SCOPE, SEQUENCE, and COORDINATION

A National Curriculum Project for High School Science Education

This project was funded in part by the National Science Foundation. Opinions expressed are those of the authors and not necessarily those of the Foundation. The SS&C Project encourages reproduction of these materials for distribution in the classroom. For permission for any other use, please contact SS&C, National Science Teachers Association, 1840 Wilson Blvd., Arlington, VA 22201-3000.

Copyright 1996 National Science Teachers Association.

SCOPE, SEQUENCE, and COORDINATION

SS&C Research and Development Center
Bill G. Aldridge, *Principal Investigator and Project Director**
Dorothy L. Gabel, *Co-Principal Investigator*
Erma M. Anderson, *Associate Project Director*
Stephen Druger, *Project Associate for Micro-Unit Development*
Nancy Erwin, *Project Editor*
Rick McGolerick, *Project Coordinator*

Evaluation Center
Frances Lawrenz, *Center Director*
Doug Huffman, *Associate Director*
Wayne Welch, *Consultant*
University of Minnesota, 612.625.2046

Houston SS&C Materials Development and Coordination Center
Linda W. Crow, *Center Director*
Godrej H. Sethna, *School Coordinator*
Martha S. Young, *Senior Production Editor*
Yerga Keflemariam, *Administrative Assistant*
Baylor College of Medicine, 713.798.6880

Houston School Sites and Lead Teachers
Jefferson Davis H.S., Lois Range
Lee H.S., Thomas Goldsbury
Jack Yates H.S., Diane Schranck

California Coordination Center
Tom Hinojosa, *Center Coordinator*
Santa Clara, Calif., 408.244.3080

California School Sites and Lead Teachers
Sherman Indian H.S., Mary Yarger
Sacramento H.S., Brian Jacobs

Iowa Coordination Center
Robert Yager, *Center Director*
Keith Lippincott, *School Coordinator*
University of Iowa, 319.335.1189

Iowa School Sites and Lead Teachers
Pleasant Valley H.S., William Roberts
North Scott H.S., Mike Brown

North Carolina Coordination Center
Charles Coble, *Center Co-Director*
Jessie Jones, *School Coordinator*
East Carolina University, 919.328.6172

North Carolina School Sites and Lead Teachers
Tarboro H.S., Ernestine Smith
Northside H.S., Glenda Burrus

Puerto Rico Coordination Center**
Manuel Gomez, *Center Co-Director*
Acenet Bernacet, *Center Co-Director*
University of Puerto Rico, 809.765.5170

Puerto Rico School Site
UPR Lab H.S.

* * * * * * * * * * * *

Pilot Sites
Site Coordinator and Lead Teacher
Fox Lane H.S., New York, Arthur Eisenkraft
Georgetown Day School, Washington, D.C., William George
Flathead H.S., Montana, Gary Freebury
Clinton H.S., New York, John Laffan**

Advisory Board

Dr. Rodney L. Doran (Chairperson), University of Buffalo

Dr. Albert V. Baez, Vivamos Mejor/USA

Dr. Shirley M. Malcom, American Association for the Advancement of Science

Dr. Shirley M. McBay, Quality Education for Minorities

Dr. Paul Saltman, University of California, San Diego

Dr. Kendall N. Starkweather, International Technology Education Association

Dr. Kathryn Sullivan, Ohio Center of Science and Industry

* Western NSTA Office, 894 Discovery Court, Henderson, Nevada 89014, 702.436.6685
** Not part of the NSF-funded SS&C project.

National Science Education Standard—Earth and Space

The Origin and Evolution of the Earth System

Interactions among the solid Earth, the oceans, the atmosphere, and organisms have resulted in the ongoing evolution of the Earth system. We can observe some changes such as earthquakes and volcanic eruptions on a human time scale, but many processes such as mountain building and plate movements take place over hundreds of millions of years.

Teacher Materials

Learning Sequence Item:

913

Topographic Maps

September 1996

Adapted by: Brett Pyle and Linda W. Crow

Interactions Among Ecosystems: Earthquakes, Volcanoes, Mountains, and Plate Movements. Students should create and use topographic maps *(Earth and Space Sciences, A Framework for High School Science Education, p. 151)*.

Contents

This micro-unit was adapted by **Brett Pyle** (Grady Middle School, Houston, Texas) and **Linda W. Crow** (Baylor College of Medicine, Houston)

913

Learning Sequence

Interactions Among Ecosystems: Earthquakes, Volcanoes, Mountains, and Plate Movements. Students should create and use topographic maps *(Earth and Space Sciences, A Framework for High School Science Education, p. 151)*.

Science as Inquiry	Science and Technology	Science in Personal and Social Perspectives	History and Nature of Science
Line It Up **Activity 1** Submersive Mapping **Activity 2** What a Stunning Profile You Have! **Activity 3** Stereo Mapping **Activity 4** Find Yourself **Activity 5** Describing Landscapes **Assessment 1** Drawing a Profile **Assessment 3**		Building a Ski Slope **Assessment 2**	Designed Cities **Reading 1**

Suggested Sequence of Events

Event #1

Lab Activity

1. Line It Up (2 hours–1/2 day)

Alternative or Additional Activity

2. Submersive Mapping (40 minutes)

Event #2

Lab Activity

3. What a Stunning Profile You Have! (50 minutes)

Alternative or Additional Activities

4. Stereo Mapping (40 minutes)
5. Find Yourself (40 minutes)

Event #5

Readings from Science as Inquiry, Science and Technology, Science in Personal and Social Perspectives, and History and Nature of Science

The following reading is included in the student version of the unit:

Reading 1 Designed Cities

Suggested additional readings:

Pennisi, E., "Filling in the Gaps." *Science News,* Vol. 144, No. 16, October 16, 1993, pp. 248–251.

Pennisi, E., "Talking Maps." *Science News*, Vol. 142, No. 23, December 5, 1992, pp. 392–393.

Assessment items are at the back of this volume.

Assessment Recommendations

This teacher materials packet contains a few items suggested for classroom assessment. Often, three types of items are included. Some have been tested and reviewed, but not all.

1. Multiple choice questions accompanied by short essays, called justification, that allow teachers to find out if students really understand their selections on the multiple choice.

2. Open-ended questions asking for essay responses.

3. Suggestions for performance tasks, usually including laboratory work, questions to be answered, data to be graphed and processed, and inferences to be made. Some tasks include proposals for student design of such tasks. These may sometimes closely resemble a good laboratory task, since the best types of laboratories are assessing student skills and performance at all times. Special assessment tasks will not be needed if measures such as questions, tabulations, graphs, calculations, etc., are incorporated into regular lab activities.

Teachers are encouraged to make changes in these items to suit their own classroom situations and to develop further items of their own, hopefully finding inspiration in the models we have provided. We hope you may consider adding your best items to our pool. We also will be very pleased to hear of proposed revisions to our items when you think they are needed.

Science as Inquiry

Line It Up

How can a contour map be constructed by direct measurement?

Overview:

This activity provides an introduction to contouring and topographic maps.

Materials:

Per class:
string, 4–5 rolls (one per contour line)

Per lab group:
broomstick
string, 20–50 ft
carpenter's line level
popsicle sticks

Procedure:

Locate a convenient area with some topographic relief that will be suitable for mapping. An ideal location would be a hillside that contains some erosional cuts due to runoff. If possible, the base of the hillside should have a parking lot or road to provide a level baseline surface. Have students mark lines on the broomsticks at 1-ft intervals. A file could be used to place small grooves in the handles at each interval to prevent the string from slipping during mapping.

Once at the mapping location, establish a flat surface area at the base of the hill as a *zero-elevation point (0).* All student mapping groups must use the same 0-elevation point. If the point is a flat parking lot or road, students may set up more than one 0-elevatlon point to avoid crowding.

Each group should attach their string to their broomstick and hang the line level on the string. They should then set the string at the l-ft line on the broomstick and stretch it from the broomstick to the hillside.

One student should check the line level while another student places popsicle sticks along the hillside at l-ft elevation. Spacing between popsicle sticks is up to the students. You may wish to suggest that they place the sticks closer together in areas of rapidly changing topography or in erosional cuts.

When students have placed the sticks at l-ft elevation, the string is raised to 2-ft elevation

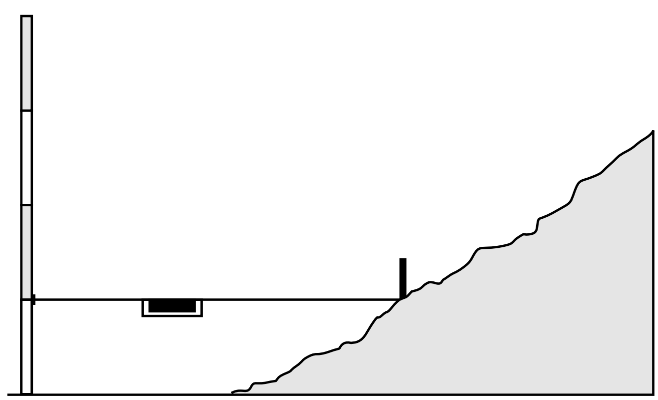


Figure 1. Placement of popsicle sticks at 1-ft elevation.

and the process is repeated. Each group could be assigned to map part of the hillside. The total elevation mapped will depend on the hillside.

Once all of the sticks have been placed, have students connect with string all of the sticks at 1-ft elevation, all of the sticks at 2-ft elevation, etc. This will create contour lines that can be observed from the base of the hill and from the top of the hill looking down.

Background:

The location chosen can play a big role in the effectiveness of this activity. A smooth sloping hillside can be mapped but will be less interesting than one containing some deep erosional cuts or undulations. Erosional cuts can be particularly effective in showing the upstream Vs that appear on contour maps.

If the base of the hill is not flat, pick a location to be the 0-elevation point. Students establish other 0-elevation points along the hillside by connecting their broomsticks *to the standard* with a leveled string. If the base of their stick is not at 0-elevation they should mark “0” on their stick and adjust all measurements accordingly. For example, should the base of their broomstick lie 3 inches above the 0-baseline, then their string should be attached 3 inches above the l-ft line to accurately mark the 1-ft contour interval on that portion of the hillside (Figure 2).

The contour interval can be varied according to the total relief of the hillside. Generally, the greater the relief the larger the contour interval that should be used. Choose an interval that will enable students to place at least 4–5 contour lines on the hillside

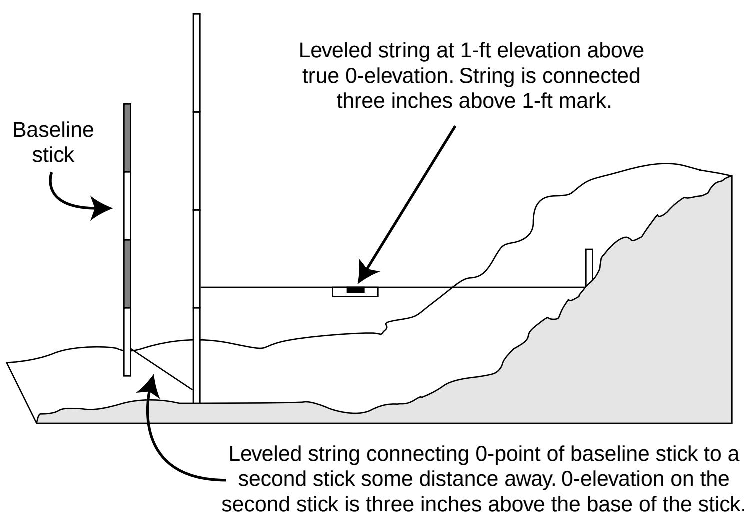


Figure 2. Proper use of a second baseline stick located where the ground is not at true zero elevation.

Variations:

Groups may vary the way they map different parts of the hillside. Students could use a l-ft contour interval for one part of the hillside and a 2-ft interval for another part. They could also vary the distance between popsicle sticks on the hillside. They should then examine what effect these variations have on the contour lines produced.

If there are no suitable outdoor sites available this lab can be modified for the classroom. Mountains of paper mache can be constructed and placed on lab tables. Students use the same procedure as described above but use the table as 0-elevation. A meter stick can be used in place of a broomstick. The contour interval is decreased to fit the size of the mountains constructed.

Adapted from:
Novastar Designs, *The TOPO Kit,* Novastar Designs, Inc., N.C., 1990.

alternative/extension activity for Event 1

Teacher Sheet

Science as Inquiry

Submersive Mapping

How can a contour map be constructed by direct measurement?

Overview:

This alternative activity provides the direct experience of creating a contour line. It is less dramatic than Activity 1 but may be less cumbersome.

Materials:

Per lab group:

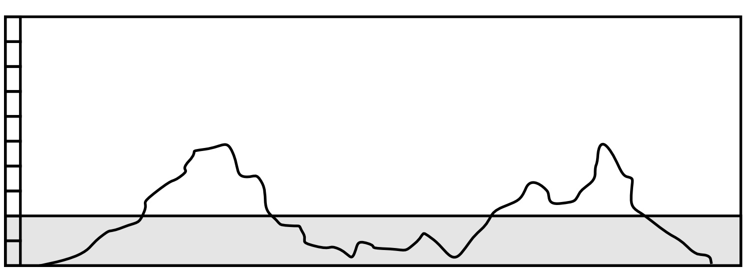
plastic box (shoebox size, preferrably clear)
clay, oil based
bamboo skewer
water

Procedure:

Before starting, shoeboxes should be marked at l-cm intervals starting at the base. These will be used as elevation lines.

Using clay, students construct hills and mountains inside the plastic box. Each group can construct their mountains as they wish, but mountains should not be higher than the top of the box. Encourage them to make at least one stream valley in the side of a hill or mountain. This will allow them to observe the upstream V shape of contour lines.

Once students have completed their clay construction have them add water to the box until it is filled to the l-cm line. They should then carefully trace a line into the clay at the waterline with a bamboo skewer and add water to the 2-cm line. They then trace a line into the clay at the new waterline and add more water . This process is repeated until the water completely covers the clay. The water is then emptied.



Water filled to 2 cm so that the 2-cm contour line can be marked.

Background:

Make sure that the clay used is oil based so that it does not dissolve in the water. The boxes do not necessarily have to be clear. If opaque boxes or buckets are used the elevation marks must be put on the inside. If the lines carved in the clay are not distinct enough, students can carefully place white string along each contour line to make it show more clearly.

Variations:

Have students mark mountains with a contour interval of 2 cm. They then empty the water and observe the lines. They should then go back and fill in the missing contour lines at 1-cm intervals. After emptying the water they compare this version to the previous one with lines at 2-cm intervals.

Students could construct a shoreline with clay and observe how changes in water level (sea level) affect it. They might construct steep and gradually sloping shorelines and compare the effects of sea level changes on each.

The clay models can be saved and used again in the next activity, "What a Stunning Profile." For details, refer to the Variations section in that activity.

Adapted from:
Prentice Hall Science, *Exploring the Planet Earth*, Ingelwood Cliffs, N.J.: Prentice Hall, Inc., 1993.

Teacher Sheet

Science as Inquiry

What a Stunning Profile You Have!

How are topographic maps and profiles created?

Overview:

This activity provides an opportunity for students to create profiles of the landscape.

Materials:

Per student:

ruler

map with elevation points (included in Student Materials)

Procedure:

Have students draw contour lines on the map following the general guidelines on the student sheet. They should carry out this exercise in pencil as mistakes are likely.

After they have drawn their contour lines have them construct a topographic profile along the line shown on the map. Placing the edge of a paper strip along the line (x, y) they mark the location and elevation of each contour line as shown (Figure 1).

After marking these points, students place the paper strip along the bottom of the graph. They then transfer the points to the graph (Figure 2) and connect the points to produce the profile.

Background:

As students are drawing thelr contour lines they should think of how the contour lines appeared from previous activities ("Line it Up" or "Submersive Mapping"). Lines should be drawn smoothly and they should never cross or just stop. They will run off of the map or close in a loop. The Technique Sheet "How to Draw Contour Lines" explains how hills and hollows differ on topographic maps. Hollows are illustrated by concentric hachured lines and hills by plain concentric lines (Figure 3).

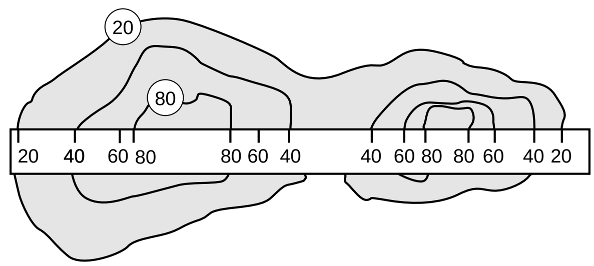


Figure 1. Marking location and elevation of contour lines.

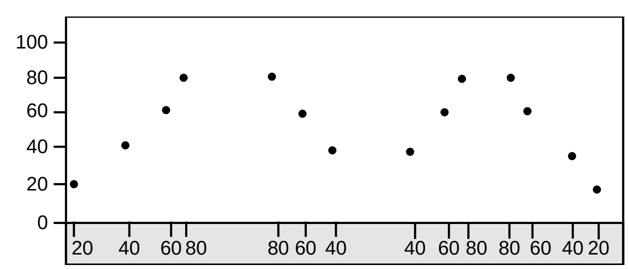


Figure 2. Transferring the points to the profile graph.

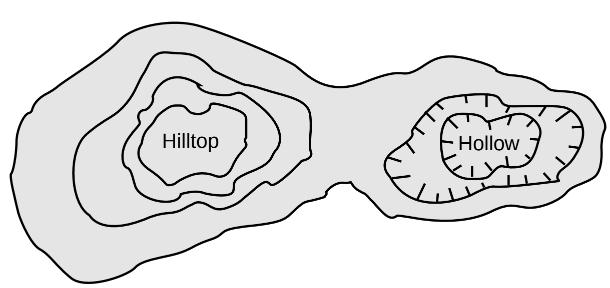


Figure 3. Plain vs. concentric hachured lines.

Variations:

If students did the "Submersive Mapping" activity, they can use the contoured clay to generate a topographic profile. Have them lay a piece of cardboard across the top of the box along the line of the profile that they wish to construct. They then place a strip of paper on top of the cardboard and mark it as shown on page 10. In this case they will be looking straight down into the box and marking the positions and elevations of the contour lines in centimeters. They can then construct a profile and compare it to the clay forms in the box.

Adapted from:
AGI/NAGT, *Laboratory Manual in Physical Geology*, Columbus, Ohio: Merrill Publishing Co., 1986.
Dallmeyer, R.D., *Physical Geology*, Iowa: Kendall/Hunt Publishing Co., 1981.

alternative/extension activity for Event 2

Teacher Sheet

Science as Inquiry

Stereo Mapping

How does a topographic profile compare with a stereo photo of the same location?

Overview:

Students construct a topographic profile and compare it to a stereo photo of the same location.

Materials:

Per student:

ruler
stereo glasses (if available)
cardboard, 1 piece 8.5 × 11in (if stereo glasses not available)
topographic maps and stereo photos (included with Student Materials)

Procedure:

Have students construct a topographic profile from point A to point B on the map of Garibaldi Lake. They should determine the contour interval from the map and label their topographic profiles accordingly. After completing their profiles, they should compare them to the three-dimensional stereo photo. Students then use the same technique with the additional map-photo pairs included with the Student Materials.

Background:

This activity can be used to reinforce map reading skills as well as develop skill in drawing topographic profiles. You may wish to discuss the absence of topographic lines within the lake, how to determine elevation gradients based on the spacing of the contour lines, use of the scale, etc.

The easiest method of viewing the stereo photos is with stereo glasses (Figure 1). Be aware that students with depth perception problems may not be able to see the three-dimensional effect even with stereo glasses.

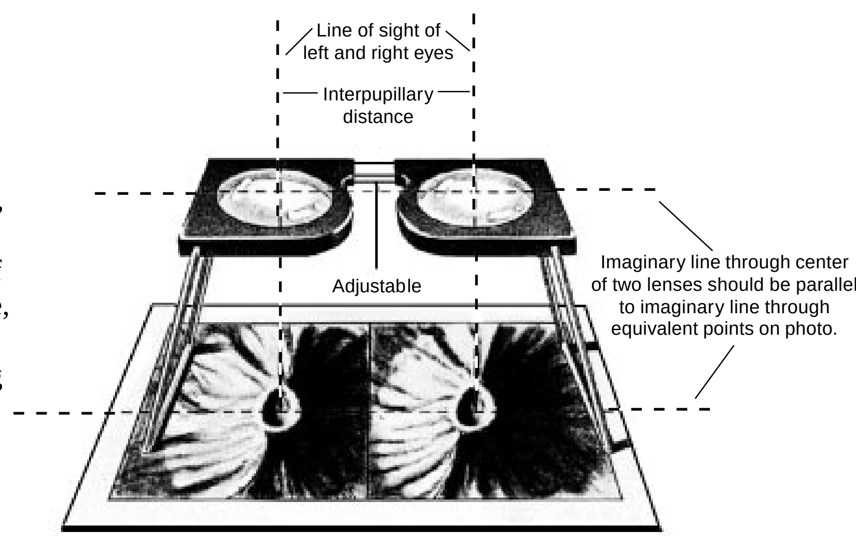


Figure 1. Viewing stereo photos with stereo glasses.

If glasses are not available supply students with a thin piece of cardboard approximately 8.5 × 11in. Have them place the cardboard upright on the line that divides the stereo pairs and look down over the cardboard so that each eye is viewing a different side of the cardhoard (Figure 2).

Focusing on a distinguishing point on the photo, they should try to bring that point from each photo together until they are one. The best point on the photos of the Garibaldi Lake region is probably the small snow-covered peak just to the right (or north) of Mount Price. When the image is no longer blurry it should appear three-dimensional.

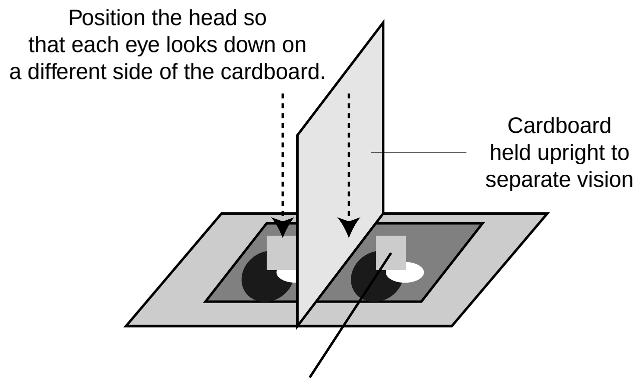


Figure 2. Viewing stereo photos with a piece of cardboard.

Variations:

If you wish students to do more than the map-photo pairs included with the Student Materials, college-level physical geology lab manuals are a good source of additional topo maps with matching stereo pairs. You may wish to give students several topographic maps and stereo photos and have them match a photo with the appropriate topo map. This will reinforce their skills in topographic map interpretation.

Adapted from:
AGI/NAGT, *Laboratory Manual of Physical Geology,* Columbus, Ohio: Merrill Publishing Company, 1986.
Dallmeyer, R.D., *Physical Geology,* Dubuque, Iowa: Kendall/Hunt Publishing Co., 1981.
DeBruin, R., *100 Topographic Maps,* Northbrook, Ill.: Hubbard Press: 1970.
Hamblin, W.K. and J.D. Howard, *Exercises in Physical Geology,* 4th Edition, Minneapolis: Burgess Publishing Co., 1975.
Jones, N.W., *Laboratory Manual for Physical Geology,* Dubuque, Iowa: Wm. C. Brown Publishers, 1995.

Topographic maps and stereo photos attached for student use:
AGI/NAGT (1986), Garibaldi Lake, B.C., photo and map.
Dallmeyer, R.D. (1981), Mount Capulin. N.M., photo and map; Stone Mountain, Ga., photo and map; Mount Katahdin, Maine, photo.
DeBruin, R. (1970), Mount Katahdin, Maine, map; Ship Rock, N.M., map.
Hamblin, W.K. (1975), Ship Rock, N.M., photo.
Jones, N.W. (1995), stereo glasses illustration; Menan Buttes, Idaho, photo and map.

alternative/extension activity for Event 2

Teacher Sheet

Science as tnquiry

Find Yourself

How do you interpret the various parts of a topographic map?

Overview:

Students are given topographic maps and asked to interpret different features.

Materials:

Per student:

topographic maps
key to topographic symbols (included with Student Materials)
protractor
ruler

Procedure:

Give students a topographic map that they will use to answer the questions on the student sheet. Before class begins, you will need to pick out a dominant feature (A) and a secondary feature (B) on the map.

Background:

Ideally these should be U.S.G.S. quadrangle maps. In addition to simply identifying various symbols on the map students should also become familiar with such items as the scale bars, north and magnetic north arrows, latitude-longitude, contour interval, and quadrangle location. These are located on the borders of the maps, and if only photocopied sections of topographic maps are used students will miss this information.

Questions on the student sheet assume that you are using the quadrangle that contains your school. You will need to add additional questions that are relevant to the map your students are using.

Maps can be ordered from the U.S.G.S. Send for a list showing the quandrangles and a current price list.

Indexes show published topographic maps. Indexes for each state, Puerto Rico and the Virgin Islands of the United States, Guam, American Samoa, and Antarctica show available published maps. Index maps show quadrangle location, name, and survey date. Also listed are special maps and sheets, with prices, map dealers, federal distribution centers, and map reference libraries, and instructions for ordering maps. Indexes and a booklet describing topographic maps are available free on request.

How maps can be obtained. Mail orders for maps of areas east of the Mississippi River, including Puerto Rico, the Virgin Islands of the United States, and Antarctica, should be ordered from the U.S. Geological Survey Distribution Section, 1200 South Eads Street, Arlington, VA 22202. Maps of areas west of the Mississippi River, including Alaska, Hawaii, Louisiana, Minnesota, American Samoa, and Guam, should be ordered from the Distribution Section, Federal Center, Denver, CO 80225. A single order combining both eastern and western maps may be placed with either office. Residents of Alaska may order Alaska maps or an index for Alaska from the Distribution Section, 310 First Avenue, Fairbanks, AK 99701. Order by map name, state, and series. Maps without woodland overprint are available on request. On an order amounting to $300 or more at the list price, a 30% discount is allowed. No other discount is applicable. Prepayment is required and must accompany each order. Payment may be made by money order or check payable to the U. S. Geological Survey, or cash (the exact amount) at sender's risk. Your zip-code is required.

Sales counters are maintained in the following U. S. Geological Survey off ices; maps of the area may be purchased in person:

1200 South Eads St., Arlington, VA
General Services Administration Bldg., Room 1028, 18th & F Streets NW, Washington, D.C.
1109 North Highland St., Arlington, VA
900 Pine St., Rolla, MO
345 Middlefield Rd., Menlo Park, CA
7638 Federal Bldg., 300 North Los Angeles St., Los Angeles, CA
504 Custom House, 555 Battery St., San Francisco, CA
Federal Center, Building 41, Denver, CO
1012 Federal Bldg., 1961 Stout St., Denver, CO
1100 Commerce St., Room 1-C 45, Dallas, TX
8102 Federal Federal Bldg., 125 South State St., Salt Lake City, UT
678 U. S. Court House, 920 West Riverside Ave., Spokane, WA
108 Skyline Bldg., 508 Second Ave., Anchorage, AK
441 Federal Bldg., 709 West 9th St., Juneau, AK
310 First Ave., Fairbanks, AK

Commercial dealers sell U. S. Geological Survey maps at their own prices. Names and addresses of dealers are listed in each state index.

Variations:

You may choose to use maps of your local area. This adds interest for the students and gives them a frame of reference. The dominant feature could be the school and the secondary feature their home.

Adapted from:
U.S. Geological Survey

Topographic Map Symbols
(Variations will be found on older maps)

Primary highway, hard surface
Secondary highway, hard surface
Light-duty road, hard or improved surface
Unimproved road
Road under construction, alignment known
Proposed road
Dual highway, dividing strip 25 feet or less
Dual highway, dividing strip exceeding 25 feet
Trail

Railroad: single track and multiple track
Railroads in juxtaposition
Narrow gage: single track and multiple track
Railroad in street and carline
Bridge: road and railroad
Drawbridge: road and railroad
Footbridge
Tunnel: road and railroad
Overpass and underpass
Small masonry or concrete dam
Dam with lock
Dam with road
Canal with lock

Buildings (dwelling, place of employment, etc.)
School, church, and cemetery — Cem
Buildings (barn, warehouse, etc.)
Power transmission line with located metal tower
Telephone lne, pipeline, etc. (labeled as to type)
Wells other than water (labeled as to type) — Oil, Gas
Tanks: oil, water, etc. (labeled as to type) — Water
Located or landmark object; windmill
Open pit, mine, or quarry; prospect
Shaft and tunnel entrance

Horizontal and vertical control stations:
- Tablet, spirit level elevation — BM 5653
- Other recoverable mark, spirit level elevation — 5455

Horizontal control station: tablet, vertical angle elevation — VABM 9519
- Any recoverable mark, verticle angle or checked elevation — 3775

Vertical control station: tablet, spirit level elevation — BM X 957
- Other recoverable mark, spirit level elevation — X 954

Spot elevation — X 4657
Water elevation — X 5657 870

Boundaries: National
- State
- County, parish, municipio
- Civil township, precinct, town, barrio
- Incorporated city, village, town, hamlet
- Reservation, National or State
- Small park, cemetery, airport, etc.
- Land grant

Township or range line, United States land survey
Township or range line, approximate location
Section line, United States land survey
Section line, approximate location
Township line, not United States land survey
Section line, not United States land survey
Found corner: section and closing
Boundary monument: land grant or other
United States mineral or location monument

Index contour
Intermediate contour
Supplementary contour
Depression contour
Fill
Cut
Levee
Levee with road
Mine dump
Wash
Tailings
Tailings pond
Shifting sand or dunes
Intricate surface
Sand area
Gravel beach

Perennial streams
Intermittent streams
Elevated aqueduct
Aqueduct tunnel
Water well and a spring
Glacier
Small rapids
Small falls
Large rapids
Large falls
Intermittent lake
Dry lake bed
Foreshore flat
Rock or coral reef
Sounding, depth curve
Piling or dolphin
Exposed wreck
Sunken wreck
Rock, bare or awash; dangerous to navigate

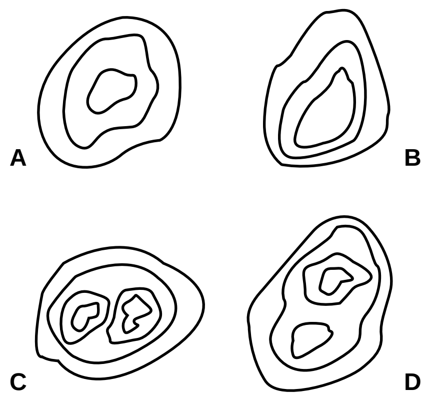
Marsh (swamp)
Submerged marsh
Wooded marsh
Mangrove
Woods or brushwood
Orchard
Vineyard
Scrub
Inundation area
Urban area

Science as tnquiry

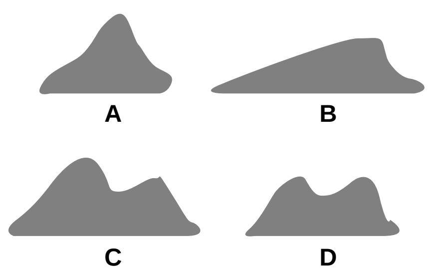
Describing Landscapes

Item:

1. Look at the topographic drawings that follow. Describe what each would look like if you could see it firsthand.



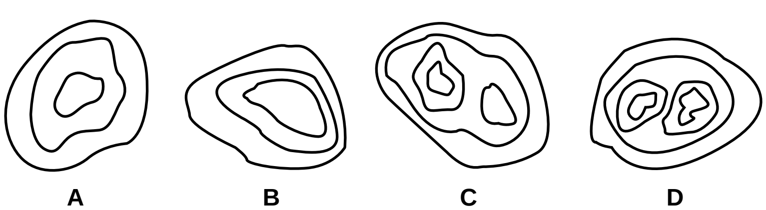
2. Look at the land profiles that follow. Draw topographic views using contour lines.



Answers:

1. A. A hill with gentle slopes.
   B. A hill with a steep southern side.
   C. A round hill with two summits or peaks.
   D. A hill with two summits (peaks); the northern one is higher.

2.



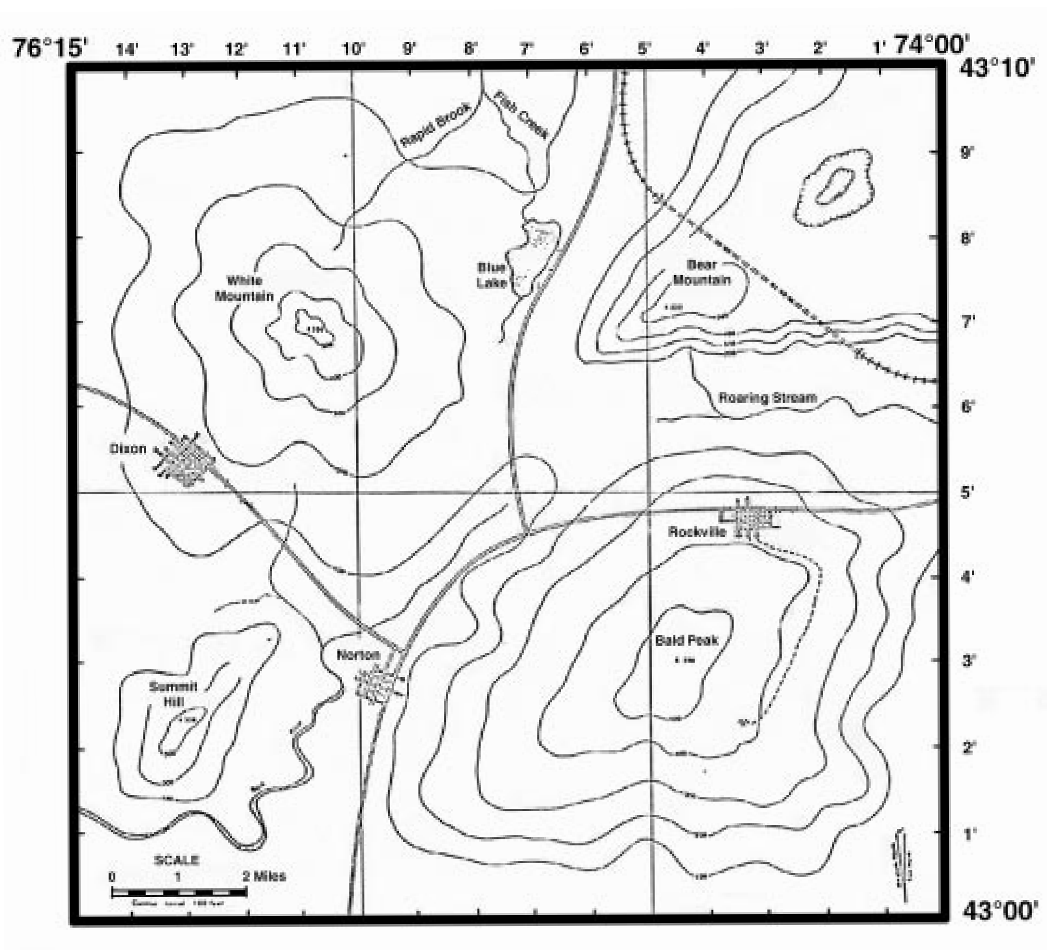
Science in Personal and
Social Perspectives

Building a Ski Slope

Item:

Examine the topographic map below and answer the questions that follow.

1. Name the highest mountain.
2. Which town has the highest elevation?
3. Which mountain has the steepest slope?
4. What is the latitude and longitude of Norton?
5. How far is Blue Lake from Norton?
6. Design a ski slope for a resort. Pick a location and describe why you chose this location.



Answers:

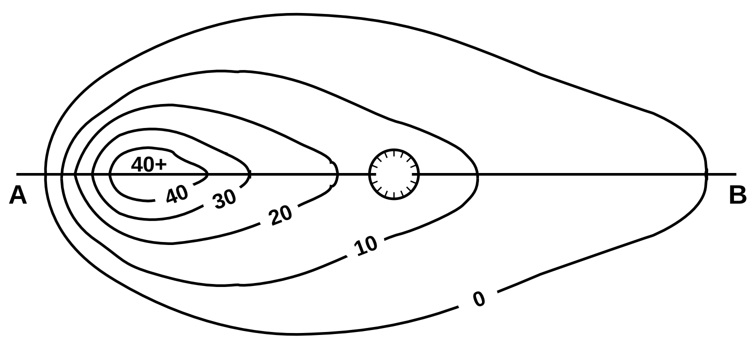
1. Balk Peak
2. Rockville
3. Bear Mountain
4. Latitude: 43^{o} 2.75 min. north
   Longitude: 76^{o} 9.5 min. west
5. The distance measures 3.5 inches. Using a scale of 1 inch equaling 2 miles, the distance is 7 miles.
6. Answers will vary. Look for locations that have a steep slope for skiing or a variety of slopes for beginners and experts.

Science as tnquiry

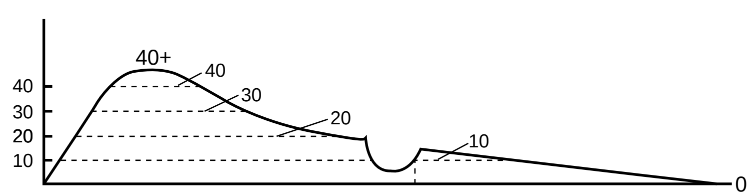
Drawing a Profile

Item:

Using the topographic map that follows, draw a profile along line AB.



Answer:



Consumables

Item	Quantity per lab group	Activity
bamboo skewer	1	2*
cardboard, 8 1/2 × 11in (if stereo glasses are not available)	1 piece per student	4*
clay, oil-based	—	2*
handouts	—	3
key to symbols (included with Student Materials)	1 per student	5*
map with elevation points (included with Student Materials)	1 per student	3
popsicle sticks	—	1
string (one per contour line)	4–5 rolls per class	1
string	20–50 ft	1
topographic map	1 per student	5*
topographic maps and matching stereo photos (included with Student Materials)	1 each per student	4*
water	—	2*

Nonconsumables

Item	Quantity per lab group	Activity
broomstick	1	1
carpenter's line level	1	1
plastic box (shoebox size, preferrably clear)	1	2*
protractor	1 per student	5*
ruler	1 per student	3, 4, 5*
stereo glasses (if available)	1 per student	4*

*indicates alternative/additional activity

Key to activities:
1. Line It Up
2. Submersive Mapping
3. What a Stunning Profile You Have!
4. Stereo Mapping
5. Find Yourself

Activity Sources

AGI/NAGT, *Laboratory Manual in Phsical Geology*. Columbus, Ohio: Merrill Publishing Co., 1986.
Dallmeyer, R.D., *Physical Geography*. Dubuque, Iowa: Kendall/Hunt Publishing, 1981.
DeBruin, R., *100 Topographic Maps*. Northbrook, Ill.: Hubbard Press, 1970.

Continued

Hamblin, W.K. and J.D. Howard, *Exercises in Physical Geography*, 4th Edition. Minneapolis: Burgess Publishing Col, 1975.
Jones, N.W., *Laboratory Manual for Physical Geology*. Dubuque, Iowa: Wm. C. Brown Publishers, 1995.
Novastar Designs, *The TOPO Kit*. N. Carolina: Novastar Designs, Inc., 1990.
Prentice Hall Science, *Exploring the Planet Earth*. Ingelwood Cliffs, N.J.: Prentice Hall Inc., 1993.
U.S. Geological Survey

Topographic maps and stereo photos:
AGI/NAGT (1986), Garibaldi Lake, B.C., photo and map
Dallmeyer, R.D. (1981), Mount Capulin, N.M., photo and map; Stone Mountain, Ga., photo and map; Mount Katahdin, Maine, photo.
DeBruin, R. (1970), Mount Katahdin, Maine, map; Ship Rock, N.M., map.
Hambin, W.K. (1975), Ship Rock, N.M., photo.
Jones, N. W. (1995), stereo glasses illustration; Menan Buttes, Idaho, photo and map.

Student Readings

McDougall, M., "Designed Cities." *Exploring* Magazine, Vol. 16, No. 1, Spring 1992, p. 13.