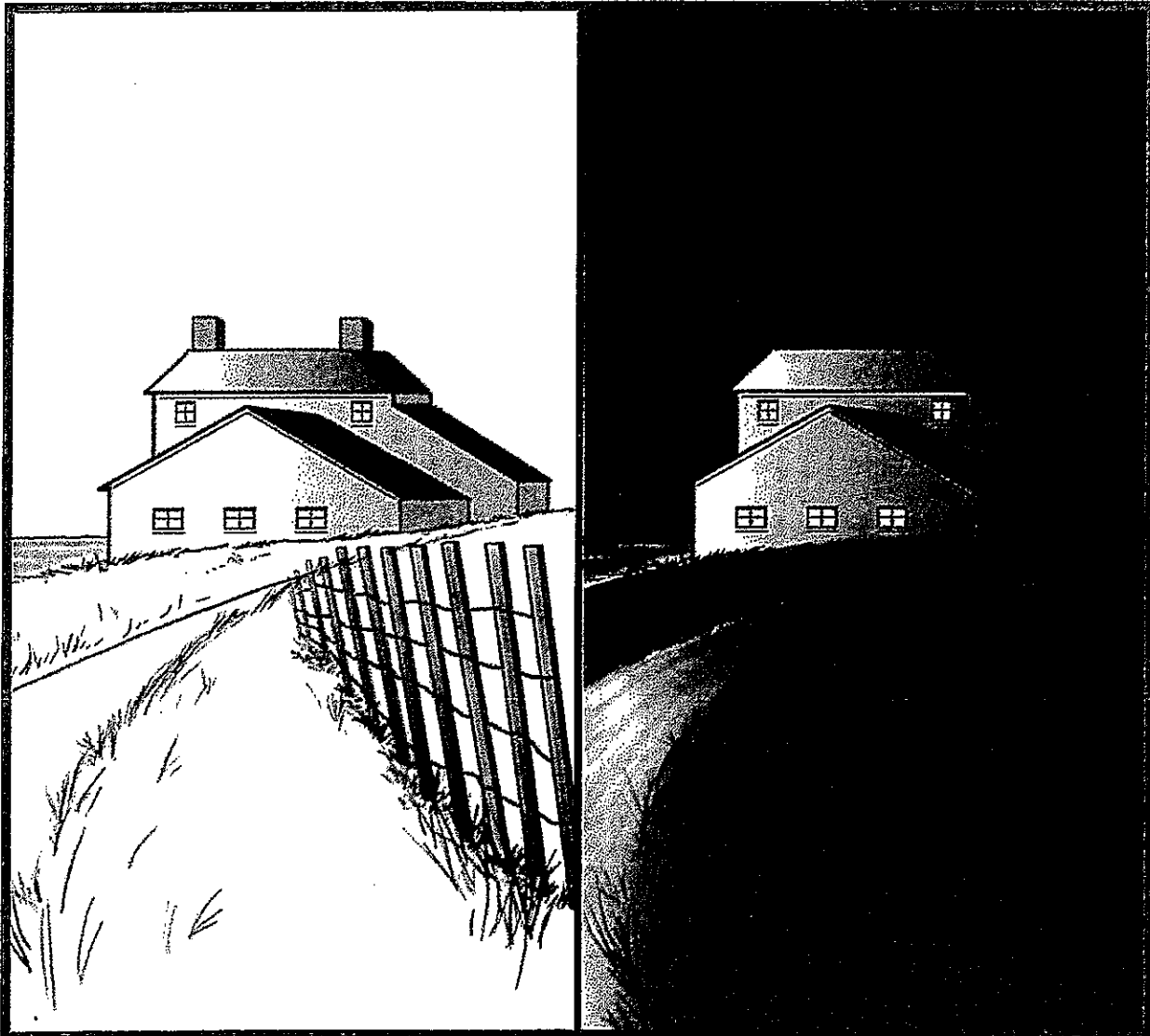
Spring/Fall _____

5. Based on data in the lab and your personal observations determine if the following statements are true or false and explain why.

"The sun is directly overhead at 12:00 Noon"

"The sun always rises due east and sets due west"

What causes day and night?



KEY TERMS

equinox: day on which the sun shines directly on the equator.

Northern Hemisphere: the part of the Earth north of the equator.

solstice: day on which the north pole points toward or away from the sun.

Southern Hemisphere: the part of the Earth south of the equator.