

Your Name \_\_\_\_\_

Group Members { \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Score \_\_\_\_\_

Minutes \_\_\_\_\_

Standard 1

Key idea 3

**Scientific Inquiry**

- The observations made while testing proposed explanations, when analyzed using conventional and invented methods, provide new insights into phenomena

Standard 4

Key idea 1

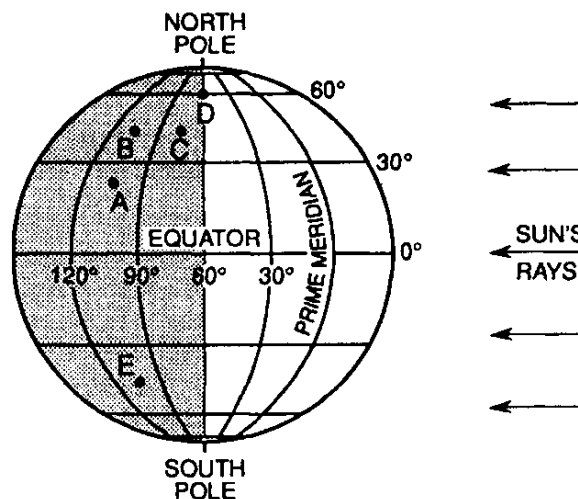
PI: 1.1c

- Earth's coordinate system of latitude and longitude, with the equator and prime meridian as reference lines, is based upon Earth's rotation and our observation of the Sun and stars

**Major Understandings:**

1.1c Earth's coordinate system of latitude and longitude, with the equator and prime meridian as reference lines, is based upon Earth's rotation and our observation of the Sun and stars.

- Distinguish between the lithosphere, hydrosphere and atmosphere
- Read and interpret "Selected Properties of Earth's Atmosphere" page 14 Earth Science Reference Tables
- Read and interpret "Average Chemical Composition Chart" - front page Earth Science Reference Tables
- Distinguish between latitude and longitude
- Locate and record the coordinates of selected cities in NY State



## Mini Lesson 1: Spheres of Earth

Many people believe that Earth is a perfectly round sphere, however that simply is not true. The actual shape of Earth is an oblate spheroid. Earth bulges slightly in the middle (at the equator) due to its rotation (spinning). It is similar to being spun on a swing and trying to keep your feet in. Evidence of Earth's shape include the disappearing and reappearing of ships on the horizon, time differences between distant places, Earth's shadow on the moon during a lunar eclipse, and pictures from space. The bulge at the equator is so small a spherical Earth is used as a model. In addition to Earth's shape we will be investigating parts of Earth and Earth's coordinate system.

There are three basic spheres of Earth, lithosphere, hydrosphere and atmosphere. The atmosphere consists of the shell of gasses that surrounds Earth. The hydrosphere includes oceans, lakes, rivers, and ground water. Finally the lithosphere is the solid part of Earth and includes the bedrock on the continents and the ocean floor.

### Need to know:

1. What is the shape of Earth? \_\_\_\_\_
2. Why does Earth bulge at the equator? \_\_\_\_\_
3. List four pieces of evidence that supports Earth's shape as nearly spherical.
  - 1 \_\_\_\_\_
  - 2 \_\_\_\_\_
  - 3 \_\_\_\_\_
  - 4 \_\_\_\_\_
4. List and describe the three basic spheres of Earth.
  - 1 \_\_\_\_\_ - \_\_\_\_\_  
\_\_\_\_\_
  - 2 \_\_\_\_\_ - \_\_\_\_\_  
\_\_\_\_\_
  - 3 \_\_\_\_\_ - \_\_\_\_\_  
\_\_\_\_\_

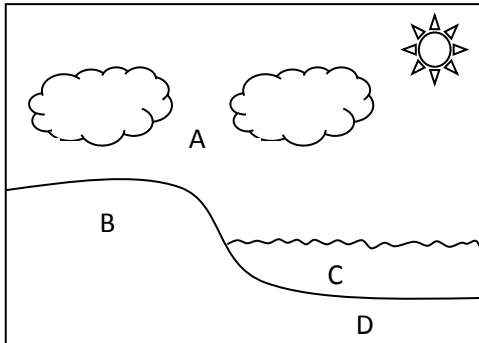
**"Average Chemical Composition of Earth's Crust, Hydrosphere, and Troposphere" ESRT cover  
 "Inferred Properties of Earth's Interior" ESRT pg 10  
 Selected Properties of Earth's Atmosphere" ESRT pg 14**

**Procedure:**

1. Look at the diagram below. Letters A, B, C, and D represent spheres of Earth. Write the letter or letters that refers to each sphere of Earth.

**Materials**

- ✓ ESRT's
- ✓ Colored pencils
- ✓ Highlighter



Atmosphere \_\_\_\_\_  
 Hydrosphere \_\_\_\_\_  
 Lithosphere \_\_\_\_\_

2. The lithosphere:

- a. Turn to page 10 in the Earth Science Reference Tables and look at the diagram.
- b. Find and highlight the word "Lithosphere" at the top, center left of the diagram.
- c. What two layers of Earth are included in the lithosphere?

\_\_\_\_\_ and \_\_\_\_\_

- d. Turn to the front of the Earth Science Reference Tables to the chart labeled "Average Chemical Composition of Earth's Crust, Hydrosphere, and Troposphere".
- e. Which part of the chart matches one of the included layers in the lithosphere? \_\_\_\_\_
- f. What two categories is the crust divided into? *percent by* \_\_\_\_\_ *and percent by* \_\_\_\_\_
- g. This chart lists the chemical compositions of parts of Earth. The word abundant means it has a lot of something. What are the two most abundant elements by percent mass in Earth's crust? \_\_\_\_\_ *and* \_\_\_\_\_
- h. What are the two most abundant elements by percent volume in Earth's crust?

\_\_\_\_\_ *and* \_\_\_\_\_

- i. Not including the "other" category, what are the two least abundant elements by percent mass in Earth's crust? \_\_\_\_\_ *and* \_\_\_\_\_
- j. Not including the "other" category, what are the two least abundant elements by percent volume in Earth's crust? \_\_\_\_\_ *and* \_\_\_\_\_

3. The atmosphere:

- a. Turn to page 14 in the Earth Science Reference Tables and look at the illustration labeled "Selected Properties of Earth's Atmosphere".
- b. Find the portion of the chart labeled "Temperature Zones" and highlight those words. Notice that the atmosphere is divided into layers based on composition and temperature zones and that their names end with "sphere".
- c. Using the highlighter, trace over the three dotted lines that divide the layers (*go through the names on the lines as well*). These are the boundaries between the layers - notice that these boundary names end with "pause".
- d. List the three boundary names listed on the lines, beginning with the one closest to Earth's surface.

\_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_

- e. List the four layers that are labeled on the diagram. These words end in "sphere".

\_\_\_\_\_

\_\_\_\_\_

- f. The left side of the diagram is the altitude scale to be used with all three (3) sections (Temperature Zones, Atmospheric Pressure, and Water Vapor) of this chart.

What is it called when the altitude is 0 (zero)? \_\_\_\_\_

- g. What are the two scales used for Altitude? \_\_\_\_\_ and \_\_\_\_\_

- h. Each scale is divided by small lines.

How many kilometers does each line represent (scale on the left side)? \_\_\_\_\_ km

How many miles does each line represent (scale on the right side)? \_\_\_\_\_ mi

- i. Complete the chart to the right by writing down the altitude in kilometers and miles next to each boundary.

Hint: Look at the highlighted lines.

Boundary	Kilometers (km)	Miles (mi)
Tropopause		
Stratopause		
Mesopause		

- j. How far does the Thermosphere extend? \_\_\_\_\_ km
- k. Go to the bottom of the diagram and highlight the word "Temperature (°C)"
- l. What is the coldest temperature listed on the scale at the bottom of the diagram? \_\_\_\_\_ °C
- m. What is the hottest temperature listed on the scale at the bottom of the diagram? \_\_\_\_\_ °C

- n. What is the temperature in the Troposphere at Sea Level? \_\_\_\_\_ °C  
 What is the temperature at the top of the Troposphere? \_\_\_\_\_ °C  
 Does the temperature [ increase or decrease ] as altitude increases in the Troposphere?
- o. What is the temperature at the bottom of the Stratosphere? \_\_\_\_\_ °C  
 What is the temperature at the top of the Stratosphere? \_\_\_\_\_ °C  
 Does the temperature [ increase or decrease ] as altitude increases in the Stratosphere?
- p. What is the temperature at the bottom of the Mesosphere? \_\_\_\_\_ °C  
 What is the temperature at the top of the Mesosphere? \_\_\_\_\_ °C  
 Does the temperature [ increase or decrease ] as altitude increases in the Mesosphere?
- q. What is the temperature at the bottom of the Thermosphere? \_\_\_\_\_ °C  
 What is the temperature that the Thermosphere exceeds? \_\_\_\_\_ °C  
 Does the temperature [ increase or decrease ] as altitude increases in the Thermosphere?
- r. Take out the blue and red colored pencils. If the temperature increases in a temperature zone, trace the line with the red colored pencil. If the temperature decreases in a temperature zone, trace the line with the blue colored pencil.
- s. Go to the top of the diagram, locate and highlight the label "Atmospheric Pressure". The scale is located at the bottom of the chart. What is the unit used for pressure? \_\_\_\_\_
- t. What is the pressure at sea level? \_\_\_\_\_ atm  
 Does the pressure [ increase or decrease ] as altitude increases in the atmosphere?
- u. Go to the top of the diagram, locate and highlight the label "Water Vapor". The scale is located at the bottom of the chart.  
 What is the unit used for Water Vapor? \_\_\_\_\_  
 Where is the concentration of water vapor the greatest? \_\_\_\_\_  
 Where does most of the water vapor in the atmosphere come from? \_\_\_\_\_
- v. Keeping in mind the names of the layers in the atmosphere, turn to the front page of the Earth Science Reference Tables and go back to the chart labeled "Average Chemical Composition of Earth's Crust, Hydrosphere, and Troposphere".  
 Which category is a layer in the atmosphere? \_\_\_\_\_  
 What is the most abundant element in the Troposphere? \_\_\_\_\_

Not including the "other" category, write down the name of the elements in the **troposphere** and their percentages in the chart to the right.

Element name	Percentage

4. The hydrosphere:

Not including the "other" category, write down the name of the elements in the hydrosphere and their percentages in the chart to the right.

Element name	Percentage

✓ **Check Point**

- (1) In which layer of the atmosphere is most of the water vapor located? \_\_\_\_\_
- (2) Name the layer, closest to Earth's surface, where the temperature increases as you increase altitude \_\_\_\_\_
- (3) What happens to atmospheric pressure as you increase altitude? \_\_\_\_\_
- (4) What is the temperature at the Tropopause? \_\_\_\_\_
- (5) At what boundary is the coldest temperature found? \_\_\_\_\_
- (6) In which two layers of the atmosphere can the temperature be 15 °C?  
 \_\_\_\_\_ *and* \_\_\_\_\_
- (7) What is the highest concentration of water vapor? \_\_\_\_\_ g/m<sup>3</sup>
- (8) What is the altitude of the Mesopause in km? \_\_\_\_\_
- (9) What sphere of Earth contains hydrogen? \_\_\_\_\_
- (10) What element is found in the crust, hydrosphere and troposphere? \_\_\_\_\_
- (11) What sphere includes the crust and rigid mantle? \_\_\_\_\_
- (12) Which sphere would be considered "liquid"? \_\_\_\_\_
- (13) Which sphere would be considered "gas"? \_\_\_\_\_
- (14) Which sphere would be considered "solid"? \_\_\_\_\_
- (15) Put the spheres, from questions 12, 13, and 14 above, in order of increasing density.

Least dense

Most dense

## Regents Questions:

- \_\_\_\_1. Earth's hydrosphere is best described as the  
(1) solid outer layer of Earth  
(2) liquid outer layer of Earth  
(3) magma layer located below Earth's stiffer mantle  
(4) gaseous layer extending several hundred kilometers from Earth into space
- \_\_\_\_2. Earth's troposphere, hydrosphere, and lithosphere contain relatively large amounts of which element?  
(1) iron                      (2) oxygen                      (3) hydrogen                      (4) potassium
- \_\_\_\_3. Oxygen is the most abundant element by volume in Earth's  
(1) inner core                      (2) troposphere                      (3) hydrosphere                      (4) crust
- \_\_\_\_4. Ozone is concentrated in Earth's atmosphere at an altitude of 20 to 35 kilometers. Which atmospheric layer contains the greatest concentration of ozone?  
(1) mesosphere                      (2) thermosphere                      (3) troposphere                      (4) stratosphere
- \_\_\_\_5. An air temperature of 95°C most often exists in which layer of the atmosphere?  
(1) troposphere                      (2) stratosphere                      (3) mesosphere                      (4) thermosphere
- \_\_\_\_6. Which temperature zone of Earth's atmosphere contains the most water vapor?  
(1) mesosphere                      (2) stratosphere                      (3) thermosphere                      (4) troposphere
- \_\_\_\_7. In which two temperature zones of the atmosphere does the temperature increase with increasing altitude?  
(1) troposphere and stratosphere                      (3) stratosphere and thermosphere  
(2) troposphere and mesosphere                      (4) mesosphere and thermosphere
- \_\_\_\_8. Which element is most abundant in Earth's lithosphere?  
(1) oxygen                      (2) silicon                      (3) hydrogen                      (4) nitrogen

## Mini Lesson 2: Earth's Coordinate System

Earth's coordinate system of latitude and longitude is based on the motions of Earth and the location of stars. As Earth rotates (spins) it causes day and night. When the sun is highest in the sky it is solar noon for that location. Time of day depends on where you are. Lines of longitude separate the different time zones. Earth rotates  $15^\circ$  per hour ( $360^\circ$  in 24 hours) therefore we have 24 different time zones, every  $15^\circ$ . If you travel to the west it is earlier in the day. For example, California is three hours earlier New York State. "If you go West time becomes less." If you travel to the East, it is later in the day.

In the Northern hemisphere the star used for a reference point is Polaris, also known as the North Star. It is located almost directly over the North Pole. Sailors used Polaris to navigate because the altitude of Polaris is equal to the observer's **north** latitude. Specific lines of latitude are determined by the location of the noon Sun in the sky at certain times of the year. The Tropic of Cancer ( $23\frac{1}{2}^\circ$  N) and Tropic of Capricorn ( $23\frac{1}{2}^\circ$  S) are the farthest locations north or south of the equator where the sun can be directly overhead. The Arctic Circle ( $66\frac{1}{2}^\circ$  N) and Antarctic Circle ( $66\frac{1}{2}^\circ$  S) are the first locations north or south of the equator where there can be 24 hours of daylight or 24 hours of darkness.

### Need to know:

1. What two factors determine Earth's coordinate system?  
(a) \_\_\_\_\_  
(b) \_\_\_\_\_
2. Where is the sun located at solar noon? \_\_\_\_\_
3. How many degrees per hour does Earth rotate? \_\_\_\_\_
4. How many time zones are on Earth? \_\_\_\_\_
5. If two people are on the same line of longitude, what do they have in common? \_\_\_\_\_
6. It is 7 AM in Hamburg and you would like to call a relative in Reno, Nevada. The longitude for Hamburg is  $74^\circ$ W, and for Reno it is  $119^\circ$ W. Approximately how many degrees of longitude are between them? \_\_\_\_\_ How many hours apart are they? \_\_\_\_\_ Why is it a good idea to wait a few hours before you call? \_\_\_\_\_
7. Name the star that is used as a reference point in the Northern Hemisphere.  
\_\_\_\_\_ also known as the \_\_\_\_\_



8. Name the location on Earth where this star is located above. \_\_\_\_\_
9. What is the altitude of Polaris equal to? \_\_\_\_\_
10. Name the two locations highest latitude north and south of the equator where the noon sun can be directly overhead. \_\_\_\_\_ and \_\_\_\_\_
11. Name the two locations (lowest latitude north and south of the equator) that experience 24 hours of daylight or 24 hours of darkness.  
\_\_\_\_\_ and \_\_\_\_\_

## Laboratory Activity 2.1

## Drawing Lines of Latitude and Longitude

[40]

### Introduction:

Lines of latitude and longitude are measured as angles from the center of Earth. Lines of latitude are called parallels and measure distance in degrees North and South of the Equator. Lines of longitude are called meridians and measure distance in degrees East and West of the Prime Meridian.

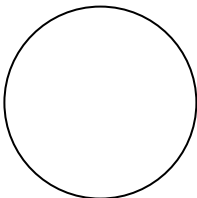
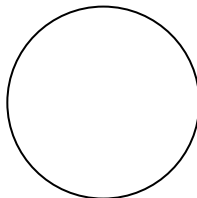
### Materials

- ✓ 2 - Styrofoam spheres
- ✓ Sharpie markers
- ✓ Wooden skewers
- ✓ Scissors
- ✓ Paper
- ✓ Glue
- ✓ protractor

### Objective:

- Draw lines and latitude and longitude using a protractor and ruler
- Observe the lines of latitude and longitude as they may appear on a diagram

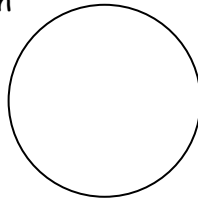
### Procedure: Drawing Longitude

- a. Take a skewer and one sphere. Carefully push the skewer through the sphere where the indent is located (on top and bottom). Write the letter "N" for *north* at the top of the sphere and the letter "S" for *south* at the bottom.
- b. Hold the sphere directly in front of you and draw a line from the top to the bottom. Label this line "Prime meridian". This is located at  $0^\circ$  longitude and is a reference point.
- c. Turn the sphere around and draw a line from top to bottom again, half way around the sphere. Label this line "International Date Line". It is located at  $180^\circ$  Longitude.
- d. Turn the sphere one quarter way around and draw another line top to bottom. Repeat for the other side. You should now have 4 lines of longitude drawn, each  $90^\circ$  apart. These lines are called meridians, commonly known as lines of longitude.
- e. Draw a line half way between each of the four already drawn. There are now a total of 8 lines drawn.
- f. Holding the skewer with the sphere directly in front of you, draw what you see in the circle to the right. This is a side view of Earth's longitude lines. 
- g. Hold the sphere so that you are looking at it from the top. This is a view of the lines of longitude from the North Pole. Draw what you see in the circle to the right. 

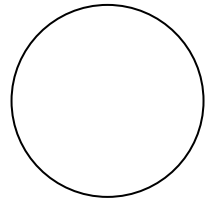
**Procedure: Drawing Latitude**

- h. Take a skewer and the other sphere. Carefully push the skewer through the sphere where the indent is located (on top and bottom). Write the letter "N" for *north* at the top of the sphere and the letter "S" for *south* at the bottom.
- i. Hold the sphere directly in front of you and draw a circle around the middle of the sphere. This represents the line for the equator. Label the equator.
- j. Draw another circle around the sphere about 2 centimeters (the width of your finger) above and parallel to the first circle. Repeat this step twice so that you have a total of three lines above the equator.
- k. Hold the sphere upside down and repeat step c.

l. Holding the sphere directly in front of you, draw what you see in the circle to the right. This is a side view of Earth's latitude lines.



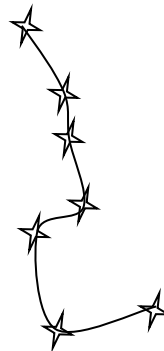
m. Hold the sphere so that you are looking at it from the top. This is a view of the lines of latitude from the North Pole. Draw what you see in the circle to the right.



- n. Draw a small star and cut it out. Place the star on the top of the skewer above the North Pole. This star is called Polaris, or the North Star.
- o. Since sailors used Polaris to navigate in the Northern Hemisphere, it is important to know how to find it. Label the two constellations below - remember to look at the sizes of each.

p. Using a colored pencil, draw a line through the two bottom stars at the end of the cup on the Big Dipper. Continue the line past the second star and place an arrow at the end. Label these two stars "pointer stars", because they point to Polaris. Polaris is the first star in the handle of the Little Dipper. circle and label Polaris.

Big Dipper



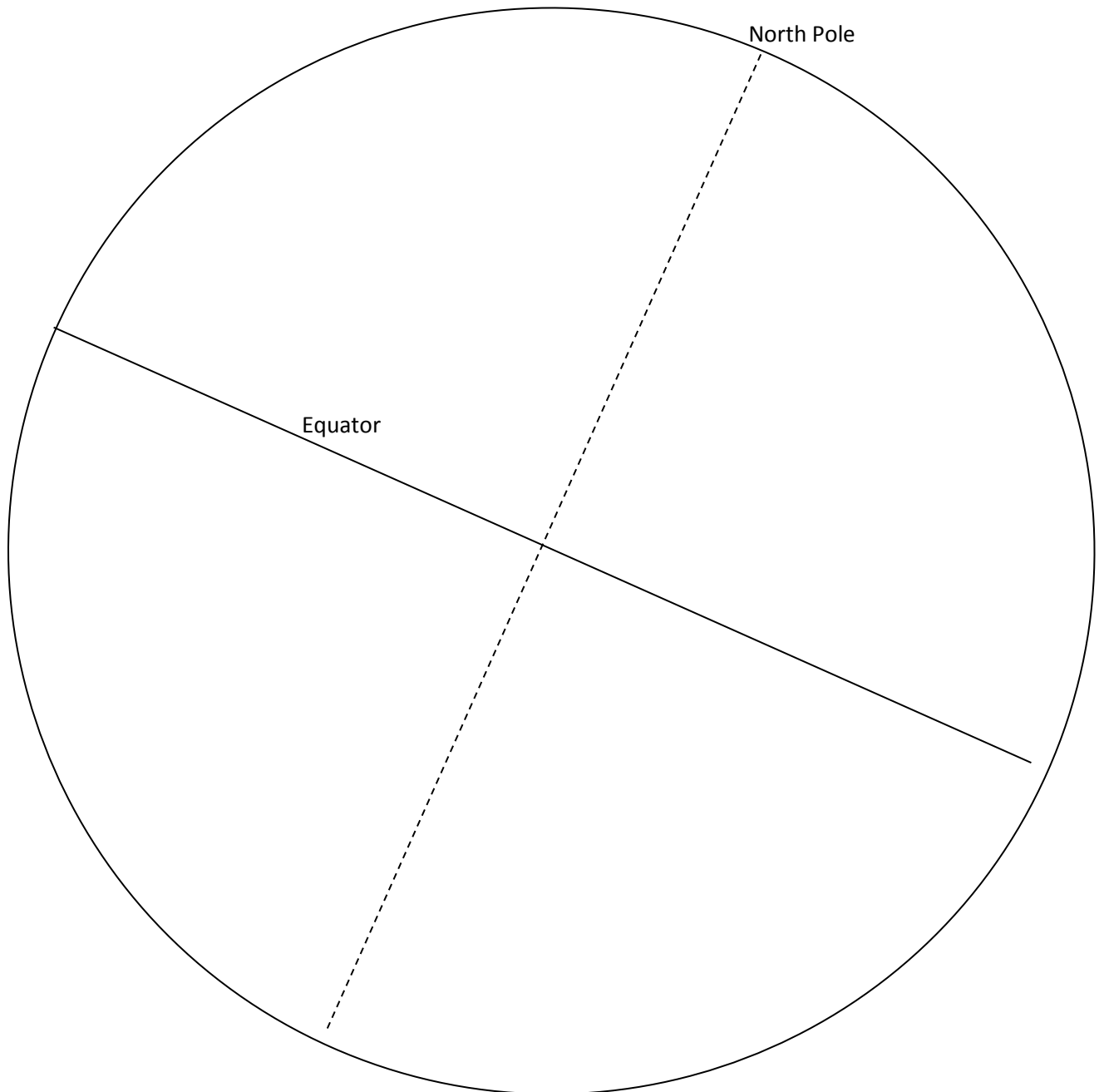
Little Dipper

- q. When looking at a clear sky at night you can almost always see the Big Dipper. Other than Polaris, most of the stars that make up the Little Dipper are not very bright and therefore you can rarely "see" the Little Dipper.
- r. The Big Dipper and Little Dipper are asterisms (star patterns that are not constellations but are part of a different constellation). The stars in the Big Dipper make up part of Ursa Major (the Big Bear) and Little Dipper is part of Ursa Minor (the Little Bear). Write the constellation names (Ursa Major and Ursa Minor) next to the stars that the Big and Little Dipper are a part of.

2. Another perspective:

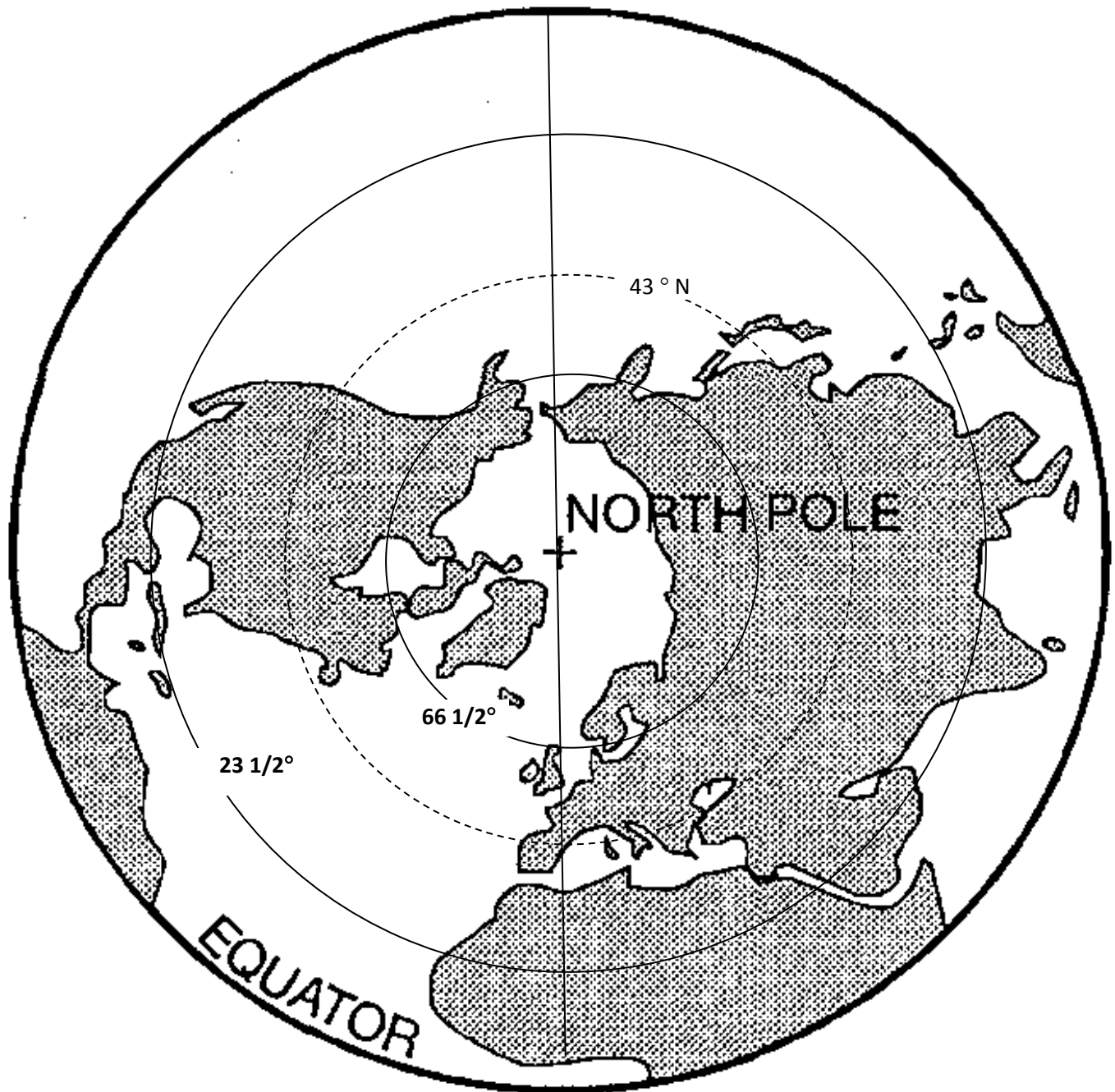
a. Latitude

1. On the diagram below, place the protractor on the line labeled equator, with  $90^\circ$  directly north (toward the North Pole). Remember Earth is tilted  $23\frac{1}{2}^\circ$ .
2. On each side of the protractor, place a mark at  $23\frac{1}{2}^\circ$  and at  $66\frac{1}{2}^\circ$ .
3. Draw a straight line, parallel to the equator, connecting the  $23\frac{1}{2}^\circ$  & points and a line connecting the  $66\frac{1}{2}^\circ$  points.
4. Turn your packet around and repeat steps 2 - 3 for the southern hemisphere. Now turn your packet back right side up.)
5. Label the South Pole, Axis and the four latitude lines you just drew (Tropic of Cancer, Tropic of Capricorn, Arctic Circle, Antarctic Circle). Include their angular values.



b. Longitude

1. The vertical line on the diagram below that passes through the North Pole will be used as a reference point. Label the bottom half of the line "Prime Meridian" and the top half "International Date Line".
2. Place a protractor on the "+" in the center of the diagram with the vertical line passing through the  $90^\circ$  angle mark on the protractor.
3. Starting at  $0^\circ$  on the left of the protractor mark every  $15^\circ$ . This indicates the separation of the time zones on Earth. (Earth rotates  $15^\circ$  per hour). Go past the  $90^\circ$  mark and continue around the protractor until you reach  $180^\circ$ .
4. Using a ruler, draw a line from one end of the circle to the other that passes through each mark and the center point of the North Pole.
5. Using the arrows for direction of rotation, label each time zone around Earth.



6. Draw two curved arrows (one on the left, one on the right) that illustrate the counterclockwise direction in which Earth rotates.
7. Looking at the bottom of your diagram, label the section between the prime meridian and the first meridian to the left 12 noon.
8. Determine the location of Buffalo, NY by following the directions below.
9. Place the protractor on the prime meridian with the  $90^\circ$  angle to the left and mark the  $79^\circ$  angle. Draw a line from the center of the North Pole through the point you just marked.
10. Place an "X" where the dotted line and the line you just drew intersect. Label it "Buffalo".

✓ **Check Point**

- (1) What is located at  $0^\circ$  Longitude? \_\_\_\_\_
- (2) What is the highest value for longitude? \_\_\_\_\_ $^\circ$
- (3) What is located there (the name)? \_\_\_\_\_
- (4) What are lines of longitude called? \_\_\_\_\_
- (5) Which direction do lines of longitude run? ( north - south /or/ east - west )
- (6) Do the lines of longitude intersect? \_\_\_\_\_ Where? \_\_\_\_\_
- (7) If two locations were on the same line of longitude, what do they have in common? \_\_\_\_\_
- (8) As an observer travels west across different lines of longitude (think of going to California from here) is it earlier in the day or later? \_\_\_\_\_
- (9) How many degrees does Earth rotate in one day? \_\_\_\_\_ $^\circ$  In one hour? \_\_\_\_\_ $^\circ$
- (10) How many time zones are there on Earth? \_\_\_\_\_
- (11) What is located at  $0^\circ$  Latitude? \_\_\_\_\_
- (12) What is the highest value for latitude? \_\_\_\_\_ $^\circ$ N and \_\_\_\_\_ $^\circ$ S
- (13) What is located there (the two names)? \_\_\_\_\_ and \_\_\_\_\_
- (14) What are lines of latitude called? \_\_\_\_\_
- (15) Do the lines of latitude intersect? \_\_\_\_\_ Why not? \_\_\_\_\_
- (16) If two locations north of the equator are on the same line of latitude, what do they have in common? \_\_\_\_\_
- (17) Where is Polaris located? \_\_\_\_\_
- (18) What constellation do you need to use to find Polaris? \_\_\_\_\_
- (19) What constellation is Polaris located in? \_\_\_\_\_
- (20) Name the farthest line of latitude north of the equator where the noon sun can be directly overhead. \_\_\_\_\_
- (21) Name the farthest line of latitude south of the equator, where the noon sun can be directly overhead. \_\_\_\_\_
- (22) What is the name given to the first line of latitude north of the Equator where there can be 24 hours of daylight? \_\_\_\_\_
- (23) What is the name given to the first line of latitude south of the Equator where there can be 24 hours of darkness? \_\_\_\_\_

**Introduction:**

In order to determine a location using Earth's coordinate system you must know how to read and interpret the lines of latitude and longitude. Each degree( $^{\circ}$ ) of latitude or longitude is equal to 60 minutes ( $'$ ). Halfway between two lines would be 30 minutes. For example, a location between the with a latitude that is halfway between  $42^{\circ}\text{N}$  and  $43^{\circ}\text{N}$  would be  $42^{\circ}30'$  North, if it is between  $42^{\circ}30'$  N and  $43^{\circ}\text{N}$  its latitude would be  $42^{\circ}45'$  N'. **REMEMBER - LATITUDE always comes before LONGITUDE** (alphabetically as well: Lat, Lon).

**Materials**

- ✓ Pencil
- ✓ ESRT's
- ✓ Ruler
- ✓ Color pencils
- ✓ Highlighter

**Objective:**

- To determine locations in New York State using the coordinate system of latitude and longitude
- To become familiar with using page 2 of the ESRT's (Earth Science Reference Tables)

**Procedure:** (Use the map on page 3 in your Earth Science Reference Tables)

1. Latitude: Using a pink color pencil, connect all of the lines of latitude beginning at the top of the map with  $45^{\circ}$ , and ending with  $40^{\circ}30'$  at the bottom of the map. Remember these lines run east and west (horizontal).
2. Longitude: Using an orange color pencil, softly draw lines connecting  $79^{\circ}\text{W}$  (located to the left top part of the map - in Lake Ontario) to  $79^{\circ}\text{W}$  (located to the left bottom part of the map - in Pennsylvania). Continue drawing meridians at corresponding points of longitude starting with  $79^{\circ}30'$  (there are little lines half way between the labeled marks) and ending with  $73^{\circ}$ . Include all of the 30' points ( $78^{\circ}30'$ ). Remember these line run north and south (vertical).
3. All of the degrees are already labeled on the map. Label the 30 minute marks between each of the degree labels.
4. With a blue color pencil, trace all of the rivers and lightly color all of the lakes.
5. Using a yellow highlighter, highlight all towns and cities.

✓ **Check Point**

- (1) Name the three states located east of New York State. \_\_\_\_\_  
\_\_\_\_\_ , \_\_\_\_\_
- (2) What is located southeast of Long Island? \_\_\_\_\_
- (3) What is located directly north of Long Island? \_\_\_\_\_
- (4) Name the two states labeled on the map that are located south of New York State.  
\_\_\_\_\_ , \_\_\_\_\_
- (5) What is located west of Buffalo? \_\_\_\_\_
- (6) What is located directly north of Rochester? \_\_\_\_\_
- (7) What is the elevation of Lake Erie? \_\_\_\_\_ m

(8) What is the elevation of Lake Ontario? \_\_\_\_\_ m

(9) Name seven rivers that appear on the map \_\_\_\_\_ ,  
\_\_\_\_\_  
\_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_  
\_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_

(10) Name two cities that are located close to the same line of latitude as Elmira.  
\_\_\_\_\_ and \_\_\_\_\_

(11) Name the city located close to the same longitude as Ithaca. \_\_\_\_\_

(12) Name the city located east of New York City. \_\_\_\_\_

(13) Name the two mountains found on the map. \_\_\_\_\_ & \_\_\_\_\_

(14) What city is located close to the same line of longitude as Old Forge? \_\_\_\_\_

(15) What city that is located close to the same line of latitude as Utica? \_\_\_\_\_

(16) What is the latitude and longitude of Niagara Falls? \_\_\_\_\_ ° 'N , \_\_\_\_\_ ° 'W

(17) Name the city located at approximately 42°N and 74°W. \_\_\_\_\_

(18) What is the latitude and longitude of Albany? \_\_\_\_\_ ° 'N , \_\_\_\_\_ ° 'W

(19) Name the two cities located closest to Lake Ontario. \_\_\_\_\_ , \_\_\_\_\_

(20) Name the city located at approximately 42°56' N and 78°45' W. \_\_\_\_\_

(21) What is the latitude and longitude of Rochester? \_\_\_\_\_ ° 'N , \_\_\_\_\_ ° 'W

(22) Name the city located at approximately 43°58' N and 75°48' W. \_\_\_\_\_

(23) What is the latitude of the North Pole? \_\_\_\_\_ ° \_\_\_\_\_

(24) Explain why two circles of latitude never touch. \_\_\_\_\_

(25) Explain why the distance between two meridians at the North Pole is 0 miles. \_\_\_\_\_

(26) The diagram to the right illustrates Earth's latitude and longitude coordinate system. Letters A, B, C, and D are locations on Earth.

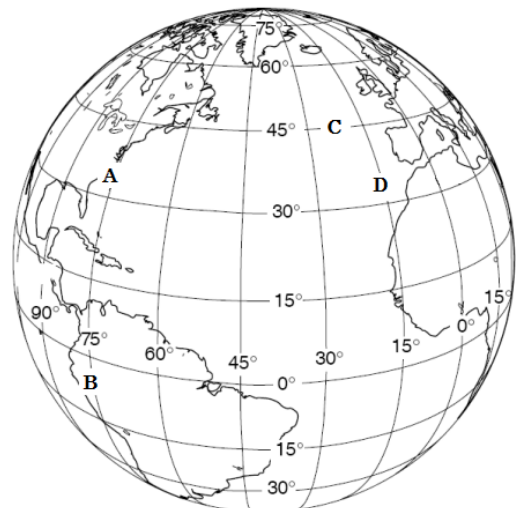
(a) Using a red color pencil, trace the Equator.

(b) Using a green color pencil, trace the Prime Meridian. (be careful)

(c) Which two letters have the same time of day?  
\_\_\_\_\_ & \_\_\_\_\_

(d) What is the altitude of Polaris for location C? \_\_\_\_\_

(e) What time is it at location A if it is 5:00 PM at location D? \_\_\_\_\_

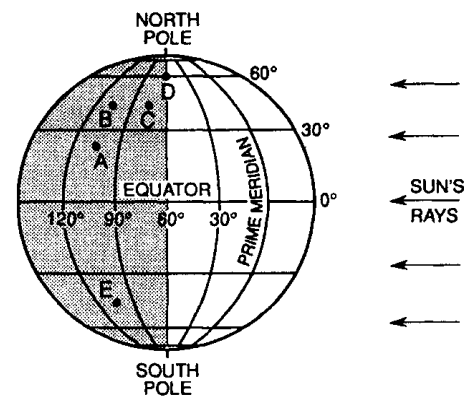


## Regents Questions:

- \_\_\_1. As a person travels due west across New York State, the altitude of Polaris will  
 (1) increase                      (2) decrease                      (3) remain the same
- \_\_\_2. At what latitude would an observer on the Earth find the altitude of Polaris to be  $37^\circ$ ?  
 (1)  $37^\circ$  South                      (2)  $53^\circ$  North                      (3)  $37^\circ$  North                      (4)  $90^\circ$  North
- \_\_\_3. A person knows the solar time on the Prime Meridian and the local solar time. What determination can be made?  
 (1) the date    (3) the longitude at which the person is located  
 (2) the altitude of Polaris                      (4) the latitude at which the person is located
- \_\_\_4. What could be the approximate location of an observer if he measured the altitude of Polaris to be 41 degrees above the horizon?  
 (1) Watertown                      (2) Massena                      (3) Buffalo                      (4) New York City
- \_\_\_5. An observer on a moving ship notices that the altitude of Polaris increases each night. Local solar noon occurs at the same time each day. In what direction is the ship moving?  
 (1) due east                      (2) due west                      (3) due south                      (4) due north

Base your answers to questions 6 through 8 on the diagram of the Earth below. Some of the latitude and longitude lines have been labeled. Points A through E represent locations on the Earth's surface.

- \_\_\_6. What are the approximate latitude and longitude of location A?  
 (1)  $105^\circ$  N,  $25^\circ$  W                      (3)  $25^\circ$  N,  $105^\circ$  E  
 (2)  $25^\circ$  N,  $105^\circ$  W                      (4)  $105^\circ$  S,  $25^\circ$  E
- \_\_\_7. What do locations A, B, and E have in common?  
 (1) They are the same latitude.  
 (2) They are in the same season.  
 (3) They have the same local time.  
 (4) They have the same prevailing wind direction
- \_\_\_8. The latitude and longitude of which location are closest to those of New York State?  
 (1) A                      (2) B                      (3) C                      (4) D

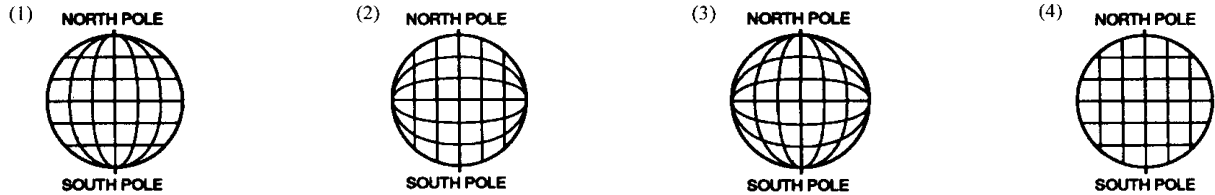


- \_\_\_9. As a ship crosses the Prime Meridian, the altitude of Polaris is  $65^\circ$ . What is the ship's location?  
 (1)  $0^\circ$  longitude,  $65^\circ$  South latitude                      (3)  $0^\circ$  latitude,  $65^\circ$  West longitude  
 (2)  $0^\circ$  longitude,  $65^\circ$  North latitude                      (4)  $0^\circ$  latitude,  $65^\circ$  East longitude
- \_\_\_10. Cities located on the same meridian (longitude) must have the same  
 (1) altitude                      (2) latitude                      (3) solar time                      (4) length of daylight



11. An observer on Earth measures the altitude of Polaris and finds it to be 0 degrees. This observer must be at the  
 (1) North Pole (2) Arctic Circle (3) Equator (4) Tropic of Cancer

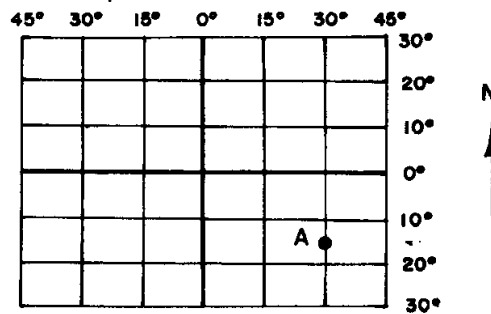
12. The diagrams below represent four systems of imaginary lines that could be used to locate positions on a planet. Which system is most similar to the latitude-longitude system used on the Earth?



13. Which reference line passes through both the geographic North Pole and the geographic South Pole?  
 (1) 0° latitude (2) 0° longitude (3) Tropic of Cancer (4) Tropic of Capricorn

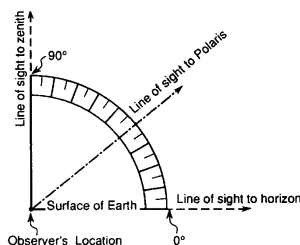
14. The diagram below represents a portion of a map of the Earth's grid system. What is the approximate latitude and longitude of point A?

- (1) 15° N, 30° W
- (2) 15° S, 30° W
- (3) 15° N, 30° E
- (4) 15° S, 30° E



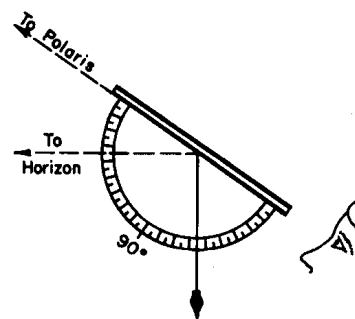
15. What is the location of Binghamton, New York?  
 (1) 42° 06' N lat, 75° 55' W long. (3) 42° 54' N lat, 76° 05' W long.  
 (2) 42° 06' N lat, 76° 05' W long. (4) 42° 54' N lat, 75° 55' W long

16. The diagram below shows the altitude of Polaris above the horizon at a certain location. What is the latitude of the observer?



- (1) 10° N
- (2) 40° N
- (3) 50° N
- (4) 90° N

17. What is the latitude of the observer shown in the diagram below?



- (1) 35° N
- (2) 55° N
- (3) 90° N
- (4) 125° N

**"Generalized Landscape Regions of New York State" Earth Science Reference Tables page 2**

The Earth Science Reference Tables include two separate maps of New York State. The map on page three includes city names, lakes, rivers and latitude, as well as surrounding states. It also includes Bedrock Geology that will be addressed in the *Geologic History* packet. The map on page two shows the boundaries of each of the landscape regions in New York State. These maps were drawn on the same scale so that they can be compared to each other. For example, find Ithaca on the map on page 3. By referring to the map on page 2 you can determine that Ithaca is located in the Allegheny Plateau landscape region.

- Materials**
- ✓ ESRT's
  - ✓ Colored pencils

1. List the New York State landscape regions that are found in the *ESRT's* on page 2

Plateau (highlands)	Plains (lowlands)
<b>Mountains</b>	

2. Using the ESRT's, pages 2 & 3 to determine the landscape region for each of the following locations.

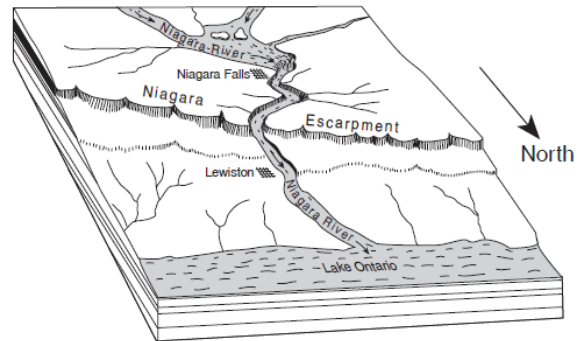
Location	Landscape Region	Location	Landscape Region
Albany		Niagara Falls	
Binghamton		Old Forge	
Buffalo		Oswego	
Elmira		Plattsburg	
Ithaca		Riverhead	
Jamestown		Rochester	
Kingston		Watertown	
Massena		Syracuse	
New York City		Utica	

✓ **Check Point**

1. Find the map scale. What is the largest number listed for miles? \_\_\_\_\_
2. Find the map scale. What is the largest number listed for kilometers? \_\_\_\_\_
3. What landscape region is Long Island located on? \_\_\_\_\_
4. Name the landscape region located at 42°N, 74°30'W. \_\_\_\_\_
5. Name the landscape region located at 44°N, 75°W. \_\_\_\_\_
6. Name the landscape region located at 43°N, 76°W. \_\_\_\_\_

**Regents Review Questions:**

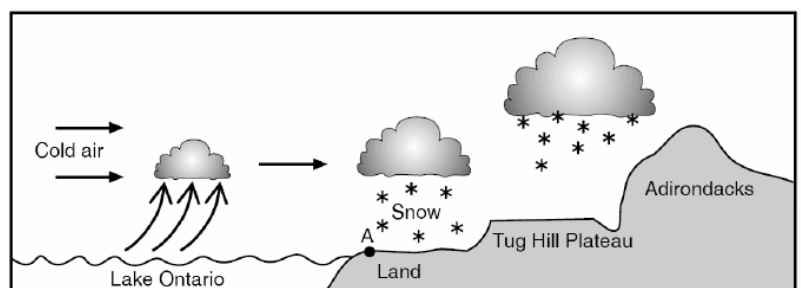
- \_\_\_\_ 1. The block diagram to the right shows a view of the Niagara Falls region of New York State. In which New York State landscape region is Lewiston located?
- (1) St. Lawrence Lowlands
  - (2) Atlantic Coastal Plain
  - (3) Erie-Ontario Lowlands
  - (4) Allegheny Plateau



- \_\_\_\_ 2. In which New York State landscape region is Niagara Falls located?
- (1) Tug Hill Plateau
  - (2) St. Lawrence Lowlands
  - (3) Allegheny Plateau
  - (4) Erie-Ontario Lowlands
- \_\_\_\_ 3. Which two locations are in the same New York State landscape region?
- (1) Albany and Old Forge
  - (2) Massena and Mt. Marcy
  - (3) Binghamton and New York City
  - (4) Jamestown and Ithaca
- \_\_\_\_ 4. Buffalo, New York, and Plattsburgh, New York, are both located in landscape regions called
- (1) mountains
  - (2) highlands
  - (3) plateaus
  - (4) lowlands
- \_\_\_\_ 5. The generalized landscape regions of New York State are identified chiefly on the basis of
- (1) nearness to continental boundaries
  - (2) nearness to major mountain ranges
  - (3) climatic conditions
  - (4) surface bedrock characteristics

6. State the name of the New York State landscape region that includes location A shown in the diagram to the right.

\_\_\_\_\_

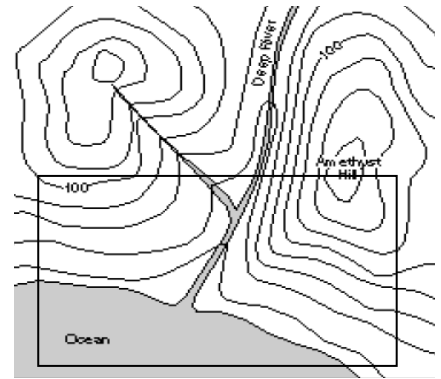


## Mini Lesson 3: Mapping Fields

A field is a generic term given for an area that can be measured. Field values that might be measured include temperature, barometric pressure, elevation, pollution or even the strength of an earthquake. Isolines connect points of equal value with- in a field. When a field map is specific, so are the names of the isolines. A topo- graphic map shows different elevations and the isolines are called contour lines. Isotherms are isolines that connect points of equal temperature. Isobars connect points of equal air pressure.

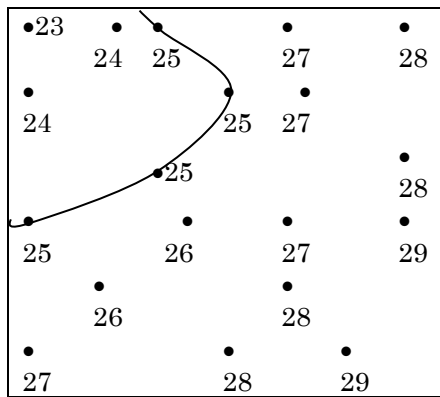
The change in value between two consecutive isolines is called the "interval", for instance a 5m contour interval.

A field map is a snapshot of a particular area. Just as the roads of a map of a town do not end at the edge of the map, isolines do not end at the edge of a field map. As you can see on the diagram to the right, the isolines do not end at the edge of that map either (the boxed in area).



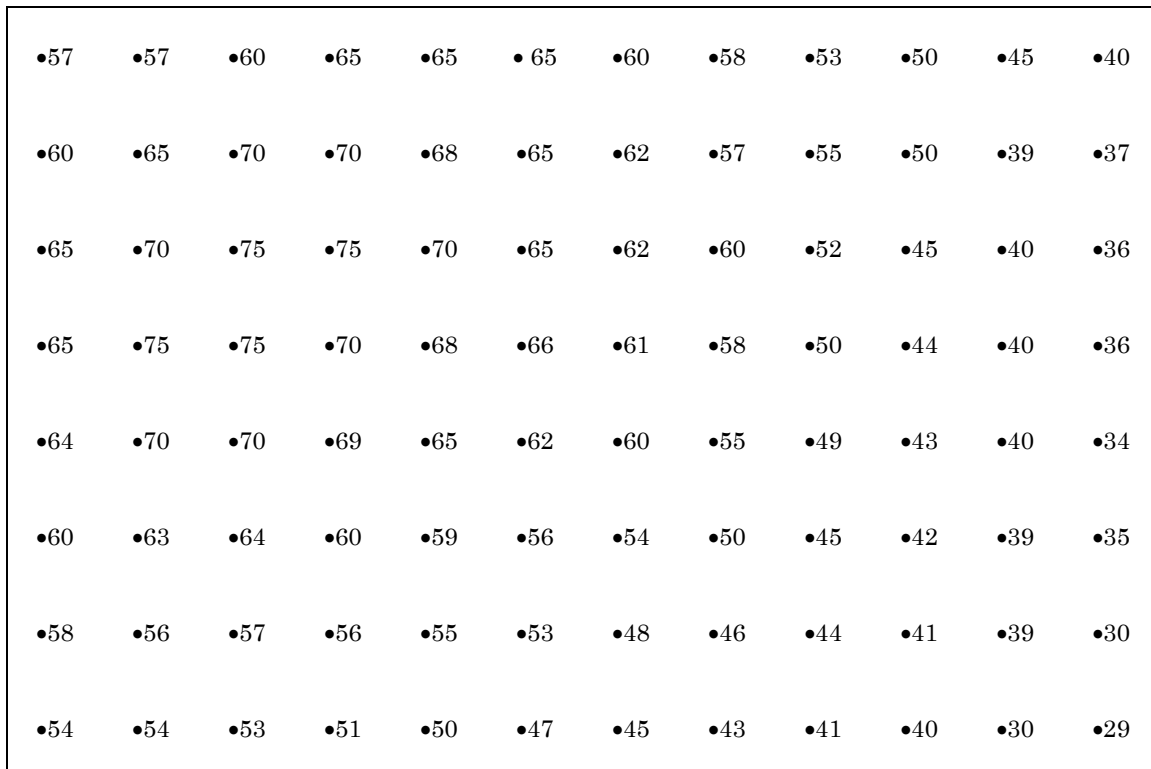
### Need to know:

1. What is the term given for an area that can be measured? \_\_\_\_\_
2. Name five examples of variables that can be measured within a field. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_, \_\_\_\_\_  
\_\_\_\_\_, \_\_\_\_\_
3. What points do isolines connect? \_\_\_\_\_
4. What type of map shows different elevations? \_\_\_\_\_
5. What do contour lines connect? \_\_\_\_\_
6. What do isotherms connect? \_\_\_\_\_
7. What do isobars connect? \_\_\_\_\_
8. What is a field map? \_\_\_\_\_
9. Do contour lines end at the edge of a map? \_\_\_\_\_  
Give an example to support your response above. \_\_\_\_\_  
\_\_\_\_\_

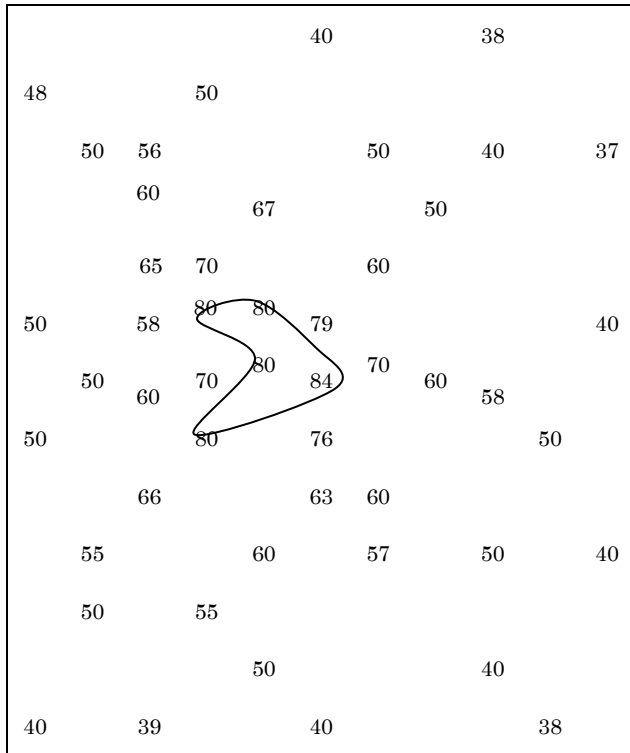


- Using a pencil, softly draw a line connecting all the points that have a value of 27. Follow the general pattern for the 25 isoline already drawn.
- Connect all points with a 28 value, then 29, again following the general pattern of the previous lines drawn
- Draw the 26 isoline, make sure it falls between the 25 and 27 values
- Connect all points with a 24 value, then the single 23 value

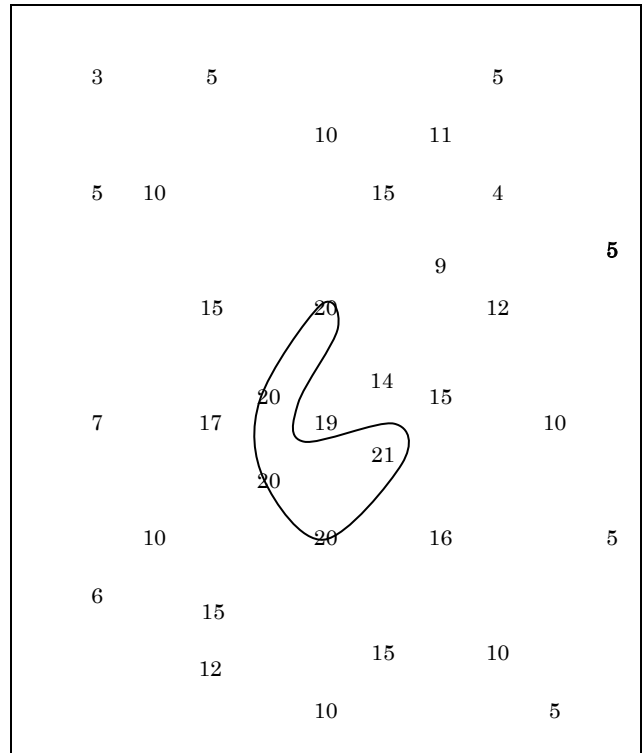
Draw the Isolines for the field below using an interval of 5



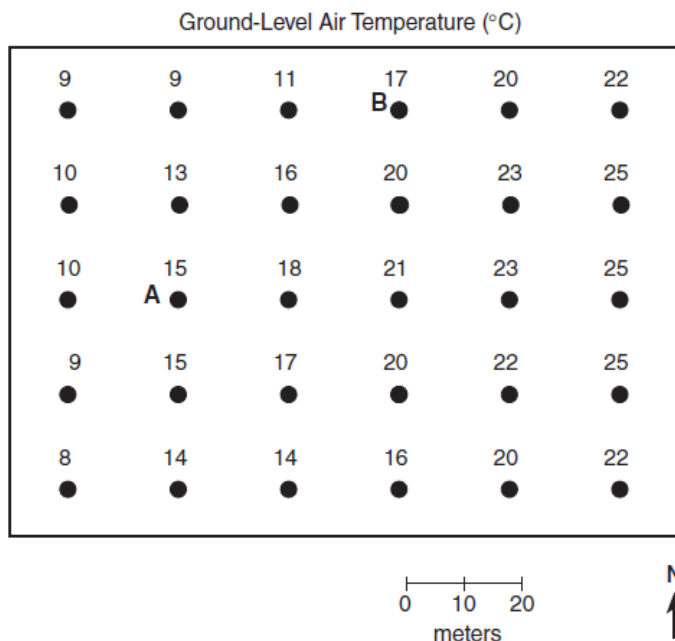
Contour interval = 10



Contour interval = 5



On the field map below, draw only the 15°C and the 20°C isotherms. Isotherms must be extended to the edge of the map.



Base your answers to questions 1 and 2 on the temperature field map provided below. The map shows air temperatures, in degrees Fahrenheit, recorded at the same time at weather stations across North America. The air temperature at location *A* has been deliberately left blank.

(1) On the map provided below use smooth, curved solid lines to draw the 30°F, 40°F, and 50°F isotherms.

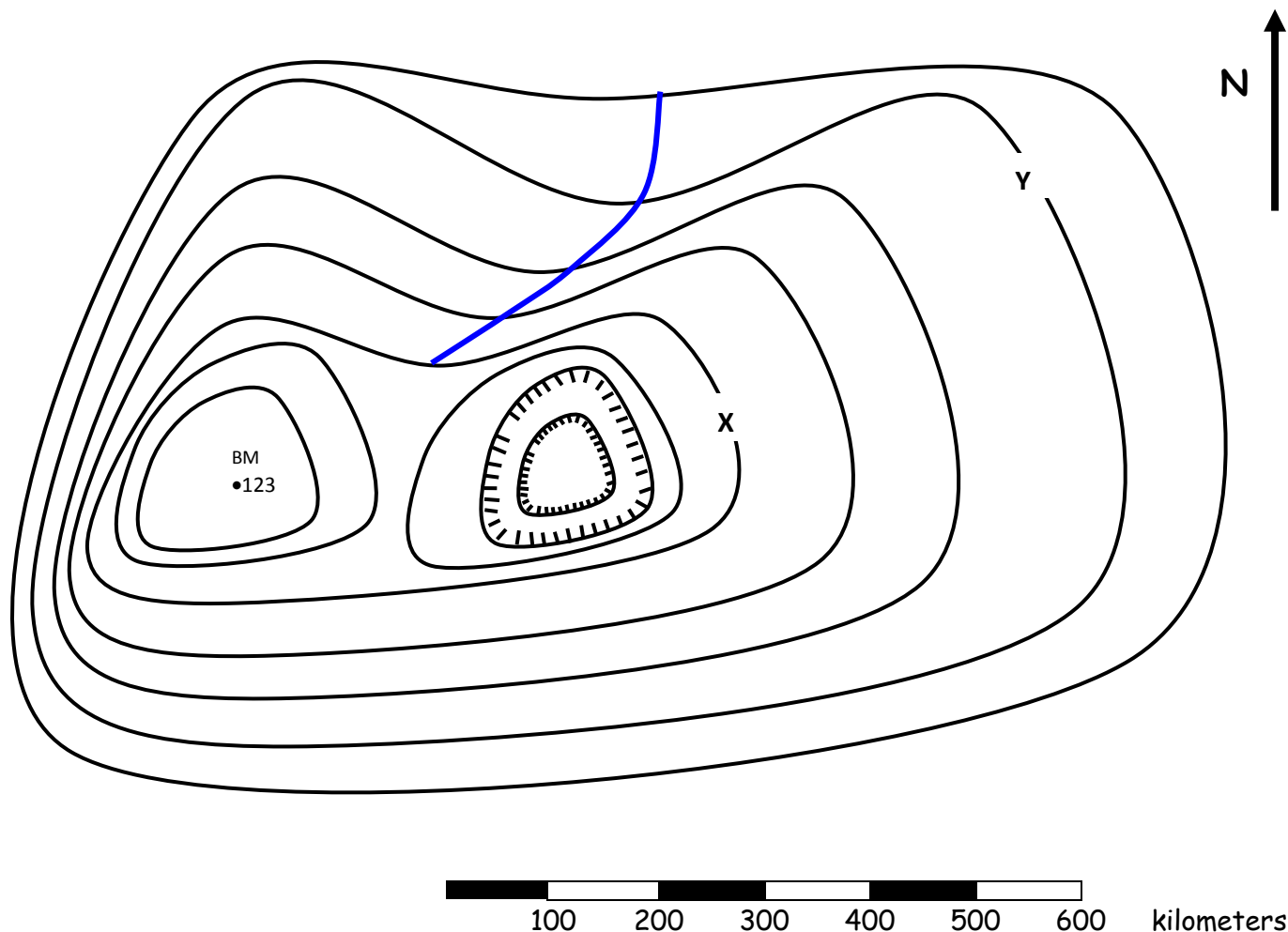
(2) What is the most probable air temperature at location *A*? \_\_\_\_\_



Use this map to answer the questions below.


**Materials**

- ✓ Color Pencils
- ✓ Highlighter



1. A map scale measures distance across the surface of a map.
  - Highlight the units on the map scale above.
  - What is the distance between "X" and "Y"? \_\_\_\_\_
2. A compass direction is also located on a map. Highlight the compass direction.
3. This is an island in an ocean and therefore the first contour line around the outside of the island has an elevation of 0 (zero, sea level). Label the first contour line 0.
4. A contour interval is the difference in elevation between two contour lines. In other words, what the lines count by. The contour interval for this map is 20 meters. Label each contour moving up through the island - counting by 20.



5. A depression contour is used to show a decrease in elevation (a pit). It has hash marks along it like this:  The first depression contour has the same value as the adjacent contour around it. Any additional depression contours count down using the same contour interval as the entire map. 1.15 line spacing is so hash mark diagram would fit.
  - Using a purple color pencil, color in the depression.
  - Label the depression contour lines with the correct elevations.
  
6. A bench mark states the exact elevation of a specific location. On a map a "BM" is used to indicate the location of a bench mark. Using a yellow color pencil, lightly color over the bench mark and its value. What is the elevation of the bench mark? \_\_\_\_\_
  
7. The steepest section of the island can be located by finding where the contour lines are closest together. Gentle slopes are where the contour lines are farthest apart.
  - Using a red colored pencil, place an "S" where the steepest slope of the island is.
  - Using a green colored pencil, place a "G" where the most gentle slope of the island is.
  
8. Streams always flow downhill, from higher elevation to lower elevation. Another way to determine the direction of stream flow is to look at the contour lines and the way that they bend where the stream is. The contour lines always bend upstream. Locate the stream on the top center part of the map on page 22. Using a blue color pencil trace the stream and place an arrow to show the direction of flow.
  
9. The highest elevation on a map is not the same value as the highest contour line. The highest possible elevation on a map is one less than the next highest contour line. Find the highest contour line and determine what the next contour higher would be. Subtract one for the highest possible elevation.
  - What is the highest contour line on the map? \_\_\_\_\_
  - What is the highest possible elevation on the map? \_\_\_\_\_
  
10. When referring to a contour map, gradient is the same as slope. The gradient formula is used to determine how steep or how gentle a slope is. Find the formula on the front of the Earth Science Reference Tables and write it in the box to the right.
  
11. - The change in field value is the difference between the values of the two end points.
  - What is the change in field value between points "X" and "Y" on the map on page 22? \_\_\_\_\_
  - What is the distance between "X" and "Y"? \_\_\_\_\_
  - Determine the gradient between "'X' and "Y" below.

**Formula:**

**Substitute  
Numbers**

**Solution (with units) \_\_\_\_\_**

✓ **Check Point**

1. What does a map scale measure? \_\_\_\_\_
2. How do you know a land feature is an ocean island when looking at a contour map? \_\_\_\_\_  
\_\_\_\_\_
3. What is a contour interval? \_\_\_\_\_  
\_\_\_\_\_
4. What is a depression? \_\_\_\_\_
5. What is used to identify a depression on a topographic map? \_\_\_\_\_
6. What is the value of the first depression contour line? \_\_\_\_\_  
\_\_\_\_\_
7. What does a bench mark indicate? \_\_\_\_\_
8. How can you tell which side of a hill has the steepest slope? \_\_\_\_\_  
\_\_\_\_\_
9. Which direction do streams always flow? \_\_\_\_\_
10. Which direction do contour lines bend when they cross a stream? \_\_\_\_\_
11. If the contour interval is 10m and the highest contour line has an elevation of 90m, what is the highest possible elevation at the top of the hill? (to the nearest meter) \_\_\_\_\_
12. What is another name for gradient? \_\_\_\_\_

**Show what you know:**

**Topographic Map & Gradient Practice**

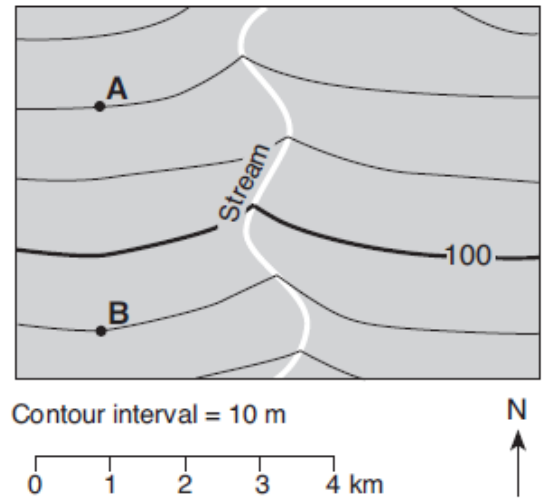
1. A map shows two locations A and B. They are 15 kilometers apart. Location A has an elevation of 525 meters and location B has an elevation of 150 meters. What is the gradient between the two locations?

Formula:

Substitute  
Numbers

Solution  
(with units)

The topographic map below shows the location of a stream. Points *A* and *B* are locations on Earth's surface.



2. What is the contour interval? \_\_\_\_\_
3. What is the distance between point A and point B? \_\_\_\_\_
4. What is the approximate gradient between point A and point B? \_\_\_\_\_
5. Which direction is the stream flowing? \_\_\_\_\_

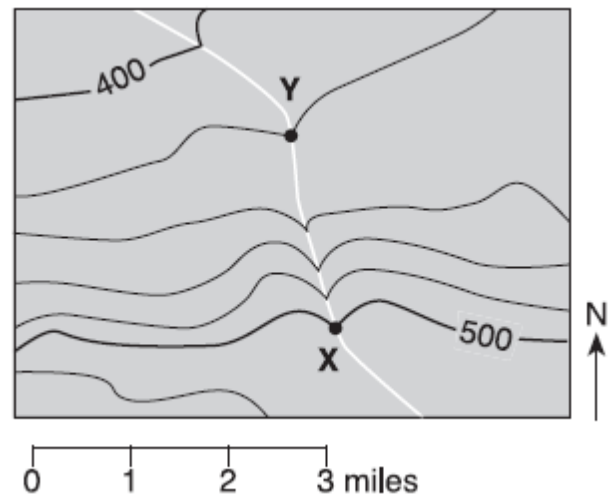
Give one piece of evidence to support your answer to stream flow direction.

---



---

The topographic map to the right shows a stream crossing several contour lines and passing through points *X* and *Y*. Elevations are measured in feet.



6. What is the contour interval? \_\_\_\_\_
7. What is the distance between point X and point Y? \_\_\_\_\_
8. What is the approximate gradient between point X and point Y? \_\_\_\_\_
9. Which direction is the stream flowing? \_\_\_\_\_

Give two pieces of evidence to support your answer to stream flow direction.

---

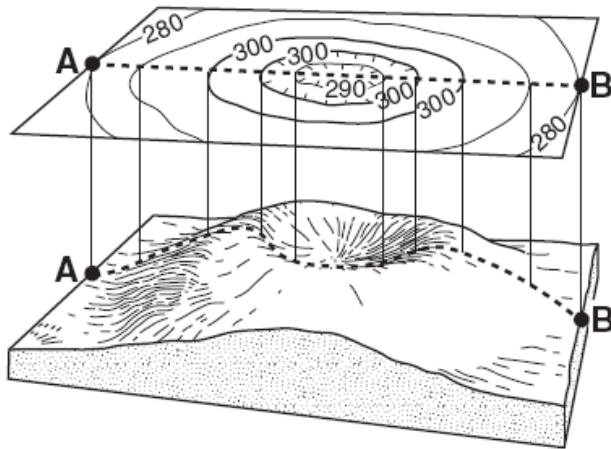


---

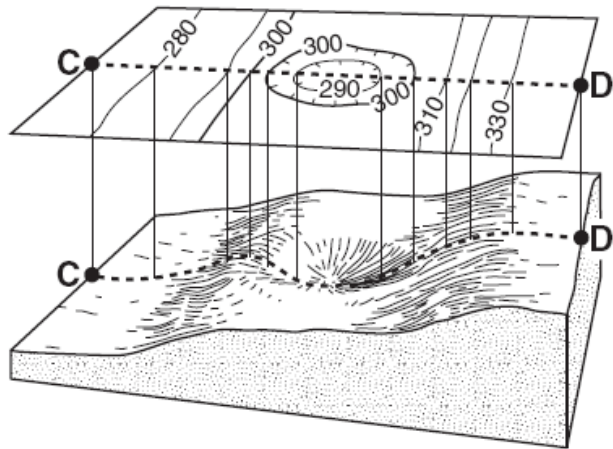
10. Which location ( *X* or *Y* ) has the steepest slope? \_\_\_\_\_  
Support your answer. \_\_\_\_\_

11. Which location ( *X* or *Y* ) would water flow the fastest? \_\_\_\_\_  
Support your answer. \_\_\_\_\_

Base your answers to questions 12 and 13 on the topographic maps and block diagrams of two landscape regions shown below. The block diagrams show a three-dimensional view of the topographic maps directly above them. Elevations are measured in feet. Points *A*, *B*, *C*, and *D* are locations on Earth's surface.

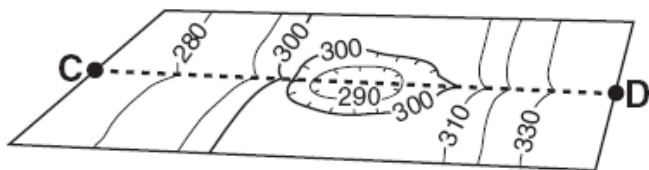


Landscape 1

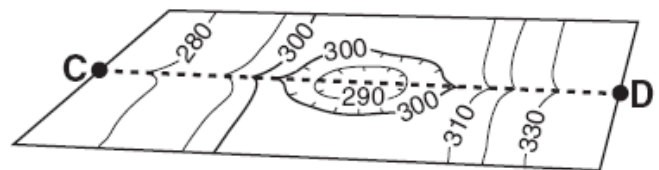


Landscape 2

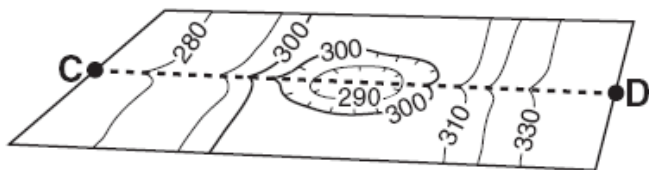
- \_\_\_ 12. Which contour interval is used on both topographic maps?  
 (1) 10 ft                      (2) 20 ft                      (3) 30 ft                      (4) 40 ft
- \_\_\_ 13. A stream begins to flow downhill from point *D* toward the depression. After a period of time, the depression fills with water. Overflowing water from the depression moves downhill toward point *C*. Which topographic map shows the most likely resulting change in the contour lines?



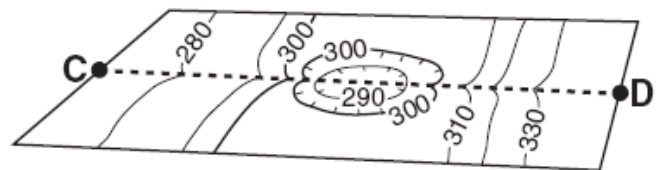
(1)



(3)



(2)



(4)

**Introduction:**

Many of you have already been exposed to contour maps (topographic maps). Sometimes things are better understood if you can see a 3D model. Using cheerios, paper and glue, you will be constructing your very own land form.

**Materials**

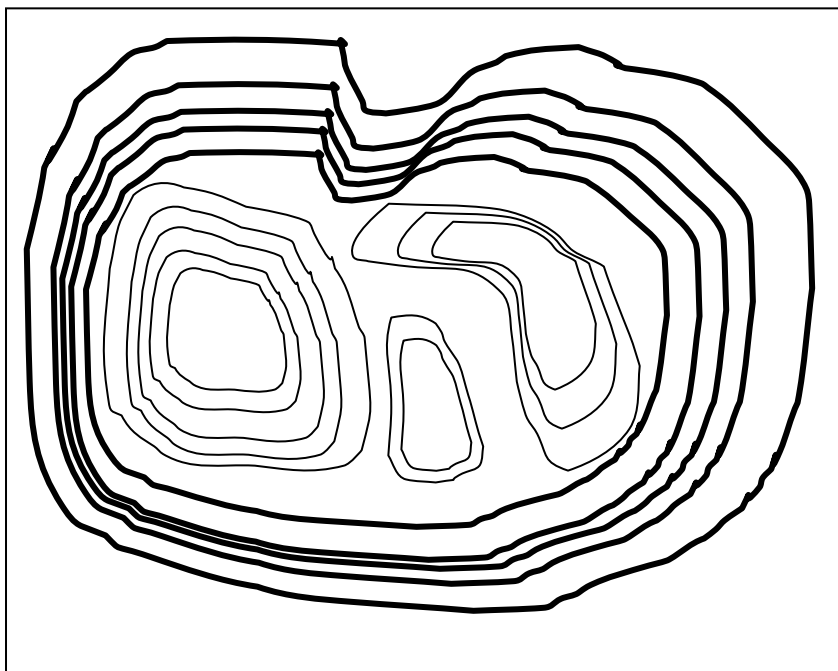
- ✓ Color Pencils
- ✓ Highlighter
- ✓ Glue

**Objective:**

- To design and construct a three dimensional contour map.

**Procedure:**

1. Using a full sheet of construction paper, trace an outline using a THICK marker. Make it as large as you can.
  - Make sure you have at least one area where the landform curves inward.

**Sample:**

2. Very carefully cut out your landform. This is the base.
3. Using the construction paper and marker, continue to draw several smaller versions of your landform. Separate them into separate hills.
  - You must have at least 6 levels to your map.
  - Include at least 2 hills on your map.
4. Keep the base separate from the other pieces you cut out.

5. Not including the base, very carefully glue the cheerios to the bottom of each of the outlines you have cut out. Again - **(NOT THE BASE)**
6. Place the outlines on top of each other. **DO NOT GLUE** the outlines to each other.
7. Move all of the outlines to one side of the base landform. What do you notice about the steepness of the slope, when the lines are closer together?

---



---

8. Look at the other side, where the lines are far apart. What do you notice about the steepness of the slope on this side of the hill?

---



---

9. Look at where the lines are for the indentation. This is where a stream would be. Remember that water will flow downhill. Which direction do the curves of the landform point (upstream or downstream)? \_\_\_\_\_

10. Move your outlines anywhere you wish on the base. Carefully glue the levels to each other.

11. Have your instructor check your work and initial your lab.



✓ **Check Point**

- (1) Explain why contour lines on a map cannot ever cross. \_\_\_\_\_

---



---

- (2) Does water always flow into a lake? \_\_\_\_\_ Explain your answer. \_\_\_\_\_

---



---

- (3) What does every point on a specific contour line have in common? \_\_\_\_\_

---



---

- (4) If the first contour line is 0 m, what type of landform is this? \_\_\_\_\_

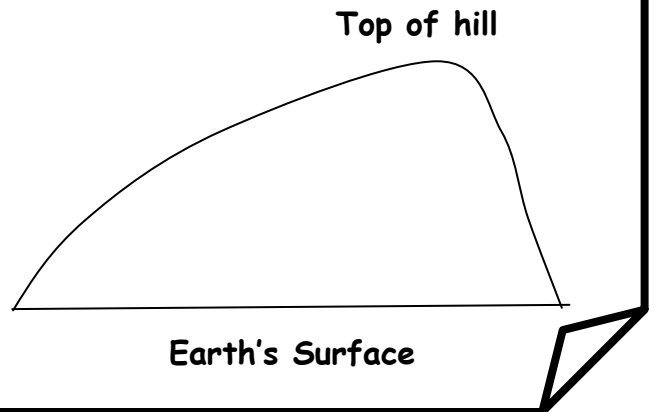
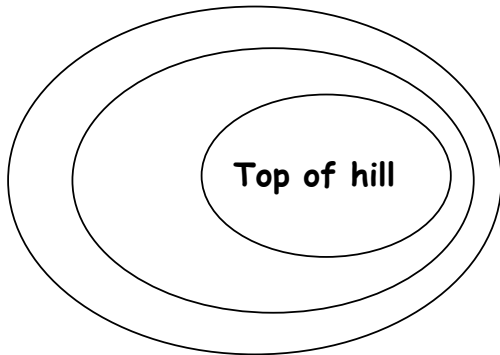
- (5) If each contour line (level) on your model represents 100 m, what is the elevation of the highest contour line? \_\_\_\_\_ m

- (6) If each contour line (level) on your map represents 100 km, what is the highest possible elevation of your map? \_\_\_\_\_ m

## Mini Lesson 4: Profiles

A topographic map is a map that shows the different elevations of an area. Like a road map, it is a view of an area from an overhead perspective. In other words, you are looking down on the area as if you were in a helicopter. A profile is a side view of an object.

Below are two diagrams of a hill. To the left is what it would look like on a topographic map. To the right is what the profile of the hill looks like.



### Reading Review:

1. What is the difference between a topographic view and a profile?

---

---

2. In the space provided below, draw a pizza pie.

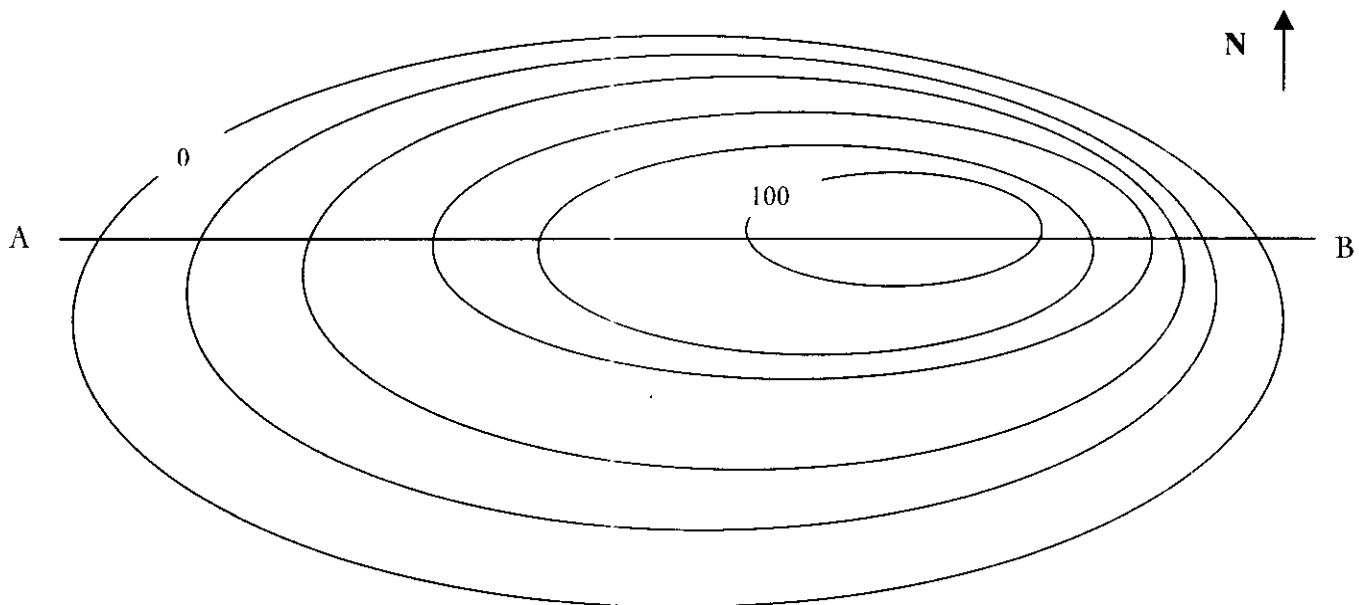
3. Did you draw an overhead view (topographic) or a profile view? \_\_\_\_\_

**Materials**

- ✓ Color Pencils
- ✓ Highlighter

1. Determine the contour interval for the map below.
2. Label the contour lines on the map, **above** the profile line that cuts through the middle of the map.
3. Place a scrap paper across the profile line and mark each place a contour line touches the paper **and** mark the elevation at each mark.
4. Place the scrap paper at the bottom of the graph on page 33, all the way to the left.
5. Place a dot (•) on the zero line where the scrap paper is marked zero.
6. Move the scrap paper up to the 20 m elevation line, keeping the zero mark all the way to the left.
7. Place a dot(•) directly above the mark for 20 m. Continue to move the scrap paper up still lining it up with the zero on the left. Mark each corresponding elevation with the mark you made on the scrap paper.
8. Remember that once you have reached 100 m you must mark BOTH places that are at 100 m.
9. Begin to move the scrap paper down and mark the corresponding elevations again.
10. Once all the dots are on the graph, connect the dots with a smooth line.

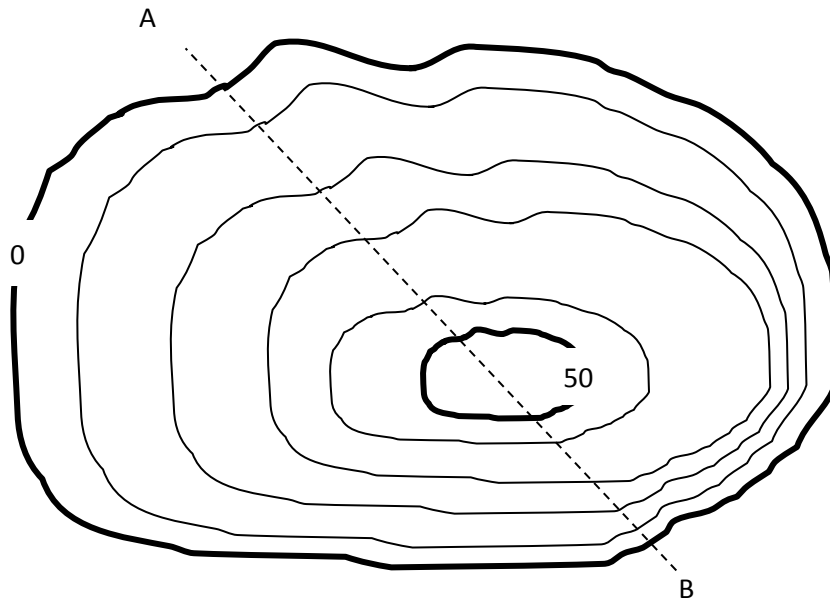
**\*\* IMPORTANT:** Hills are not flat - the line you draw for the top of the hill must be a little above the line for highest elevation points you plotted. Also, do not draw your line so that it touches the next line of elevation above the hill.

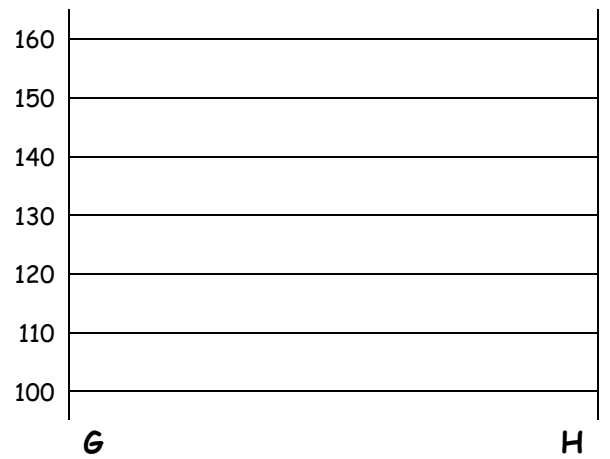
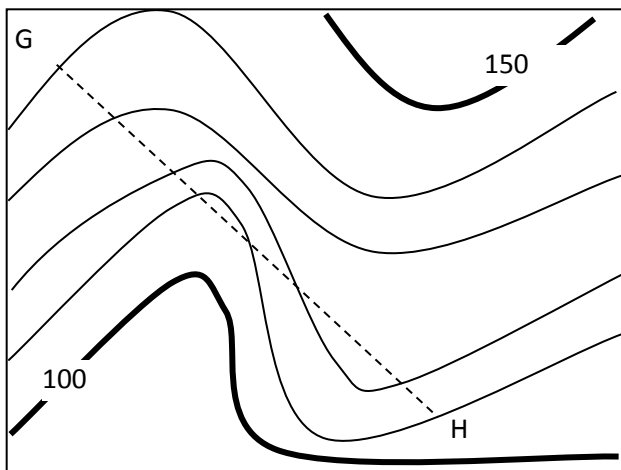
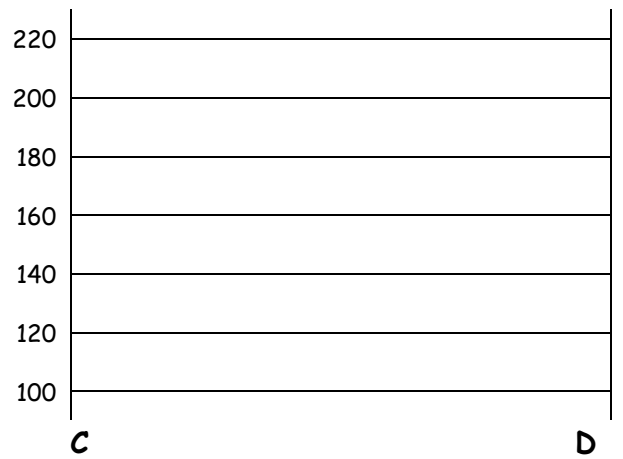
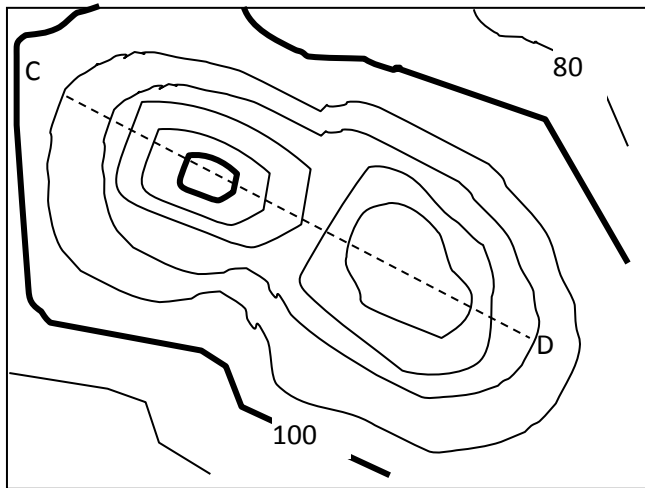
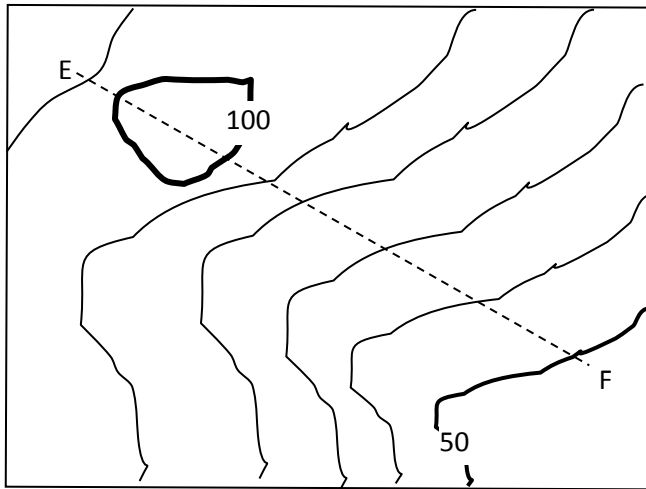




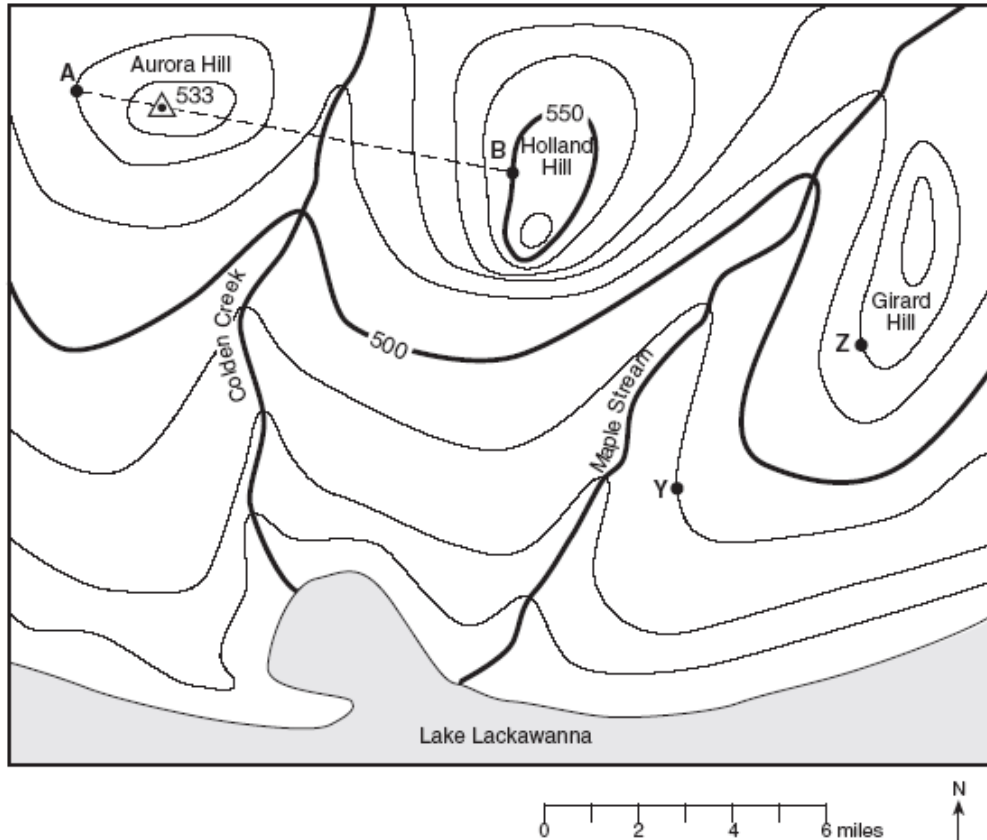


**Practice:** Draw a profile on the graph provided for each contour map by following the directions on page 30.



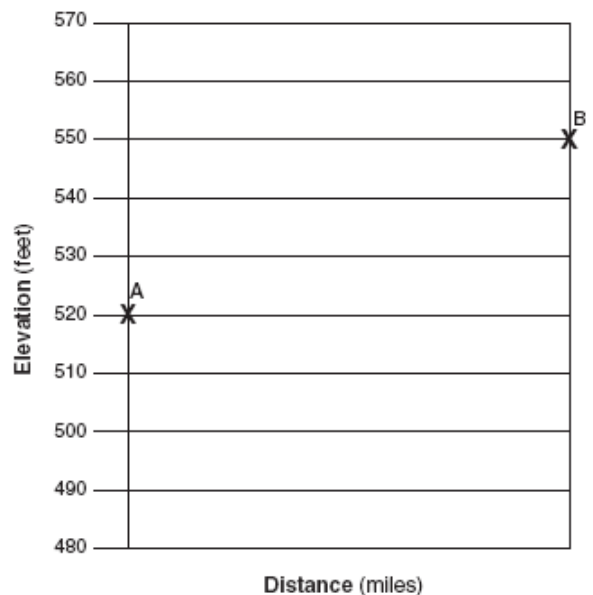


Base your answers for questions 1 through 5 on the topographic map below. Points *A*, *B*, *Y*, and *Z* are reference points on the topographic map. The symbol  $\triangle$  533 represents the highest elevation on Aurora Hill.

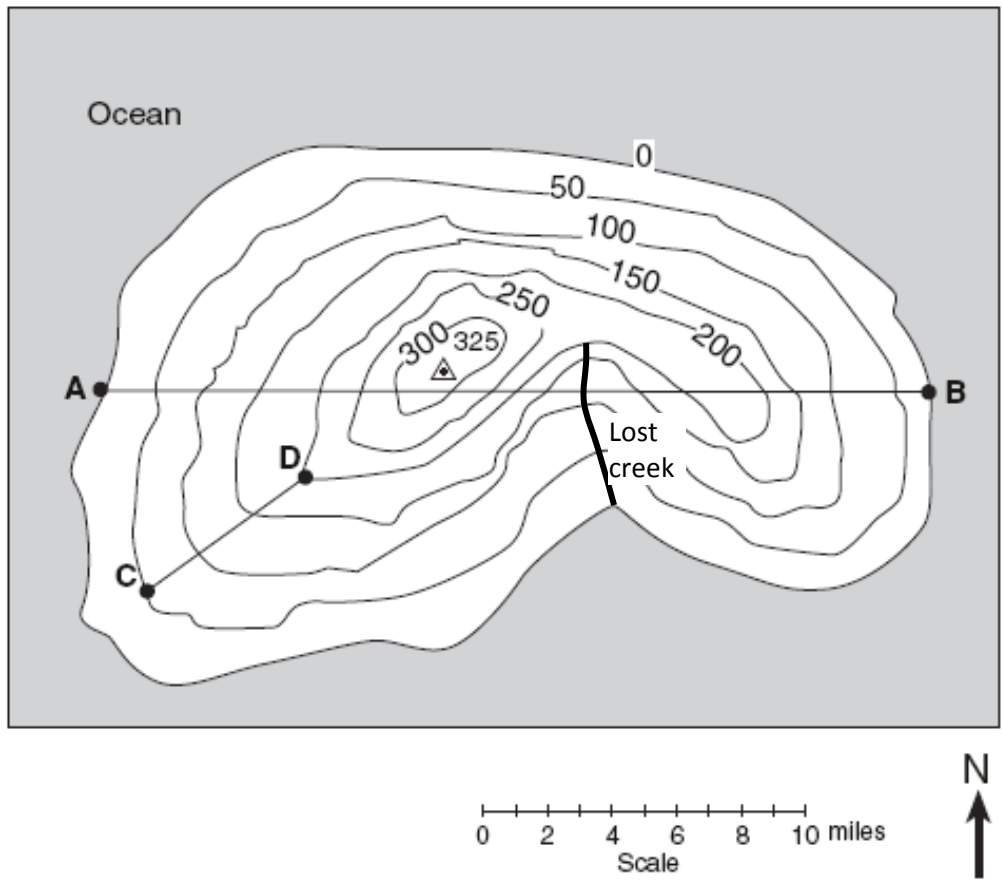


1. What is the contour interval for this map? \_\_\_\_\_
2. State the general compass direction in which Maple Stream is flowing. \_\_\_\_\_
3. Describe the evidence shown on the map that indicates that the southern side of Holland Hill has the steepest slope. \_\_\_\_\_
4. Calculate the gradient between points *Y* and *Z* on the map, and label the answer with the correct units.

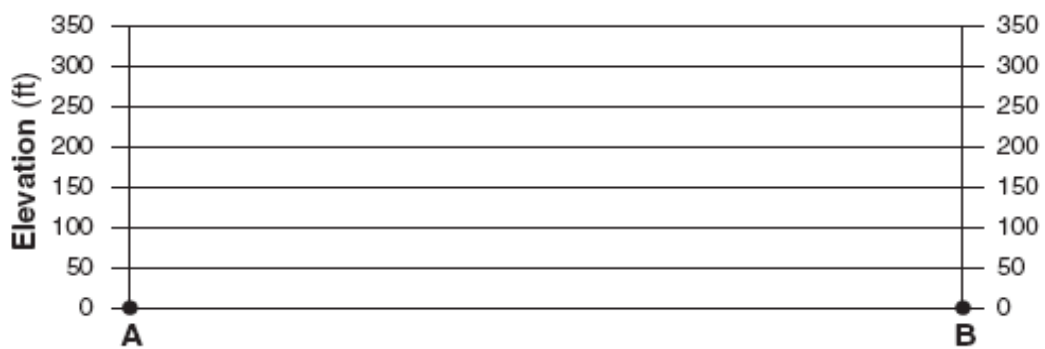
5. On the grid provided to the right, construct a topographic profile from point *A* to point *B*.



Base your answers for questions 6 through 9 on the topographic map of an island below. Elevations are expressed in feet. Points A, B, C, and D are locations on the island. A triangulation point shows the highest elevation on the island.



6. What is the contour interval of this map? \_\_\_\_\_
7. Toward which compass directions does Lost Creek flow? \_\_\_\_\_
8. Draw a profile of the island between points A and B.



9. Determine the gradient, in feet per mile, along the straight line from point C to point D. Show All Work (to the nearest tenth).