

Name: _____

Date: _____ Period: _____

Water and Climate

The Physical Setting: Earth Science

Lab Activity: Climate Variables

INTRODUCTION:

The state of the atmosphere continually changes over time in response to the uneven distribution of energy in the atmosphere. The short-term changes in temperature and precipitation are fundamental controls of weather, and their long-term averages are called climate. Since climate is averaged weather, we must take a look at the average temperature and average precipitation in a particular region to determine the climate.

We know that there are many different climates on Earth. From tropical regions near the equator to the frozen deserts at the poles, each climate varies tremendously and is characterized by its long term weather conditions.

OBJECTIVE:

You will determine particular climate variables that control a region's average temperature and precipitation and be able to recognize trends in data that help establish a regions climate.

VOCABULARY:

Climate

Greenhouse Effect

Angle of Insolation

Radiative Balance

Temperature Range

Intensity

Lab Activity: Climate Variables

PROCEDURE A: ANGLE OF INSOLATION

There are variations in the angle at which the sun's rays strike Earth's surface. You have observed the changing altitude of the Sun during the day and annual variation of the altitude of the noon Sun, but there is also a change as you increase or decrease your latitude. This change produces differences in intensity of insolation at Earth's surface.

- Data was obtained from an experiment that is used to show how angle of insolation can effect the temperature over a period of time.
- Use the data table below to construct a graph on the following page for the different angles of insolation and the temperatures they received over a 15 minute period.

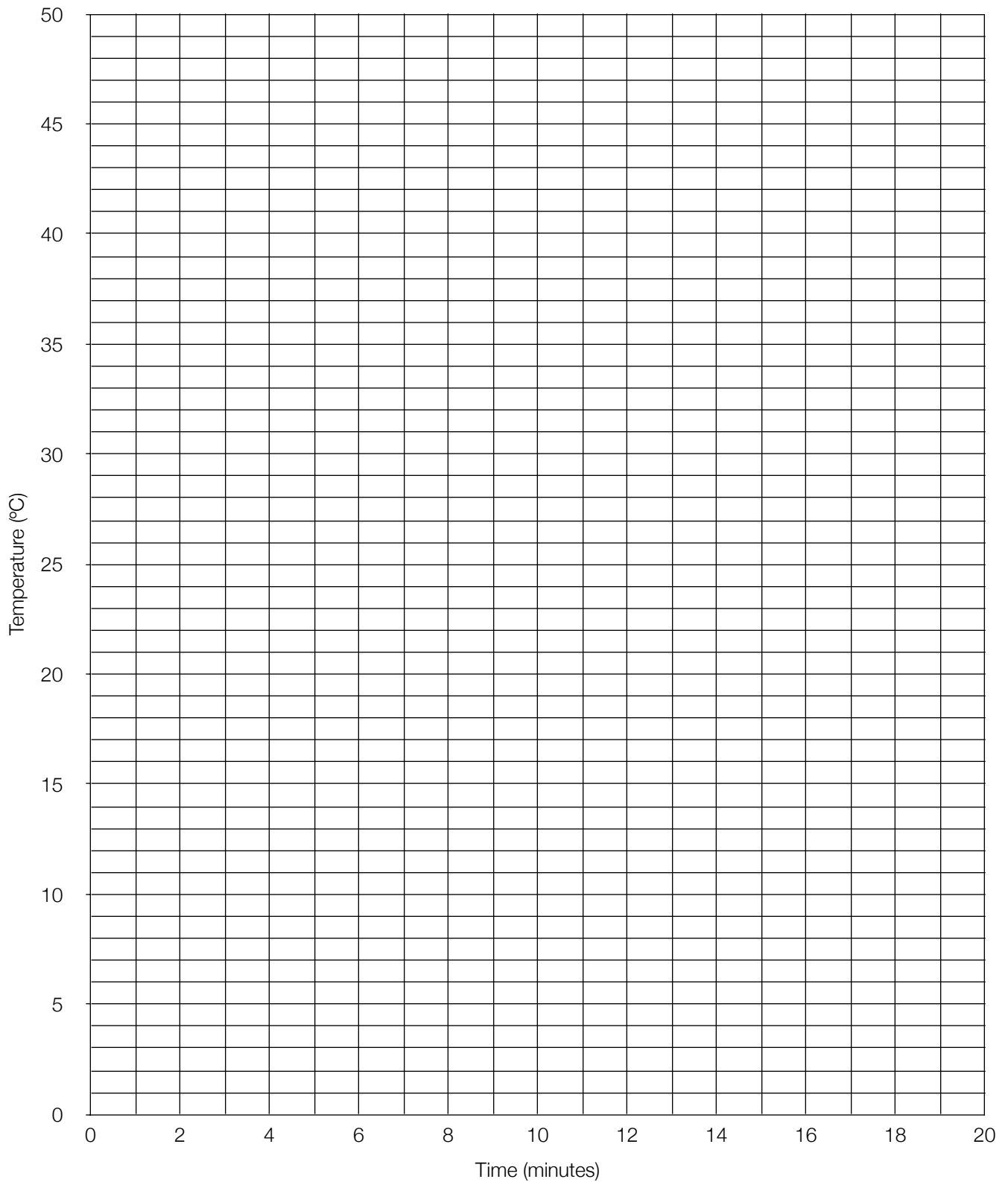
30°	
Time (min)	Temp. (°C)
0	20
1	22
2	22.5
3	23.5
4	24
5	25
6	25.5
7	26
8	26.5
9	27
10	27.5
11	28
12	28.5
13	29
14	29.5
15	30

60°	
Time (min)	Temp. (°C)
0	20
1	23
2	24
3	26
4	27
5	28.5
6	29.5
7	30.5
8	31.5
9	32.5
10	33
11	33.5
12	34
13	34.5
14	35
15	35.5

90°	
Time (min)	Temp. (°C)
0	20
1	24
2	26
3	28
4	30.5
5	32.5
6	34
7	35.5
8	37
9	38
10	38.5
11	39.5
12	40
13	40.5
14	41
15	41.5

Lab Activity: Climate Variables

GRAPH A: ANGLE OF INSOLATION



Lab Activity: Climate Variables

PROCEDURE B: ABSORPTION AND RADIATION BY LAND AND WATER

Approximately 70 percent of Earth's surface is covered by water. The unequal rates of heating of land and water cause temperature conditions that impact local and world-wide weather patterns. Long Island's climate region is greatly influenced by the Atlantic Ocean and the Sound.

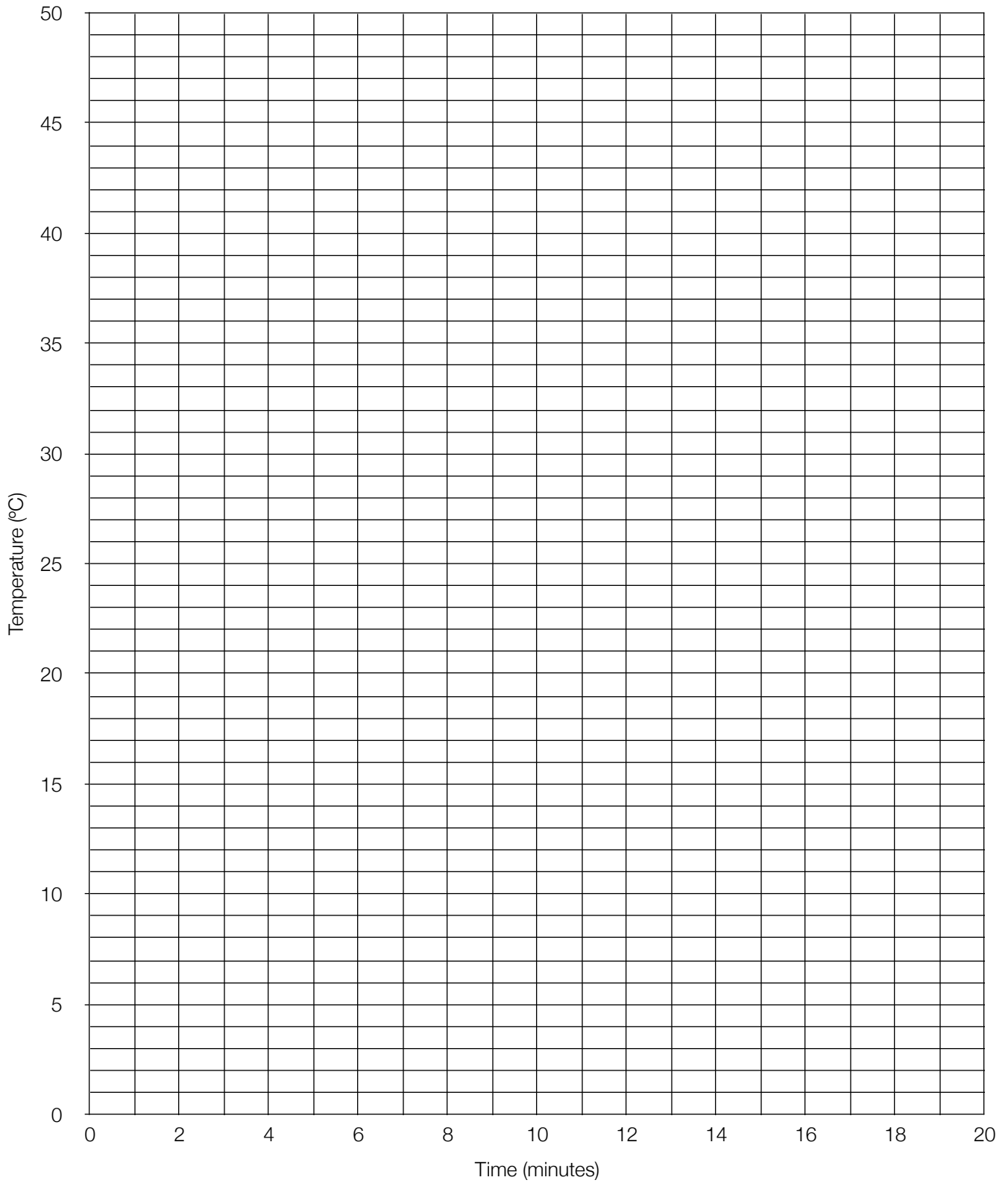
- Data was obtained from an experiment that is used to compare the rates at which water surfaces and land surfaces heat up over a period of time. During the first 10 minutes the surfaces were allowed to heat up. The heat source was then removed and during the next ten minutes allowed to cool off.
- Use the data table below to construct a graph on the following page for the absorption and radiation by land and water over a 20 minute period.

Time (min)	0	1	2	3	4	5	6	7	8	9	10
Soil Temp. (°C)	21.0	23.0	26.0	28.0	30.5	33.0	35.0	36.5	37.5	38.5	39.0
Water Temp. (°C)	21.0	21.5	22.5	23.0	23.5	24.0	25.0	25.5	25.5	26.0	26.0

Time (min)	11	12	13	14	15	16	17	18	19	20
Soil Temp. (°C)	37.5	35.0	34.0	32.0	30.5	29.0	28.0	26.5	25.5	24.5
Water Temp. (°C)	26.0	26.0	25.5	25.5	25.0	24.5	24.5	24.0	23.5	23.0

Lab Activity: Climate Variables

GRAPH B: ABSORPTION AND RADIATION BY LAND AND WATER



Lab Activity: Climate Variables

PROCEDURE C: COASTAL AND CONTINENTAL TEMPERATURE RANGES

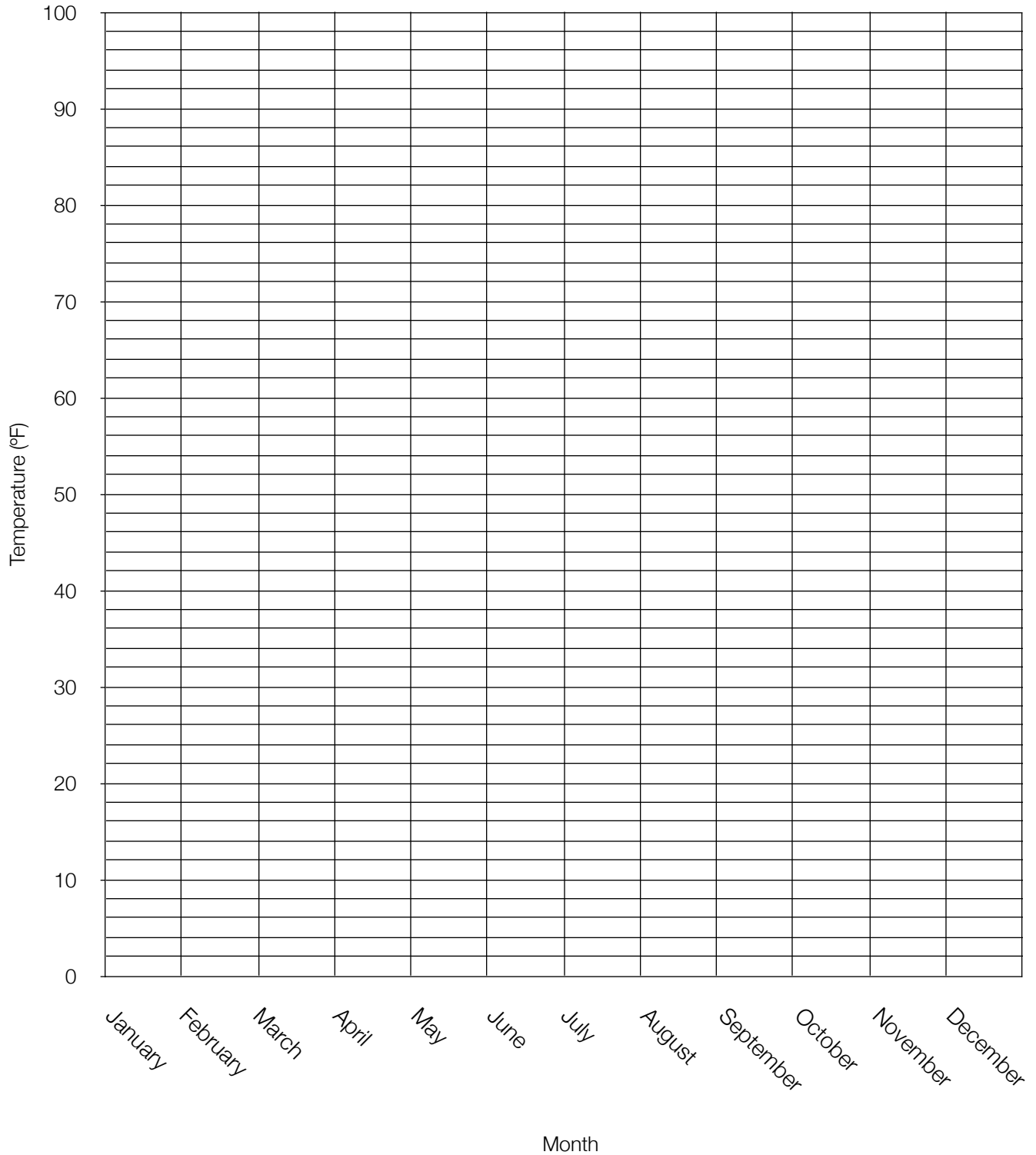
There are large variations in average monthly temperatures among cities located at the same latitude. This suggests that factors other than latitude are responsible for a regions climate. A major influence other than the angle of insolation is the location of a city relative to a large body of water.

- The average monthly temperature was obtained from four different cities in the United States for the span of one year.
- Use the data table below to construct a line graph of the following four cities average monthly temperature. Be sure to label each line with the appropriate city.

Month	Temperature (°F)			
	New York, NY	Bismarck, ND	Los Angeles, CA	Phoenix, AZ
January	32	9	58	54
February	34	16	60	58
March	42	28	61	62
April	53	43	63	70
May	63	55	66	79
June	72	64	70	88
July	77	71	74	94
August	76	68	75	92
September	68	57	74	86
October	59	46	70	75
November	48	29	63	62
December	37	14	58	54

Lab Activity: Climate Variables

GRAPH C: COASTAL AND CONTINENTAL TEMPERATURE RANGES



Lab Activity: Climate Variables

DISCUSSION QUESTIONS:

1. From procedure A, which angle of insolation received the most direct rays and heated to the highest temperature?
2. From procedure A, what is the relationship between the angle of insolation and the rate at which the temperature changes?
3. From procedure B, which was a better absorber and radiator of heat energy?
4. From procedure B, how do water and land surfaces differ in their abilities to absorb and radiated heat energy?
5. From procedure C, even though all the cities were in the United State, how could you tell from the temperature data that all were in the Northern Hemisphere?
6. From procedure C, describe the differences in annual temperature ranges between a coastal region and an inland region and explain why they differ?

CONCLUSION: Other than the climate variable studied in this lab, what other variable might influence a regions climate?