

TOPOGRAPHIC MAP SKILLS - Part I

Purpose:

This exercise will acquaint students with the skills necessary to use and understand topographic maps.

Concepts:

A topographic map is the projection of a landscape onto a piece of paper; showing detailed surface features of the Earth such as elevation and slope.

Duration of Lesson:

Two 50-minute class periods (one 50-minute class period if activities are assigned for homework)

Objectives:

As a result of participation in this lesson, the learner will be able to:

1. understand the importance of reading topographic maps in repository site characterization;
2. locate prominent points on a map;
3. measure and calculate horizontal distances;
4. determine differences in elevation between different locations; and
5. describe the location of points using latitude and longitude coordinates.

Skills:

Analyzing, calculating, constructing, determining contour intervals, finding scale, longitude and latitude, visualizing

Vocabulary:

Conventional notation, degree, equator, geophysical pole, hour, latitude, longitude, meridian, minute, notation, prime meridian, second, symbol

Materials:

Reading Lesson

Topographic Map Skills, p. SR-37

Activity Sheets

Topographic Map Skills, p. 211

Practice with Scale, Latitude, and Longitude, p. 213

Contouring, p. 215

Topographic Maps of Landscapes, p. 217

Background Notes

Topographic Map Skills, p. 83

Contours and Cornflakes, p. 85

Other

U.S. Geological Survey topographic map (7-1/2 or 15-minute version) - See p.81 for ordering instructions
12- or 18-inch English or metric ruler, preferably both
Pencil, graph paper

Suggested Procedure:

1. Before beginning the reading lesson you may wish to review the meaning of meridian, longitude, and latitude. It may also be helpful to review notation for degrees, minutes, and seconds and to discuss symbols. The following definitions may be useful:
 - a) *meridian* — a great circle of the Earth's surface, passing through both geophysical poles.
 - b) *latitude* — the angular distance north or south of the equator, measured in degrees along a meridian.
 - c) *longitude* — the angular distance (on the Earth, a globe, or a map) east or west of the prime meridian at Greenwich, England, to a point on the Earth's surface for which the longitude is being determined, expressed in degrees or in hours, minutes, and seconds.
 - d) *conventional notation* — used to signify degrees ($^{\circ}$), minutes ($'$), and seconds ($''$). For example, $115^{\circ}30'21''$ means 115 degrees, 30 minutes, and 21 seconds. Remember that each degree contains 60 minutes and each minute contains 60 seconds.
 - e) *symbols* — both natural and manmade features are indicated by symbols. The shape, size, location, and color all have special significance. Symbols for water features are blue, and man-made objects (roads, railroads, buildings, etc.) are black. Green distinguishes wooded areas from clearings. Contour lines are brown. Many map symbols are pictographs, resembling the objects they identify.
2. When students have completed the reading, it may be helpful to be sure they understand the information presented by reviewing Figure 5 and by having them identify features mentioned (i.e., mountainous terrain, flat terrain, elevation of contours) on the sample map in Figure 5 .
3. After students have completed the reading lesson they can do the exercises in small groups or individually. Begin with the activity entitled *Practice with Scale, Latitude and Longitude*. It may be necessary to review answers before continuing.
4. Learning to get an overall impression of what the landscape represented by a topographic map looks like takes some practice and imagination. Do the exercises entitled *Topographic Maps of Landscapes* to practice visualizing what the topographic map for a given landscape looks like.
5. Have students construct a topographic map by connecting points of equal elevation on the handout entitled *Contouring*.
6. When students have completed their topographic maps, have them describe the land feature that it represents.

(River Valley cutting between two peaks.)

7. When students have completed these activities they should be ready to look at and discuss a topographic map. Give each group a map and discuss the following as a class.

Metric equivalents have not been provided for this lesson because the topographic maps available through the U.S. Geological Survey (USGS) are not metric.

Suggested Discussion Questions: "U.S. Geological Survey topographical map"

1. Determine the contour interval and scale of the topographic map of Busted Butte.

(Contour interval is 20 feet; scale is 1: 24,000.)

2. What are the dimensions of the map in latitude and longitude?

(7-1/2 minutes by 7-1/2 minutes)

3. Find the latitude and longitude grid ticks along the edge of the map and in the interior of the map. What are the dimensions of the map segments defined by these grid ticks?

(2-1/2 minutes x 2-1/2 minutes)

4. Calculate the length (in feet or miles) of any two adjacent borders of the map by using the scale 5280 feet = 1 mile.

(Measure the length on the map using a ruler accurate to a tenth of an inch. Suppose this happens to be 18.3 inches. If the scale of the map is 1:24,000, then 1 inch on the map equals 24,000 inches on the ground. Therefore, the distance represented by 18.3 inches is $18.3 \times 24,000$ inches = 439,000 inches. 439,000 inches divided by 12 inches [1 foot] = 36,600 feet. If you want the answer in miles: 36,600 divided by 5280 [feet per mile] = 6.9 miles.)

5. Calculate the length (in meters or kilometers) of the same two borders of the map using the scale and a metric ruler.

(Suppose the measurement is 46.3 centimeters. A scale of 1 : 24,000 means that one centimeter on the map equals 24,000 centimeters on the ground. Therefore, $46.3 \times 24,000$ centimeters = 1,111,200 centimeters. Divide by 100 [centimeters per meter] to get 11,112 meters. If you want the answer in kilometers, divide by 1000 [meters per kilometer] to get 11.1 kilometers.)

6. Look at the map carefully and try to find:
- the highest and lowest areas on the map
 - areas of relatively steep slopes
 - areas of relatively gentle slopes
 - areas where ephemeral (i.e., very short-lived) streams or storm runoff might flow and the direction of that flow

(Answers may vary.)

Teacher Evaluation of Learner Performance:

Student participation in class discussion and completion of activities will indicate understanding.