# Lab Exercise 1

## Latitude, Longitude, and Time

## Lab Exercise and Activities

### ✳ SECTION 1

**Great and Small Circles**

1. London, England and Colombo, Sri Lanka (English Channel, Germany, Carpathian Mtns.) ***English Channel, Netherlands, Germany, Carpathians, Romania, Black Sea, Turkey, Zagros Mountains, Iran, Arabian Sea, southern tip of India***

2. Vancouver, British Columbia and Sydney, Australia ***Vancouver Island, Pacific Ocean, Tropic of Cancer, Hawaiian Islands (Kauai, Niihau), Equator, International Date Line, New Hebredes, New Caledonia, Tasman Sea***

3. Your home town and Beijing, China ***Personal answer depends on your location***

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## ✳ SECTION 2

### Latitude and Parallels

**1.**

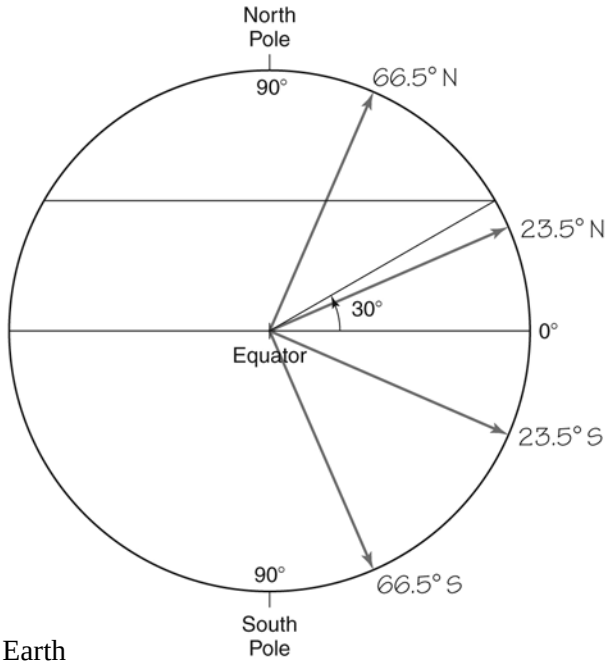


**Figure 1.3**
Measuring latitudes on Earth

**2.** Parallels have often been used to demarcate political boundaries. The 49th parallel north forms a portion of the border between which two countries?

***The Canada–United States border from Manitoba/Minnesota area to the Pacific Coast.***

**3.** Parallels made famous by wars in the last century include the ***38th*** parallel dividing the two Koreas and the ***17th*** parallel that divided Vietnam until 1975. (The border was approximately 80 km (50 mi) north of the city of Hue.)

**4.** Using a globe and your atlas or other world map, locate three cities that are located at approximately the 23rd parallel in the Northern Hemisphere; note their location in degrees (and minutes if your map is detailed enough to estimate minutes). Use the globe first, then refer to the atlas maps to better determine specific latitudes. Be sure and list their country names as well.

| | **City and Country Name** | **Longitude (degrees and minutes if possible)** |
|---|---|---|
| **a)** | ***Cabo San Lucas, Mexico*** | ***109° 55' W*** |
| **b)** | ***Havana, Cuba*** | ***82° 24' W*** |
| **c)** | ***Guangzhou, China*** | ***113° 15' E*** |

**5.** Now locate three cities that are located at approximately your latitude.

| | **City and Country Name** | **Longitude** |
|---|---|---|
| **a)** | ***Personal answers*** | |
| **b)** | | |
| **c)** | | |


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## ✳ SECTION 3

**Longitude and Meridians**

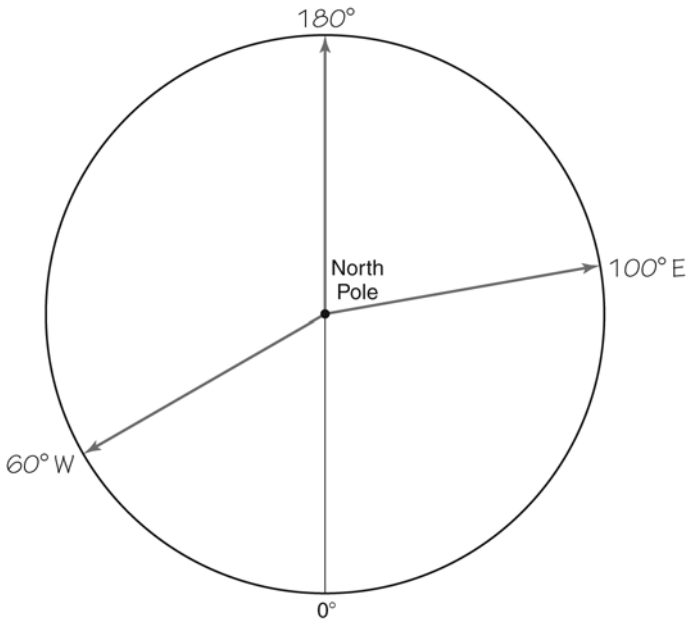


**Figure 1.5**
Measuring longitudes on Earth

**1.** On a political globe or world map follow the International Date Line across the Pacific Ocean. Why do you think the International Date Line is not straight, but zigs and zags? ***The International Date Line zigzags to avoid local confusion. If the Date Line passed through a country, imagine the confusion of having the country split with each side experiencing a different day! Political reasons exist as well. The island country of Kiribati moved the International Date Line to its eastern margin (150° west longitude) to be the first to experience each new day. These distortions of the IDL only apply to the countries and their territorial waters and not to international waters between them and the 180th meridian.***

**2.** Examine an atlas or a political globe and in the spaces marked a through h list the provinces and states through which the 100th meridian in the Western Hemisphere passes—north to south. The first answer is provided for you in bracketed italics.

**a)** [*Nunavut, Canada*]
**b)** ***Manitoba***
**c)** ***North Dakota***
**d)** ***South Dakota***
**e)** ***Nebraska***
**f)** ***Kansas***
**g)** ***Oklahoma***
**h)** ***Texas***

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## ✳ SECTION 4

### Earth's Geographic Grid

**1.** Locate and give the geographic coordinates for the following cities (to a tenth of a degree if your atlas maps are detailed enough) or identify the cities from the given coordinates.

| | City | Latitude and Longitude |
|---|---|---|
| **a)** | Greenwich, London, England | [*51.5°N 0°*] |
| **b)** | Rio de Janeiro, Brazil | ***22.5° S 43.3° W*** |
| **c)** | Your state's/province's capital city | ***55.8° N 37.6° E*** |
| **d)** | [*Tokyo, Japan*] | 35.7°N 139.7°E |
| **e)** | ***Luanda, Angola*** | 8.8°S 13.2°E |

On the map grid in Figure 1.6, plot the coordinates in items 1 (a) through (e) above; and label the city names.

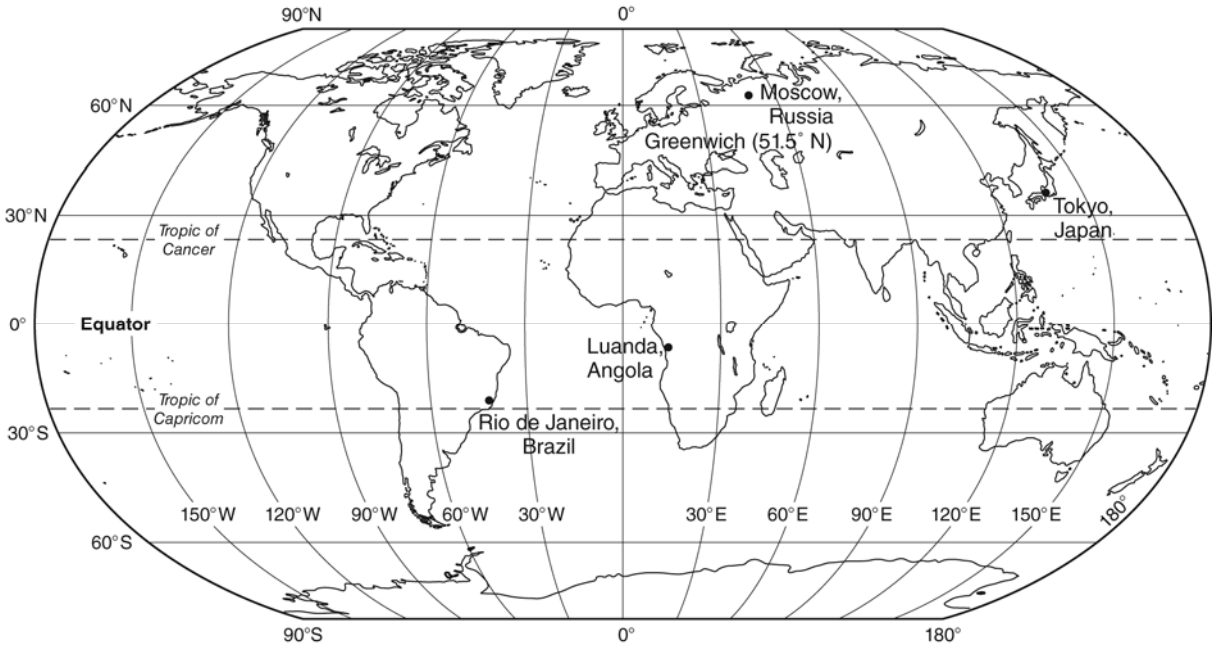


**Figure 1.6**
Plotting coordinates

**2.** Using your knowledge of latitude and longitude, find and circle the errors in the following geographic grid coordinates. Rewrite the coordinates correctly in the space to the right. You do not have to locate these on a map.

**a)** DMS format Lat. 57° 86′ 24″ S, Long. 149°02′63″ N [*minutes cannot exceed 60′*]

**b)** DD format Lat. 105.03° W, Long. 93.99° E ***Lat. 05.03° N or S, Long. 86.01° W***


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**3.** If you were halfway between the equator and the South Pole and one-quarter of the way around Earth to the west of the Prime Meridian, what would be your latitude and longitude?

***45° S, 90° W***

**4.** You are at 10° N and 30° E; you move to a new location which is 25° south and 40° west of your present location. What is your new latitudinal/longitudinal position?

***15° S, 10° W***

**5.** You are at 20° S and 165° E; you move to a new location which is 45° north and 50° east from your present location. What is your new latitudinal/longitudinal position?

***25° N, 145° W***

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## ✳ SECTION 5

### Latitude and Longitude Values

**1.** **a)** Mumbai, India and the equator ***19° × 111 km/1° = 2109 km or, 19° × 69 mi/1° = 1311 mi***

**b)** Miami, Florida and 10° south latitude ***26° × 111 km/1° = 2886 km or, 26° × 69 mi/1° = 1794 mi***

**c)** Edinburgh, Scotland and the 5th parallel north ***51° × 111 km/1° = 5661 km or, 51° × 69 mi/1° = 3519 mi***

**d)** Your location and the equator ***Personal answer***

**2.** The table also shows that the linear distance separating each 1° of longitude decreases toward the poles. For example, at 30° latitude each degree of longitude is separated by slightly more than 96 km (nearly 60 miles), and at 60° latitude, the linear distance is reduced to approximately half that at the equator. For each of the following latitudes, determine the linear distance in km and in miles for 15° of longitudinal arc (along a parallel):

| | **km** | **miles** |
|---|---|---|
| **a)** 40° latitude: | [$15° \times 85.40\ km = 1281\ km$] | [$15° \times 53.07 = 796\ mi$] |
| **b)** 50° latitude: | ***1075.50 km (15 × 71.70 km)*** | ***668.25 mi (15 × 44.55 mi)*** |
| **c)** 90° latitude: | ***0 km*** | ***0 mi*** |

**3.** What do you estimate is the approximate linear distance of a degree of longitude at your present location in km? ***Personal answers*** in miles? _____ one minute of longitude in km? _____ in miles? _____ one second of longitude in km? _____ in miles? _____ a tenth of a degree in km? _____ in miles? _____ one hundredth of a degree in km? _____ in miles? _____ (longitudinal arc along a parallel).

**4.** Again using Table 1.1, what is the linear distance in km and miles along the parallel at your latitude from the prime meridian to you? ***Personal answer***


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## ✳ SECTION 6

### Time, Time Zones, and the International Date Line

**1.** From the map of global time zones in Figure 1.7, determine the present time in the following cities: (For your time use the starting time of the lab.)

Moscow ***Personal answers*** Los Angeles _____

London _____ Honolulu _____

Chicago _____ Mumbai _____

**2.** You may not always have a time zone map available, but by remembering the relationship of 1 hour for every 15° of longitude, you can easily calculate the difference in time between places. Indicating and using the standard meridians to determine time zones, solve the following problems. Show your work:

**a)** If it is 3 A.M. Wednesday in Vladivostok, Russia (132° E), what day and time is it in Moscow (37° E)?

[*The controlling meridian for Moscow is 105° away from Vladivostok's controlling meridian of 135° E* (135° – 30° = 105° *difference*). *Since Earth rotates 15° per hour, Moscow is 7 hours earlier than Vladivostok (105° difference / 15° rotation* per hour = 7 hours *time difference*), *therefore if it is 3* A.M. *Wednesday in Vladivostock it is 8* P.M. *Tuesday in Moscow*.]

**b)** If it is 7:30 P.M. Thursday in Winnipeg, Manitoba, Canada (97° W), what day and time is it in Harare, Zimbabwe (31° E)? ***4:30 a.m. Friday – this is according to the standard/controlling meridian; since Calgary is at 114° W, it is closest to the 120°W standard meridian – Pacific Standard Time. However, Calgary uses Mountain Time based on the 105° W meridian, which would put Harare only 9 hours later than Calgary.***

**c)** If you depart from San Francisco International Airport at 10:00 P.M. on Tuesday, what day and time will you arrive in Auckland, New Zealand (175° E), assuming a flight time of 14 hours?

***8 a.m. Thursday***

**3.** If there is a difference of 15° of longitude for each hour of time, how much difference in time is there for 1° of longitude? ***4 minutes of time (1 hr or 60 min ÷ 15)***

for 1′ of longitude? ***4 seconds of time (1' = 1/60 of 1°; 4 seconds = 1/60 of 4 min)***

**4.** What is the standard (controlling) meridian for your time zone (75°—Eastern, 90°—Central, 105°—Mountain, 120°—Pacific, 135°—Alaska, other)?

***Personal answer***

How many degrees of longitude separate you from this standard controlling meridian?

***Personal answer***

How does your distance from the standard meridian affect the difference between the time on your clocks and actual Sun (solar) time? (Calculate the difference between standard and Sun time using the answer you determined in #3 above). ***Personal answer***

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**5.** Assume the time on your watch, showing local standard time, is 4:15 P.M. A chronometer (a clock giving Coordinated Universal Time) reads 2:15 A.M. What is your longitude? ***150° W***

**6.** Does your community adopt daylight saving time? What are the dates for adjusting clocks in the spring and fall? ***Personal answer***

**7.** What time does your physical geography lab start

**a)** according to standard time? ***Personal answers***

**b)** according to daylight saving time?

**c)** in UTC?

(24-hour clock time in Greenwich, England; e.g., 3:00 P.M. = 15:00 hours)


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