Objectives

- Compare and contrast latitude and longitude.
- Describe how time zones vary.

Vocabulary

- cartography
- equator
- latitude
- longitude
- prime meridian
- International Date Line
Cartographers use an imaginary grid of parallel lines and vertical lines.

- Equator is halfway between the poles.

Northern and Southern hemispheres on either side.
Latitude lines -- run parallel

- to the equator.
- Equator is 0 degrees.
- North Pole 90 N
- South Pole 90 S
Latitude

Degrees of Latitude

- Each degree of latitude is equivalent to about 111 km on Earth’s surface.
- Cartographers took Earth’s 40,000 km circumference and divided it by 360 degrees since it’s a sphere.
- Degrees are divided into 60 smaller units - minutes
- A minute is divided into 60 even smaller units known as seconds.
Longitude lines are also called meridians**

 Longitude--- distance in degrees east or west of the prime meridian.

 The prime meridian, representing 0° longitude, runs thru Greenwich, England.
Longitude

- Points west of the prime meridian are numbered from 0° to 180° west longitude (W).
- Points east of the prime meridian are numbered from 0° to 180° east longitude (E).
Longitude

- Lines of longitude are not parallel; they are large semicircles that extend vertically from pole to pole.

Degrees of Longitude

Distance of a degree of longitude gets less as you get close to the poles!

They converge together…at the pole in single point.
– Need both latitude and longitude for a coordinate
– For example, the location of New Orleans is 29°57´N, 90°04´W.
– Note the symbols for degrees and minutes…
Time Zones

• Each time zone is 15° wide, corresponding roughly to lines of longitude.
• 6 time zones in the USA
There are six different time zones in the United States.
Time Zones

Calendar Dates

- Each time you travel through a time zone, you gain or lose time, eventually gaining or losing an entire day.
- The **International Date Line**, or 180° meridian, serves as the transition line for calendar days.

- Traveling west across the International Date Line, you would advance your calendar one day.
- Traveling east, you would move your calendar back one day.
Section Assessment

1. Match the following terms with their definitions.

D. latitude
B. longitude
A. prime meridian
C. equator

A. the reference point for longitude
B. the distance in degrees east or west of 0°
C. the reference point for latitude
D. the distance in degrees north or south of 0°
2. If it is 10 A.M. in Madagascar, what time is it in Washington, D.C.?

It is 2 A.M. in Washington, D.C.
Section Assessment

3. Identify whether the following statements are true or false.

  ____ false ____ A degree of longitude always represents the same distance.

  ____ true ____ If you travel west across the International Date Line, you advance your calendar one day.

  ____ false ____ Lines of latitude are not perfectly parallel to each other.

  ____ true ____ When referencing a specific place on Earth by its coordinates, latitude always comes first.
End of the Section
Objectives

• **Compare** and **contrast** different map projections.
• **Analyze** topographic maps.
• **Describe** map characteristics, such as map scales and map legends.

Vocabulary

- Mercator projection
- conic projection
- gnomonic projection
- topographic map
- contour line
- contour interval
- map legend
- map scale
Mercator Projections

A Mercator projection – uses all parallel lines.

Areas distorted especially near poles (Greenland)
Best for direction...however. Like coastline shapes.
Conic Projections

A conic projection--image projecting onto a cone.

# The cone touches at one latitude.

Less distortion near that line…

• Good for small areas-less distortion (road maps)
Gnomonic Projections

A gnomonic projection --projected onto a piece of paper touching at only one point.

Good for long navigation.

Called great-circle routes.
Topographic Maps

Topographic maps are detailed maps showing the elevations of hills and valleys of an area.
– A **contour line** connects points of equal elevation.

I.
– The **contour interval** is the difference in elevation between two side-by-side contour lines.
Topographic Maps

Depression Contour Lines

- Depression contour lines are used to represent features that are lower than the surrounding area.
- On a map, depression contour lines have *hachures*, or short lines at right angles.
Map Legends

• Topographic maps and most other maps include both human-made and natural features.

A **map legend** explains what the symbols represent.
Map Scales

• On topographic maps, GRADIENT is the elevation difference between 2 points divided by the distance.

• Close contour lines means steep!
Map Scales

- A *verbal scale* expresses distance as a statement, such as “One centimeter is equal to one kilometer.”
- A *graphic scale* consists of a line that represents a certain distance, such as 5 km or 5 miles.
- A *fractional scale* expresses distance as a ratio, such as 1:63 500. One unit from map = that many units in real life. Smaller ratio is more detailed!
Section Assessment

1. Match the following terms with their definitions.

   C. projection  
   A. contour interval  
   D. map legend  
   B. map scale

A. the difference in elevation between two side-by-side contour lines
B. a diagram that explains what the symbols on a map represent
C. a map made by transferring points and lines on a globe’s surface onto a sheet of paper
D. the ratio between distances on a map and actual distances on the surface of Earth
Section Assessment

2. Which type of map would be best suited for the following applications?

C  An aviator is trying to identify the shortest route between New York and London.

B  A cartographer for the state department of transportation has been tasked with making a new state road map.

D  A group of friends is planning on hiking in the back country of Idaho.

A  A sailor is sailing up the coast from South America to North America.
3. What does it mean if a map says “Scale 1:100 000”? 

This fractional scale means that one unit on the map represents 100 000 units on Earth’s surface. For example, one inch on the map would equal 100 000 inches on Earth’s surface.
End of the Section
Objectives

- **Compare** and **contrast** the different forms of radiation in the electromagnetic spectrum.
- **Discuss** how satellites and sonar are used to map Earth’s surface and its oceans.
- **Describe** the Global Positioning System.

Vocabulary

- remote sensing
- electromagnetic spectrum
- frequency
- Landsat satellite
- **Topex/Poseidon** satellite
- Global Positioning System
- sonar
Remote sensing -- collecting data about Earth from far above Earth’s surface using many different techniques.
The Electromagnetic Spectrum

Wave Characteristics

- All electromagnetic waves travel at the speed of 300,000 km/s in a vacuum.
- Electromagnetic waves have distinct wavelengths and frequencies.
- The **electromagnetic spectrum** is the arrangement of all electromagnetic radiation.
- Frequency is the number of waves that pass a particular point each second.
- These unique characteristics help determine how the energy is used by different satellites to map Earth.
# The Electromagnetic Spectrum

## Wave Characteristics

Note: Wave not to scale

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<th>Microwaves</th>
<th>Infrared radiation</th>
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Landsat Satellites

A Landsat satellite receives infrared to track crops, movement of Earth’s plates, and pollution. Computers change the data into color coded digital images…see pg. 38.
**Topex/Poseidon Satellite**

The *Topex/Poseidon satellite* uses radar to map the ocean floor.

Topex stands for topography experiment...

Also used to study ocean currents.
The Global Positioning System

The **Global Positioning System**, or **GPS**,
Exact position on Earth.
Uses 24 satellites or more transmitting microwave frequencies
Several satellites can be picked up at any moment
Section Assessment

1. Match the following terms with their definitions.

   B. remote sensing
   D. frequency
   A. Landsat
   C. Topex/Poseidon

   A. a satellite that receives reflected wavelengths of energy emitted by Earth’s surface
   B. the process of collecting data about Earth from far above Earth’s surface
   C. a satellite that uses radar to map features on the ocean floor
   D. the number of waves that pass a particular point each second
2. Number the following wave types beginning with the longest wavelength.

3. Infrared radiation
4. Visible light
6. X rays
1. Radio waves
7. Gamma rays
2. Microwaves
5. Ultraviolet radiation
3. How does the Global Positioning System work?

Each Global Positioning Satellite orbits Earth and transmits high frequency microwaves that contain information about the satellite’s position and the time of transmission. The orbits of the satellites are arranged so that signals from several satellites can be picked up at any given moment by a GPS user equipped with a receiver. The receiver calculates the user’s precise latitude and longitude by processing the signals emitted by multiple satellites.
End of the Section
Study Guide
Section 2.1
Section 2.2
Section 2.3
Chapter Assessment
Image Bank
Section 2.1 Main Ideas

• Cartographers use a grid system to locate exact positions on Earth. Lines of latitude refer to distances north and south of the equator. Lines of longitude refer to distances east and west of the prime meridian.

• Earth is divided into 24 time zones. Each zone represents a different hour. The International Date Line, or 180° meridian, is the transition line for calendar days. The calendar advances to the next day in each time zone at midnight.
Section 2.2 Main Ideas

• Maps are flat models of Earth’s surface. All maps contain some sort of distortion in the shapes or areas of landmasses.

• Maps are made by transferring points and lines on a globe onto paper. Mercator projections and gnomonic projections are commonly used for navigation by ships and planes. Conic projections are best suited for mapping small areas.

• Topographic maps show changes in elevation of Earth’s surface. Contour lines connect points of equal elevation. A map legend explains the symbols on a map. A map scale shows the relationship between distances on a map and actual distances on Earth.
Section 2.3 Main Ideas

• The process of gathering data about Earth from far above the planet is called remote sensing. The electromagnetic spectrum shows the arrangement of electromagnetic radiation, which is often used by remote-sensing devices to map Earth.

• Landsat satellites use visible light and infrared radiation to map Earth’s surface. The Topex/Poseidon satellite uses radar to map features on the ocean floor.

• The Global Positioning System is a satellite-based navigation system that allows a user to pinpoint his or her exact location on Earth.
Multiple Choice

1. Which of the following is NOT true about lines of latitude.
   
a. They are parallel to each other.
   
b. They connect the north and south poles.
   
c. They are either referenced as north or south.
   
d. Latitude is measured from 0º to 90º.

*Lines of latitude* are parallel to the equator. The equator is 0º and each pole is 90º. *Lines of longitude* connect the north and south pole.
2. What is the reference point for lines of longitude?
   a. the equator
   b. the International Date Line
   c. the prime meridian
   d. Earth’s center

The prime meridian, which runs through Greenwich, England, is 0° longitude. The equator is the reference for latitude. The International Date Line, which is 180° E or W, is opposite the prime meridian. Earth’s center is used to find the line of latitude but it is not a reference point.
Multiple Choice

3. What represents equal elevation on a topographical map?
   a. great circles  c. hachures
   b. a map scale  d. contour lines

Great circles represent the shortest distance between two points on a sphere. A map scale is the ratio between distances on a map and actual distances on the surface of Earth. Hachures are short lines at right angles to the contour line, to indicate depressions.
Multiple Choice

4. What is the distance between one degree of longitude?
   a. 111 km
   b. 48 km
   c. 2 km
   d. all of the above

Remember the lines of longitude are not parallel. The distance between lines of longitude ranges from 111 km to essentially the distance covered by a point at the poles.
Multiple Choice

5. The *Topex/Poseidon* satellite uses _____ to map features on the ocean floor.
   
   a. radar  
   b. sonar  
   c. gamma rays  
   d. GPS  

Sea Beam uses *sonar*, which is the use of sound waves to detect and measure objects underwater. *Gamma rays* are at the high end of the electromagnetic spectrum, beyond the frequency that radar uses. *GPS* is the global positioning system which is a navigation system.
6. What characteristic do all electromagnetic waves share?

All electromagnetic waves travel at the speed of 300 000 km/s in a vacuum, a value commonly referred to as the speed of light.
7. If it is 6:00 P.M. on July 4 in Los Angeles, California, what day and time is it in Tokyo, Japan?

It would be 10:00 A.M. on July 5.
8. Identify whether the following statements are true or false.

- **false** Contour lines can cross each other.
- **true** There are 3600 seconds in a degree.
- **true** By connecting points on a gnomonic projection, navigators can plot great-circle routes.
- **false** The United States has six time zones.
- **true** If you travel east across the International Date Line, you would move your calendar back one day.
Chapter 2 Images

U.S. Time Zones

Hawaii-Aleutian Standard Time

World Map

Globes

Alaska Standard Time

Pacific

Mountain

Central

Eastern
Chapter 2 Images

### Electromagnetic Spectrum

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- **Radio waves**
- **Microwaves**
- **Infrared radiation**
- **Visible light**
- **Ultraviolet radiation**
- **X rays**
- **Gamma rays**

*Note: Wave not to scale*
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- Click the **Chapter Resources** button to go to the Chapter Resources slide where you can access resources such as assessment questions that are available for the chapter.
- Click the **Menu** button to close the chapter presentation and return to the Main Menu. If you opened the chapter presentation directly without using the Main Menu this will exit the presentation. You also may press the **Escape** key [Esc] to exit and return to the Main Menu.
- Click the **Help** button to access this screen.
- Click the **Earth Science Online** button to access the Web page associated with the particular chapter with which you are working.
- Click the **Speaker** button to hear the vocabulary term and definition when available.