ORIGINAL

EXERCISE 3

INTRODUCTION TO THE ATMOSPHERE

THEME: Two major elements of climate are temperature and moisture. Over a long period, temperature and moisture work to produce a distinctive climate and landscape pattern.

TERMS:

- Weather
- Climate
- Climate controls
- Latitude
- Distribution of land and water
- Circulation of the atmosphere
- Altitude
- Topographic barrier
- Storms
- Aleutian Low
- Icelandic Low
- Climograph
- Circulation of the Ocean

GUIDELINES: At the conclusion of this exercise, you should be able to:

1. Outline the seven controls of climate.
2. Construct a climograph using temperature and precipitation data.
3. Explain how the controls operate to produce the climate shown on the climograph.
4. Describe the landscape appearance of the place represented by the climograph.

Understanding the atmosphere is made easier if we look closely at that with which we are familiar--**WEATHER AND CLIMATE.** Although weather varies from moment to moment, it is possible to make generalizations about its long term pattern. Long term weather patterns produce climate.

The climate of a given area is influenced by many factors. Frequently, the factors are identified simply as **CLIMATIC CONTROLS.** It should be noted that the controls are more like intricately interwoven modifiers of the weather acting collectively to determine patterns. But we will begin by viewing each control as if it were an individual element dominating the weather and climate of a place. The seven major controls are:

1. **LATITUDE.** As one moves from the equator to the poles, the angle of the sun's rays become more oblique. Thus, there is less energy from the sun striking the surface. The overall result is that it becomes colder. In other words, as you increase in latitude from 0° to the poles, the temperature decreases. On the other hand, with a decrease in latitude, from the poles to 0°, temperatures increase.

2. **DISTRIBUTION OF LAND AND WATER.** Air resting on top of the land heats and cools rapidly while air resting on water heats and cools slowly. Thus, the weather and climate of a place which is controlled by the land will experience a dramatic temperature change during the day. A place next to a large body of water will not experience large temperature changes during the course of a day.

3. **GENERAL CIRCULATION OF THE ATMOSPHERE.** The winds of the tropics generally blow from a northeast or southeast direction while the winds of the mid latitudes blow west to east. Equally significant is the surface over which the air moves. For example, wind travelling over land will take on the characteristics of that place, resulting in considerable temperature change. Air that is moving across water will promote uniform temperatures in a place next to the water.

4. **GENERAL CIRCULATION OF THE OCEAN.** As with the wind, we need to observe where the circulating water originates and where it is going. Water from the tropics which flows along the shores of the mid and high latitude land masses will help keep temperatures warmer in the winter. Similarly, water from the high latitudes will act to cool places in the mid and low latitudes.

5. **ALTITUDE.** When we move from sea level up a mountain, temperatures decrease. Conversely, when we come down the mountain, temperatures increase. Like latitude, altitude as a control can be summarized as: increase altitude, temperatures decrease; decrease altitude, temperatures increase.

6. **TOPOGRAPHIC BARRIER.** By blocking or diverting the wind, a mountain causes the windward side of the mountain to receive a greater amount of precipitation. The leeward side receives much less rain. Thus, there is a "wet" side and a "dry" side to mountain ranges. These differences can be seen on rainfall and climate maps.

7. **STORMS.** Most storms in the northern hemisphere have their beginning in the **ALEUTIAN LOW** located in the Gulf of Alaska or in the **ICELANDIC LOW** near Iceland. There

is a tendency for these storms to move from one low pressure center to the other travelling west to east. Places near the lows or along the path of movement will experience storms most of the time. Hence, storms are considered to be a control of climate.

Temperature and precipitation amounts, which most clearly reflect these controls, can be represented in graphic form. The graph is called a **CLIMOGRAPH**. Examine the climograph below (Figure 3.1). Note that temperature values are given on the left side and precipitation values on the right.

Temperature data can be put in graphic form by placing a dot in the middle of the monthly column. The dots for each month are connected producing a temperature line.

Precipitation amounts are shown by filling in the monthly column to a height corresponding to the precipitation amount.

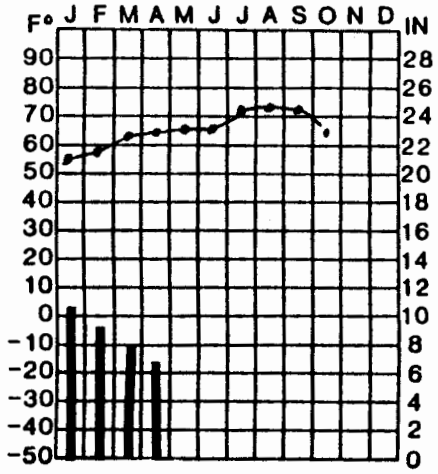


FIGURE 3.1 Climograph example.

A place will have a distinctive landscape appearance as a result of its climate. We can characterize the appearance with terms such as cloudy, windy, cold, warm, snowy, green, desert-like and mountainous.

All of this--climatic controls, climographs, and landscape appearance--is brought together in the following activities. You will need to consult the maps in your textbook which show major landforms of the world, ocean currents, and the general atmosphere circulation. The maps can be located by using the index in your textbook.

ACTIVITIES: THE ATMOSPHERE

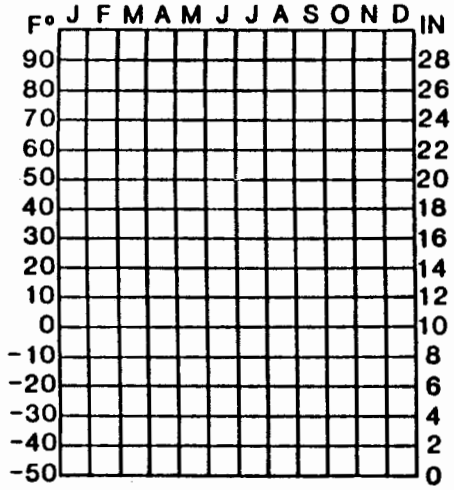
Name:_____ **Class:**_____

1. Start the exercise by locating the 10 places listed below on the world map.

Uaupes, Brazil	0°	67° W
Escanaba, Michigan	45° N	87° W
Portland, Oregon	45° N	123° W
Eureka, California	41° N	124° W
New York, New York	41° N	74° W
Reykjavik, Iceland	64° N	22° W
Quito, Ecuador	0°	78° W
San Francisco, California	37° N	122° W
Las Vegas, Nevada	36° N	115° W
Bergen, Norway	60° N	5° E

2. Construct a climograph for Uaupes, Brazil, using the following temperature data (°F) and precipitation data (In).

	J	F	M	A	M	J	J	A	S	O	N	D
°F	80	80	80	80	79	78	77	78	80	80	81	80
In	10	8	10	10	12	9	9	7	5	7	7	10



Uaupes, Brazil Climograph

Uaupes is considered to be an example of a place whose weather and climate is primarily controlled by latitude.

a. Explain how the control works in Uaupes.

_____

_____

b. Describe its seasons.

_____

_____

_____

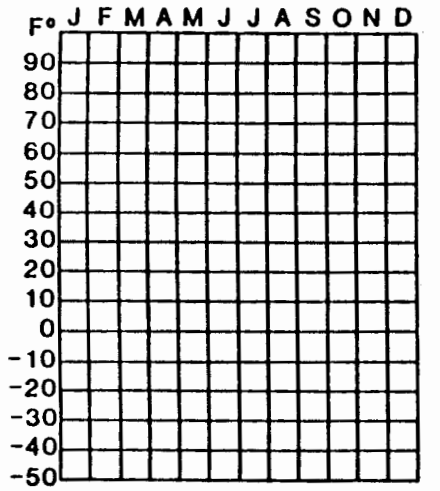
3. Escanaba, Michigan and Portland, Oregon are typical cities which have their winter temperature controlled respectively by land and water even though their latitudes are similar. Using the data below, plot the monthly average temperatures of both places on the graph. Use a solid line for Escanaba and a dashed line for Portland.

	J	F	M	A	M	J	J	A	S	O	N	D
°F	15	15	24	38	51	61	67	64	55	46	33	21

Escanaba, Michigan

	J	F	M	A	M	J	J	A	S	O	N	D
°F	39	42	47	52	57	62	65	65	62	54	47	41

Portland, Oregon



Escanaba and Portland Temperature Graph

a. Explain how the winter temperature of Escanaba indicates land control.

_____

_____

_____

b. Describe Escanaba's summer.

_____

_____

_____

c. Explain the winter temperature condition of Portland from a water control point of view.

_____

_____

_____

d. Describe Portland's seasons.

_____

_____

_____

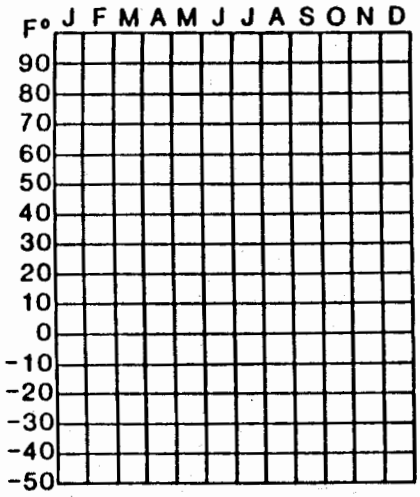
4. Eureka, California and New York, New York are good examples of atmospheric circulation as a control. Plot their temperatures on the following graph using a solid line for Eureka and a dashed line for New York.

	J	F	M	A	M	J	J	A	S	O	N	D
°F	48	48	48	50	54	57	57	57	57	53	52	48

Eureka, California

	J	F	M	A	M	J	J	A	S	O	N	D
°F	30	30	37	48	61	69	73	73	70	59	44	35

New York, New York



Eureka and New York Temperature Graph

a. Explain how the surface over which the wind moves sets up the climatic control of atmospheric circulation for Eureka.

b. Describe Eureka's seasons.

c. Indicate how the wind moving over the land determines the climatic control of New York.

d. Describe New York's year-round climate.

_____

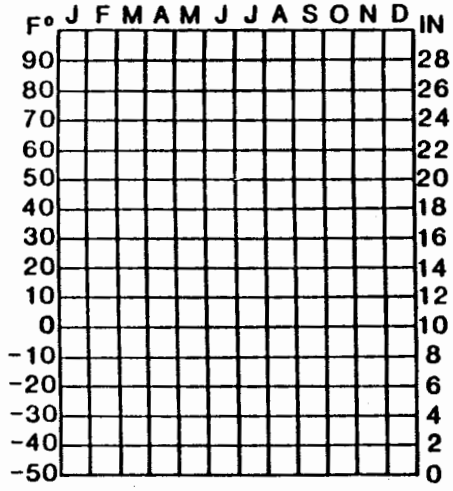
_____

_____

5. Altitude as a control, particularly as compared to latitude, is shown by the climograph of Quito, Ecuador. Construct a climograph using the following data.

	J	F	M	A	M	J	J	A	S	O	N	D
°F	59	59	59	58	58	58	59	59	59	59	59	59
In	4	4	6	7	5	2	1	1	3	4	4	3

Quito, Ecuador



Quito, Ecuador Climograph

a. Explain how altitude controls Quito's climate.

_____

_____

_____

b. Describe Quito's landscape appearance.

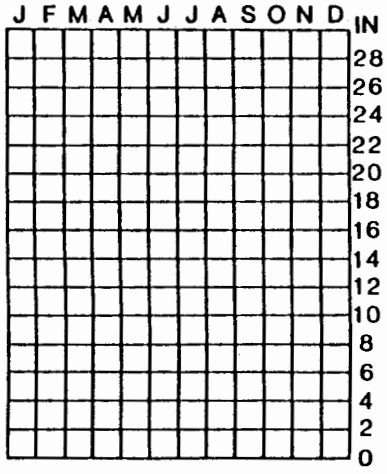
_____

_____

6. A comparison of precipitation amounts often reveal a topographic barrier as the principle climatic control. Plot the monthly average inches (In) of precipitation data given below for San Francisco, California and Las Vegas, Nevada.

	J	F	M	A	M	J	J	A	S	O	N	D
In	5	4	3	2	1	0	0	0	0	1	3	5

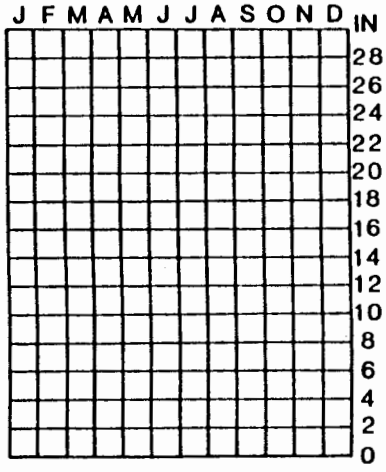
San Francisco, California



San Francisco, California Precipitation Graph

	J	F	M	A	M	J	J	A	S	O	N	D
In	1	1	0	0	0	0	1	1	0	0	0	0

Las Vegas, Nevada



Las Vegas, Nevada precipitation Graph

a. Explain how the topographic barrier has produced a wet side of the mountain.

_____

_____

_____

b. Describe the seasons of the wet side.

_____

_____

_____

c. Explain how the topographic barrier has produced a dry side of the mountain.

_____

_____

_____

d. Describe the landscape appearance of Las Vegas.

_____

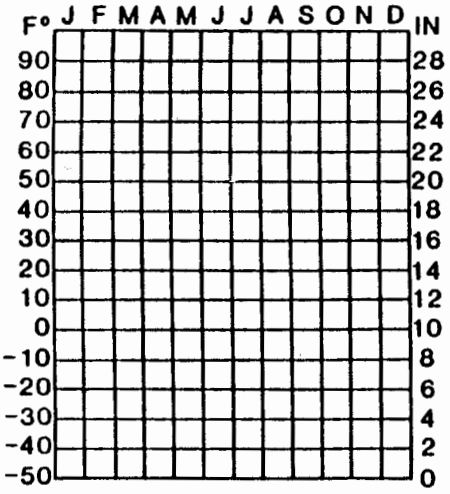
_____

_____

7. The weather and climate of a place controlled by storms is Bergen, Norway. Construct a climograph of Bergen using the data below.

	J	F	M	A	M	J	J	A	S	O	N	D
°F	35	35	38	44	53	58	61	60	55	48	41	36
In	8	6	5	4	4	4	5	7	9	9	8	8

Bergen, Norway



Bergen, Norway Climograph

a. Explain how storms serve as the climatic control.

_____

_____

_____

b. Describe the landscape appearance of Bergen.

_____

_____

_____