

Name: _____ Laboratory Section: _____
Date: _____ Score/Grade: _____

Video
Exercise 8
Pre-Lab Video



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LAB EXERCISE

Temperature Patterns

Lab Exercise and Activities

SECTION 1

Elevation and Temperature

1. Using the temperature graphs provided in **Figure 8.1**, plot the data from Table 8.1 for these two cities. Use a smooth curved *line graph* to portray the temperature data. Calculate the **average annual temperature** and the **temperature range** (difference between the highest and lowest) for each city.

2. Why are the temperatures at La Paz more moderate in every month and so consistent overall as compared to Concepción?

Monthly temperatures in La Paz are lower as a result of its higher altitude. The temperatures are uniform overall because of the consistent daylength and high Sun altitude throughout the year produced by its near-equator location.

3. Recall that the *normal lapse rate* of temperature change with altitude is $6.4^{\circ}\text{C}/1000\text{ m}$, or $3.5^{\circ}\text{F}/1000\text{ ft}$. Calculate the difference in elevation between La Paz and Concepción and calculate what the difference in their *mean (average) annual temperatures* should be, based on cooling at the normal lapse rate. Is the actual difference between the mean annual temperatures for these two cities higher, lower, or the same as that produced by calculating average normal lapse rate conditions? (Show your work.)

The absolute difference in average annual temperature between La Paz and Concepción is lower than that found by calculating the average normal lapse rate between the two locations. The actual annual temperature range; $25.0^{\circ}\text{C} - 9.0^{\circ}\text{C} = 16^{\circ}\text{C}$. At the normal lapse rate; $3613\text{ m difference in altitude times } 6.4^{\circ}\text{C per } 1000\text{ m} = 23.1^{\circ}\text{C}$. Stable conditions produced by lower environmental lapse rates must be in effect during winter months (May to August).

4. The annual march of the seasons and the passage of the subsolar point between the Tropics of Cancer and Capricorn affect these stations. Can you detect from your temperature graphs these seasonal effects? Explain.

Both stations show slight winter (June and July) cooling as the Sun moves to the northern hemisphere. Temperatures indicate two annual passages of the Sun's overhead rays (90° solar altitude).

La Paz, Bolivia

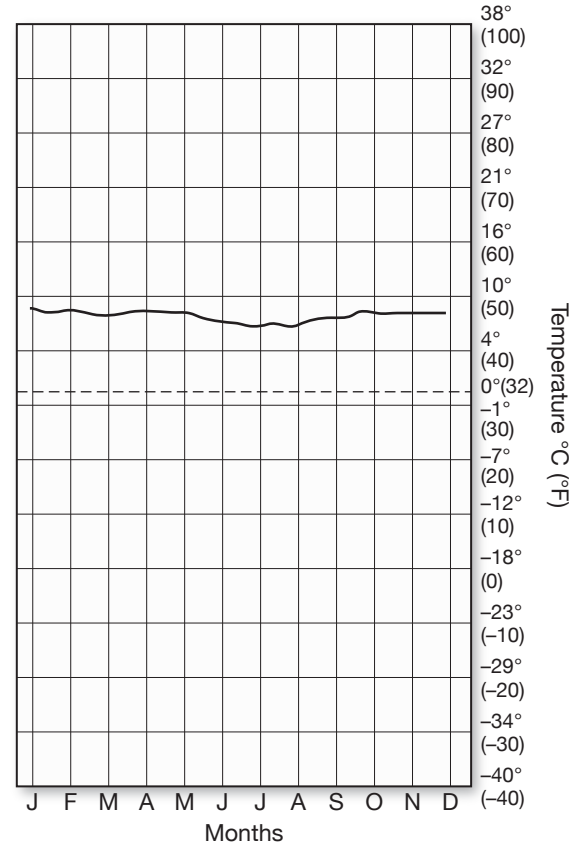
Latitude: 16.5° S Longitude: 68.17° W

Elevation: 4103 m 13,461 ft

Population: 993,000

Avg. Annual Temperature (°C, °F): 9.0°C, 48.2°F

Annual Temp. Range (°C, °F): 3.0°C, 5.4°F



Concepción, Bolivia

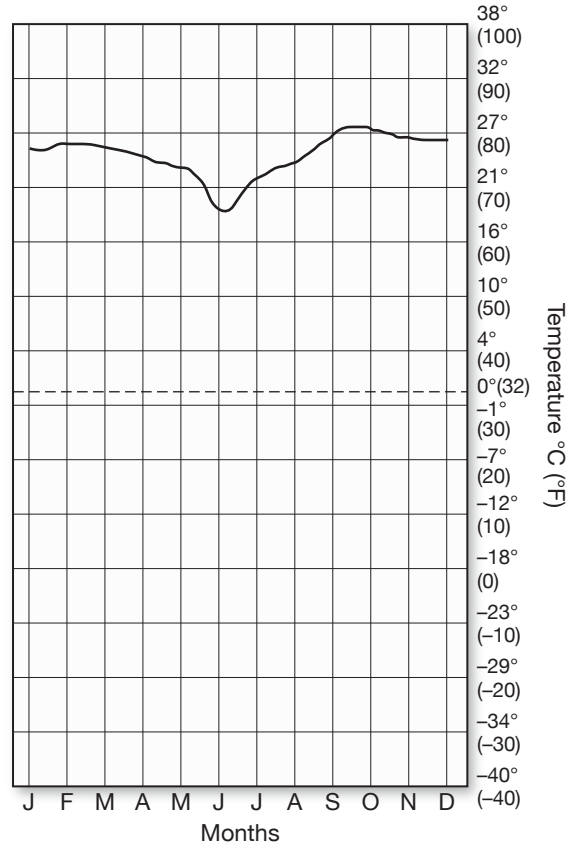
Latitude: 16.25° Longitude: 62.05°

Elevation: 490 m 1608 ft

Population: 10,000

Avg. Annual Temperature (°C, °F): 25°C, 77.0°F

Annual Temp. Range (°C, °F): 7.0°C, 14.4°F



▲ **Figure 8.1** Temperature graphs for La Paz and Concepción, Bolivia

SECTION 2

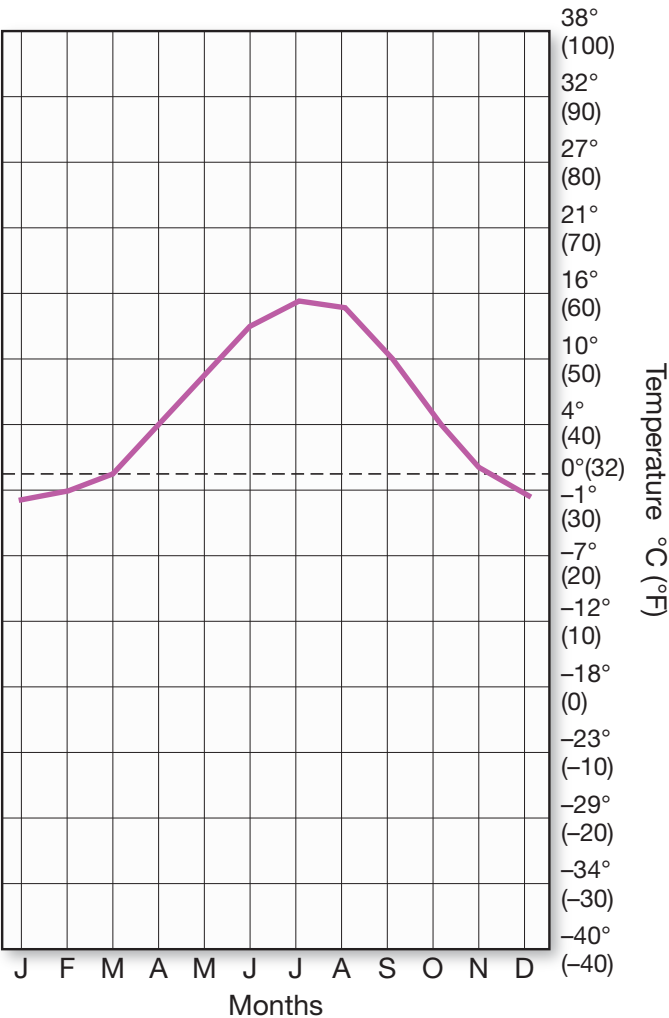
Marine vs. Continental Effects

1. Using the data given in **Table 8.2**, plot the temperatures for these three cities and portray with a smooth curved *line graph* on the temperature graph in **Figure 8.3**. Calculate the average annual temperature and temperature range for each city.

Trondheim, Norway

Avg. Annual Temperature (°C, °F): 5.8°C (42.4°F)

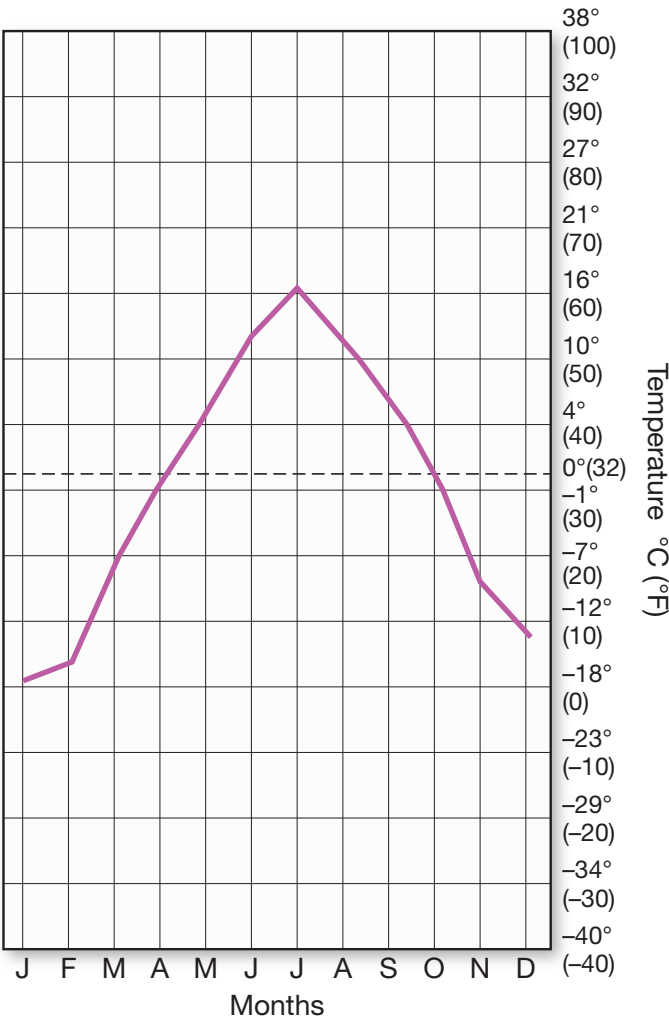
Annual Temp. Range (C°, F°): 16.9°C, (30.4°F)



Ukhta, Russia

Avg. Annual Temperature (°C, °F): 0.4°C (31.3°F)

Annual Temp. Range (C°, F°): 33.0°C, (59.4°F)



▲ Figure 8.3 Temperature graphs for Trondheim, Norway, Ukhta, Russia, and Yakutsk, Russia.

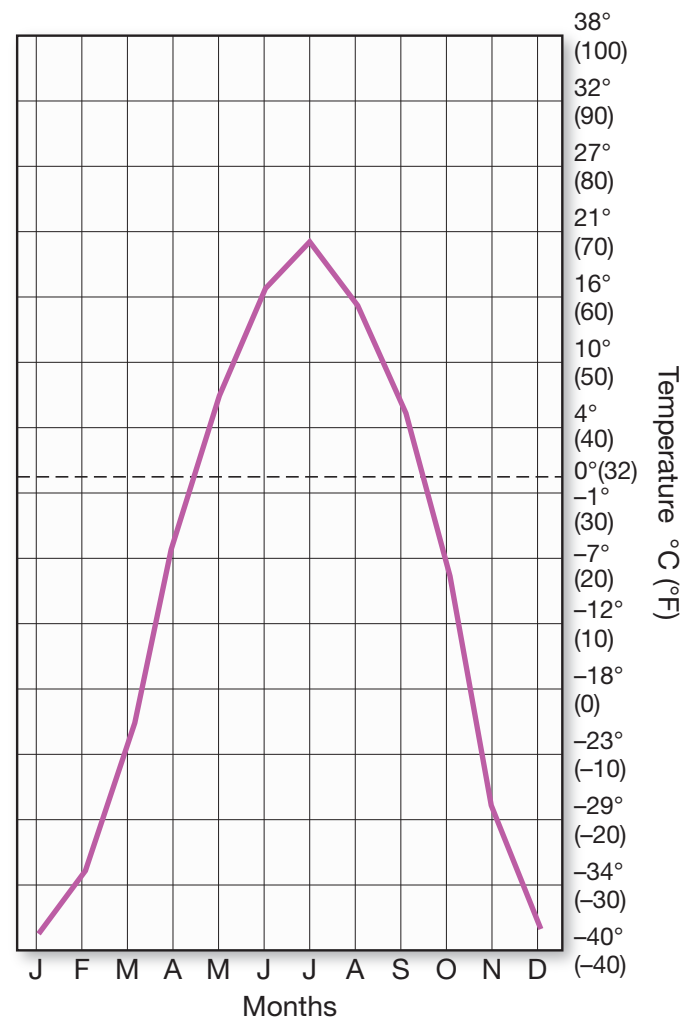
2. Compare and contrast the marine temperature regimes of Trondheim with the continental regimes of Ukhta and Yakutsk. What significant differences do you note?

Trondheim's temperatures are warmer and more moderate.

Yakutsk, Russia

Avg. Annual Temperature (°C, °F): -8.7°C (16.3°F)

Annual Temp. Range (C°, F°): 58.1°C, (104.6°F)



3. How many months register average temperatures below freezing in Trondheim, Ukhta, and Yakutsk? How many months above 10°C does each city have? Explain.

Trondheim: 3, Ukhta: 6, Yakutsk: 7.

Trondheim: 4, Ukhta: 6, Yakutsk: 5.