Name ______________________________ Date __________

Climates and Biomes

Lab 61

Background

A biome is defined as a large geographic region that has a particular type of climax community. Biomes are identified by the characteristic plants that dominate the landscape (such as grasslands) or by physical features and climate (such as deserts or tundra). While you are probably familiar with many of the biomes of the world, you may not know what causes biomes to exist. The kinds of plants and animals that coexist and survive in a particular area are determined by the soil, topography, and climate in that area. Biomes take many years to establish. Keep in mind that their boundaries are not as distinct as we would like to think of them, and actually blend into each other.

Objectives

In this lab you will:

1. Investigate some of the physical processes that determine climate.
2. Graph climate data from different places.
3. Classify climate graphs into general biome categories.
4. Use your graphs to compare various biomes.

Materials

graph paper
colored pencils
calculator
ruler
political/relief maps of North America

Procedures and Observations

PART I. LATITUDE AND RADIANT ENERGY

Because the earth is shaped like a sphere, the sun's rays strike the earth at different angles. Look at Figure 1 on the next page. Although the amount of energy striking points A, B, and C is equal, the amount that is absorbed depends on the angle of the sun's rays.

1. Consider the effect that latitude has on radiant energy (heat) absorption.
   a. *Why is more radiant energy absorbed at A than at B or C?*

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   b. *What immediate effect would the amount of radiant energy striking a part of the earth have on that place?*

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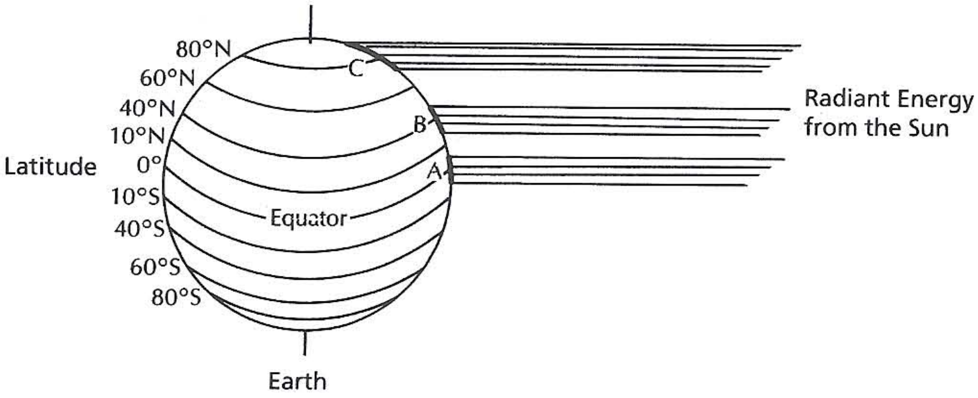

Figure 1. Latitude and Radiant Energy

c. *In general, what happens to temperature as one moves north or south of the equator?*

PART II. EFFECT OF LARGE BODIES OF WATER

Land warms and cools quickly. Places near the middle of a continent will experience temperature extremes—hot summers and cold winters. Water, however, warms and cools more slowly than land. In fact, ocean temperatures in a given region do not vary much during the year. This causes the temperatures in coastal areas (where the wind blows off the water) and on islands to be consistent throughout the year.

Large lakes and oceans also add humidity to the air and increase precipitation. "Lake effect" snow results from cold air blowing across a large lake, gathering moisture and then, upon further cooling, dropping moisture in the form of snow on the shoreline and slightly inland.

a. *In which of the cities shown in Figure 2 would the most consistent temperatures be found?*

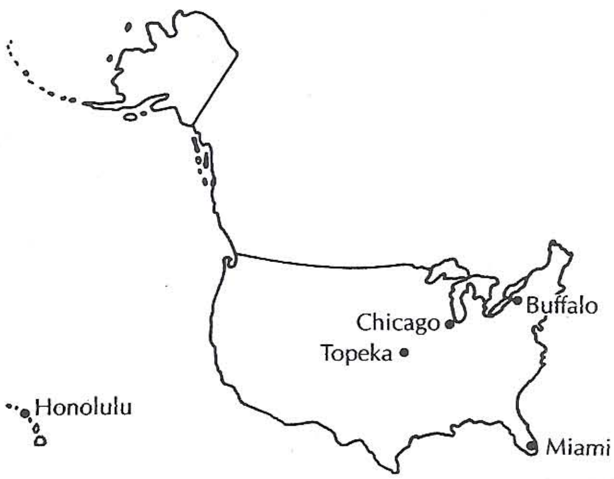

Figure 2

b. *Where would extremes in temperature be expected?*

____

c. *Where would the most precipitation be expected?*

____

d. *Where would precipitation likely fall as "Lake Effect" snow?*

____

PART III. MOUNTAIN EFFECTS

The most obvious mountain effect on climate is the elevation effect. As elevation increases, average temperature decreases.

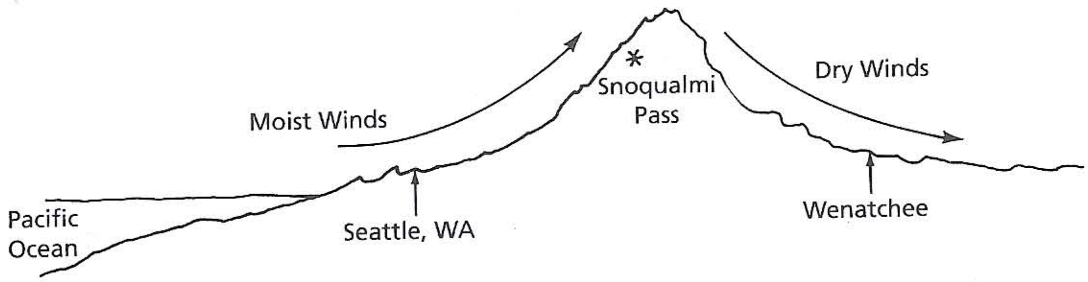

Figure 3. Effects of Mountains on Climate

a. *Would you expect Seattle or Snoqualmi Pass to have a higher annual average temperature?*

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b. *How is altitude on a mountain similar to the effect of latitude in Part I?*

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When moist air from over the ocean is blown inland toward a mountainous area, the air is pushed up by the mountain and cooled. Cooling causes condensation and so rain or snow falls on the mountainside close to the ocean. By the time the air moves over the top of the mountain, it has lost its moisture. Moving down the other side of the mountain, the air is warmed. It becomes a warm, dry wind.

c. *Which place shown in Figure 3 would have the greatest annual precipitation?*

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d. *Which place would have the lowest annual precipitation ?*

____

e. *Which place would have the most snowfall?*

____

PART IV. GRAPHING CLIMATE DATA

Scientists often put data into graphic form for analysis. This makes the information easier to interpret and understand.

1. Study the data in Table 1, which was collected from the National Oceanic and Atmospheric Administration (NOAA).

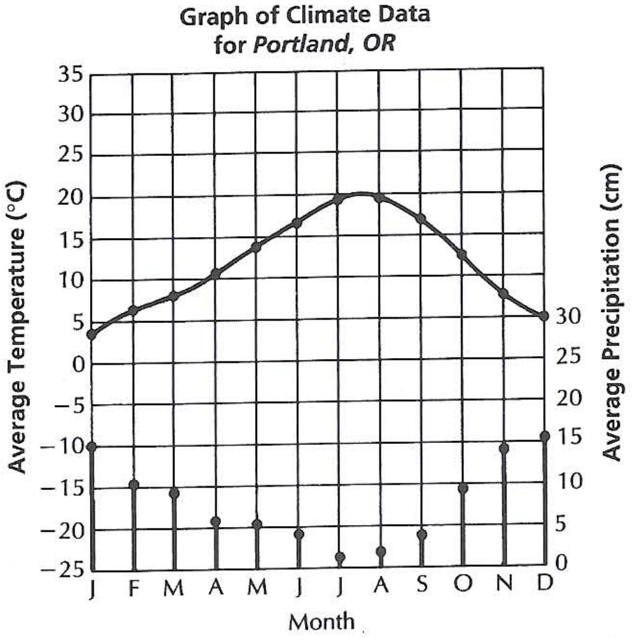
Table 1

City	Month					Temperature (°C) (boldface top number) Rainfall/Precipitation (cm) (bottom number)						
	J	F	M	A	M	J	J	A	S	O	N	D
Portland, OR	**3.3** 15	**6.1** 10.4	**7.8** 9.1	**10.5** 5.6	**13.9** 5.3	**16.7** 4	**19.4** 1.3	**19.4** 2	**16.7** 4	**12.2** 9.1	**7.2** 14.2	**5** 15.2
Pt. Barrow, AK	**–27** 0.48	**–28** 0.44	**–26** 0.28	**–18** 0.28	**–7.5** 0.3	**0.6** 0.9	**3.9** 2	**3.3** 2.3	**–0.8** 1.6	**–8.5** 1.3	**–18** 0.58	**–24** 0.43
Santa Monica, CA	**12.1** 8.1	**12.3** 8.6	**12.9** 5.3	**14.5** 3.2	**15.8** 0.28	**17.1** 0.15	**19.1** 0.02	**19** 0.05	**19** 0.43	**16.5** 0.99	**14.5** 2.9	**12.7** 7.2
Des Moines, IA	**–5.2** 3.1	**–3.2** 2.8	**2.2** 3.1	**10.4** 6.3	**17** 10.2	**23** 12.3	**25.2** 7.6	**24** 9.7	**19.2** 7.6	**13** 5.7	**3.8** 4.3	**–2.4** 2.8
Minneapolis, MN	**–10.9** 1.8	**–9** 2	**–2.4** 3.8	**6.8** 4.7	**14** 8.1	**19.2** 10.2	**22.4** 8.3	**21.1** 8.1	**15.7** 6.1	**9.4** 4	**–0.4** 3.6	**–7.7** 2.2
Wichita, KS	**0** 2.5	**3** 2.5	**7.5** 4.3	**13.5** 8.9	**18.2** 9.7	**24** 12.5	**27.1** 8.6	**26.7** 7.3	**22** 8.1	**15.6** 5.4	**7.3** 4.3	**1.9** 2.8
Phoenix, AZ	**10.5** 1.8	**12.8** 1.5	**15.5** 2	**20** 0.76	**24.5** 0.25	**29.4** 0.25	**32.8** 2	**31.7** 3	**28.9** 1.8	**22.2** 1.3	**15.5** 1.3	**11.6** 2
Nashville, TN	**3.3** 12.2	**5** 11.2	**9.4** 12.7	**15.5** 10.4	**20.5** 10.4	**25** 8.6	**26.7** 9.7	**26.1** 8.1	**22.2** 7.9	**16.1** 5.6	**8.8** 8.9	**4.4** 11.4
Winnipeg, Manitoba	**–19** 2.1	**–16** 1.8	**–8** 2.3	**3** 3.9	**11** 6.6	**17** 8	**20** 7.6	**18** 7.5	**12** 5.3	**6** 3.1	**–5** 2.5	**–14** 1.9
Fairbanks, AK	**–24** 2.3	**–19** 1.3	**–13** 1	**–1.4** 0.6	**8.4** 1.8	**14.6** 3.6	**15.3** 4.7	**12.4** 5.6	**6.3** 2.8	**–3.2** 2.2	**–15.6** 1.5	**–22** 1.4
New Orleans, LA	**11.6** 11.4	**13.3** 12.2	**16.1** 13.9	**20.5** **10.7**	**23.9** 10.7	**26.7** 12	**27.7** 17	**27.7** 13.5	**25.5** 14.2	**21.1** 5.8	**15.5** 9.9	**12.8** 13
Pittsburgh, PA	**0** 7.1	**0.5** 5.8	**4.5** 8.8	**11.2** 8.6	**16.9** 9.6	**21.8** 10.1	**23.8** 9.1	**22.8** 8.8	**18.9** 6.8	**12.3** 6.4	**5.9** 5.9	**0.6** 6.3

a. *Use the data in Table 1 to make graphs of average temperature and average precipitation versus month of the year for each city. A sample graph for Portland, Oregon, is shown on the next page. Label each graph with the city whose weather data is plotted.*

Name ______________________________

Climates and Biomes (continued)



Use your graphs to classify each city in a biome. Consider the range of temperatures and the total amount of precipitation.

b. *Complete Table 2 by filling in the column marked "Examples" with the name of the cities which fit in each biome.*

Table 2

Name	Yearly Average Rainfall/ Precipitation	Yearly Temperature Range (winter lows and summer highs)	Examples
Tundra	1–12 cm/yr.	Very Cold Winters (–28°C) Summers (3–12°C)	
Taiga	Far north (8 cm) West (40 cm) Central (50 cm)	Cold Winters (–25°C) Short Summers (20°C)	
Temperate Deciduous Forest	60–150 cm/yr.	Cold Winters (–10°C) Warm Summers (26°C)	
Temperate Grassland Prairie	25–75 cm/yr.	Cold Winters (–5°C) Warm Summers (28°C)	
Mid-Latitude Rain Forest	90–200 cm/yr.	Small Year-Round Variance Winters (2°C) Summers (20°C)	
Chaparral	Dry Summers (0.3 cm) Wet Winters (3.5 cm)	Cool Winters (12°C) Warm Summers (20°C)	
Desert	Less Than 25 cm/yr.	Winters (8°C) Summers (39°C) Large Daily Variation	

Analysis and Interpretations

1. Look at the graphs of Pt. Barrow, Fairbanks, Winnipeg, and Minneapolis. Locate them on a map. Explain how the temperature and precipitation change with latitude.

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2. Graph the data given below for Walla Walla, Washington.Then compare this graph carefully with the Portland graph on page 379. Locate these two cities on a map. Explain the differences in yearly temperature range and precipitation.

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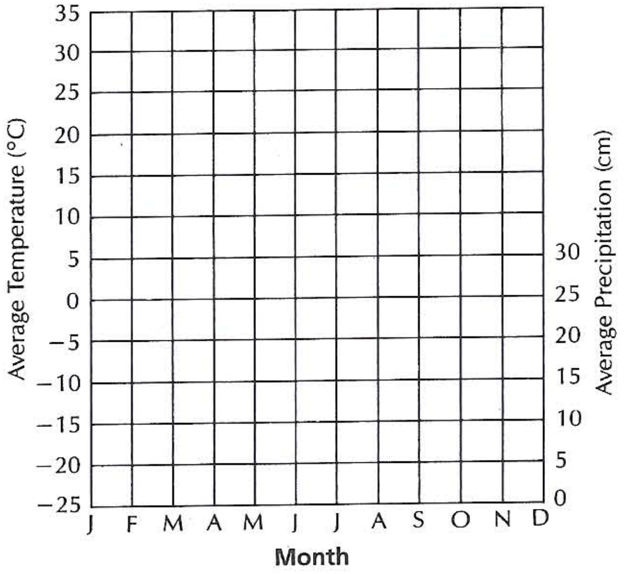
	Temp. (°C)	Precip. (cm)
J	0.6	4.8
F	3.5	3.8
M	7.8	3.9
A	12	3.6
M	16	3.8
J	19.5	3
J	24.5	0.5
A	23.2	0.75
S	18.9	1.9
O	12.8	3.8
N	5.7	4.3
D	3.2	4.7

Graph of Climate Data for *Walla Walla, WA*



3. Which of the locations was difficult to place into a biome? Why?

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4. What seems to be the difference between the graphs of Des Moines and Nashville? Is this enough to separate the two places into separate biomes?

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Name ____________________

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5. Graph the following data given below for Chicago, IL. In what biome might Chicago be classified?

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	Temp. (°C)	Precip. (cm)
J	–4.4	4.8
F	–2.7	4
M	2.8	6.9
A	10	9.6
M	15.5	8.6
J	21.7	10.1
J	23.9	10.4
A	23.3	7.8
S	18.9	7.6
O	12.8	6.6
N	4.4	5.6
D	–1.6	5.3

Graph of Climate Data for *Chicago, IL*