Watershed Topography

Adapted from: An original Creek Connections activity.
Creek Connections, Box 10, Allegheny College, Meadville, Pennsylvania, 16335

Grade Level: Basic to intermediate.

Duration:
Reading Elevation—20 minutes
Contour Lines—20 minutes
Working with 3-D Models—25 minutes
The Contour Model-25 minutes

Setting: Classroom.

Summary: Students learn about contour lines, elevation, and landforms via three-dimensional models in the context of watershed topography and use this knowledge to complete worksheets and drawings of topographic maps.

Objectives: Students will be able to define topography, determine the elevation of any point on a topographic map, read contour lines to identify landforms such as hills, drumlins, and valleys, and draw topographic maps of three-dimensional models.

Vocabulary: topography, watershed, contour lines, index contour lines, intermediate contour lines, contour interval, bench mark, drumlin, bench marks

Related Module Resources:
- Website: Landforms on Topographic Maps http://www.csus.edu/indiv/s/slaymaker/Geo110L/landforms.htm
- Book: Reading Maps—Stereograms and stereoscope glasses

Materials (Included in Module):
- Worksheets & Answer Keys: Reading Elevation and Contour Lines
- Overheads: Watershed Topography Figures 1 & 2, Watershed Topography Figures 3-8
- Keys: The Contour Model—05 cm and 1.0 cm contour intervals
- 6 white three-dimensional models
- 6 clear plastic sweater boxes
- Laminated full Townville quads (8) and Meadville 11x17" quad sections (20)
- Blank overhead transparencies and wet-erase markers
- 2 clear plastic Contour Models with lids
- Food coloring
- *Extension:* some containers of play doh, string

Additional Materials (NOT Included in Module):
- Overhead projector
- 2 pitchers or other containers to hold 2-3L water for each of two Contour Models
- Extensions: additional play doh/modeling clay, foam board, scissors, glue

ACADEMIC STANDARDS: GEOGRAPHY

6th Grade
7.1.6.A. Describe geographic tools and their uses.
- Geographical representations to display spatial information: topography

7.2.6.A. Describe the physical characteristics of places and regions.
- Components of Earth's physical systems (e.g., relief and elevation (topography))
- Comparisons of the physical characteristics of different places and regions (e.g., topography)

BACKGROUND:

Topography is the physical make-up of the land, including natural and man-made physical features. One can study the topography of any place, be it a town, city, or wilderness. In this activity, we are particularly interested in the topography, or physical make-up, of watersheds as represented on topographic maps.

A **watershed** is the total land area that drains into a particular waterway. Topographic maps use colors and symbols to represent the physical features of an area. Although watershed boundaries are not pre-drawn on topographic maps, these boundaries can be determined using the landforms represented on topographic maps as a guide. Topographic maps are unlike other maps in that they indicate elevation with **contour lines**. These light brown lines connect points of equal elevation. Some contour lines, darker brown lines called **index contour lines**, are labeled with their elevation. Equal units of elevation separate other light brown lines (**intermediate contour lines**) that fall between index contour lines. The difference in elevation between two adjacent contour lines is called the **contour interval**. The contour interval is constant on a given map but differs from map to map and can be found near the legend and scale of the map. **Bench marks** (BM) are significant points on topographic maps whose precise elevation have been determined and is labeled on topographic maps. In addition, many hilltops denoted by Xs are labeled with their precise elevations. Some road intersections are also labeled with their elevations. Although we cannot determine the exact elevation of points on topographic maps not labeled as BM or X or that do not fall on contour lines, it is possible to estimate the elevation of points that fall between contour lines. For example, if a point falls exactly between two contour lines of 1200 feet (366 meters) and 1210 ft. (369 m.), we know that the elevation of that point must be between 1200 (366 m.) and 1210 (369 m.) feet. The slope between the two contour lines, however, may not be constant so although we sometimes need to estimate the elevation of the point (split the difference and say it's 1205 ft. (367 m.)), it is important to keep in mind that this estimate might be off by a few feet.

Because they connect points of equal elevation, the shape and position of contour lines indicate the location of hills and valleys. The key to understanding
is being able to mentally picture the three-dimensional landforms represented by two-dimensional contour lines (Figure 1). A few general rules of contour lines might help you do so.

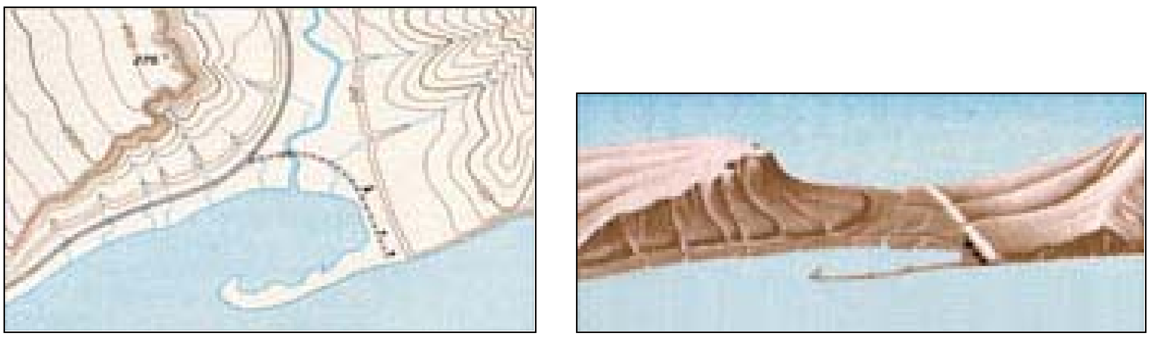


Figure 1. The topographic map on the left uses contour lines to create a two-dimensional representation of the landform on the right.
Source: http://mac.usgs.gov/mac/isb/pubs/booklets/symbols/reading.html

First, contour lines represent elevation. Contour lines never cross and the distance between them indicates the steepness of the slope. Closely spaced contour lines represent steep slopes; there is a rise in elevation (each contour line is a new elevation) over a shorter distance. More spread out contour lines denote more gradual slopes – rise in elevation over a longer distance. Irregularly-shaped or zigzag contour lines depict uneven, rugged terrain. In these areas, there are frequent increases and decreases in elevation and little flat land.

Second, patterns of concentric circular or oval contour lines depict hills. The smallest circle or oval in the "middle" of these concentric circular or oval contour lines represents the exact hilltop (highest elevation) (Figure 2). If at the top of a hill there were concentric circular contour lines with hachure-marks, this would indicate the elevation is going down (a depression) instead of rising. An example of this depression at the top of a high elevation might be a big crater or volcanic crater; therefore, you might

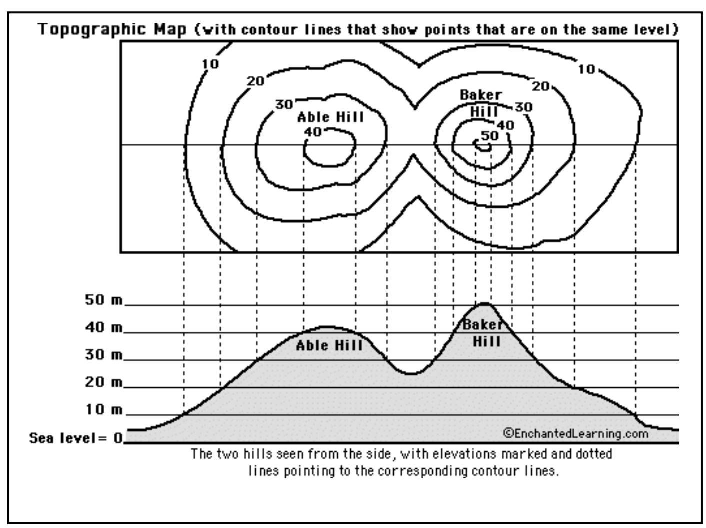


Figure 2. *Source: http://www.enchantedlearning.com/geography/mapreading/topo/*

not see this too often on Western PA maps. However, you could see a specific type of hill called a **drumlin**, which is rounded at one end and more pointed at the other. These streamlined hills of glacial till and bedrock often are parallel with the direction of past ice movement in the state. Hills also have another revealing contour line pattern: sometimes parts of the concentric circular or oval contour lines that represent hills and drumlins form U-shaped patterns. These U-shaped contour lines denote the ridges of hills (Figure 2A).

Conversely, V-shaped contour lines represent valleys, ravines, or gullies (Figure 2A). As small streams cut into hillsides to form valleys, ravines, or gullies, they erode away V-shaped sections of hillsides, resulting in the V-shaped patterns on topographic maps. Think of a circular hill being represented by big, stuffed apple pie. If you wanted to cut into that pie to remove a tiny piece right along the edge (just like a new little stream wants to start cutting into a hillside), you would make a small V shaped cut to remove a piece. Want a bigger piece, make a bigger V shaped cut further into the center of the pie. A stream keeps cutting into a hillside, just like you keep cutting further into the pie. A small stream or storm runoff might start flowing through the new V-shaped ravine that it has carved into a hillside.

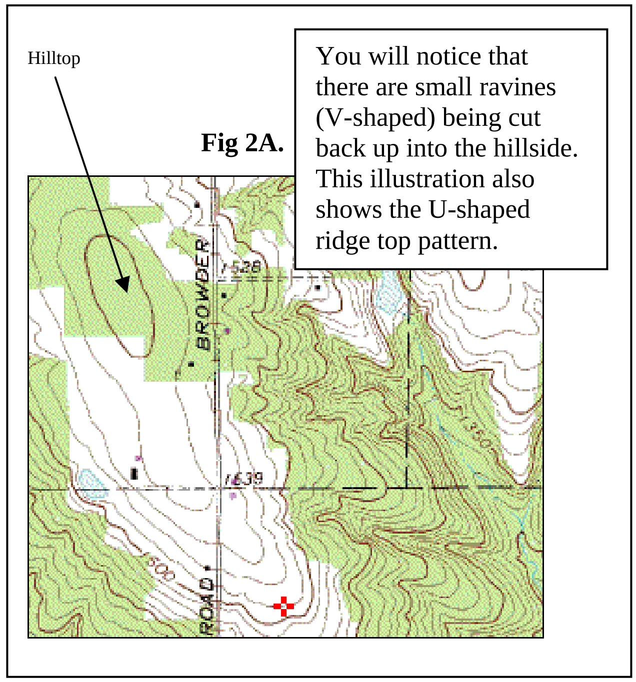


Fig 2A.

OVERVIEW:

Students learn to read contour lines and elevation, and to recognize different landforms, such as hills, valleys, and depressions on simplified topographic maps. They then use this knowledge to complete the "Reading Elevation Worksheet" and/or the "Contour Lines Worksheet" and/or work with 3-D models and "The Contour Model" to compare three-dimensional landforms to their topographic representations and/or draw topographic maps of their own.

PROCEDURE: *Reading Elevation Worksheet*

Teacher Preparation:

Make copies of the Reading Elevation worksheet for your students and locate the Townville and Meadville laminated partial quads in the module. Locate the Reading Elevation Answer Key at the end of this activity write-up.

Student Activity:

1. Introduce the topic of topography and explain how contour lines indicate elevation. Describe how to use the contour interval of a topographic map as well as index contour lines to determine the elevation of a given point.

2. Distribute Townville and Meadville laminated partial quads and Reading Elevation worksheets to your students.

3. Have students work individually or in groups to determine the elevation of the various points described on the worksheet.

4. Go over the answers with students.

PROCEDURE: ***Contour Lines Worksheet***

Teacher Preparation:

Make copies of the Contour Lines worksheet for your students and locate the Contour Lines Answer Key at the end of this activity write-up.

Student Activity:

1. Introduce the topic of topography and discuss how contour lines indicate various landforms.

2. Distribute the Contour Lines worksheet to students and have them work individually to match the landform descriptions to their corresponding topographic map.

3. Go over the answers with students.

PROCEDURE: ***Working with 3-Dimensional Models (white, light plastic)***

Teacher Preparation:

1. Locate the six white three-dimensional models and corresponding overhead transparency in the module. You will also need the six clear plastic sweater boxes and wet erase fine point markers.

2. To help students see the "contour lines" on the 3D contour models, it helps to trace these lines in wet-erase marker on the models before using them in class.

3. Procure and set up an overhead projector.

Student Activity:

OPTION A

1. Remind students that topographic maps are two-dimensional representations of three-dimensional landforms. Show them only Figure 1 on the overhead transparency.

2. Now show students the simple topographic map of Figure 2 while covering up the associated side profile below it. Ask them to describe the landform represented by this simple topographic map. Is it flat land or a hill? Where is the hilltop? Is there a valley? Where are the steep and gradual slopes?
   Uncover the hill profile graph and explain it to students.

3. There are additional overhead transparencies (Figures 2.B, 2.C., 2.D) that you can show students to further their comprehension if necessary.

4. Now find the transparency with Fig. 3 – Fig. 8 on it. These simple topographic maps have corresponding 3-D, white, plastic models for them. Present <u>only</u> Figure 3 to students. Again, ask them to describe the landform represented by this simple topographic map. Is it flat land or a hill? Where is the hilltop? Is there a valley? Where are the steep and gradual slopes?
   Show students Model #1 and explain that the landform on the model corresponds to the topographic map in Figure 3.

5. Next present the six three dimensional models and ask students to match Figure 4 to its corresponding 3-D model.

6. Repeat steps 4 and 5 for Figures 5, 6, 7, and 8.

<u>OPTION B</u>

1. Remind students that topographic maps are two-dimensional representations of three-dimensional landforms. Show them Figures 1 and 2 on the overhead transparency. Figures 2.B, 2.C, and 2.D can also be used.

2. Now show students the 3-D, white plastic Model #1. Ask them to describe the terrain represented by this model. Is it flat land or a hill? Where is the hilltop? Is there a valley? Where are the steep and gradual slopes?

3. Point out the lines on the Model and explain that these lines are contour lines and are spaced at equal intervals of increasing elevation. Explain that if they look directly down on the Model, the pattern of the lines is equivalent to the contour lines on topographic maps.

4. Place a clear plastic sweater box over top of the Model. Closing one eye and looking down on the Model through the clear plastic, use a <u>wet erase</u> marker to draw the contour lines on a blank overhead transparency that you have taped to the sweater box using removable tape. The contour lines on Model #1 are closely spaced so you may want to draw every other contour line. Remove the overhead transparency from the sweater box and project the image so that the entire class can see. Review the prominent features of the simple topographic map you have just drawn and then compare your drawing to Figure 3 on the overhead transparency in the module.

5. Now divide the class into five groups and give one of the remaining five models, a clear sweater box, and a <u>wet erase</u> marker to each group. Have them look down on the models and draw their own simple topographic maps. They can draw directly on the sweater box. (You might want to test that the <u>wet erase</u> markers you are using will *completely* wipe off the box with a damp paper towel). Once they have drawn their topographic map, they should compare it with Fig. 4-8 on the transparency to make sure it looks like the one for their landform.

6. If time permits, have groups switch models and have students draw a simple topographic map for this new model.

<u>PROCEDURE</u>: *The Contour Model (clear, plastic model of a volcanic mountain)*
Teacher Preparation:

1. Fill pitchers or other containers such as glass beakers with 2-3L water for each model and add a few drops of food coloring to slightly color the water.

2. Locate the clear plastic contour models, clear plastic lids, and <u>wet-erase</u> fine point markers in the module. Find the Contour Model Key transparencies at the end of this activity write-up.

Student Activity:

1. Introduce the topic of topography and discuss how contour lines indicate elevation on topographic maps and that these maps are two-dimensional representations of three-dimensional landforms. Overhead transparencies of Fig. 1, 2, 2.B, 2.C, 2.D, may be helpful.

2. Divide the class into 2 groups and give them the clear, plastic model, a transparent plastic lid, a <u>wet erase</u> marker, and a pitcher (or other type of container or large beakers) of slightly colored water to each group.

3. Ask students to observe the landform represented by the model. What kind of landform is it? *A volcano.* Have them note steep areas and areas with a more gradual slope. Based on what they have learned from the introduction and previous topographic map activities, how do they expect the landform to be represented on a topographic map? What will the contour lines look like for the different areas of the model? *The model is hill-like so there will be concentric circular or oval contour lines. Those around the steep cone of the volcano will be more closely spaced than those is the relatively flat area next to the cone. The ridges will be represented by U-shaped contour lines.*

3. Remind students that contour lines connect points of equal elevation. Explain to them that they will be adding water to different depths (corresponding to different elevations) and looking at the line formed by the edge of the water that is in contact with the model.

4. Have students pour about one third of the water in their pitcher into the model. Walk around to the different groups and have them show you the edge of the water that is in contact with the model. Remind them that all points along this edge are at the same elevation.

5. Now have the groups place the clear lid on top of their model. The lid is slightly smaller than the edge of the model so have them push the lid flush against the upper

left hand corner of the model. They should do this each time they put the lid on to insure that it is in the same position. They should also always have the cut corner in the upper-right of the model so that the lid is oriented the same way each time it is placed on the model.

6. Ask them to close one eye and look straight down on the model. On top of the lid using a wet erase marker, have them trace the edge of the water that is in contact with the model (ignore random drops on the model). All the points on the line they have just drawn are at the same elevation. Ask students what kind of lines connects points of equal elevation. *Contour lines!* They have just drawn a contour line.

7. Now have them pour a little more water (the quantity is up to them) and trace the new contour line.

8. After the groups clearly understand what is meant by "the edge of the water that is in contact with the model" and have drawn two or more practice contour lines, have them pour the water in the model back into the pitcher.

9. This time they are going to make a more precise topographic map for their model. Have students note the centimeter markings on the side of their models. Tell them that they will be pouring in water to measured elevations in the model corresponding to the centimeter (or 0.5 centimeter) markings. Explain that on real topographic maps the change in elevation between contour lines remains constant (usually 10 ft. (3 m) or 20 ft. (6 m)); thus, they must also use consistent intervals of elevation (1 cm or 0.5 cm on our model) when making their topographic maps.

10. Have students pour water to the 1 cm marking on the side of their models.

11. Next have them put the lid on the model and position it as described in step 5 above.

12. As is step 6 above, have them close one eye, look straight down on the model, and trace the edge of the water that is in contact with the model on top of the lid using a wet erase marker.

13. Have them remove the lid and pour water to the next 0.5 or 1 cm marking (your choice) and repeat steps 12 and 13.

14. Have them continue to add water in appropriate increments and trace the waters edge until the volcano cone is completely submerged.

15. Finally, assuming that the elevation of the bottom of the model is 6,280 feet (1914 meters) and that one-centimeter equals 250 feet (76 meters), have students label the elevation of each of the contour lines on their "topographic maps."

16. Check students' elevation labels and topographic maps by comparing them to "The Contour Model Answer Keys" at the end of this activity. Students' contour lines may

be slightly different depending on the eye they closed, the orientation of the model, and the exact depth of water added (i.e., if they added slightly more or less than 1 cm of water, the distance between and shape of their contour lines will vary).

DISCUSSION:

All Activities

What are contour lines? *Light brown lines on topographic maps that connect points that are at equal elevation for the landforms that the map is representing.*

How can you tell if two points have the same elevation? *They are on the same contour line or are on separate contour lines of identical elevation.*

What is a contour line interval? *The elevation difference between two adjacent contour lines. Commonly, contour line intervals are 10 feet on 1:24,000 scale topographic maps for Western PA.*

Reading Elevation

Other than using contour lines, what are some other ways that you could determine the elevation of certain points on a topographic map? *Bench marks (BM) with a corresponding elevation are commonly found, other elevation marks/tablets that are shown on the map, spot elevation marks (x's) with corresponding elevation given, spot elevation marks (x's) on top of prominent hilltops, some road intersections or bridges have an elevation listed, some bodies of water will have an elevation listed.*

What does BM stand for and what do points labeled as BM tell us about elevation? *BM stands for bench mark. BM points are labeled with their exact elevation.*

Is it possible to accurately determine the exact elevation of a point that falls between two contour lines by using a topographic map? *No! In fact, when asked to determine the elevation of a point that falls between two contour lines, it is best to say that the elevation is between the two contour lines value and leave it at that. Elevation does not necessarily decrease on a consistent slope between two contour lines so it is often inaccurate to estimate the elevation. However, for a stream gradient exercise for example, it is sometimes necessary to estimate the elevation of such points.*

Contour Lines Worksheet and Working with 3-D Models Activities

How can you distinguish hills on topographic maps? *Concentric circular or oval contour lines.*

How are valleys illustrated on topographic maps? *V-shaped contour lines.*

What do U-shaped contour lines represent? *Ridges.*

What is a drumlin? How can you distinguish a drumlin from other types of hills? *A drumlin is a type of hill that is rounded or blunt at one end, and narrow and/or pointed at the other. You can distinguish drumlins from other types of hills by this characteristic shape. Landform Model #2 (Fig 4) contains two drumlins.*

How can you distinguish relatively flat land from steep slopes or rugged, uneven terrain? *Relatively flat land will have only a few, spread out contour lines whereas steep slopes have closely spaced contour lines and rugged terrain is represented by irregularly shaped and spaced contour lines.*

Do any of the contour lines on your worksheet cross? Why not? *Contour lines cannot cross because they represent distinct elevations for our land. A single point on land cannot have multiple elevations.*

Of the six 3-D white plastic landform models, which ones do you think represent topography commonly found in Western Pennsylvania? *Landform Model #1, Fig. 3 (Eroded Hill); Model #2, Fig. 4 (Drumlins); Model #6, Fig. 6 (Glaciated Valleys). The Appalachian Mountains (Model #5, Fig. 7) are found just to the east, but they are not volcanic with a crater on top. There may be some examples of small-scale alluvial fans (Model #4, Fig. 6) for waterways that drain into Lake Erie.*

Working with 3-Dimensional Models –Option B Only

How did your mental images of the landforms represented on the various simple topographic maps compare to the 3-D models? *Answers will vary.*

The Contour Model

What is the shape of the contour lines that represent the volcano on your "topographic maps"? *Concentric circular contour lines.*

What did the edge of the water correspond to? *All points at the same elevation, which makes up a contour line!*

Why did we add water at consistent elevation intervals (.5 or 1.0 cm) instead of at random? *Because the contour interval (elevation difference between contour lines) on topographic maps is consistent (usually 10 or 20 ft (3 or 6 m.)). We wanted to maintain this principle on our topographic maps.*

Had there been a valley on the model, how would the shape of the contour lines have differed? *There would have been V-shaped contour lines.*

What can be said about all points on a given contour line? *They all have the same elevation.*

What is the elevation of the center of the cone relative to its rim? Although it was difficult to determine the elevation of the depression in this activity, were we to add it to our topographic maps, how would it be represented? *The center of the cone is at a lower elevation than the rim. It would be represented by a circular contour line with hachure marks. If desired, have students add the cone depression to their topographic maps.*

Compared to larger contour intervals, do smaller contour intervals show more or less detail on topographic maps? *The smaller the contour interval, the greater the detail shown.*

Would we find a volcanic mountain as a typical landform in Western Pennsylvania? *No, we do have the Appalachian Mountains just east of us, but none are volcanic with a crater at the top. Most of our Pennsylvania mountains also have a more gradual elevation rise to them. Also, the highest point in Pennsylvania is Mt. Davis at only 3,213 ft. (980 m.); the mountain in this exercise had an elevation of 8,030 ft. (2,448 m.)*

EVALUATION:

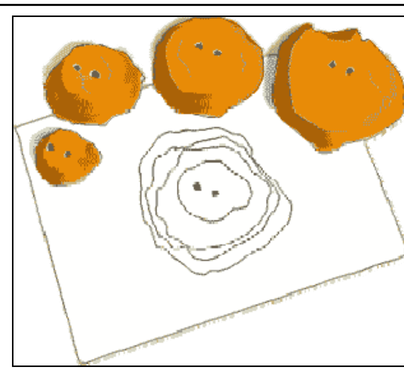
- Students have accurately completed worksheets or drawings.
- Discussion questions above.
- Pick random points on topographic maps and have students determine their elevation and describe the landforms represented there.

EXTENSIONS AND MODIFICATIONS:

If students are still having difficulty grasping how two-dimensional topographic maps represent three-dimensional landforms, these extensions might help.

- Select an area of a topographic map and have students create an elevation profile comparable to Figure 2. in the background section. Draw a straight line across the map and have students figure out what the topography would be like if they walked that straight line.

- Have students use a fist-sized or larger mound of play-doh or homemade modeling clay (check out a recipe on-line at http://spaceplace.jpl.nasa.gov/srtm_makemap1b.htm) to shape a landform, e.g., a hill. Have them poke two holes straight down into their landform using a pen or pencil. Then have them wrap a piece of string or dental floss horizontally around the landform, about 1cm from its peak. Have them pull the string towards themselves to slice off the top section of the landform. Have them transfer this section of the landform to a blank piece of paper and trace its perimeter. Have them repeat this process, slicing off about 1cm more of the landform and tracing it until they reach the bottom of the landform. The holes that they poked in the landform should help them line up the different layers. The result of this process will be their own topographic map of their landform! *Note: firm but not crumbly play-doh works best for this activity.*



Building your own 3-D model with modeling clay.

Source: http://spaceplace.jpl.nasa.gov/srtm_make1a.htm

- Have students build their own 3-D models using a topographic map and sheets of craft foam (available in craft stores) or sturdy foam board (available most office supply stores) or cardboard. Select a relatively simple topographic map feature (such as a hill) and enlarge it using a photocopier so that the contour lines are at least ½ inch apart and the feature fits on an 8 ½ by 11 inch piece of paper. Have students use tracing paper to trace the outer-most contour line as well as the next outermost contour line (which they should trace as a dotted line). The dotted line will help you line up the different layers. Also label the elevation of the solid contour line. With a new piece of tracing paper, trace the next outermost line from the last tracing as a solid line and the next contour line towards the center with a dotted line. Continue using new pieces of tracing paper until all the concentric circular or oval contour lines have been traced. Now use carbon paper to trace the solid and dotted lines and elevations onto the craft foam or foam board. Each piece of tracing paper should be copied onto its own piece of craft foam or foam board. (If you decide to use foam board, which is relatively thin, double the layers to create more drastic contrasts between elevations.) Now cut out the craft foam or foam board pieces along the solid line using scissors or a utility knife. (Adult supervision required!). Start with the largest piece of craft foam or foam board and stack the sections, using the dotted lines as guides. You may want to glue the pieces together.

Building your own 3-D model with foam board.

Source: Van Burgh, Dana, Elizabeth N. Lyons, and Mary Boyington. How to Teach with Topographic Maps. National Teacher Association, 1994.

NOTES (PLEASE WRITE ANY SUGGESTIONS YOU HAVE FOR TEACHERS USING THIS ACTIVITY IN THE FUTURE):

Worksheet: Watershed Topography—Reading Elevation

Name____Date______________

Townville Quad

1. What is the contour interval on this map? ___________ feet

2. What is the elevation at the intersection of Hamilton Road and Dewey Road?
___________ feet

3. What is the elevation of the barn west of the intersection of Muddy Creek and Route 77?
___________ feet

4. What is the elevation of the middle of the pond southwest of the intersection of Fine Road and Mercer Road that was added to this map since its last edition? ___________ feet

5. What are the elevations at the headwaters (start) of the three small intermittent streams that converge southwest of east-west-running (not north-south) portion of Three Bridges Road east of the pipeline? ___________, ___________, and ___________ feet

6. What is the elevation of the large wetlands of Muddy Creek northeast of South Richmond Corners? ___________ feet

Meadville Quad

7. The contour interval on this map is 10 feet. Is there anywhere on this map where the contour interval (elevation difference between two adjacent brown contour lines) is greater than 10 feet? Explain your answer. ____
____
____
____

8. What is the elevation of the headwaters (start) of Bennyhoof Creek? ___________ feet

9. What is the elevation of the Fredericksburg Township School? ___________ feet

10. What is the elevation of the County Home Cemetery north of Woodcock Creek?
___________ feet

11. What is the elevation of the first church on Mosiertown Road south of Blacks Corner?
___________ feet

12. What is the elevation of the Allegheny College athletic field (located north of Allegheny College)? ___________ feet

13. What is the elevation of the summit of Round Top? ___________ feet. If you were to hike from the summit of Round Top northeast to French Creek, how many feet in elevation would you descend? ____________ feet.

14. Without even looking at contour lines, how would you know that Saegertown has an elevation of approximately 1130 feet? ____
____
____

ANSWER KEY: WATERSHED TOPOGRAPHY—READING ELEVATION

Townville Quad

1. What is the contour interval on this map? *10 feet (3 meters)*

2. What is the elevation at the intersection of Hamilton Road and Dewey Road?
1218 feet (371 meters)

3. What is the elevation of the barn west of the intersection of Muddy Creek and Route 77?
1190-1200 feet (363 - 366 meters)

4. What is the elevation of the middle of the pond southwest of the intersection of Fine Road and Mercer Road that was added to this map since its last edition? *between 1500 and 1510 feet (457 and 460 meters)*

5. What are the elevations at the headwaters (start) of the three small intermittent streams that converge southwest of east-west-running (not north-south) portion of Three Bridges Road east of the pipeline? *1490+, 1450-, 1460- feet (454+, 442-, 445- meters)*

6. What is the elevation of the large wetlands of Muddy Creek northeast of South Richmond Corners? *between 1440 and 1460 feet (439 and 445 meters)*

Meadville Quad

7. The contour interval on this map is 10 feet. Is there anywhere on this map where the contour interval (elevation difference between two adjacent brown contour lines) is greater than 10 feet? Explain your answer. *No. Contour lines are consistently at 10 feet (3 meter) intervals.*

8. What is the elevation of the headwaters (start) of Bennyhoof Creek? *Between 1410 and 1420 feet (430 and 433 meters)*

9. What is the elevation of the Fredericksburg Township School? *1140 feet (347 meters)*

10. What is the elevation of the County Home Cemetery north of Woodcock Creek?
Between 1140 and 1120 feet (347 and 341 meters)

11. What is the elevation of the first church on Mosiertown Road south of Blacks Corner?
1290 feet (393 meters)

12. What is the elevation of the Allegheny College athletic field (located north of Allegheny College)? *Between 1380 and 1390 feet (421 and 424 meters)*

13. What is the elevation of the summit of Round Top? *1512 feet (461 meters)* If you were to hike from the summit of Round Top northeast to French Creek, how many feet in elevation would you descend? *Between 432 and 442 feet (from 1512 feet to between 1080 and 1070 feet)*
Between 132 and 135 meters (from 461 meters to between 329 and 326 meters)

14. Without even looking at contour lines, how would you know that Saegertown has an elevation of approximately 1130 feet (344 meters)? *There is a BM of 1128 feet (343.5 meters) at one of the intersections in town.*