

Name: \_\_\_\_\_ Date: \_\_\_\_\_

# UNIT TWO

## Climate factors and impacts

\*Dedicated to \_\_\_\_\_

**ABSTRACT AND RATIONALE**

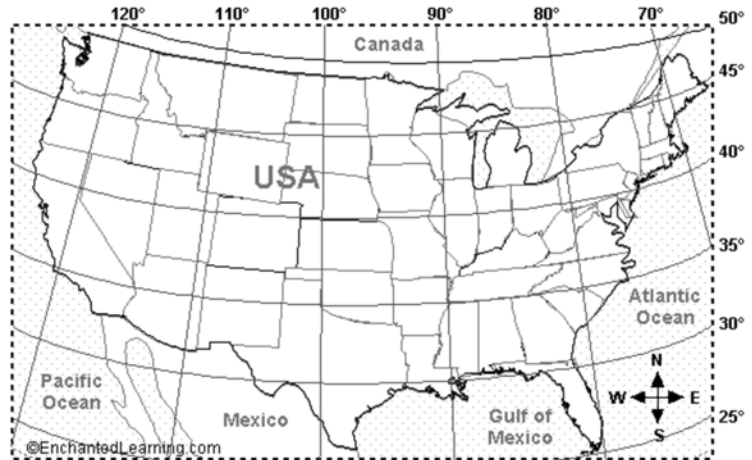
Earth’s climate is always changing. Climatic variability, including changes in the frequency of extreme events (like droughts, floods and storms), has always had a large impact on humans. A particularly severe drought can cost US citizens billions of dollars. For this reason, scientists study past climatic variability on various time scales to gain clues that will help society plan for future climate change. The study of past climate change also helps us understand how humans influence the Earth's climate system. The climatic record over the last thousand years clearly shows that global temperatures increased significantly in the 20th Century

**TASK STATEMENT/PROBLEM BASED LEARNING/REAL WORLD PROBLEM:**

At the end of this unit, you will be given a lab practicum. There are three objectives of the practicum. 1) To calculate and graph the data between two climatic regions. 2) To compare the climate difference between the two places. 3) to analyze and state the major climate factors.

What are some major climatic factors?


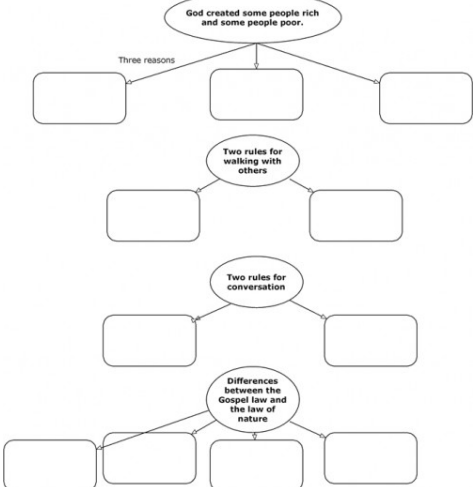
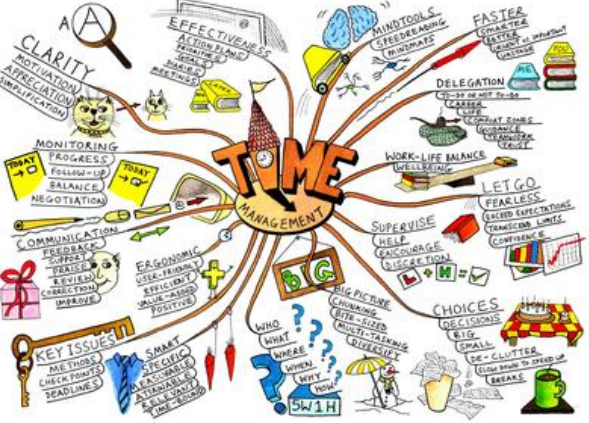
Option#1:	Location: Auburn, Maine
Option#2:	Location: Seattle, Washington
Option#3:	Location: Spokane, Washington
Option#4:	Location: Homestead, Florida
Option#5	Location: Lincoln, Nebraska



**HOMWORK READING**

Read page 474-475 in the textbook and take notes. Do this on a separate sheet of paper and be ready to hand it in during the beginning of the period.

Below are few examples of the note taking strategies. Pick one you like and use the style for your note

<p><b>List</b></p> 	<p><b>Graphic Organizer</b></p> 
<p><b>Summary</b></p> <p><b>Invasive Species:</b></p> <ul style="list-style-type: none"> <li>Non-native</li> <li>Alien</li> <li>Exotic</li> <li>Non-indigenous</li> <li>Introduced</li> </ul> <p>Other names</p> <ul style="list-style-type: none"> <li>Eat and compete with natives</li> <li>Breed with natives</li> <li>Introduce new parasites</li> <li>Disrupt available nutrients</li> </ul> <p>How they invade</p> <ul style="list-style-type: none"> <li>Control of chemically</li> <li>Mechanically</li> <li>Biologically</li> <li>Ecologically</li> </ul> <p>How to control them</p> <ul style="list-style-type: none"> <li>Pet Trade</li> <li>Garden seed trade</li> <li>To overcome another species problem</li> <li>Flooding</li> <li>Migrating wildlife</li> <li>Human mobility</li> <li>Global trade</li> </ul> <p>How they get relocated. Split into accidental and purposeful</p>	<p><b>Pictorial</b></p> 

*Anticipation Guideline (Climate)*

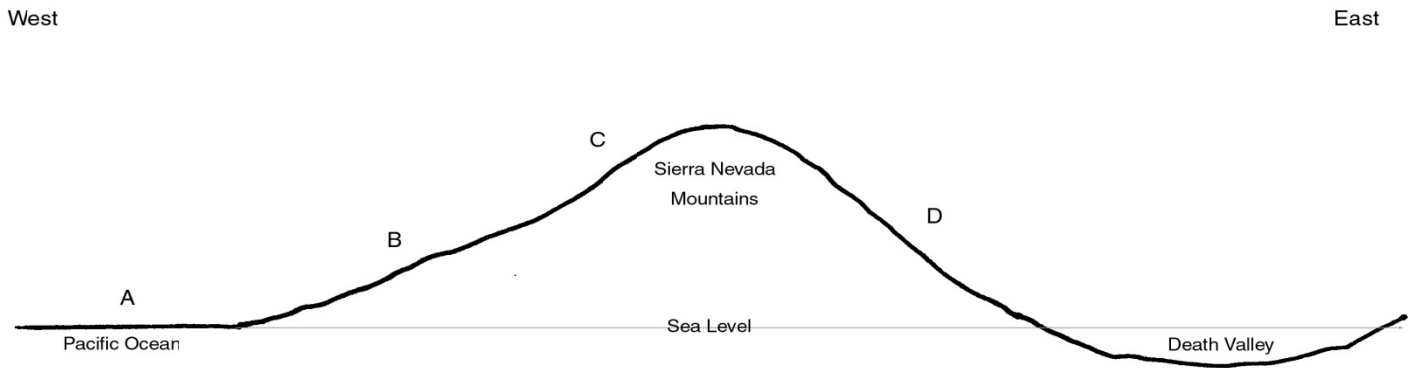
Read page#466-470 in your Earth Science Textbook. Base on the reading; **decide** whether or not each statement below is true (yes) or False (no). If the statement is no, please **indicate** the page# and line# where the correct answer is located in the text. In addition, be sure to **correct** the wrong word in the statement with the correct vocabulary. You may only fill out yes or no on one side of the table. The other side of the table will be done by you after hurricane topics.

Yes	No	Statements	Yes	No	Page# Line#
		Climate is a short term weather pattern			
		Latitude is the same meaning as elevation			
		Climate is described by temperature and precipitation			
		Higher the latitude, cooler the climate			
		Higher the elevation, warmer the climate			
		Coastal areas often have extreme climate			
		Topography/Mountains affect climate			
		Greenland is an example of a polar climate			
		Dry climate occur in regions that lose more gain more water to evaporation than they receive			

**CLIMATE NOTES**

The following notes are regional climate factors that could dictate the annual temperature and precipitation of a place.

**Mountain/Orographic/Rainshadow Effect**



Windward Side of the mountain

Leeward Side of the mountain

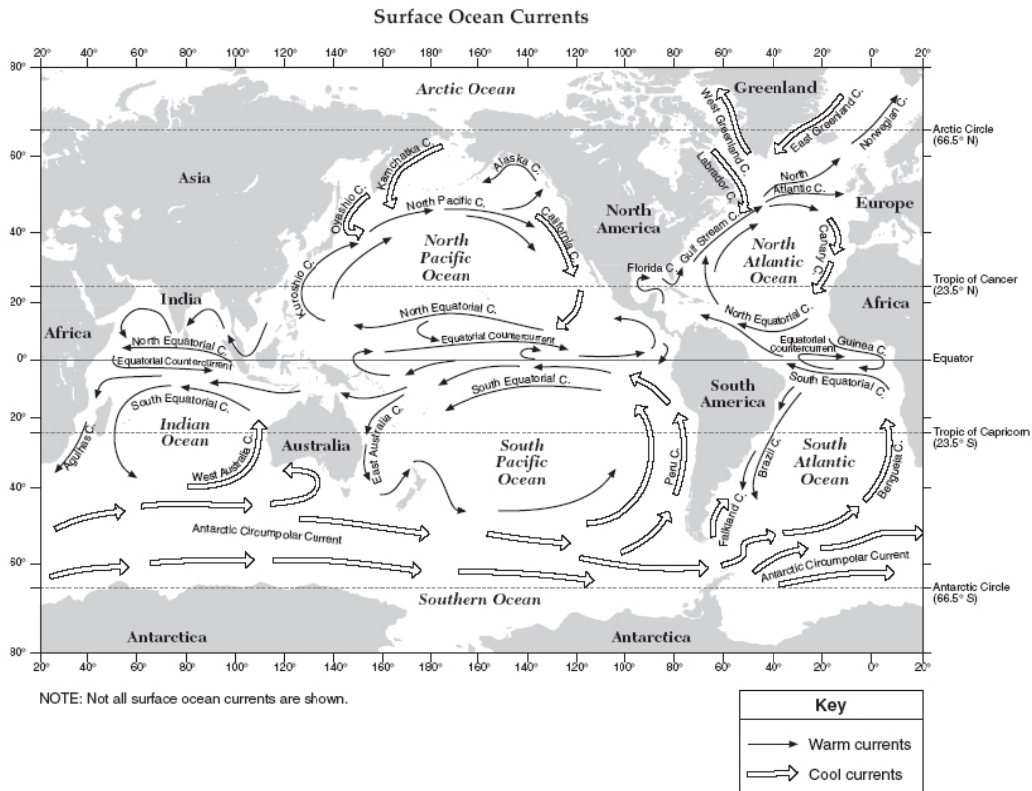
Elevation Effect

<b>Language Representation</b>	<b>Graphic Representation</b>

Water/Coastal Effect

Language Representation	Graphical Representation

Ocean current Effect

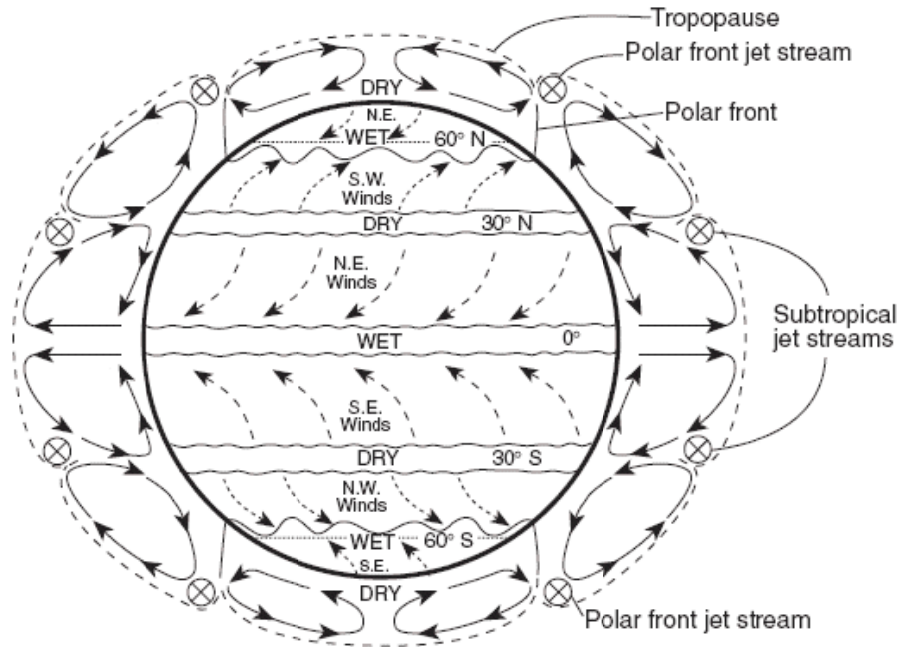


1. Curvature of the current is due to \_\_\_\_\_
2. Ocean currents help to distribute \_\_\_\_\_ across the planet
3. This type of circulation is called: \_\_\_\_\_

Prevailing Wind Effect

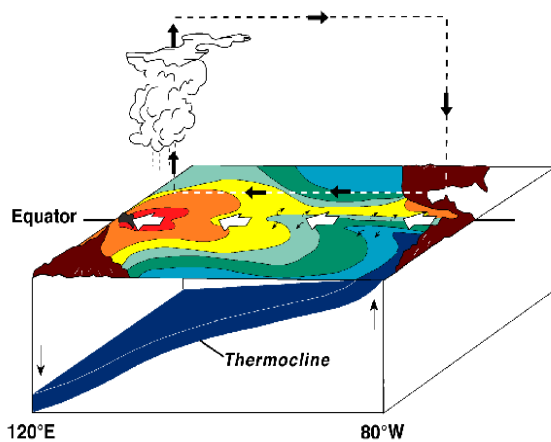
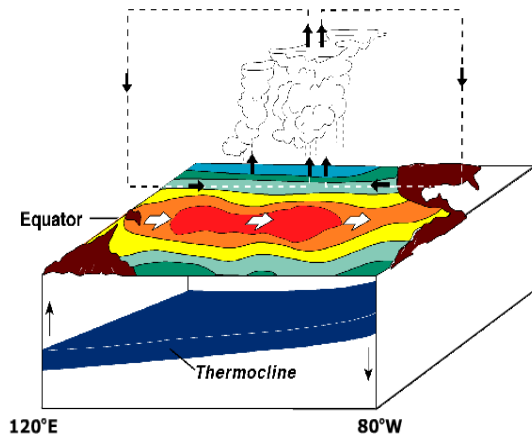
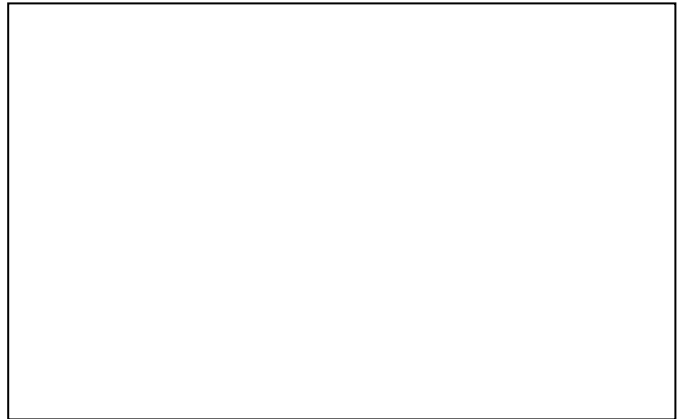
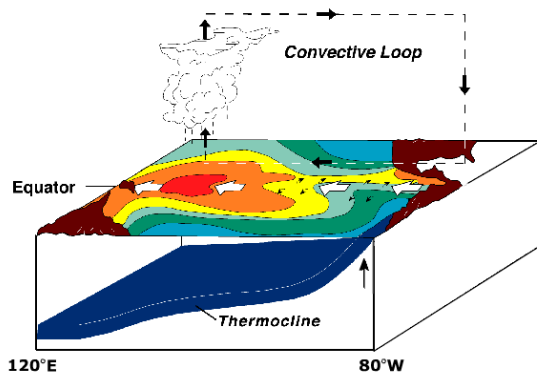
The drawing on the right shows the locations of the belts near the time of an equinox. The locations shift somewhat with the changing latitude of the Sun's vertical ray. In the Northern Hemisphere, the belts shift northward in the summer and southward in the winter.

(Not drawn to scale)



Name: \_\_\_\_\_ Date: \_\_\_\_\_

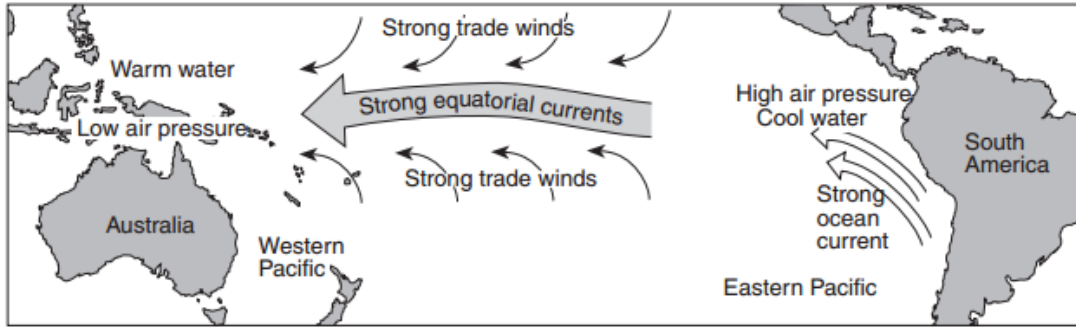
### EL NINO & LA NINA



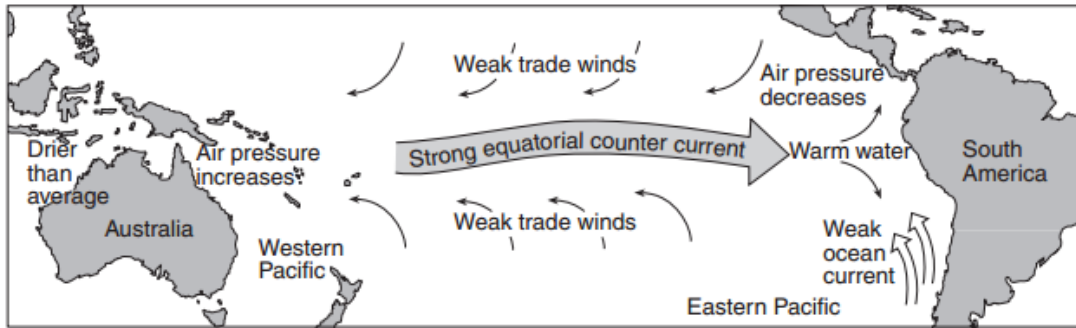


**Homework**

**Normal Climate Conditions**



**El Niño Conditions**



**El Niño Conditions**

El Niño conditions occur with a buildup of warm water in the equatorial Pacific Ocean off the coast of South America. The immediate cause of this buildup is a change in air pressure that weakens the southern trade winds. These are the planetary winds that move air from 30° S to the equator. Normally, these strong, steady winds, with the help of their counterparts in the Northern Hemisphere, push equatorial water westward away from South America. But, at intervals of two to seven years, these winds weaken, causing the westward water flow to reverse. This results in an accumulation of unusually warm water on the east side of the equatorial Pacific Ocean. This warm water not only changes the characteristics of the air above it, but also is thought to be the cause of weather changes around the world. El Niño conditions may last only a few months, but often last a year or two.

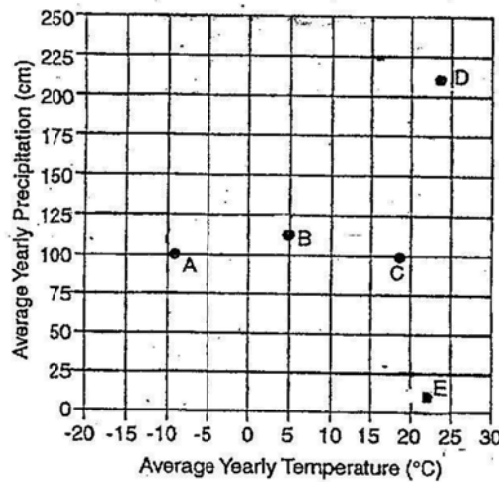
Name: \_\_\_\_\_ Date: \_\_\_\_\_

Use the diagram and the reading to help you answer the questions. This will be collected for points.

1. The trade winds between 30° S and the equator usually blow from the
  - (1) northeast
  - (2) southeast
  - (3) northwest
  - (4) southwest
  
2. Under normal climate conditions, what are the characteristics of the surface ocean current that flows along most of the west coast of South America?
  - (1) cool water moving toward the equator
  - (2) cool water moving away from the equator
  - (3) warm water moving toward the equator
  - (4) warm water moving away from the equator
  
3. During El Niño conditions, air above the Pacific Ocean moving over the land on the equatorial west coast of South America is likely to be
  - (1) cooler and drier than usual
  - (2) cooler and wetter than usual
  - (3) warmer and drier than usual
  - (4) warmer and wetter than usual
  
4. Equatorial Pacific trade winds weaken during El Niño conditions when air pressure
  - (1) falls in the western Pacific and rises in the eastern Pacific
  - (2) falls in both the western and eastern Pacific
  - (3) rises in the western Pacific and falls in the eastern Pacific
  - (4) rises in both the western and eastern Pacific

**Homework**

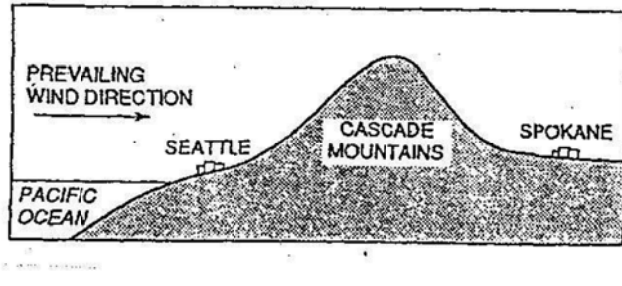
1. Which single factor generally has the greatest effect on the climate of an area on the Earth's surface?
  - a) the distance from the Equator
  - b) the extent of vegetative cover
  - c) the degrees of longitude
  - d) the month of the year
  
2. Base your answer to the following question on the graph, which shows the average yearly temperature and average yearly precipitation for Earth location A through E



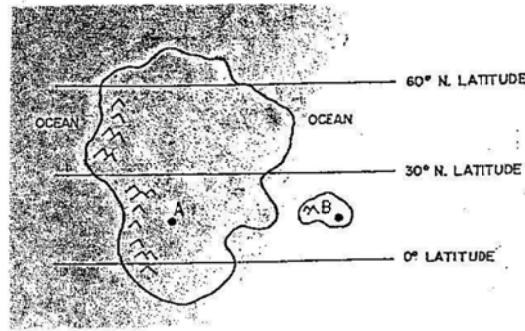
- a. Location A and C have different average yearly temperatures. What climate factor(s) can cause this difference?
  
- b. Which type of planetary wind pattern could possibly be present at location E?
  
- c. Which letter could possibly represent the windward side and leeward side of the mountain?

Name: \_\_\_\_\_ Date: \_\_\_\_\_

3. The diagram below shows the positions of the cities of Seattle and Spokane, Washington. Both cities are located at  $48^{\circ}$  North latitude, and they are separated by the Cascade Mountains.



- a. Why is the windward side of the mountain located over Seattle and leeward side over Spokane?
4. The diagram below represents an imaginary continent and a nearby island



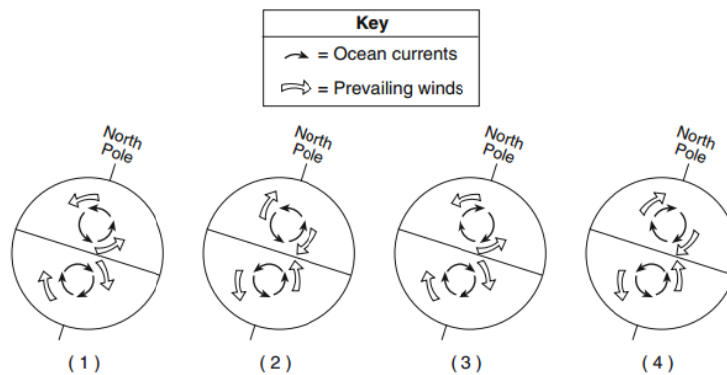
Which climatic variable causes location A to have cooler winters and warmer summers than location B?

5. The map below shows an eastern portion of North America. Point A and B represent locations on the eastern shoreline



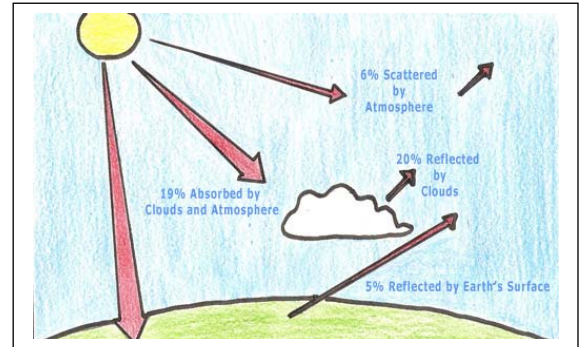
Which factor is primarily responsible for location A having a lower average yearly temperature than location B?

- (1) Nearness to a large body of water
  - (2) Elevation
  - (3) Latitude
  - (4) Prevailing winds
6. Which diagram correctly represents the curving of Earth's ocean currents and prevailing winds due to the Coriolis effect?



Name: \_\_\_\_\_ Date: \_\_\_\_\_

**Greenhouse Effect Notes**



Key Idea #1: \_\_\_\_\_

Key Idea #2: \_\_\_\_\_

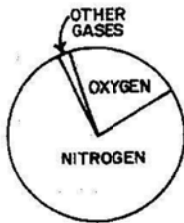
Key Idea #3: \_\_\_\_\_

Key Idea #4: \_\_\_\_\_

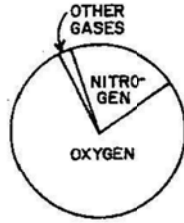
Key Idea #5: \_\_\_\_\_

Homework

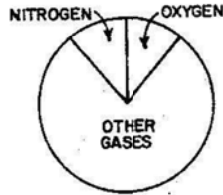
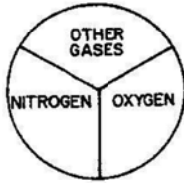
1. Which circle graph best represents the volume of gasses in the troposphere?



(1)



(3)



able to

2. Why are carbon dioxide and water vapor called the greenhouse gases?

- (1) They are found in varying amounts in Earth's atmosphere.
- (2) They are found in fixed amounts in Earth's bedrock.
- (3) They are good reflectors of infrared radiation.
- (4) They are good absorbers of infrared radiation.

5. Global warming is most likely occurring due to the an increase in

- 1) carbon dioxide and methane gases in the atmosphere
- 2) oxygen and nitrogen gases in the atmosphere
- 3) ultraviolet radiation and x rays reflected from Earth
- 4) visible light and radio waves reflected from Earth



6.

### Greenhouse Effect

The warming of Earth's surface and lower atmosphere tends to intensify with an increase in atmospheric carbon dioxide. The atmosphere allows a large percentage of the visible light rays from the Sun to reach Earth's surface. Some of this energy is reradiated by Earth's surface in the form of long-wave infrared radiation. Much of this infrared radiation warms the atmosphere when it is absorbed by molecules of carbon dioxide and water vapor. A similar warming effect is produced by the glass of a greenhouse, which allows sunlight in the visible range to enter, but prevents infrared radiation from leaving the greenhouse.

The absorption of infrared radiation causes Earth's surface and the lowest layer of Earth's atmosphere to warm to a higher temperature than would otherwise be the case. Without this "greenhouse" warming, Earth's average surface temperature could be as low as  $-73^{\circ}\text{C}$ . The oceans would freeze under such conditions.

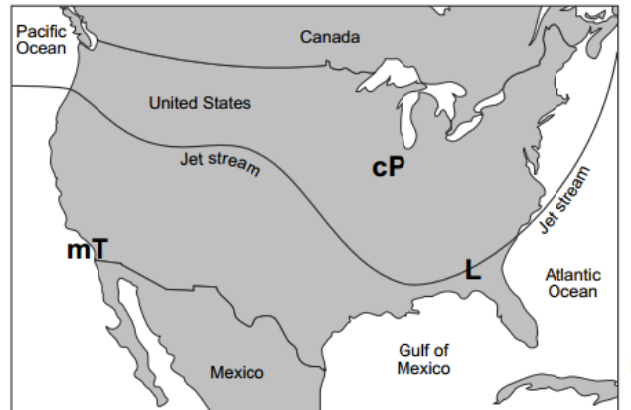
Many scientists believe that modern industrialization and the burning of fossil fuels (coal, oil, and natural gas) have increased the amount of atmospheric carbon dioxide. This increase may result in an intensified greenhouse effect on Earth causing significant alterations in climate patterns in the future. Scientists estimate that average global temperatures could increase by as much as  $5^{\circ}\text{C}$  by the middle of the 21st century.

- a) The lowest layer of Earth's atmosphere has undergone a large increase in temperature due to the presence of greenhouse gases. State the name of this temperature- zone layer
- b) Which wavelength is longer? Infrared or visible?
- c) Which page of the ESRT would you be able to find the answer to question b?
- d) Explain why most of the scientists believe an increase in greenhouse effect will cause sea level to rise
- e) State one possible change human could make to reduce the amount of greenhouse gases added to the atmosphere each year.

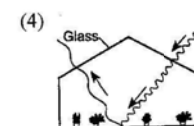
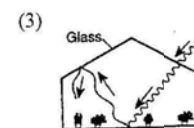
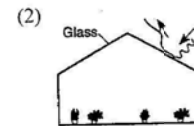
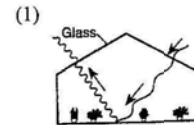
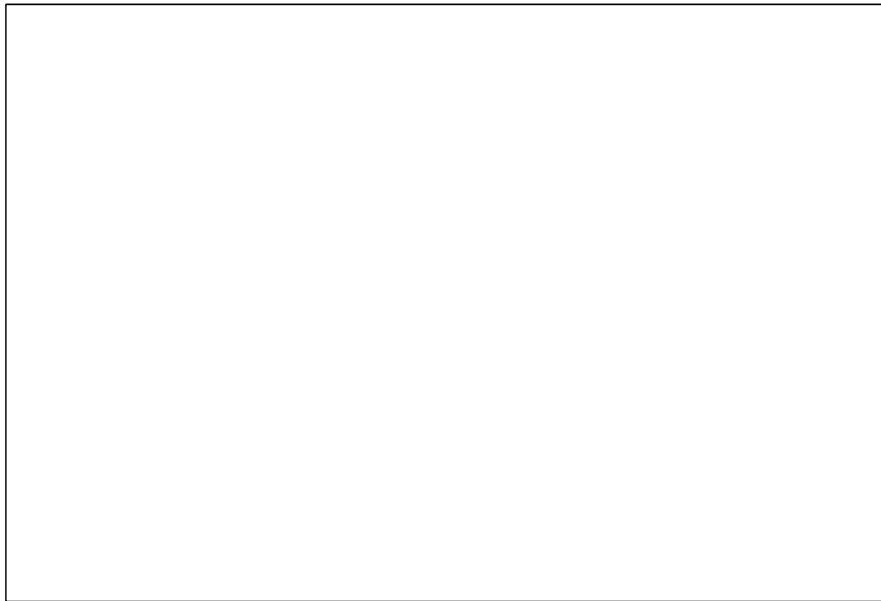


Name: \_\_\_\_\_ Date: \_\_\_\_\_

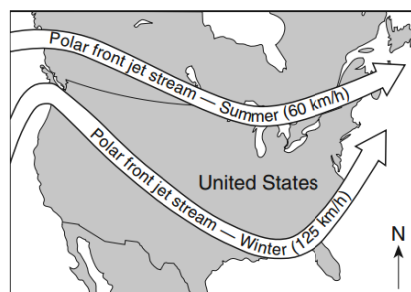
7. Base your answer to question 45 through 48 on the map below, which shows the position of the Jetstream relative to two air masses and low-pressure center (L) over the United States.



- a) In which layer of the atmosphere is this jet stream located?
- (1) thermosphere    (2) mesosphere    (3) stratosphere    (4) troposphere
- b) What is the difference in the air temperature and humidity between cP and mT air masses?
- (1) The cP air mass is warmer and less humid  
(2) The cP air mass is colder and more humid  
(3) The mT air mass is warmer and more humid  
(4) The mT air mass is colder and less humid
- c) What is the general movement of the surface winds around the center of this low-pressure area?
- (1) counterclockwise and outward                      (3) clockwise and outward  
(2) counterclockwise and inward                      (4) clockwise and inward
- d) Assuming the low-pressure center (L) follows a typical storm track, it will move
- (1) into the mT air mass to the west  
(2) into the cP airmass to the northwest  
(3) along the path of the jet stream to the northeast  
(4) along the path of the jet stream to the southwest



10. The map below shows a typical position and average velocity of the polar front jet stream during two different seasons.



For the eastern United States, the change of the polar front jet stream from this summer position to this winter position causes

- (1) warmer temperature farther north and causes storms to move more slowly
- (2) warmer temperature farther north and causes storms to move rapidly
- (3) cooler temperature farther south and causes storms to move more slowly
- (4) cooler temperature farther south and causes storms to move more rapidly

### Lake-Effect Snow

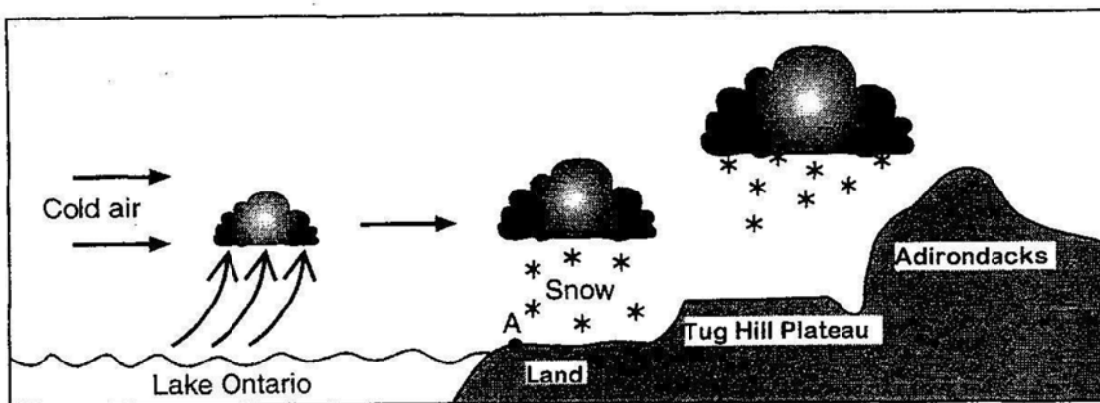
During the cold months of the year, the words "lake effect" are very much a part of the weather picture in many locations in New York State. Snow created by the lake effect may represent more than half the season's snowfall in some areas.

In order for heavy lake-effect snow to develop, the temperature of the water at the surface of the lake must be higher than the temperature of the air flowing over the water. The higher the water temperature and the lower the air temperature, the greater the potential for lake-effect snow.

A lake-effect storm begins when air flowing across the lake is warmed as it comes in close contact with the water. The warmed air rises and takes moisture along with it. This moisture, which is water vapor from the lake, is turned into clouds as it encounters much colder air above. When the clouds reach the shore of the lake, they deposit their snow on nearby land. A typical lake-effect storm is illustrated in the diagram below.

The area most likely to receive snow from a lake is called a "snowbelt." Lake Ontario's snowbelt includes the counties along the eastern and southeastern ends of the lake. Because the lake runs lengthwise from west to east, the prevailing westerly winds are able to gather the maximum amount of moisture as they flow across the entire length of the lake. There can be lake-effect snowfall anywhere around the lake, but the heaviest and most frequent snowfalls occur near the eastern shore.

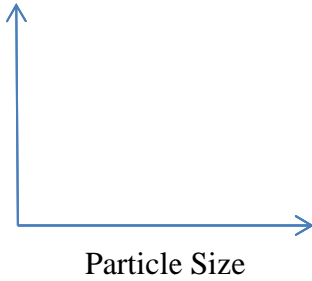
In parts of the snowbelt, the lake effect combines with a phenomenon known as orographic lifting to produce some very heavy snowfalls. After cold air has streamed over the length of Lake Ontario, it moves inland and is forced to climb the slopes of the Tug Hill Plateau and the Adirondack Mountains, resulting in very heavy snowfall.



3. State the relationship that must exist between water temperature and air temperature for lake-effect snow to develop.
4. State why locations east and southeast of Lake Ontario are more likely to receive lake-effect snow than are locations west of the lake.

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Porosity

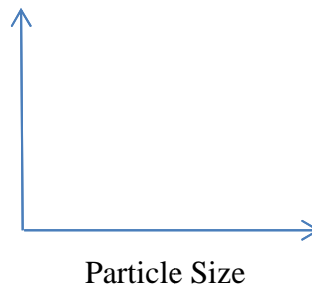


State the relationship

,

;

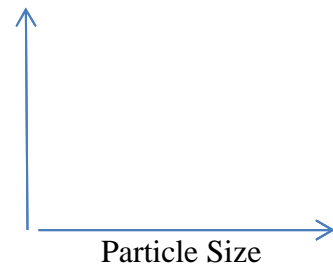
Permeability/Infiltration rate



,

;

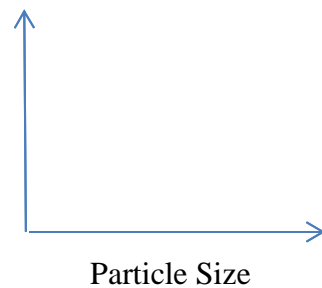
Retention



,

;

Capillarity Action



,

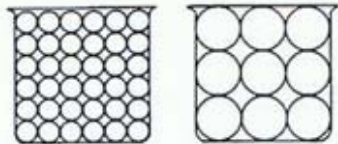
;



**Groundwater Homework**

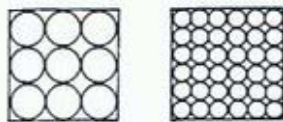
1. Apartment buildings and parking lots completely cover an area that was once an open, grass covered field. What factor most likely increased because of this construction?
- (1) capillarity
  - (2) runoff
  - (3) infiltration into the ground
  - (4) the level of the local water table

2. The diagrams below represent two identical containers filled with nonporous uniform particles. The containers represent models of two different sizes of soil particles.



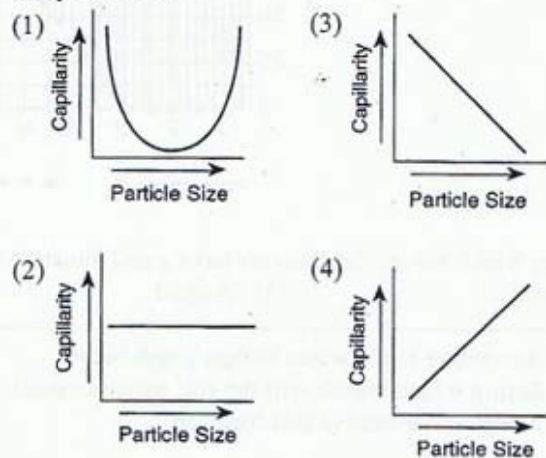
Compared to the model containing larger particles, the model containing smaller particles has

- (1) less permeability and greater porosity
  - (2) greater porosity and greater capillarity
  - (3) less permeability and greater capillarity
  - (4) greater permeability and greater porosity
3. The diagram below represents two identical containers filled with samples of loosely packed sediments. The sediments are composed of the same material, but differ in particle size. Which property is most nearly the same for the two samples?



- (1) infiltration rate
  - (2) porosity
  - (3) capillarity
  - (4) water retention
4. Which property of a well-sorted loose material will increase as the particle size decreases?
- (1) capillarity
  - (2) permeability
  - (3) porosity
  - (4) infiltration

5. Soil with the *lowest* porosity is composed of particles that are all
- (1) different sizes and shapes
  - (2) large and angular
  - (3) small and rounded
  - (4) large and rounded
6. Which graph best represents the relationship between the particle size and the capillarity of a sample of soil?



7. When rain falls on a soil surface, flooding at that location would most likely occur if the
- (1) soil surface is permeable
  - (2) soil surface is covered with vegetation
  - (3) soil pore spaces are filled to capacity
  - (4) infiltration rate exceeds the precipitation rate
8. Which set of conditions would produce the most runoff of precipitation?
- (1) gentle slope and permeable surface
  - (2) gentle slope and impermeable surface
  - (3) steep slope and permeable surface
  - (4) steep slope and impermeable surface
9. An area with a high potential for evapotranspiration has little actual evapotranspiration and precipitation. The climate of this area is best described as
- (1) hot and arid
  - (2) hot and humid
  - (3) cold and arid
  - (4) cold and humid

## Rubric for Regional Climate Unit

INDICATORS	BEGINNING Novice	DEVELOPING Apprentice	ACCOMPLISHED Practitioner	EMPLEMLARY Expert
<b>Describe natural climate factors by using and analyzing climographs</b>	<p>Understand natural vs. unnatural climate factors</p> <p>List all the natural factors discussed in class</p>	<p>Generate and compare two different climographs</p> <p>List and explain how natural factors can affect the climate</p>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Generate climographs</li> <li><input type="checkbox"/> Compare the climographs</li> <li><input type="checkbox"/> Use the climographs to analyze and explain the climate factor between two climatic regions in US</li> <li><input type="checkbox"/> Explain how different Earth and Solar System processes can affect global climate</li> </ul>	<p><i>All practitioner plus</i></p> <p>Compare the climatic zone of different regions globally and identify the main climate factor(s) between global regions</p> <p>Calculate and analyze the climate ratio of different regions</p>
<b>Explain Greenhouse Effect</b>	<p>Identify a correct greenhouse effect diagram</p> <p>Identify the source of unnatural climate factors</p>	<p>Explain the process of greenhouse effect</p> <p>Identify and explain how unnatural climate (human impact) factors affect climate</p>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Draw and label the greenhouse effect</li> <li><input type="checkbox"/> Explain in the process of greenhouse</li> <li><input type="checkbox"/> Explain how greenhouse effect relates to global cooling and heating and sea level changes</li> <li><input type="checkbox"/> How does global warming affect changes in climatic belts</li> </ul>	<p><i>All practitioner plus</i></p> <p>Explain the physics and chemistry behind why greenhouse gasses absorb infrared radiation</p> <p>Present two different views of global warming using two articles.</p>
<b>Understanding of Climate types, ground water</b>	<p>Explain the basic concepts of climate types, ground water and soil profile</p>	<p>Explain the factors that could affect how water moves through the ground</p>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Demonstrates understanding of water movement and water cycle through writing and graphic sketch</li> <li><input type="checkbox"/> Explain how particle size, porosity, shape, sorting affect water infiltration, ground permeability and water retention</li> </ul>	<p><i>All practitioner plus</i></p> <p>Identify and explain potential threats to food source in United States or globally</p>