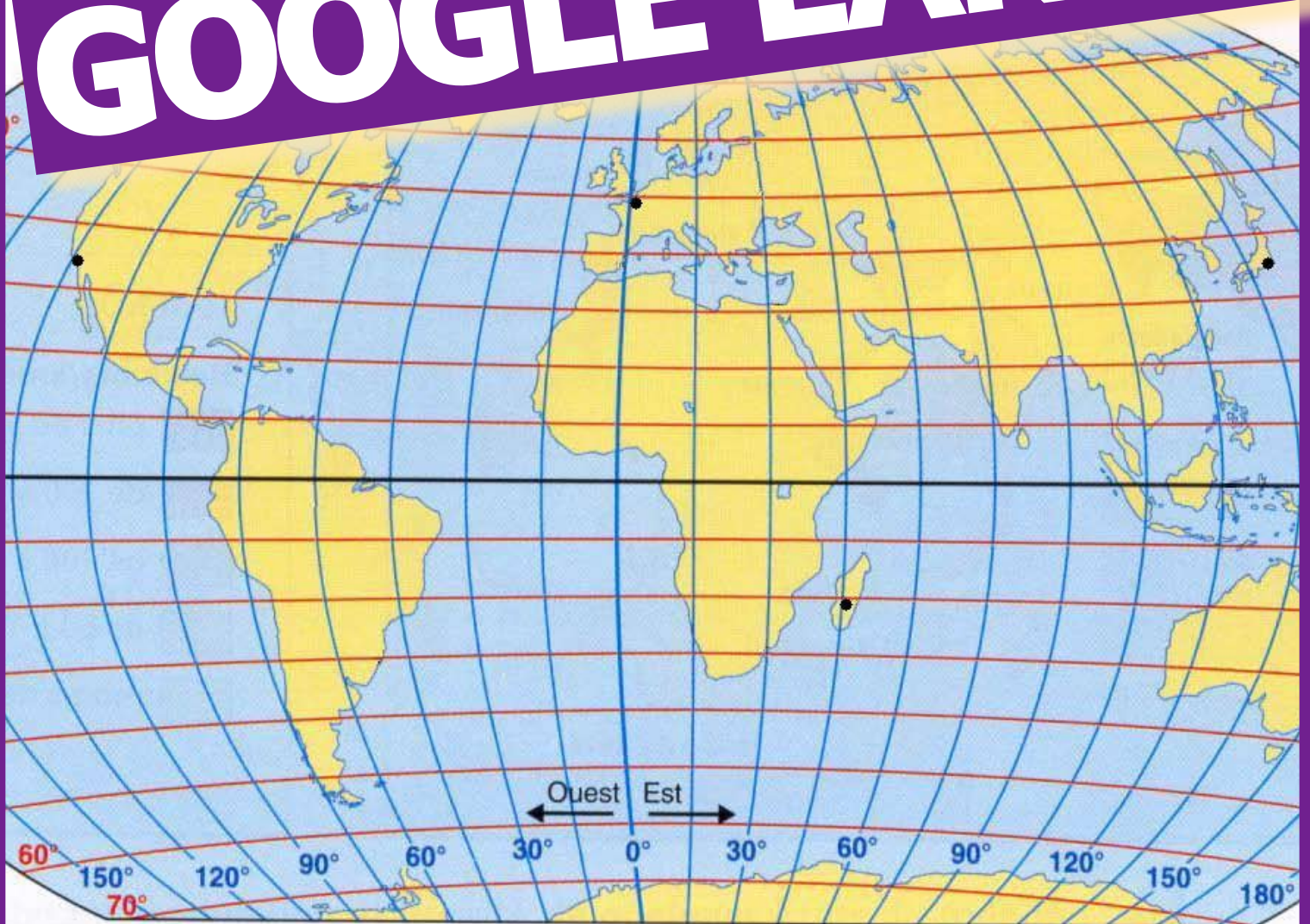


Longitude and Latitude

GOOGLE EARTH



- Lesson Plan
- Worksheets
- Answer Key

**Middle School
Resources**

Contents

Lesson Plan 3

The Lesson 4

Geographic Coordinates 7

Coordinate Formats 10

Capitals of the World 11

City Icons 14

The World's Largest, Biggest, Tallest 15

Length of a Degree of Latitude and Longitude 16

Climate 18

Travel around the World along the Equator 19

Answers 20

Lesson Plan

Overview

This lesson is designed to allow students to revise, expand and consolidate their knowledge/ understanding of latitude and longitude coordinate system using Google Earth.

Grade Ranges

Years 6 -9

Time

Two hours

Pre-requisite knowledge

Students should have a basic knowledge of the concepts. The prior content knowledge will be reviewed within the lesson. Students should be familiar with navigating around Google Earth, independently or with little teacher guidance, before doing this lesson.

Activity Preparation

Prior to the lesson, install Google Earth on computers. In Google Earth Layers, Terrain and Borders should be clicked on. The default coordinate for Google Earth is degrees, minutes, seconds. The option can be changed in Google Earth > Preferences.

Objectives

By the end of this lesson, students should be able to:

- search locations given the latitude and longitude coordinates using Google Earth;
- determine the latitude and longitude of a location on Earth using Google Earth;
- convert coordinate formats with Google Earth;
- calculate the distance of one degree of latitude and longitude at different locations;
- explain the influence of latitude on climate.

Technology and Materials Needed

Computer with Google Earth installed

Student Worksheets

Globe (optional)

The Lesson

	Teacher Activity	Student Activity
Introduction	<p>Revise terminology and concepts with the class.</p> <p>Hand out the Geographic Coordinates worksheet and have students navigate around Google Earth to answer the questions.</p>	<p>Worksheet: Geographic Coordinates</p>
Lesson Development	<p>Introduce the concept of latitude/longitude in degrees/minutes/seconds.</p> <p>Present the three commonly used ways of displaying latitudes and longitudes: degree, minutes, seconds; degree decimal minutes; decimal degrees. Ask students to determine the latitude and longitude of their home town using Google Earth and write its coordinates in each of the three formats.</p>	<p>Worksheet: Coordinate Formats</p>
	<p>Ask students to determine the latitude and longitude of different locations on Earth using Google Earth.</p> <p>Use this as an opportunity to discuss the general climate patterns that occur as latitude increases.</p> <p>Ask students to compare the climates graphs of three locations with different latitudes. Have them draw conclusions about the effect of latitude on climate.</p>	<p>Worksheet: Capitals of the World</p>

	Teacher Activity	Student Activity
	<p>Have students search locations given the latitude and longitude coordinates. Provide students with the correct answers and ask them for a self-assessment.</p>	<p>Worksheets: City Icons The World's Largest, Biggest, Tallest</p>
	<p>Have the students look at the grid in Google Earth.</p> <p>Point out: Parallels are equidistant, Meridians run perpendicular to the equator and converge at the poles.</p> <p>Consequently, only at the equator the distance represented by one degree of longitude is equal to the distance represented by one degree of latitude. As the meridians converge toward the poles, the distance represented by one degree of longitude decreases progressively to zero.</p> <p>To demonstrate that, ask students to measure the distance between degrees of latitude and longitude at two different locations in Australia.</p> <p>Have students exchange their worksheets to check each other's results.</p>	<p>Worksheet: Length of a Degree of Latitude and Longitude</p>

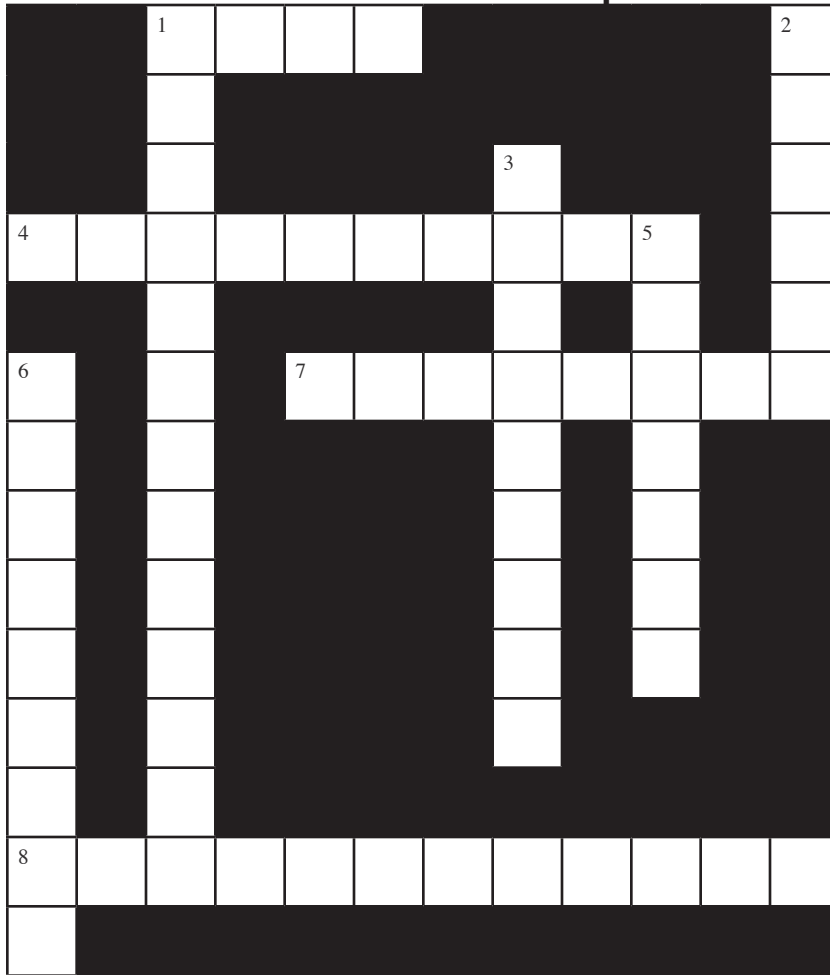
	Teacher Activity	Student Activity
Closure	<p>Whole-class guided discussion:</p> <p>Ask students to state how using Google Earth helped them understand the latitude and longitude concepts. Discuss how these concepts are important to both scientific inquiry and navigation. Finally, discuss why knowing latitude and longitude is a useful and important skill when traveling into an unknown region of the Earth.</p>	
Extra Worksheets	Extra fun for those that finish early!	<p>Worksheets:</p> <p>Climate</p> <p>Travel around the World along the Equator</p>

Assessment of Student Learning

Assess students based on their completed work and on their participation in classroom discussion. Provide frequent feedback and opportunities for self- and peer assessment.

Geographic Coordinates

Use the clues below to complete the crossword:



Across

- 1 Extreme north or south point of the Earth's axis.
- 4 Half of the terrestrial globe.
- 7 Measures distance north and south from the equator.
- 8 Measures distance east and west from the Prime Meridian.

Down

- 1 Imaginary line that passes through the city of Greenwich, England (2 words).
- 2 Unit of latitude and longitude measurement.
- 3 Another name for lines of longitude.
- 5 Represents 0° latitude.
- 6 Another name for lines of latitude.

Use the grid in Google Earth to answer the following questions:

1. What is the latitudinal value of the Tropic of Cancer?

2. At what latitude are we halfway between the equator and the pole?

3. Which important line of latitude runs 23.5° south of the equator?

4. What is the latitudinal value of the Arctic Circle?

5. How many degrees of latitude are there in one hemisphere?

6. How many degrees of longitude are there in one hemisphere?

Complete the chart below using the grid in Google Earth.

Fill in the correct hemispheres for each capital city:

Capital City	Northern or Southern Hemisphere?	Eastern or Western Hemisphere?
Oslo, Norway		
Manila, Philippines		
New Delhi, India		
Luanda, Angola		
Lima, Peru		
Nairobi, Kenya		

Using the grid lines in Google Earth, choose the correct answer to the following questions:

1. Which is the northernmost capital city - Oslo, Norway or Reykjavík, Iceland?

2. Which is the southernmost capital city - Pretoria, South Africa or Wellington, New Zealand?

3. Which is the easternmost capital city - Funafuti, Tuvalu or Suva, Fiji?

4. Which is the westernmost capital - Lima, Peru or Apia, Samoa?

Coordinate Formats

Use the Search field in Google Earth to find your home town.

In the chart below, fill in the coordinates for your home town in each of these different formats.

Format	Latitude	Longitude
Degress, minutes, seconds		
Decimal degrees		
Degrees, decimal minutes		

NOTE: By default, Google Earth displays the coordinates in degrees, minutes, seconds. To set Google Earth to decimal degrees or degrees decimal minutes, go to the Google Earth > Preferences area, and in the 3D View tab, under Show Lat/Long, select Decimal Degrees or Degrees, Decimal Minutes.

You can view how to do this by following this You Tube link:



<http://youtu.be/4NTs2nCmJ9s>



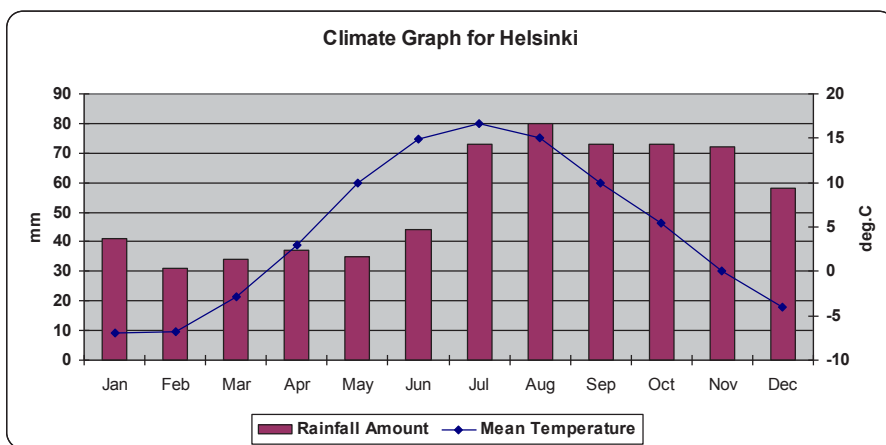
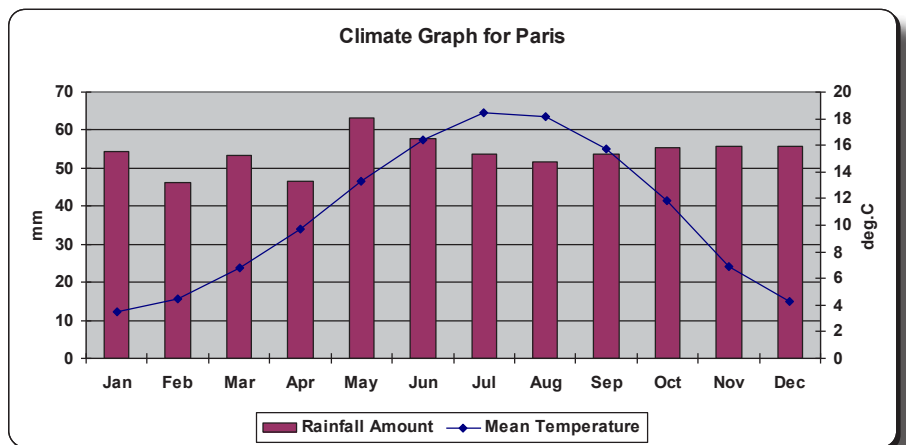
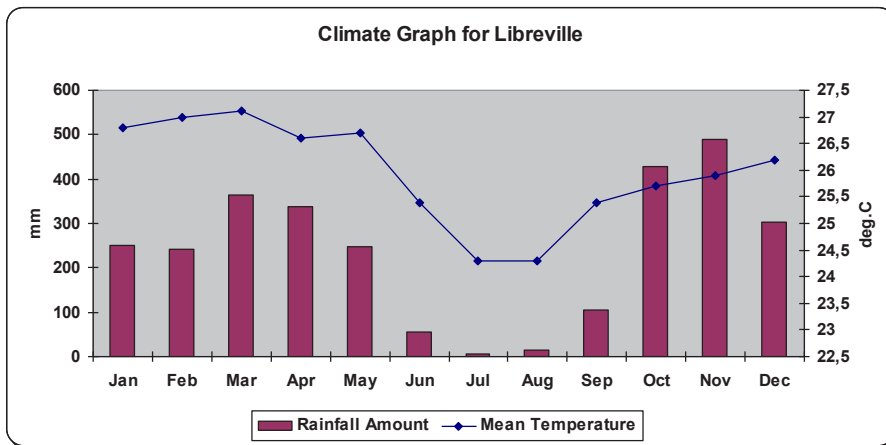
Capitals of the World

Use google Earth to complete the chart:

Capital City	Country	Location (Latitude & Longitude)	Altitude
Libreville			
Quita			
Muscat			
Ottawa			
Paris			
Moscow			
Buenos Aires			
Helsinki			



Review the climate graphs of Libreville, Paris and Helsinki.



Identify the range of monthly mean temperatures for each city, and record the value in the chart below:

Capital City	Highest monthly mean temperature	Lowest monthly mean temperature
Libreville		
Paris		
Helsinki		

What factor determines the differences in temperature between the three cities?

Write 2-3 sentences that summarize the effect of latitude on climate.

City Icons

Use Google Earth to answer the following questions.



(If you are not sure how to find these locations, review how to solve question 1 on Google Earth at this You Tube link: <http://youtu.be/ElI7Sqli5k>)

1. What is the famous tower at $48^{\circ}51'32''\text{N}$, $002^{\circ}17'45''\text{E}$?

2. What famous statue is at $22^{\circ}57'7''\text{S}$ $43^{\circ}12'38''\text{W}$?

3. What is the famous palace at 39.914722, 116.390556?

4. What are the coordinates, in degrees, minutes, seconds, of the Statue of Liberty in New York?

5. What are the coordinates, in degrees, minutes, seconds, of the Moscow Kremlin?

6. What are the coordinates, in decimal degrees, of the Sydney Opera House?

The World's Largest, Biggest, Tallest

Answer the questions below using Google Earth:

1. What is the tallest building in the world at $25^{\circ} 11' 49.7''\text{N}$, $55^{\circ} 16' 26.8''\text{E}$?

2. What is the world's largest building at $30^{\circ} 34' 15''\text{N}$, $104^{\circ} 3' 38''\text{E}$?

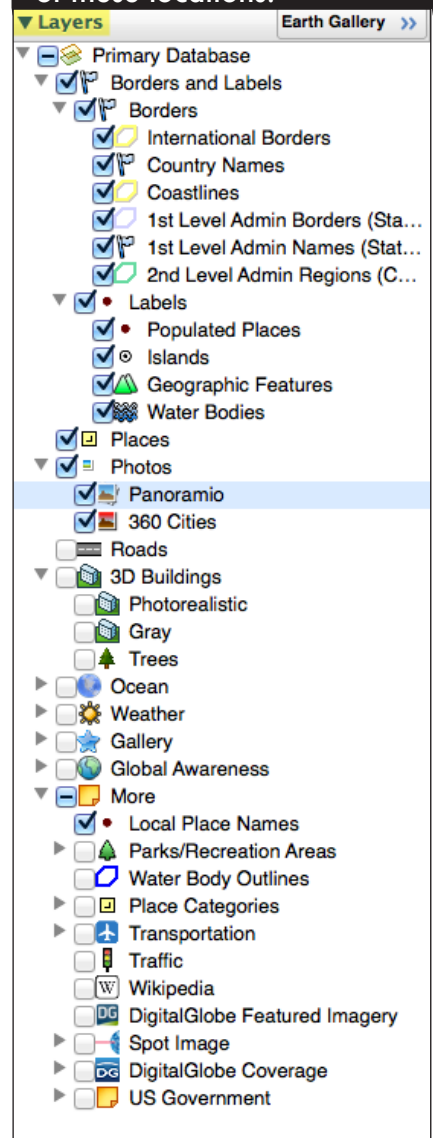
3. What is the world's biggest city by land area at $40^{\circ} 40' 12''\text{N}$, $73^{\circ} 56' 24''\text{W}$?

4. What is the world's largest city by population at $35^{\circ} 41' 22.22''\text{N}$, $139^{\circ} 41' 30.12''\text{E}$?

5. What is the world's largest delta at $22^{\circ} 42' 0''\text{N}$, $89^{\circ} 40' 0''\text{E}$?

6. What is tallest volcano in the world at $27^{\circ} 6' 34.6''\text{S}$, $68^{\circ} 32' 32.1''\text{W}$?

Use all the layers in Google Earth to find out the names of these locations.



Length of a Degree of Latitude and Longitude

Is the length of one degree of latitude/longitude the same in Melbourne, Victoria as it is in Darwin, Northern Territory?

Use Google Earth to find the answers. Follow the You Tube link -



<http://youtu.be/3Yul8CCCb0A> - to see how to perform this task.

To do

1. Type the coordinates: -37.814251, 144.963169 in the input box and click on Search. This is Melbourne.
2. Use a Placemark pin to mark this spot - call it Coordinate 1
3. Type the coordinates in the search box: - 38.814251, 144.963169 and click on Search.
Note that the latitude has increased by one degree.
4. Use a Placemark pin to mark this spot - call it Coordinate 2
5. With both coordinates visible, use the ruler to measure the distance between -37.814251, 144.963169 and -38.814251, 144.963169 and write the length of one degree of latitude in the table below.
6. Enter Darwin in the Google Earth search box and click on the Search button to navigate there.
7. Type the coordinates -12.461334, 130.839810 in the Google Earth search box and press Enter.
8. Use a Placemark pin to mark this spot - call it Coordinate 3
9. Add one degree of latitude and enter the coordinates -13.461334, 130.839810 in the search box and click on Search.
10. Use a Placemark pin to mark this spot - call it Coordinate 4
11. With both coordinates visible, use the ruler to measure the distance between one degree of latitude between the two locations.

12. Write the result of measurement in the table below.

Follow the same steps to measure the length of one longitude degree at the two locations and write the results of your measurements in the table below.

Length of:	Melbourne, Victoria, Australia	Darwin, NT, Australia
... one degree of latitude		
... one degree of longitude		

Based on your measurements, answer the following questions:

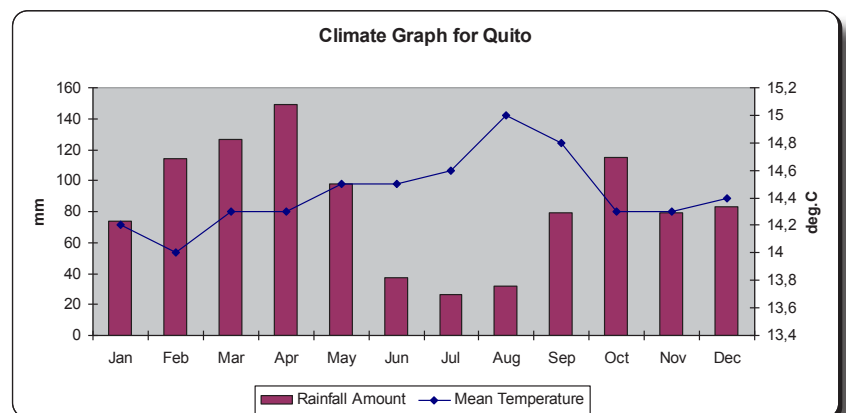
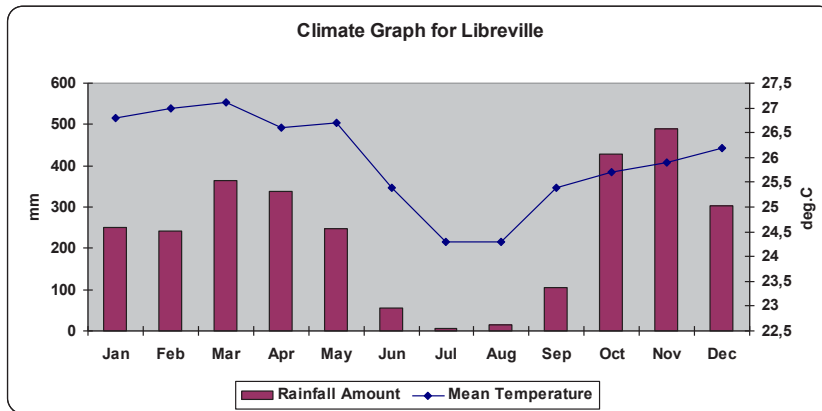
1. What is the difference between measurements of one degree of latitude at the two locations?

2. What is the difference between measurements of one degree of longitude at the two locations?

3. Explain why there is difference in results between measurements of one degree of longitude and measurements of one degree of latitude at the two locations.

Climate

Review the climate graphs for Libreville and Quito



Respond to the following questions:

1. Which of the two capital cities has the highest annual mean temperature?

2. Since both Libreville and Quito are located on the equator, what natural factor determines the differences in temperature between the two cities?

Travel around the World along the Equator

Use Google Earth to fill in the chart below:

Sequence	Location	Country	Location (latitude & longitude)	Estimated distance from previous stop(miles)
Start	Quito			0
First stop			0° 2' 2" N 51° 3' 59" W	1,900
Second stop	Libreville			
Third stop			00° 18' 49" N 32° 34' 52" E	
Fourth stop				5,300
Fifth stop	Yaren			
Sixth stop	Isabela Island, Galapagos Archipelago		0° 30' 0" S, 91° 4' 0" W	7,055
Return	Quito			

 You can view each stop via a Google Earth tour my visiting this link on You Tube:

<http://youtu.be/v2XVdLrEo0I>

Answers

Page 7 Geographic Coordinates

Across: 1 - pole; 4 - hemisphere; 7 - latitude; 8 - longitude

Down: 1 - Prime Meridian; 2 - degree; 3 - meridians; 6 - parallels

Page 8

1. 23.5° N
2. 45°
3. Tropic of Capricorn
4. 66.5° N
5. 90°
6. 180°

Capital City	Northern or Southern Hemisphere?	Eastern or Western Hemisphere?
Oslo, Norway	Northern	Eastern
Manila, Philippines	Northern	Eastern
New Delhi, India	Northern	Eastern
Luanda, Angola	Southern	Eastern
Lima, Peru	Southern	Western
Nairobi, Kenya	Southern	Eastern

Page 9

1. Reykjavik, Iceland
2. Wellington, New Zealand
3. Funafuti, Tuvalu
4. Apia, Samoa

Page 11 Capitals of the World

Capital City	Country	Location (Latitude & Longitude)	Altitude(m)
Libreville	Gabon	0° 23' 24"N, 9° 27' 0"E	12
Quita	Ecuador	00° 15' 00"S, 78° 35' 00"W	2,850
Muscat	Oman	23° 36' 31"N, 58° 35' 31"E	40
Ottawa	Canada	45° 25' 15"N, 75° 41' 24"W	70
Paris	France	48° 51' 24"N, 2° 21' 03"E	35-130
Moscow	Russia	55° 45' 0"N, 37° 37' 0"E	156
Buenos Aires	Argentina	34° 36' 12"S 58° 22' 54"W	25
Helsinki	Finland	60° 10' 15"N, 24° 56' 15"E	10

Page 13

Capital City	Highest monthly mean temperature	Lowest monthly mean temperature
Libreville	27°C (Mar)	24°C (Jul, Aug)
Paris	18°C (Jul)	3.5°C (Jan)
Helsinki	16.5 °C (Jul)	-7°C (Jan)

Latitude of the three captils has a major influence on their average temperature. Temperatures decrease with increasing latitude.

Page 14 City Icons

1. Eiffel Tower (Paris, France)
2. Christ the Redeemer (Rio de Janeiro, Brazil)
3. Imperial Palace of Beijing, China
4. 40° 41' 21"N, 74° 2' 40"W
5. 55° 45' 6"N, 37° 37' 4"E
6. -33.858667, 151.214028

Page 15 The World's Largest, Biggest, Tallest

1. Burj Khalifa, Dubai, United Arab Emirates
2. New Century Global Center in Chengdu, China
3. New York, United States of America
4. Tokyo, Japan
5. Ganges Delta (India, Bangladesh)
6. Nevados Ojos del Salado (Chile/Argentina)

Page 17 Length of a Degree

Length of:	Melbourne, Victoria, Australia (miles)	Darwin, NT, Australia (miles)
... one degree of latitude	68.94	68.94
... one degree of longitude	54.46	67.32

1. None, they are the same
2. Near Melbourne, one degree of longitude is approximately 13 miles less than it is near Darwin.
3. Lines of longitude converge, so the length of one degree of longitude decreases towards the poles. Lines of latitude are equal distance from one another from the equator to the poles.

Page 18 Climate

1. Libreville
2. Altitude affects the temperature of a location - the higher the altitude, the cooler the temperature.

Page 19 Travel around the World along the Equator

Sequence	Location	Country	Location (latitude & longitude)	Estimated distance from previous stop(miles)
Start	Quito	Ecuador	0° 15'0"S 78° 35'0"W	0
First stop	Macapa	Brazil	0° 2'2"N 51° 3'59"W	1,900
Second stop	Libreville	Gabon	0° 23'24"N 9° 27'0"E	4,180
Third stop	Kampala	Uganda	00° 18'49"N 32° 34'52"E	1,600
Fourth stop	Pontianak	Indonesia	0° 0'N 109° 20'E	5,300
Fifth stop	Yaren	Nauru	0° 32'51.72"S 166° 55'15.12"E	3,980
Sixth stop	Isabela Island, Galapagos Archipelago	Ecuador	0° 30'0"S 91° 4'0"W	7,055
Return	Quito	Ecuador	0° 15'0"S 78° 35'0"W	860