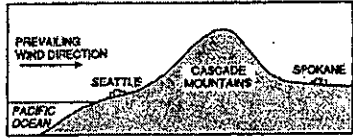


NAME: Key

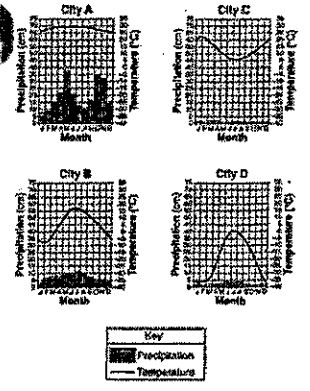
# CLIMATE AND SEASONS NOTES

## 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?

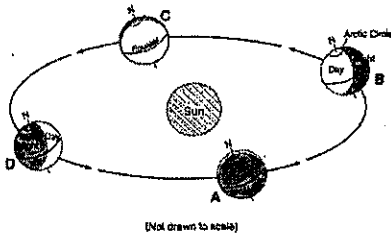
Which city has the highest temperature range?

## 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)

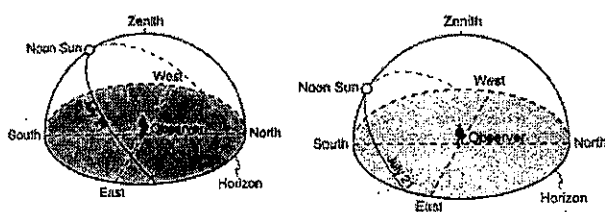
1. For the Vernal and Autumnal Equinoxes, and the Summer and Winter Solstices, you must be able to state:
  - a. The approximate noon time altitude of the sun
  - b. The date
  - c. The number of hours of daylight for the North and South Poles, the equator and New York
  - d. The point of sunrise and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

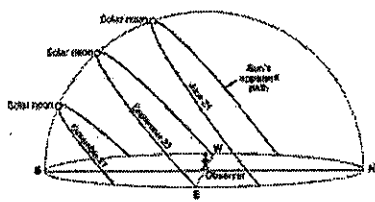


Which location would have the longest noontime shadow?

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?

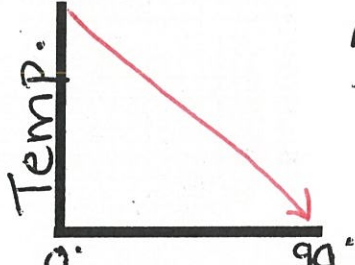
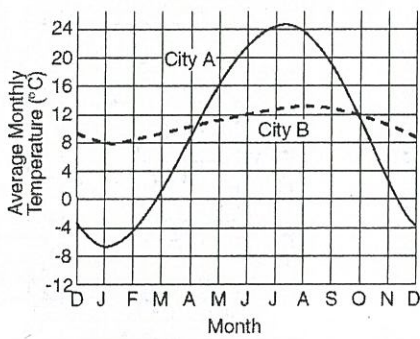
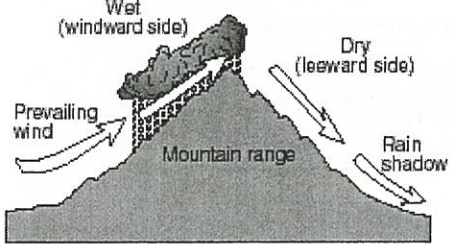

# Climate and Season Facts

- 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 (CO<sub>2</sub>), methane, and water vapor**
  14. Humans add **greenhouse gases (CO<sub>2</sub>)** to the air by / **burning fossil fuels (oil/gas)** from **cars and factories**
- Video 9.3 & 9.4
15. **Insolation means / INcoming SOLar RadiATION**
  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**

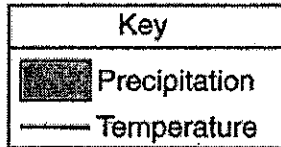
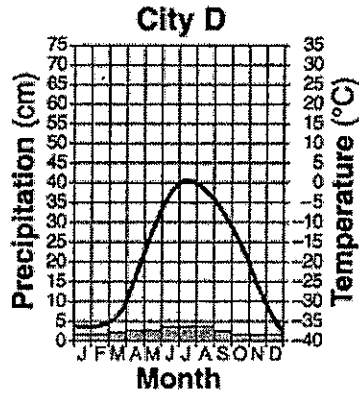
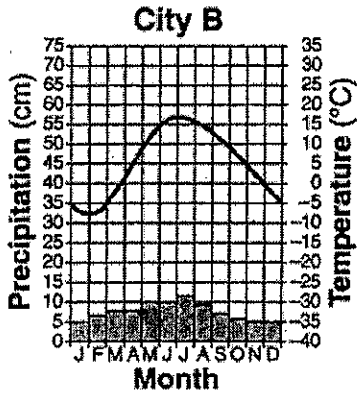
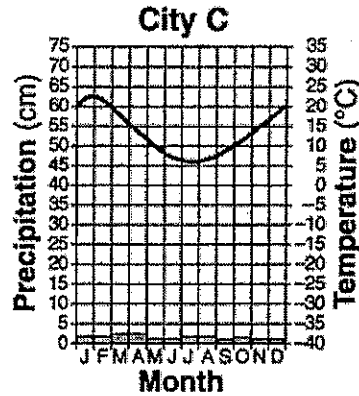
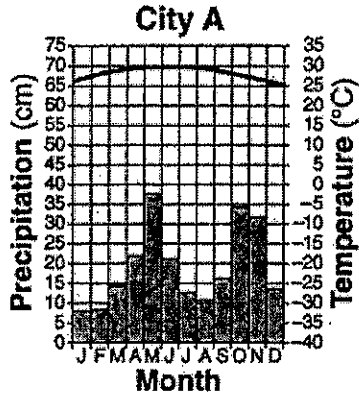
# Key Concepts & Questions



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

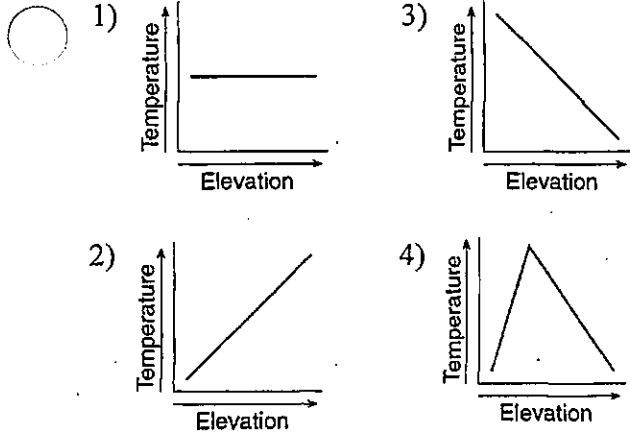
FACTOR	HOW CLIMATE IS AFFECTED
<p>① Latitude</p>	 <p>As latitude increases, the temp. <u>decreases</u>.</p> <p>Indirect</p>
<p>② Closeness to a large body of water.</p>	<p>Cities A &amp; B are located at the same latitude.</p>  <p>Water <u>Moderates</u> the temperature.</p> <p><u>Cooler</u> Summers <u>Warmer</u> Winters</p> <p>City B is closer to large body of water. The line is <u>less curved</u>. (small temp. range)</p>
<p>③ <u>mountain</u> Orographic Effect</p>	 <p>Wet (windward side) Dry (leeward side) Prevailing wind Mountain range Rain shadow</p> <p>Windward: <u>Wet, cool</u> Leeward: <u>dry, warm</u></p>
<p>④ Elevation</p>	 <p>As elevation increases, the temp. <u>Decreases</u>.</p> <p>Indirect</p>
<p>⑤ Ocean Currents</p>	<p>Warm currents = <u>warm</u> climate Cold currents = <u>cold</u> 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*.



- 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?

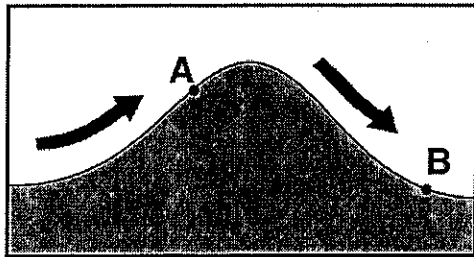


6. Which ocean current carries cool water toward Earth's equator?

- 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*.

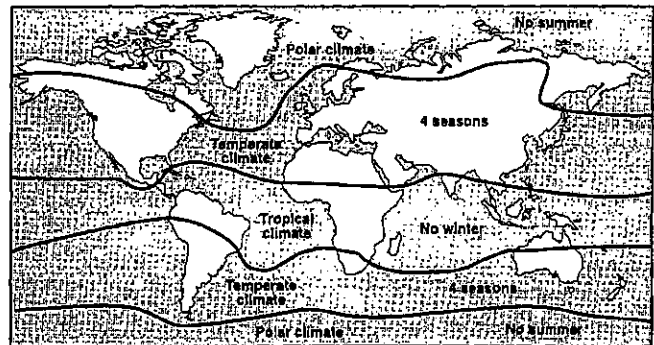
8. Which factor most likely causes two cities at the same elevation and latitude to have different yearly average temperature ranges?

- 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

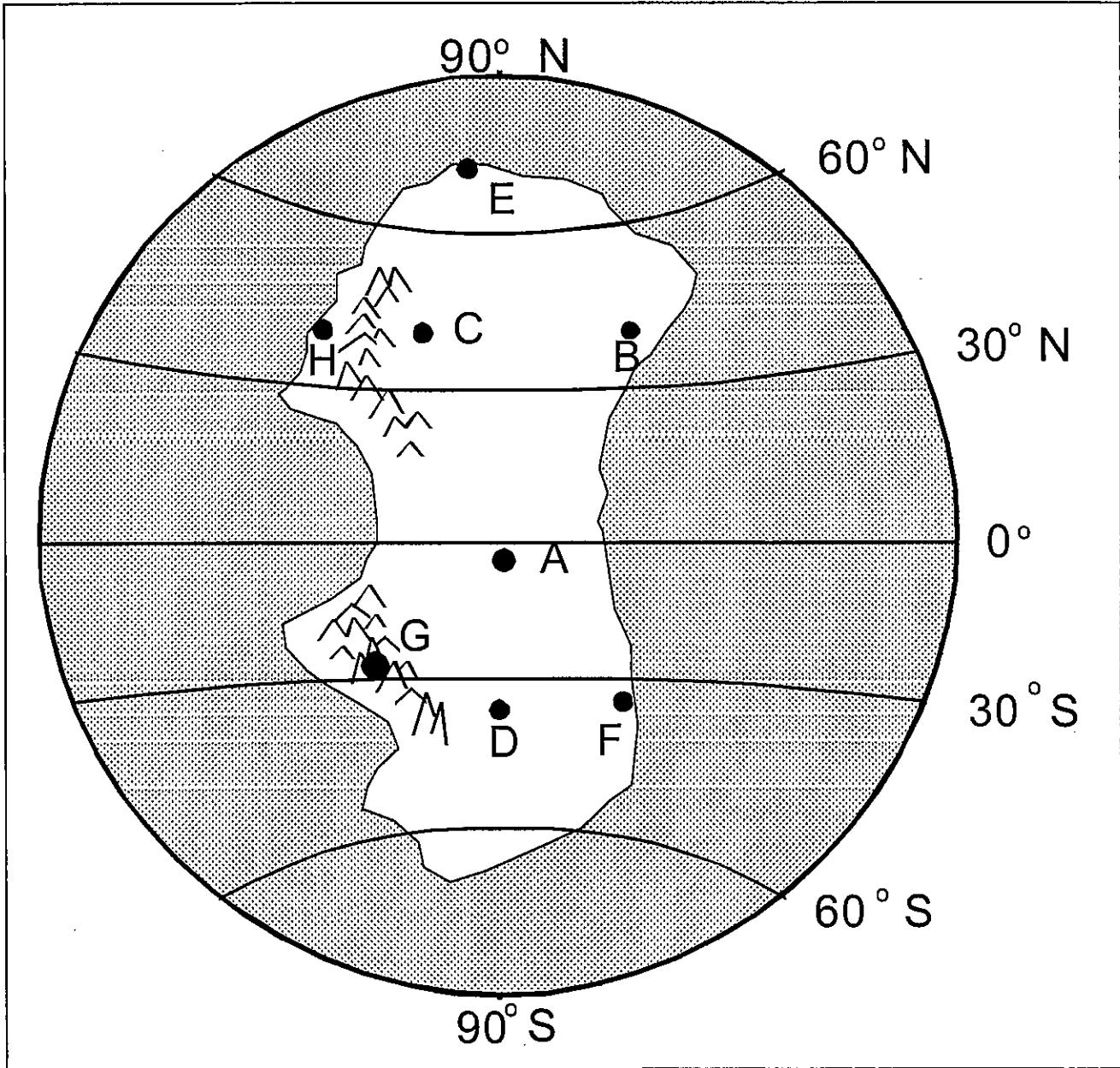
- 1) elevation
- 2) solar time
- 3) latitude
- 4) longitude

# 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.

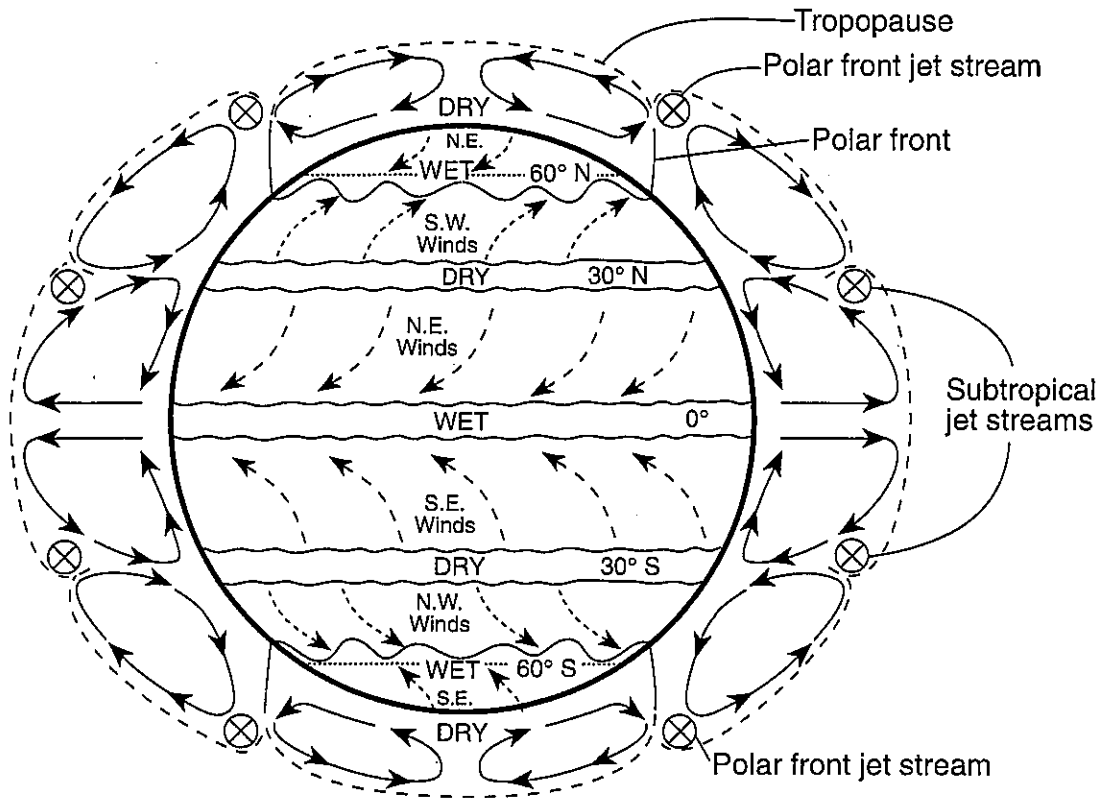
**PLANETARY WIND AND MOISTURE BELTS IN THE TROPOSPHERE**

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°	Rising	low	Wet	cloudy	conv.			
30°N and 30°S	Sink	High	Dry	clear	div.			
60°N and 60°S	Rising	low	Wet	cloudy	Conv			
90°N and 90°S	Sink	High	dry	clear	div.			

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)	NE	SW	NE	SE	NW	SE

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



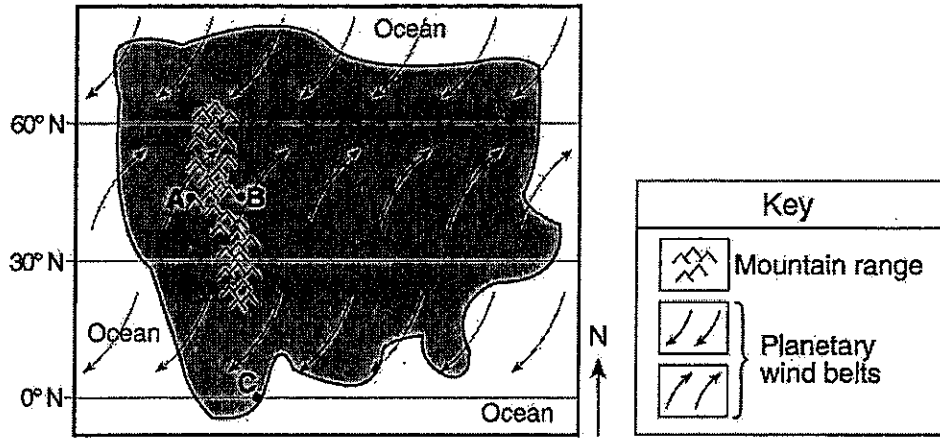
- The curving of these planetary winds is the result of
    - Earth's rotation on its axis
    - the unequal heating of Earth's atmosphere
    - the unequal heating of Earth's surface
    - Earth's gravitational pull on the Moon
  - Which wind belt has the greatest effect on the climate of New York State?
 

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

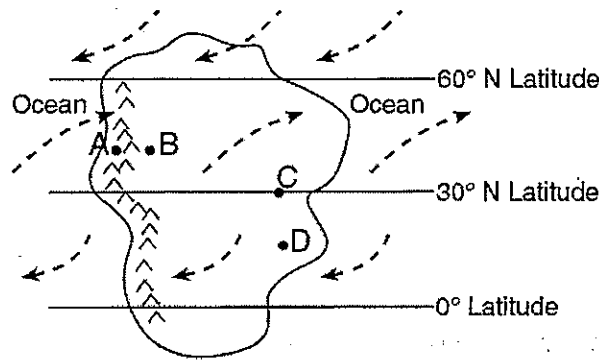
(1) cool and wet	(2) warm and wet	(3) cool and dry	(4) warm and dry
------------------	------------------	------------------	------------------
- 
- Earth's entire equatorial climate zone is generally a belt around Earth that has
    - high air pressure and wet weather
    - high air pressure and dry 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.

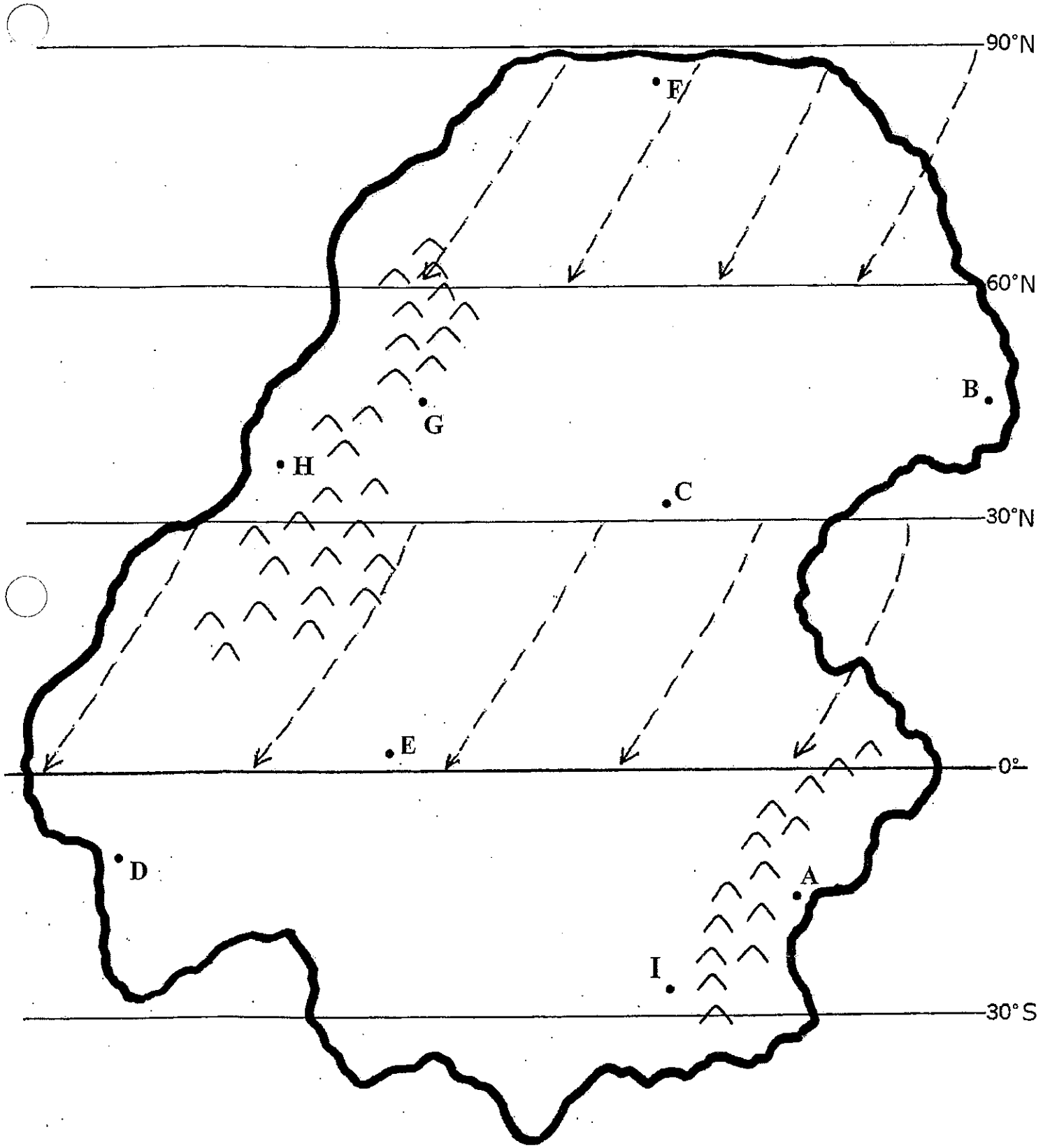
### MATERIALS

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.



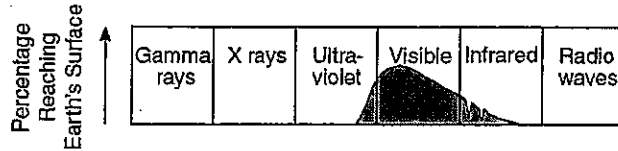
## LABORATORY QUESTIONS

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?



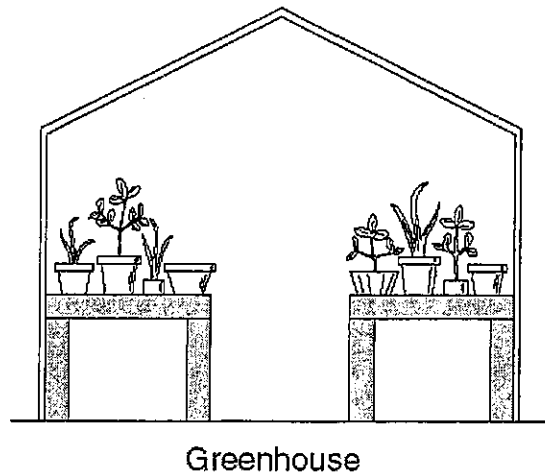
Name the primary gas which absorbs ultraviolet energy (UV) from the sun. \_\_\_\_\_

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.



## Reasons for the Seasons

Fact(s) to memorize: 15 - 25

Tilt of Earth's axis

23.5°

Different latitudes receive different intensities (direct sunlight) from the sun



Insolation

Greatest angle of insolation = most direct sunlight

Revolution around the Sun

Earth's orbit around the sun

Earth's Tilt Increases ?

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

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

## Altitude of the Noon Sun & Path through the Sky

solar noon

When the sun is highest point in the sky

The sun is NEVER directly overhead in NY

Sun is in the Southern sky in the North hemisphere

Shadow

Larger shadow when sun is lower in the sky.

What is meant by "within the tropics"?

23.5N and 23.5S

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 overhead. (23.5N + 23.5S)

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	June 21	15	24	0	North of East	North of West	High	23.5°N
Autumnal Equinox Fall	Sept 23	12			E	W	Med	0°
Winter Solstice	Dec 21	9	0	24	South of East	South of West	Low	23.5°S
Vernal Equinox	March 21	12			E	W	Med	0°

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 | 8 15 22 29 5 12 19 26 4 11 18 25 | 8 15 22 29 6 13 20 27 1 8 15 22 29 5 12 19 26 2 9 16 23 30 6 13 20 27 4 11 18 25 2 9 16  
 Jan Feb Mar Apr May June 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.

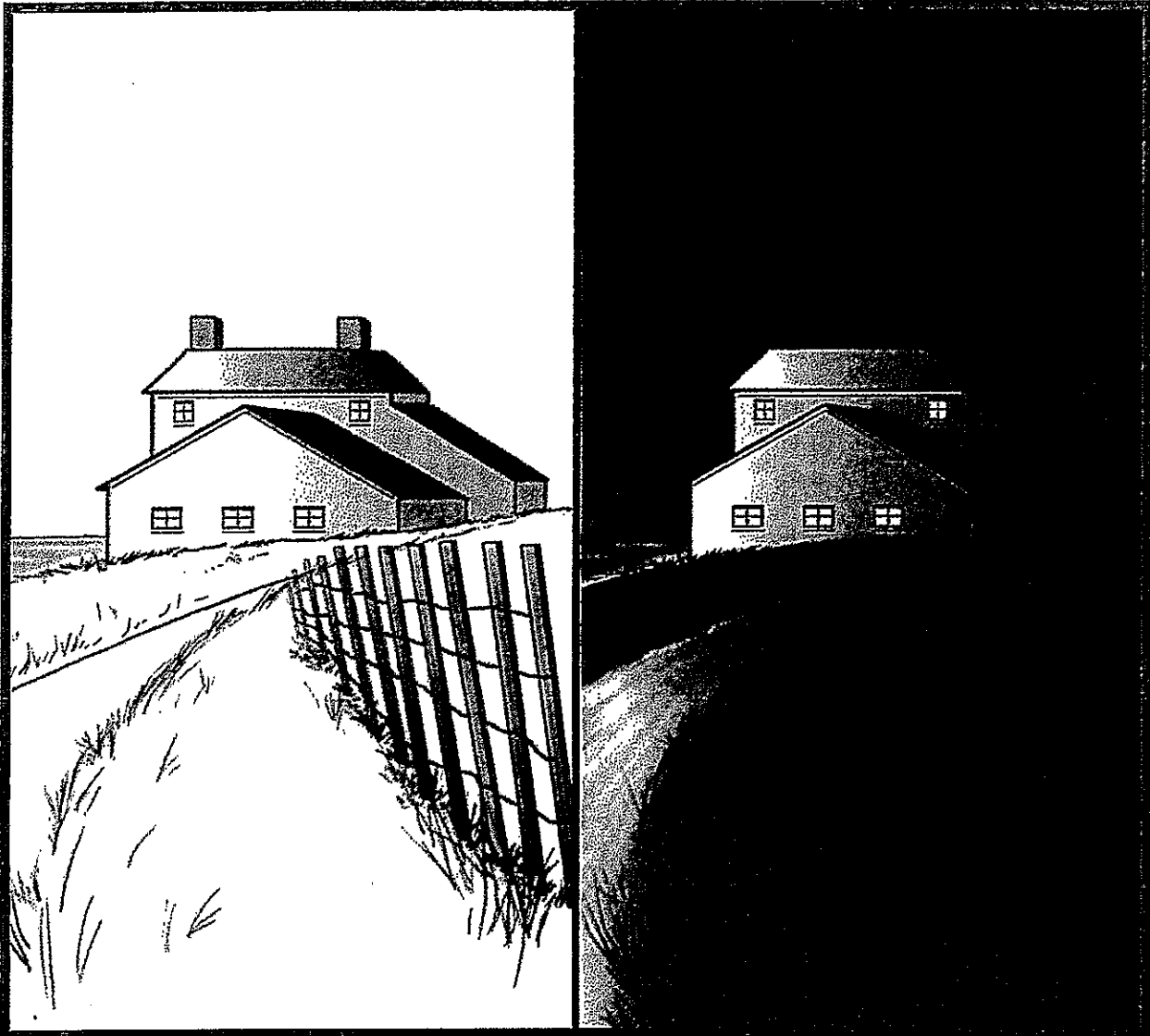
"The sun is directly overhead at 12:00 Noon"

\_\_\_\_\_

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

\_\_\_\_\_

## What causes day and night?



### KEY TERMS

**Equinox** day on which the sun stands directly on the equator.

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

**Solstice** day on which the sun is at its farthest from or away from the sun.

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

# LESSON

# 11

## What causes day and night?

Usually when you go to sleep, it is dark. You wake up the next morning, and it is light. Several hours will pass, and day will change to night again.

What causes day and night? The changes of day and night are caused by the Earth's rotation.

As the Earth rotates, only one half faces the sun at any given time. The half that is facing the sun has day. The opposite side (the side that is facing away from the sun) has night.

As the Earth rotates, new parts face the sun. Places that have night slowly turn to day. One complete rotation of the Earth takes 24 hours. In most places, therefore, one change from night to day and then back to night again takes 24 hours.

How many of these 24 hours are night? How many are day? It depends upon two things: the time of year, and how far from the equator a place is.

If the Earth's axis were vertical (straight up and down), all parts of the Earth would have 12 hours of day and 12 hours of night all year-round. But, the Earth's axis is not vertical. The Earth's axis is tilted  $23\frac{1}{2}$  degrees.

As the Earth moves around the sun, the tilt of the Earth does not change. The Earth just changes its position compared to the sun. Sometimes the Earth is tilted so that the northern portion of the Earth is facing the sun. This makes the days longer than nights in the Northern Hemisphere.

When the Earth moves to the other side of the sun, the southern portion of the Earth is facing the sun. Now the days are longer than nights in the Southern Hemisphere.

How far north and south of the equator a place is also affects how long day and night will be. The farther north or south of the equator a place is, the greater the difference in length there is between day and night.

## UNDERSTANDING DAY AND NIGHT

Study Figure A. Then answer the questions or fill in the blanks.

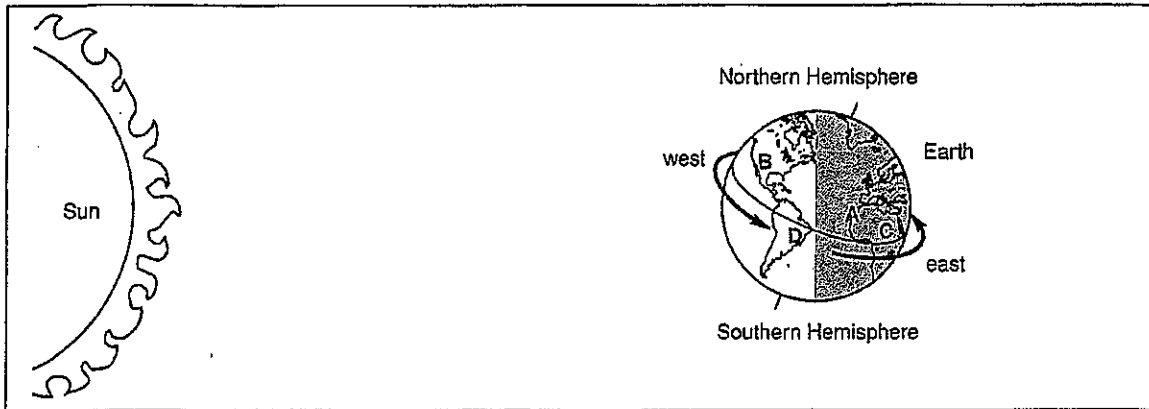


Figure A

1. The Earth turns on its axis. Another way of saying this is the Earth \_\_\_\_\_ on its axis.  
revolves, rotates
2. How many hours does one rotation of Earth take? \_\_\_\_\_
3. At any given time,
  - a) how much of the Earth is facing the sun? \_\_\_\_\_
  - b) how much of the Earth is facing away from the sun? \_\_\_\_\_
4. The part of the Earth facing the sun has \_\_\_\_\_.  
night, day
5. The part of the Earth facing away from the sun has \_\_\_\_\_.  
night, day
6. The Earth rotates from \_\_\_\_\_.  
east to west, west to east

A, B, C, and D are places on the Earth.

7. a) Which of these places are having day? \_\_\_\_\_
- b) Which of these places are having night? \_\_\_\_\_
8. Of the places that are having day, which one will move into night first? \_\_\_\_\_
9. Of the places that are having night, which one will move into day first? \_\_\_\_\_
10. a) Which places are in the Northern Hemisphere? \_\_\_\_\_
- b) Which place is in the Southern Hemisphere? \_\_\_\_\_

# THE LONG AND SHORT OF IT

Study Figure B. Answer the questions or fill in the blanks.

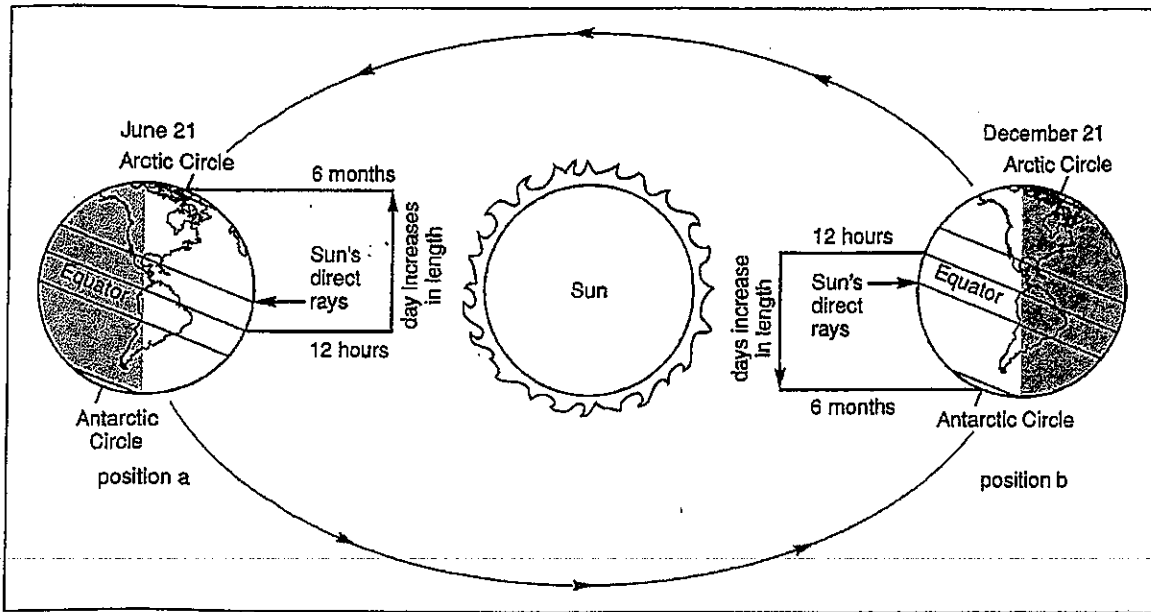


Figure B

Position a shows the Earth on June 21.

Position b shows the Earth six months later on December 21. It has now come halfway along its revolution around the sun.

1. Look at the Earth's axis on both dates. Has the angle of its tilt compared to the sun changed? \_\_\_\_\_
2. Has the direction of the tilt compared to the sun changed? \_\_\_\_\_

## JUNE 21

On June 21, the North Pole points directly toward the sun. This day in the Northern Hemisphere is the summer solstice [SOHL-stis]. On this day the north pole has 24 hours of sunlight.

1. On June 21, the \_\_\_\_\_ Hemisphere tilts toward the sun.  
Northern, Southern
2. On June 21, the \_\_\_\_\_ Hemisphere tilts away from the sun.  
Northern, Southern
3. On June 21, the \_\_\_\_\_ Hemisphere has more hours of sunlight.  
Northern, Southern
4. On June 21, the \_\_\_\_\_ Hemisphere has fewer hours of sunlight.  
Northern, Southern

5. On June 21, days are longer in the \_\_\_\_\_ Hemisphere.  
Northern, Southern
6. If days in the Northern Hemisphere are longer, then days in the Southern Hemisphere are \_\_\_\_\_.  
longer, shorter
7. On June 21, the \_\_\_\_\_ has 12 hours of day and 12 hours of night.  
equator, Arctic circle, Antarctic circle
8. As you move farther north, the days become \_\_\_\_\_.  
longer, shorter
9. On June 21, there are \_\_\_\_\_ hours of daylight in the Arctic Circle.  
zero, 12, 24
10. When it is day at the Arctic Circle, it is \_\_\_\_\_ at the Antarctic Circle.

## DECEMBER 21

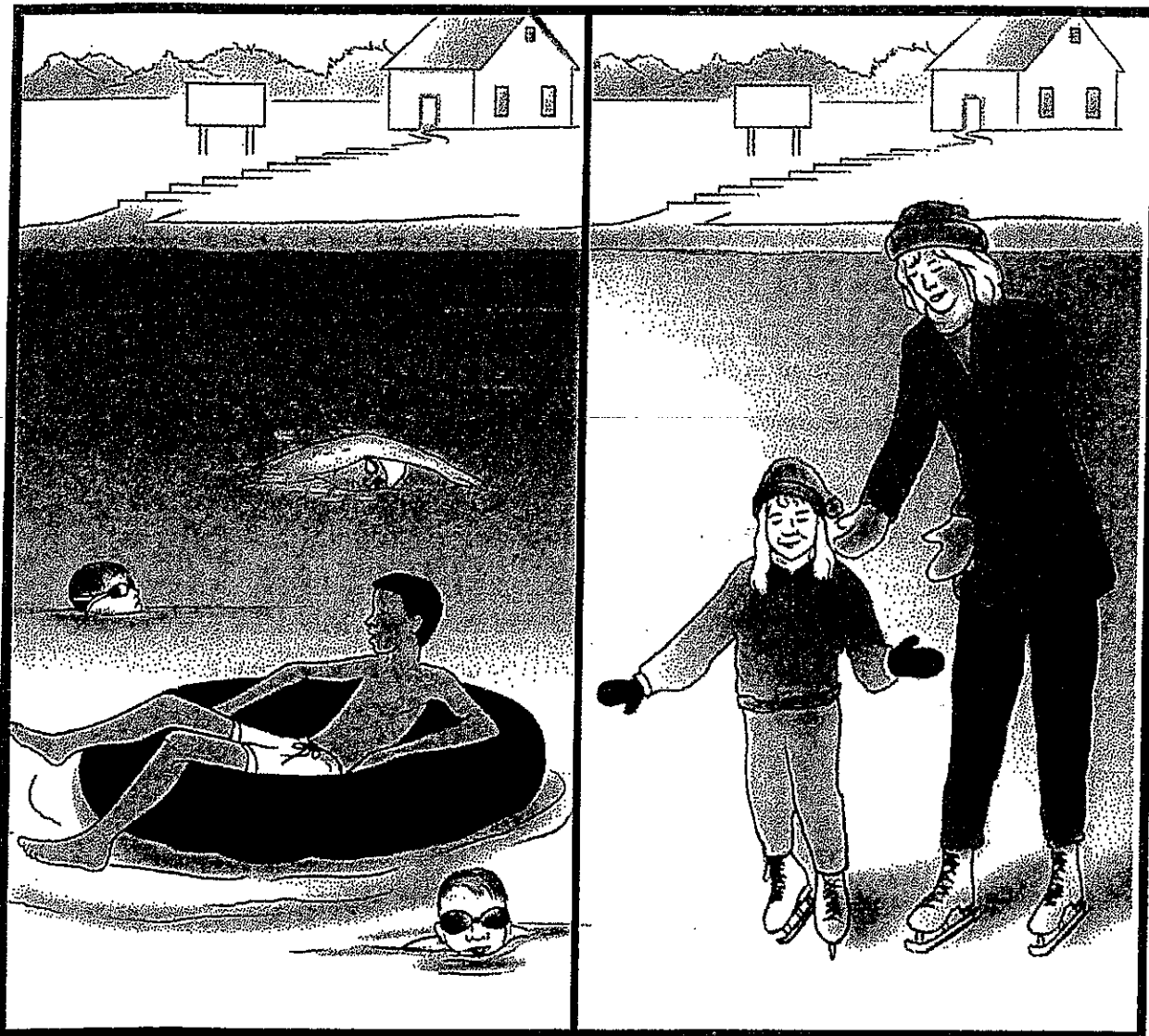
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On December 21, the North Pole points away from the sun. This day in the Northern Hemisphere is the winter solstice. On this day, the North Pole has 24 hours of darkness.

1. On December 21, the \_\_\_\_\_ Hemisphere leans toward the sun.  
Northern, Southern
2. On December 21, the \_\_\_\_\_ Hemisphere leans away from the sun.  
Northern, Southern
3. On December 21, the \_\_\_\_\_ Hemisphere has more hours of sunlight.  
Northern, Southern
4. On December 21, the \_\_\_\_\_ Hemisphere has fewer hours of sunlight.  
Northern, Southern
5. On December 21, days are longer in the \_\_\_\_\_ Hemisphere.  
Northern, Southern
6. If days in the Southern Hemisphere are longer, then days in the Northern Hemisphere are \_\_\_\_\_.  
longer, shorter
7. On December 21, the \_\_\_\_\_ has 12 hours of day and 12 hours of night.  
equator, Arctic circle, Antarctic circle
8. The length of day and night \_\_\_\_\_ seem to change at the equator.  
does, does not
9. On December 21, there are \_\_\_\_\_ hours of daylight in the Antarctic Circle.  
zero, 12, 24
10. When it is day at the Antarctic Circle it is \_\_\_\_\_ at the Arctic Circle.  
day, night



# What causes the change of seasons?



### KEY TERMS

Climate is the average weather conditions in a certain area over a long period of time.  
Temperature is the degree of hotness or coldness of an object or environment.

# LESSON

## 14

# What causes the change of seasons?

Are you ready for a vacation? Will you go swimming or will you go ice-skating? Of course, it all depends on the season.

Most people live in places that have four seasons—spring, summer, autumn, and winter.

The four seasons are marked by differences in temperature and in the lengths of day and night.

Summer, for example, is much warmer than winter. And summer days are longer than winter days.

What causes seasons? Seasons are caused by the Earth's revolution around the sun and the unchanging tilt of the Earth's axis.

You have already learned how the Earth's axis causes differences in the lengths of day and night. The axis also causes differences in temperature.

Part of the year, the axis leans towards the sun. Part of the year, the axis leans away from the sun.

For example, June 21 is the first day of summer in the Northern Hemisphere. On that day, the Northern Hemisphere leans toward the sun the most. The sun's rays strike head-on or nearly head-on over a large part of this hemisphere.

Direct rays are rays that are head on. Direct rays are strong rays. They do not spread over a large area. Direct rays heat up the Earth the most.

December 21 is the first day of winter in the Northern Hemisphere. On that day, the Northern Hemisphere leans away from the sun the most. The sun's rays do not strike head-on. They spread over a large area.

Rays that spread out are called indirect rays. Indirect rays are weak rays. They heat up the Earth the least.

## UNDERSTANDING THE CHANGING SEASONS

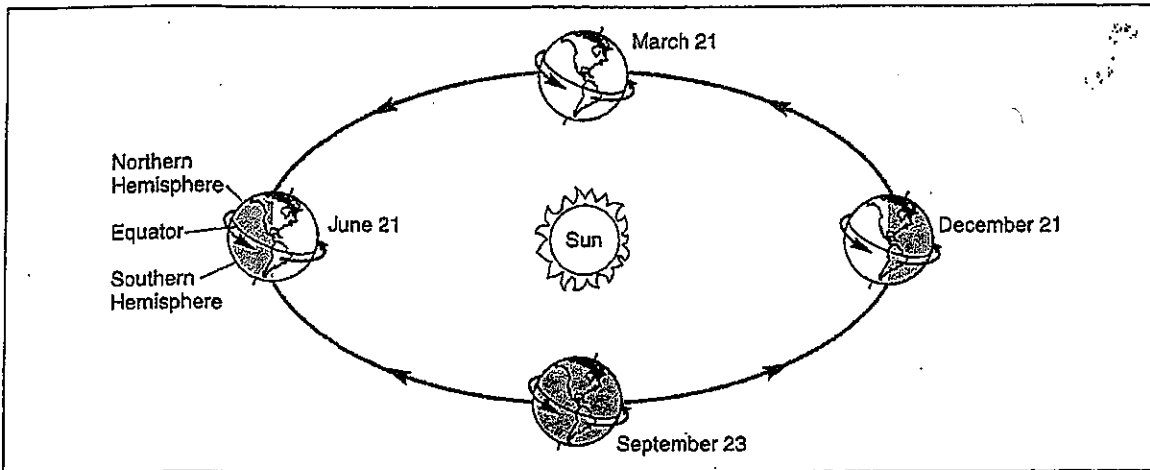


Figure B

**TAKE A TRIP.** Follow the Earth for one revolution around the sun. Study Figure B. Then fill in the blanks.

1. The Earth revolves around the sun in a \_\_\_\_\_ direction.  
clockwise, counterclockwise
2. As the Earth revolves around the sun, the Earth's axis \_\_\_\_\_ change.  
does, does not
3. On June 21, the Northern Hemisphere . . .
  - a) faces \_\_\_\_\_ the sun.  
toward, away from
  - b) has mainly \_\_\_\_\_ weather.  
cold, warm
  - c) has \_\_\_\_\_ hours of daylight than the Southern Hemisphere.  
more, fewer
  - d) receives \_\_\_\_\_ rays. These are \_\_\_\_\_ rays.  
direct, slanting                      strong, weak
  - e) has the first day of \_\_\_\_\_.  
summer, fall, winter, spring
4. Between June 21 and September 22, . . .
  - a) the Northern Hemisphere still leans toward the sun, but every day the lean becomes \_\_\_\_\_.  
greater, less
  - b) the rays become \_\_\_\_\_ direct and spread out \_\_\_\_\_.  
more, less                      more, less
  - c) the days become \_\_\_\_\_ and the nights become \_\_\_\_\_.  
longer, shorter                      longer, shorter

5. On September 23 . . .

- a) the Earth's axis is tilted \_\_\_\_\_ the sun.  
toward, away from, neither toward nor away from
- b) the sun's rays are \_\_\_\_\_ .  
direct, indirect, neither direct nor indirect
- c) \_\_\_\_\_ starts in the Northern Hemisphere.  
summer, fall, winter, spring
- d) every place on Earth has \_\_\_\_\_ hours of day and  
\_\_\_\_\_ hours of night.

6. Between September 23 and December 20 . . .

- a) the Northern Hemisphere starts to lean \_\_\_\_\_ the sun.  
toward, away from
- b) the sun's rays become more \_\_\_\_\_ . These rays are  
\_\_\_\_\_ .  
stronger, weaker
- c) days become \_\_\_\_\_ and nights become \_\_\_\_\_ .  
longer, shorter

7. On December 21 the Northern Hemisphere . . .

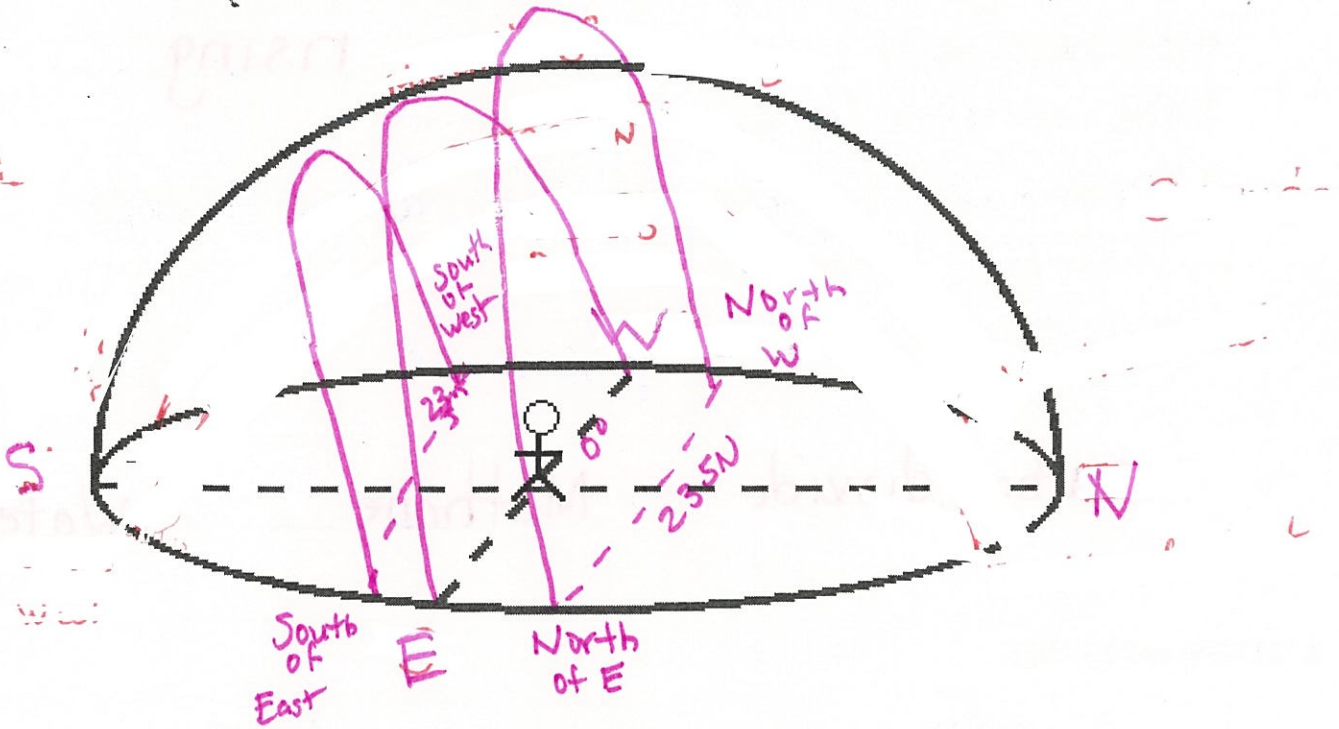
- a) faces \_\_\_\_\_ the sun.  
toward, away from
- b) has mainly \_\_\_\_\_ weather.  
cold, warm
- c) has \_\_\_\_\_ hours of daylight than the Southern Hemisphere.  
more, fewer
- d) receives \_\_\_\_\_ rays. These are \_\_\_\_\_ rays.  
direct, indirect
- e) has the first day of \_\_\_\_\_ .  
summer, fall, winter, spring

8. Between December 21 and March 20 . . .

- a) the Northern Hemisphere leans away from the sun, but every day the lean  
becomes \_\_\_\_\_ .  
more, less
- b) the rays become \_\_\_\_\_ slanting.  
more, less
- c) the days become \_\_\_\_\_ and the nights become \_\_\_\_\_ .  
longer, shorter

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

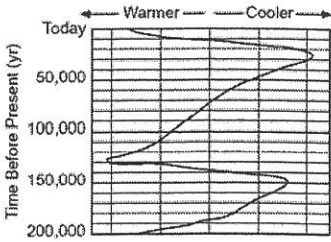


Climate and Seasons

# Global Climate Change



## 1. Ice Ages



Ice ages are Cyclical.  
The exact trigger is unknown.

## 2. Global Warming

- Average global temp. are \_\_\_\_\_.
- Glaciers melt = ocean levels are rising.
- The warming is natural.
- Humans are speeding up the process through increased levels of CO<sub>2</sub>.

• The 3 green house gasses are:

- 1) Carbon dioxide
- 2) Methane
- 3) Water Vapor

## 3. El Niño and La Niña

El Niño

La Niña

NAME: \_\_\_\_\_ PERIOD: \_\_\_\_\_ DATE: \_\_\_\_\_

LAB PARTNERS: \_\_\_\_\_ LAB #38

## GLOBAL WARMING

### INTRODUCTION

The greenhouse effect is the normal process that keeps the earth warm. Without it the earth would be frozen, unable to support life. In recent years scientists have expressed fears that we may be altering the greenhouse effect so that more heat is trapped by our atmosphere each year, resulting in a slow increase in the earth's overall temperature. The purpose of this investigation is to analyze various types of data in order to make inferences as to whether global warming is actually taking place.

OBJECTIVES The purpose of this investigation is for you to make inferences about whether or not global warming is occurring, by analyzing several different types of data.

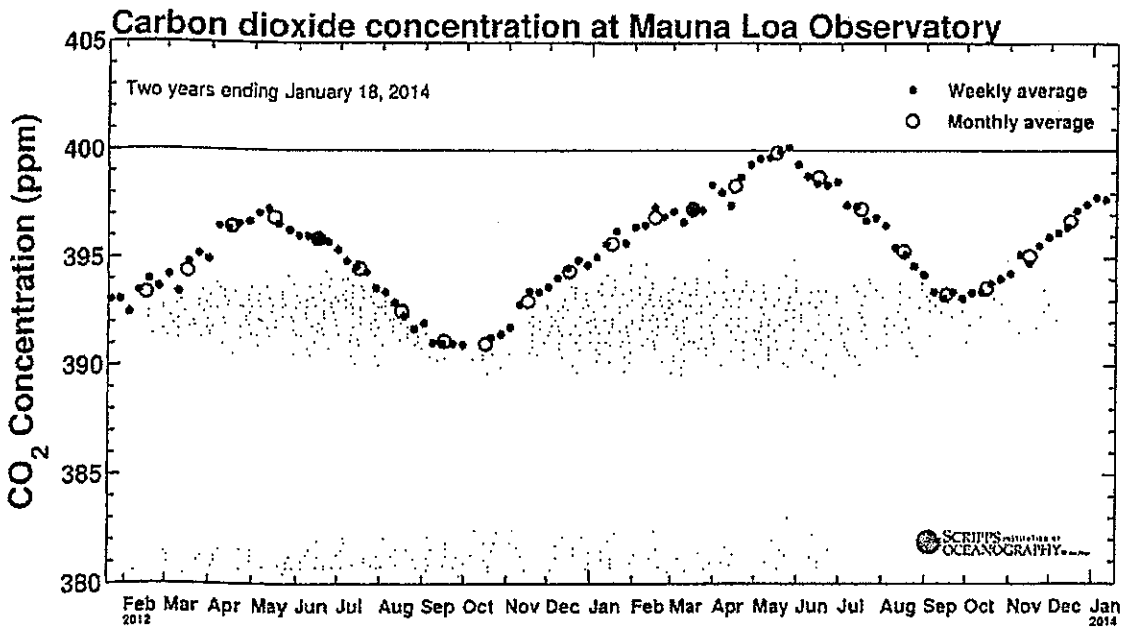
APPROXIMATE TIME 1-2 periods

### PART I CARBON DIOXIDE LEVELS

The graph below shows the average concentration of carbon dioxide in the atmosphere in parts per million (ppm) by months over a four year period.

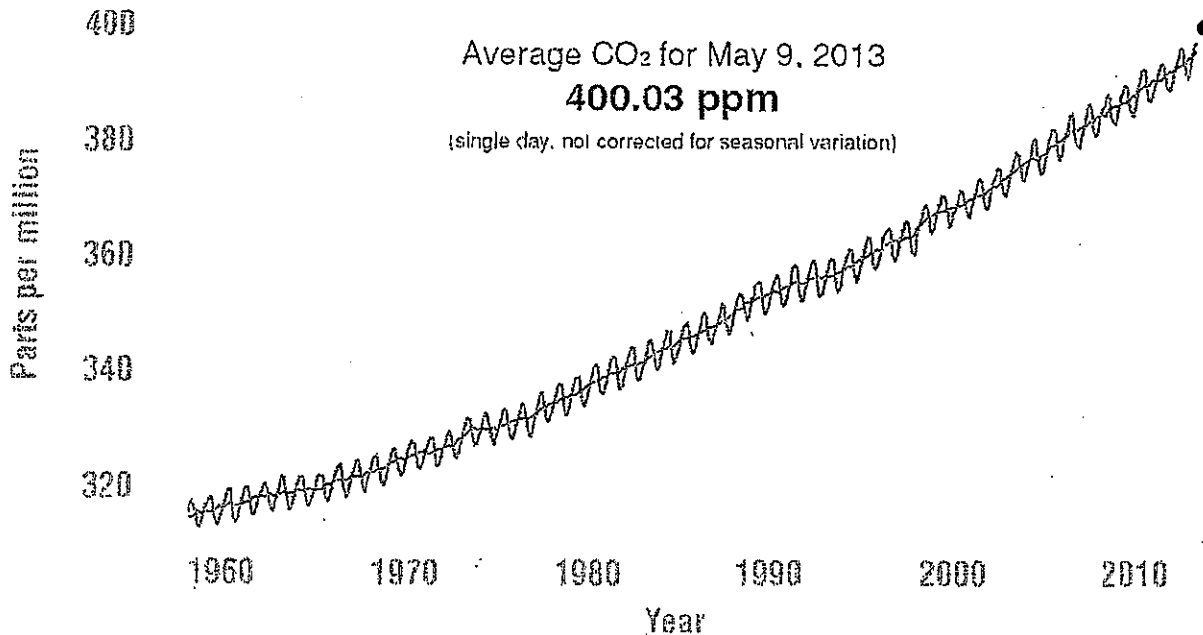
Examine the graph and answer questions 1-7.

The graph shows the pattern of change in carbon dioxide concentration over two years:



The graph below shows the average carbon dioxide concentration over 50 year period of time:

## Carbon Dioxide Concentration

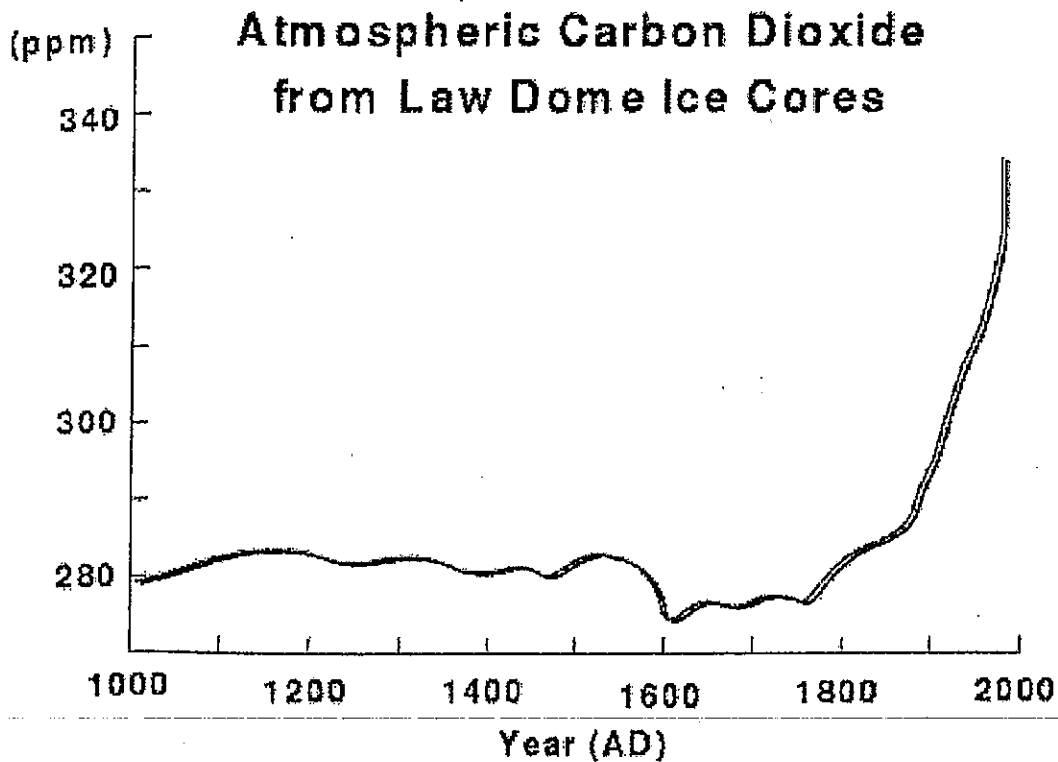


Credit: NOAA/Science Institution of Oceanography

Answer the following questions based on the graph above.

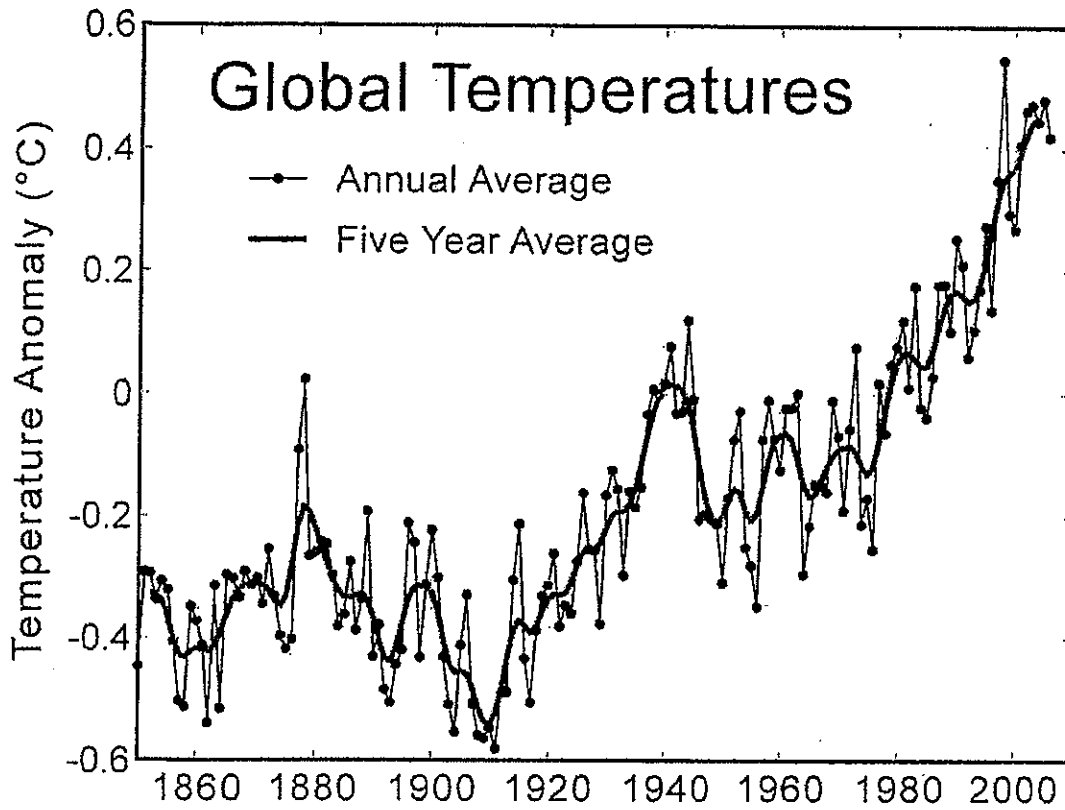
- This graph clearly shows the seasonal variation that you saw in the previous graph. What long term trend about atmospheric carbon dioxide concentration is shown by this graph?
- What do you think is responsible for this?





One of the problems with making inferences about global warming is deciding if changes we see are caused by humans or are just part of natural variations. The graph above shows atmospheric carbon dioxide levels over a much longer period.

10. Have atmospheric carbon dioxide levels been increasing steadily over the past 1000 years? How can you tell?
  
11. What events in human history in the late 1800's and early 1900's are responsible for the dramatic change in carbon dioxide concentrations?



12. If atmospheric carbon dioxide levels are increasing, then what should be happening to global temperatures?

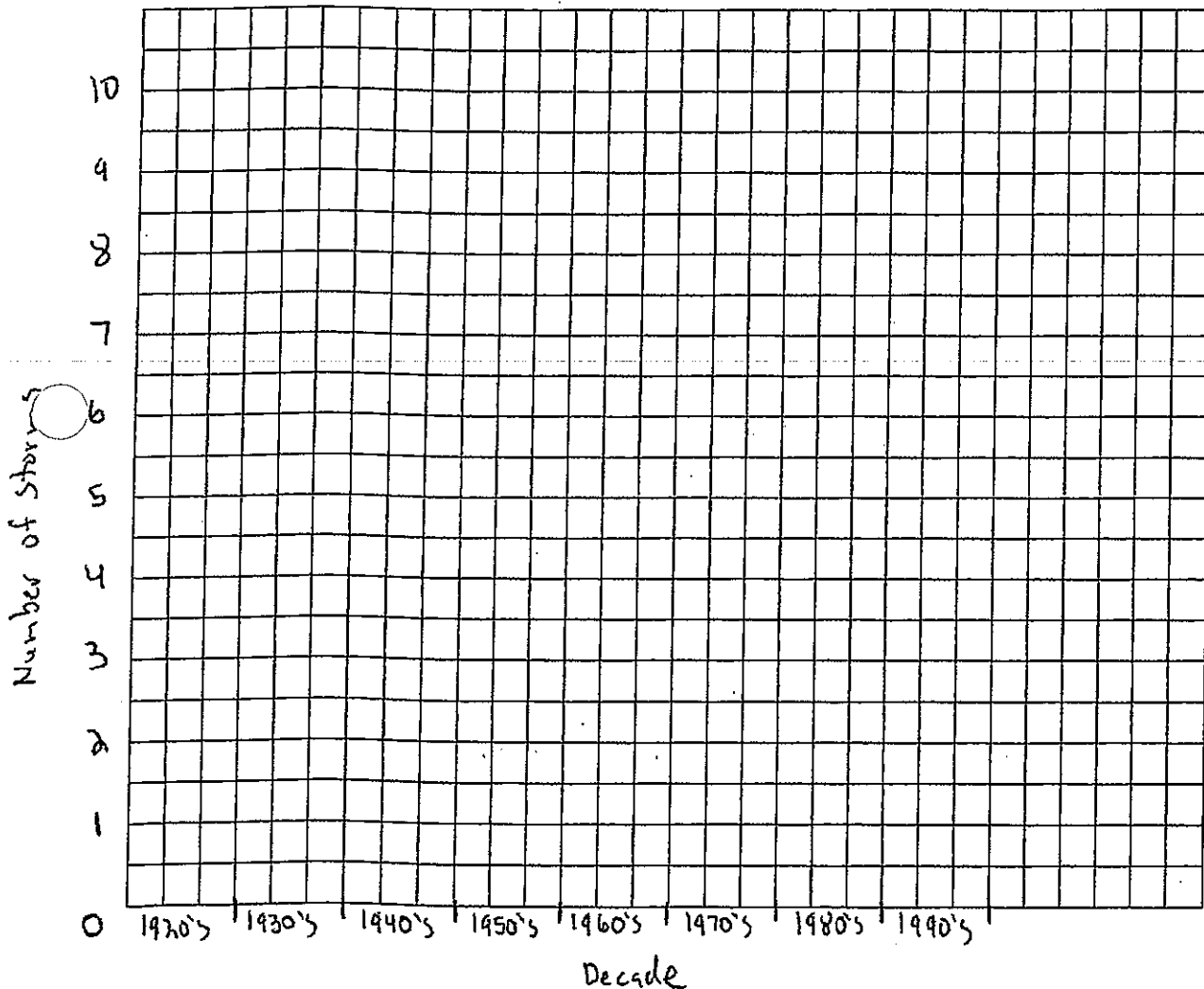
13. Explain in detail how carbon dioxide levels can affect global temperatures.

14. Does the graph above support your answer to question 12?

DECADE	NUMBER OF STORMS
1920's	5
1930's	8
1940's	8
1950's	9
1960's	6
1970's	4
1980's	4
1990's	3

Count the number of storms in each decade, plot the data below.

Graph the data above on the graph below. (Construct a bar graph)



- Based on your graph, have the number of intense hurricanes been increasing?

