

Your Name \_\_\_\_\_  
Group \_\_\_\_\_  
Members { \_\_\_\_\_  
\_\_\_\_\_

Score \_\_\_\_\_

Minutes \_\_\_\_\_

Performance Indicator 2.1

Standard 4

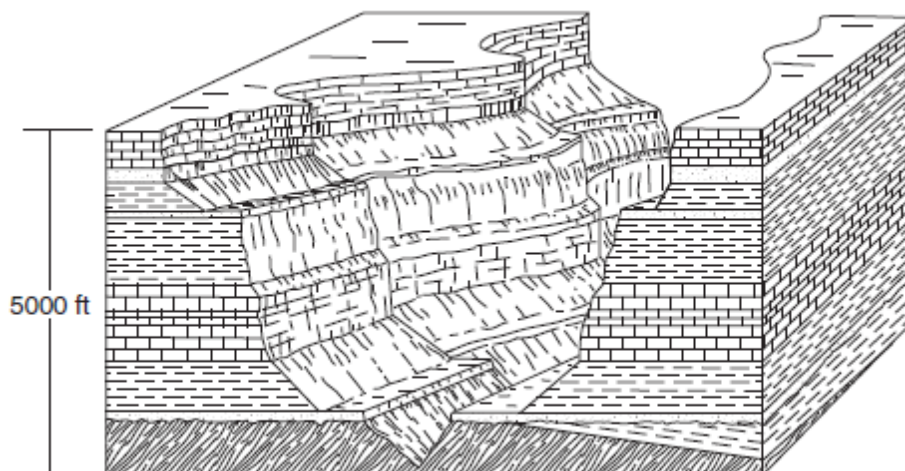
Key Idea 2

Use the concepts of density and heat energy to explain observations of weather patterns, seasonal changes, and the movements of Earth's plates.

**Major Understanding:**

- 2.1p Landforms are the result of the interaction of tectonic forces and the processes of weathering, erosion, and deposition.
- 2.1r Climate variations, structure, and characteristics of bedrock influence the development of landscape features including mountains, plateaus, plains, valleys, ridges, escarpments, and stream drainage patterns.

**Portion of the Grand Canyon**



## Mini Lesson 1: Landscape Regions and Drainage Patterns

Crustal movement, bedrock composition and climate conditions develop specific landscape regions. Two examples of tectonic forces that shape landscape regions are the formation of mountains when two plates collide and the development of plateaus when uplift and erosion occur.

Some bedrock may be more resistant to weathering (granite) while other, weaker rock (limestone) will wear away much faster. Finally, dry climates produce jagged, steep slopes (Grand Canyon) while wet climates tend to form rounded hills like the ones you see around New York State.

Drainage patterns are determined by the topographic structures and the underlying bedrock.

Landscape Region	Relief	Bedrock
Mountain	Great relief, high peaks, deep valleys	Faulted and tilted structure; many bedrock types, including igneous
Ridges	Moderate relief, rounded peaks, wide valleys	Folded sedimentary bedrock
Plateau	Moderate to high relief	Horizontal sedimentary bedrock layers
Plain	Very little relief, low elevations	Horizontal sedimentary bedrock layers
Valley	Low relief, located between ranges of hills or mountains	Any type of bedrock, area may have been eroded away by streams (V-shaped) or glaciers (U-shaped)
Escarpment	transition zone that involves a major elevation difference, often involving high cliffs	frequently formed by faults

### Need to know:

1. List three factors that help shape landscape regions.

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2. Describe how mountains are formed. \_\_\_\_\_

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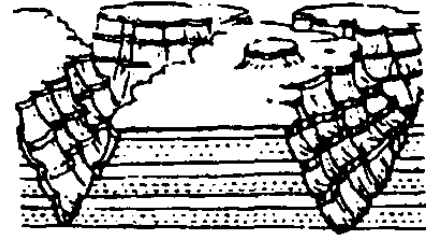
3. Describe how a plateau forms. \_\_\_\_\_

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4. What rock type mentioned in the passage is resistant to weathering? \_\_\_\_\_
5. Explain why limestone weathers faster than granite? (Hint: composition) \_\_\_\_\_

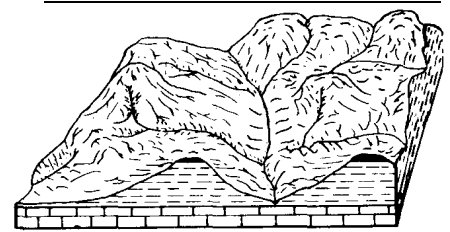
\_\_\_\_\_

6. What type of surface features are generally present in a dry climate? \_\_\_\_\_
7. What type of surface features are generally present in a wet climate? \_\_\_\_\_



8. The diagrams to the right show two different surface features affected by climate. On the line provided under each diagram, place the corresponding label that describes the climate it would be found in.

(Dry Climate or Wet Climate)



9. Name three landscape features that form from crustal movement. (Hint: read the chart above)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

10. Name three landscape features that form primarily from weathering and erosion.

\_\_\_\_\_

\_\_\_\_\_

11. What is the difference in bedrock structure between a plateau and a mountain?

\_\_\_\_\_

\_\_\_\_\_

12. What two things determine drainage patterns.

\_\_\_\_\_

\_\_\_\_\_

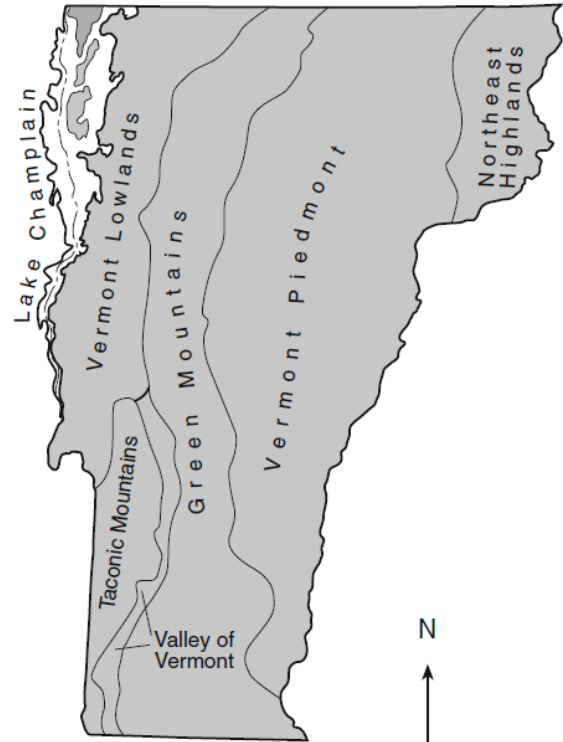
13. What is the difference between a valley and a plain? \_\_\_\_\_

\_\_\_\_\_

**Picture this:** Most of Vermont's landscape regions consist of ancient, weathered mountains that were covered by several ice sheets during the last ice age. When the ice melted, sand, cobbles, and boulders were deposited throughout the state. Vermont is divided into six landscape regions.

- (1) The Vermont Lowlands region has a mild climate, with Lake Champlain moderating its temperature.
- (2) The Green Mountains run the length of Vermont and were formed over 400 million years ago. Most of the bedrock is metamorphic and the region is known for its deposits of talc and asbestos.
- (3) The Taconic Mountains extend into New York State. Slate and marble are commonly mined in this region.
- (4) The Valley of Vermont is a narrow valley between two mountain ranges. Most of the bedrock in the region is limestone and marble.
- (5) The Vermont Piedmont covers the largest area of the state. This region consists of rolling hills and valleys. Granite mining is an important industry.
- (6) The Northeast Highlands is a mountainous region composed of granite bedrock.

**Generalized Landscape Regions of Vermont**



- \_\_\_ 1. The classification of landscape regions is primarily based on which factors?
 

(1) climate, vegetation, and surface features	(3) state boundaries, streams, and rivers
(2) bedrock type, structure, and elevation	(4) nearness to mountains, lakes, and oceans
  
- \_\_\_ 2. Which Vermont landscape region is a continuation of New York State's Champlain Lowlands landscape?
 

(1) Vermont Lowlands	(3) Taconic Mountains
(2) Valley of Vermont	(4) Green Mountains
  
- \_\_\_ 3. During which geologic period did a major orogeny form the Taconic Mountains?
 

(1) Cretaceous	(2) Permian	(3) Devonian	(4) Ordovician
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- \_\_\_ 4. Some of the bedrock in the Green Mountains is actually green in color because of the presence of the mineral chlorite. Which other mineral can cause rocks to appear green?
 

(1) sulfur	(2) magnetite	(3) olivine	(4) halite
------------	---------------	-------------	------------
  
- \_\_\_ 5. Which processes formed the granite that is mined in Vermont?
 

(1) compaction and cementation of sediments	(3) uplift and weathering of bedrock
(2) cooling and solidification of magma	(4) application of heat and pressure to shale

## Regents Questions:

- \_\_\_ 1. The major landscape regions of the United States are identified chiefly on the basis of  
(1) similar surface characteristics (3) nearness to major mountain regions  
(2) similar climatic conditions (4) nearness to continental boundaries
- \_\_\_ 2. Which city is located in a landscape region showing distorted and altered bedrock structure?  
(1) Old Forge (2) Niagara Falls (3) Syracuse (4) Binghamton
- \_\_\_ 3. Which New York State landscape region has intensely metamorphosed surface bedrock?  
(1) Appalachian Plateau (3) Adirondacks Mountains  
(2) Atlantic Coastal Plain (4) Erie-Ontario Lowlands
- \_\_\_ 4. Which city is located in the St. Lawrence Lowlands?  
(1) Kingston (2) Massena (3) Rochester (4) Albany
- \_\_\_ 5. Which characteristics of Earth's surface can be determined by using a topographic map?  
(1) Hill slope and stream gradients (3) Hilltop elevations and bedrock age  
(2) Bedrock erosion and stream velocity (4) Soil thickness and benchmark movement
- \_\_\_ 6. Which New York State landscape region contains the oldest surface bedrock?  
(1) Erie- Ontario Lowlands (3) Adirondack Mountains  
(2) Allegheny Plateau (4) Tug Hill Plateau
- \_\_\_ 7. In which type of landscape are meandering streams most likely found?  
(1) regions of waterfalls (3) steeply sloping hills  
(2) gently sloping plains (4) V-shaped valleys
- \_\_\_ 8. Which evidence best indicates that a landscape has been eroded by streams?  
(1) parallel sets of U-shaped valleys (3) thick residual soil  
(2) sand dunes (4) sorted layers of cobbles and sand
- \_\_\_ 9. The landscape of northeastern New York State was formed mainly by  
(1) mountain building and glacial erosion  
(2) faulting and volcanic activity  
(3) changes in the water level of Lake Ontario  
(4) erosion of Devonian sedimentary bedrock by rivers
- \_\_\_ 10. Which location is on a plateau landscape?  
(1) Rochester (2) Elmira (3) Old Forge (4) New York City
- \_\_\_ 11. The boundaries between landscape regions are usually determined by the location of  
(1) plate boundaries (3) population density  
(2) major cities (4) well-defined surface features

- \_\_\_ 12. The photograph below shows an eroded plateau found in the southwestern United States. The landscape was developed by the process of



- (1) crustal uplift and stream erosion  
 (2) crustal folding and stream erosion  
 (3) crustal uplift and glacial erosion  
 (4) crustal folding and glacial erosion.
- \_\_\_ 13. Tilted, slightly metamorphosed rock layers such as these are typically found in which New York State landscape region?  
 (1) Erie-Ontario Lowlands  
 (2) Tug Hill Plateau  
 (3) Atlantic Coastal Plain  
 (4) Taconic Mountains

- \_\_\_ 14. The table below describes the characteristics of three landscape regions, A, B, and C found in the United States

Landscape	Bedrock	Elevation / Slopes	Streams
A	Faulted and folded gneiss and schist	High Elevation Steep slopes	High Velocity Rapids
B	Layers of sandstone and shale	Low elevation Gentle slopes	Low velocity Meanders
C	Thick horizontal layers of basalt	Medium elevation Steep to gentle slopes	High to low velocity Rapids and meanders

- (1) A - plateau, B - mountain, C - plain  
 (2) A - plain, B - plateau, C - mountain  
 (3) A - mountain, B - plain, C - plateau  
 (4) A - plain, B - mountain, C - plateau
15. New York State's Adirondacks are classified as a mountain landscape region. Describe one bedrock characteristic and one land surface characteristic that were used to classify the Adirondacks as a mountain landscape region.

Bedrock  
 characteristic: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

Surface  
 characteristic: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

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.

<p><b>Materials</b></p> <ul style="list-style-type: none"> <li>✓ ESRT's</li> <li>✓ Colored pencils</li> </ul>
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1. List the New York State landscape regions that are found in the *ESRT's on page 2*

Plateau (highlands)	Plains (lowlands)
Mountains	

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:**

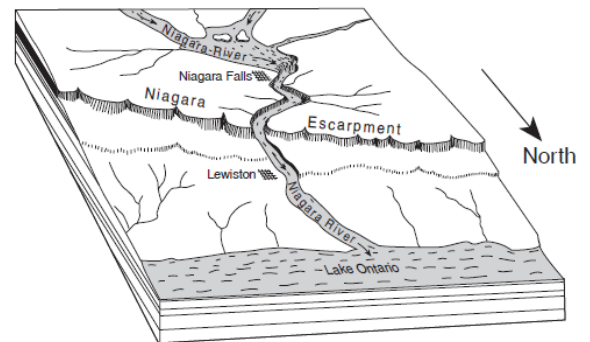
- \_\_\_ 1. The table below describes the characteristics of three landscape regions, *A*, *B*, and *C*, found in the United States.

Landscape	Bedrock	Elevation / Slopes	Streams
A	Faulted and folded gneiss and schist	High elevation Steep slopes	High velocity Rapids
B	Layers of sandstone and shale	Low elevation Gentle slopes	Low velocity Meanders
C	Thick horizontal layers of basalt	Medium elevation Steep to gentle slopes	High to low velocity Rapids and meanders

Which list best identifies landscapes *A*, *B*, and *C*?

- |  |  |
|--|--|
| (1) <i>A</i> —mountain, <i>B</i> —plain, <i>C</i> —plateau | (3) <i>A</i> —plateau, <i>B</i> —mountain, <i>C</i> —plain |
| (2) <i>A</i> —plain, <i>B</i> —plateau, <i>C</i> —mountain | (4) <i>A</i> —plain, <i>B</i> —mountain, <i>C</i> —plateau |

- \_\_\_ 2. 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

- \_\_\_ 3. In which New York State landscape region is Niagara Falls located?

- |                           |                           |
|---------------------------|---------------------------|
| (1) Tug Hill Plateau      | (3) Allegheny Plateau     |
| (2) St. Lawrence Lowlands | (4) Erie-Ontario Lowlands |

- \_\_\_ 4. Which two locations are in the same New York State landscape region?

- |                           |                                  |
|---------------------------|----------------------------------|
| (1) Albany and Old Forge  | (3) Binghamton and New York City |
| (2) Massena and Mt. Marcy | (4) Jamestown and Ithaca         |



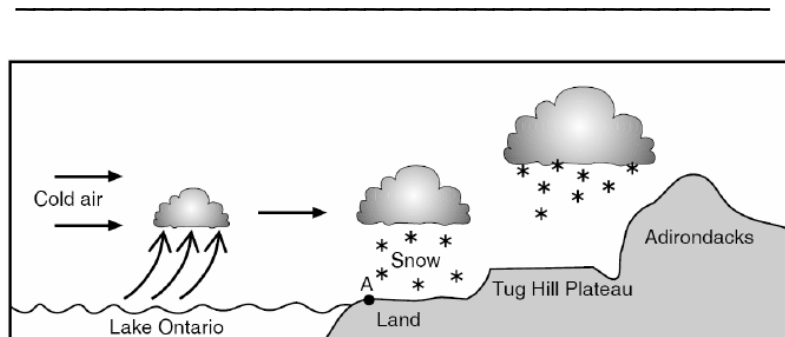
- \_\_\_ 5. Buffalo, New York, and Plattsburgh, New York, are both located in landscape regions called  
(1) mountains                      (2) highlands                      (3) plateaus                      (4) lowlands
- 

Base your answers to questions 6 and 7 on the photograph below, which shows an outcrop of sedimentary rock layers that have been tilted and slightly metamorphosed.

- \_\_\_ 6. The tilted rock structure shown in the photograph is most likely the result of the  
(1) deposition of rock fragments on a mountain slope  
(2) reversal of past magnetic poles  
(3) passage of seismic waves  
(4) collision of crustal plates
- \_\_\_ 7. Tilted, slightly metamorphosed rock layers such as these are typically found in which New York State landscape region?  
(1) Taconic Mountains  
(2) Atlantic Coastal Plain  
(3) Tug Hill Plateau  
(4) Erie-Ontario Lowlands



- \_\_\_ 8. Which characteristics best distinguish one landscape region from another?  
(1) human population density and types of environmental pollutant  
(2) composition of bedrock and variety of fossils  
(3) bedrock structure and elevation of land surfaces  
(4) stream gradients and soil types
- \_\_\_ 9. The generalized landscape regions of New York State are identified chiefly on the basis of  
(1) nearness to continental boundaries                      (3) climatic conditions  
(2) nearness to major mountain ranges                      (4) surface bedrock characteristics
10. State the name of the New York State landscape region that includes location A shown in the diagram below.



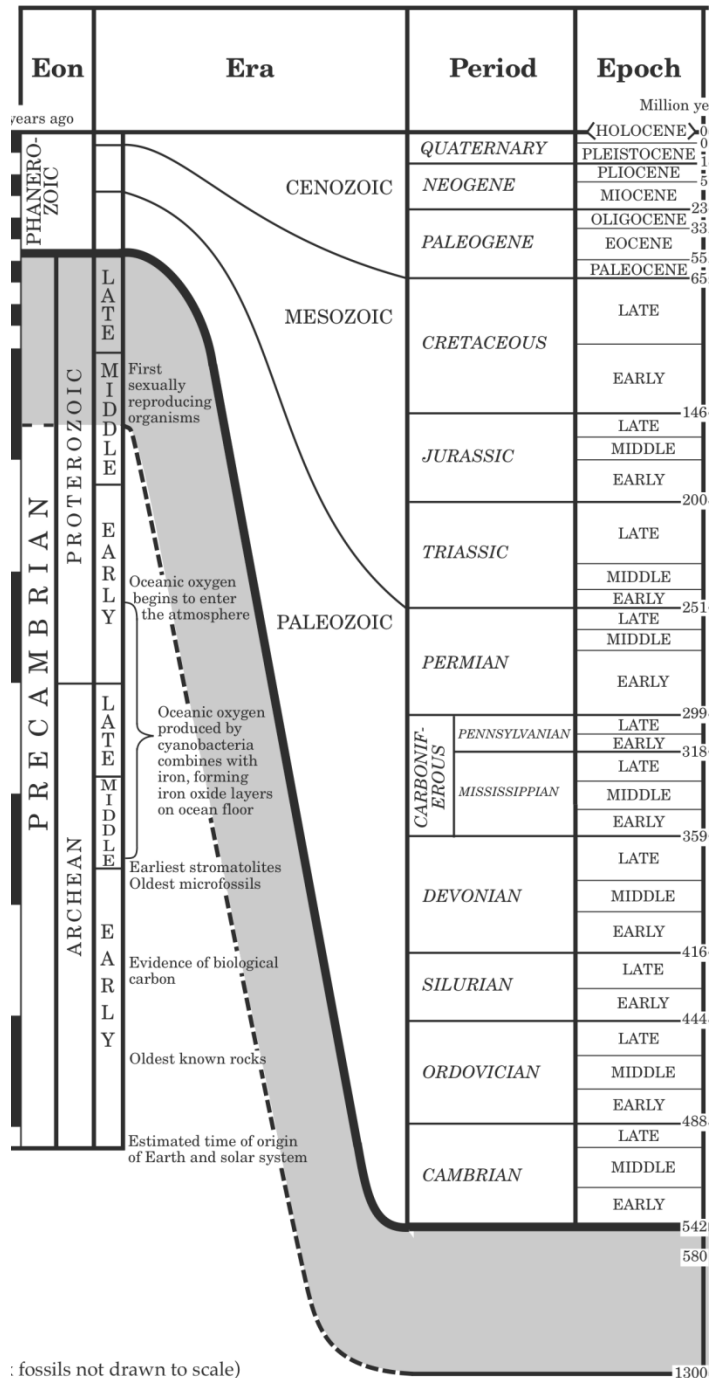
**"Interpreting the Generalized Bedrock Geology of NY State Map" ESRT pg 3  
& "Geologic History of New York State Chart" ESRT pg 8**

The graph below shows the water velocity needed keep different sized particles moving in a stream. This same graph is in your Earth Science Reference tables. Four thin lines have been added to illustrate the increase in particle size able to be transported.

- Materials**
- ✓ ESRT's
  - ✓ Highlighter
  - ✓ Color pencils

1. Below is a copy of a section of the Table on page 8 of your Earth Science Reference Tables.

2. Turn to page 3 in the Earth Science Reference Tables.
3. Look at the bottom left side of the page under "Geologic Periods and Eras in New York State".
4. Read each piece of information carefully and any periods and eras or epochs that are mentioned, highlight them on the table to the right, beginning with Cretaceous.
5. Turn to page 8 in the Earth Science Reference Tables and highlight the names there as well.
6. Look under the column labeled "NY Rock Record". If the section has some kind of shading in it, it means that the rock record is there. If it is blank, it means it is not present in New York State.
7. Is there a connection between the times you highlighted (Periods, Eras, Epochs) and the rocks that are present in New York State. \_\_\_\_\_



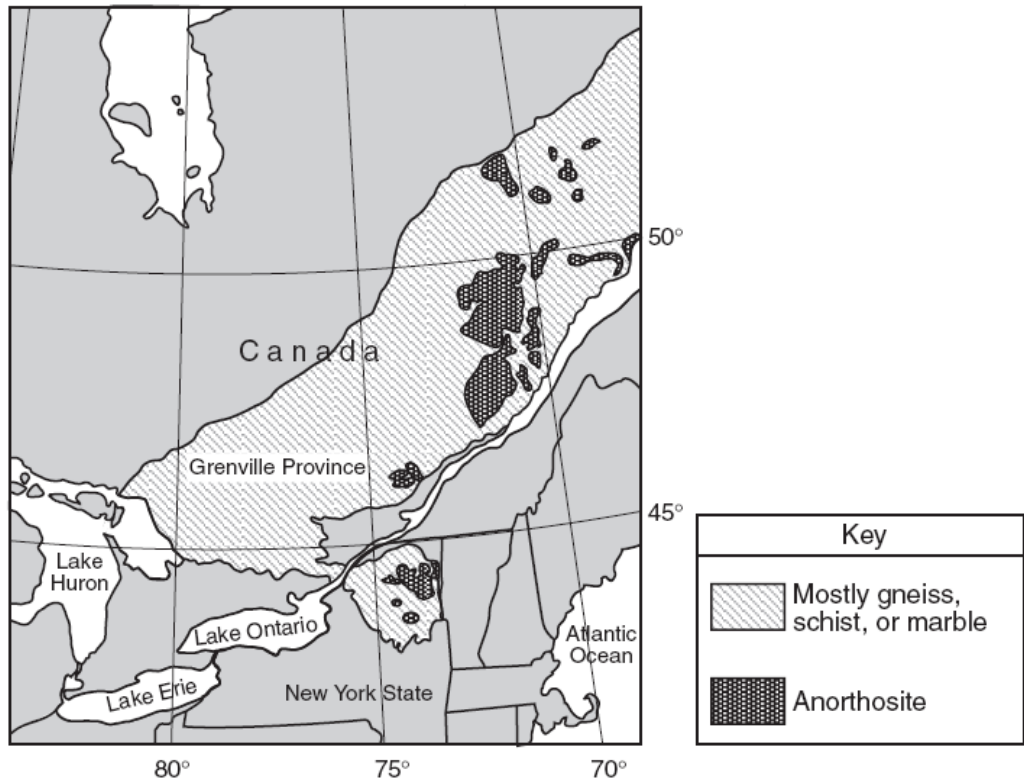
8. The rock record is complete for the Pleistocene Epoch. The entire section is shaded in. Is the rock record for that epoch sediment or bedrock? \_\_\_\_\_
9. Name the four periods where the rock layer is complete. \_\_\_\_\_  
\_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_
10. Name three periods that have absolutely no rock record in New York State.  
\_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_
11. An unconformity (missing rock record) occurs when there extreme erosion. Both the Neogene and Paleogene periods have no rock record. Look to the far right of the table on pages 8 and 9 of the reference tables and read the event description at the very top. What caused the rock record during those two periods to go missing?  
\_\_\_\_\_
12. There are different ways to state of age of rocks. You can either name the era, period, or epoch or state the age in millions of years. For example, how old is the Allegheny Plateau? \_\_\_\_\_ or \_\_\_\_\_ million years old  
name on key between ... and ...
13. Determine the age of each of the following regions or locations in New York State.
- |                       |       |    |       |                   |
|-----------------------|-------|----|-------|-------------------|
| Watertown             | _____ | or | _____ | million years old |
| St. Lawrence Lowlands | _____ | or | _____ | million years old |
| Old Forge             | _____ | or | _____ | million years old |
| Syracuse              | _____ | or | _____ | million years old |
14. Name three index fossils that may be found Elmira, NY. *(there are more than three)*  
\_\_\_\_\_ , \_\_\_\_\_ , \_\_\_\_\_
15. Why is it unlikely that any index fossils will be found in the Adirondack Mountains? \_\_\_\_\_

### ONE MORE SECTION

- Look at the column labeled "Inferred Positions of Earth's Landmasses". These illustrations show the inferred movement of the landmasses throughout geologic time.
16. What continent is shaded in dark black \_\_\_\_\_
17. In which compass direction has North America moved throughout time? \_\_\_\_\_
18. Where was North America located 458 million years ago? \_\_\_\_\_
19. In what hemisphere was most of the land mass 458 million years ago? \_\_\_\_\_
20. In what hemisphere was most of the land mass 59 million years ago? \_\_\_\_\_

**Regents Questions:**

Base your answers to questions 1 through 3 on the map below. The map shows some regions where metamorphic bedrock of the Grenville Province in northeastern North America is exposed at Earth's surface.



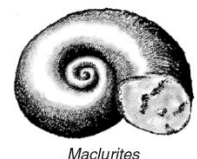
- \_\_\_\_ 1. The bedrock of the Grenville Province is generally thought to have formed approximately
- |                           |                            |
|---------------------------|----------------------------|
| (1) 250 million years ago | (3) 560 million years ago  |
| (2) 400 million years ago | (4) 1100 million years ago |

- \_\_\_\_ 2. Which New York State location has surface bedrock that consists mainly of anorthositic rock?
- |               |             |               |           |
|---------------|-------------|---------------|-----------|
| (1) Old Forge | (2) Massena | (3) Mt. Marcy | (4) Utica |
|---------------|-------------|---------------|-----------|

- \_\_\_\_ 3. Which location has surface bedrock that consists mostly of gneiss, schist, or marble?
- |                 |                 |                 |                 |
|-----------------|-----------------|-----------------|-----------------|
| (1) 43° N 81° W | (2) 47° N 69° W | (3) 46° N 78° W | (4) 49° N 71° W |
|-----------------|-----------------|-----------------|-----------------|

- \_\_\_\_ 4. The presence of which index fossil in the surface bedrock most likely indicates that a forest environment once existed in the region?
- |                         |                        |                         |                         |
|-------------------------|------------------------|-------------------------|-------------------------|
| (1) <i>Aneurophyton</i> | (2) <i>Centroceras</i> | (3) <i>Cystiphyllum</i> | (4) <i>Bothriolepis</i> |
|-------------------------|------------------------|-------------------------|-------------------------|

- \_\_\_\_ 5. The diagram below shows an index fossil found in surface bedrock in some parts of New York State. In which New York State landscape region is this gastropod fossil most likely found in the surface bedrock?
- |                       |                          |
|-----------------------|--------------------------|
| (1) Tug Hill Plateau  | (3) Adirondack Mountains |
| (2) Allegheny Plateau | (4) Newark Lowlands      |



*Maclurites*

**Introduction:**

The way water drains from an area depends on bedrock orientation and surface features. Remember that water will flow downhill.

**Materials**

- ✓ Scissors
- ✓ Glue stick

**Objective:**

- To match the drainage pattern to the surface feature

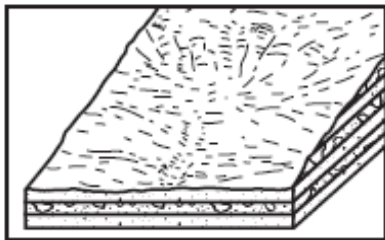
**Procedure:**

1. Remove the last page of this packet.
2. Cut out each of the drainage patterns.
3. Match the drainage pattern to the topographic picture and description below.
4. Check with your teacher before you glue it into the chart.

**Drainage description:****Appearance****Dendritic**

- most common stream pattern
- tributaries seem to flow in the same direction, creating a larger stream
- usually on undisturbed, horizontal rock layers

- looks like branches on a tree

**Radial**

- occurs when the streams flow away from a high point
- develops over a smooth dome or volcanic cone

- looks like spokes on a wheel



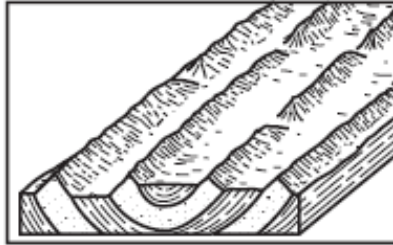
**Drainage description:**

**Appearance**

**Rectangular:**

- occurs where drainage flows along folds and faults

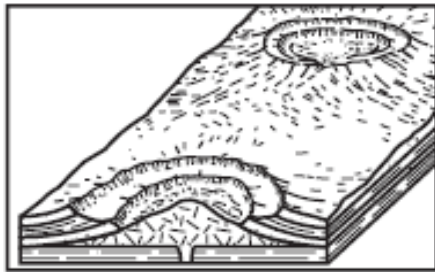
- looks like parallel lines with tributaries going into each path



**Annular:**

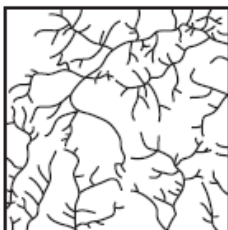
occurs on an eroded dome

- appears to be a circular pattern with small tributaries that go into each circle

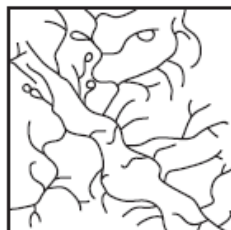


**Regents Questions:**

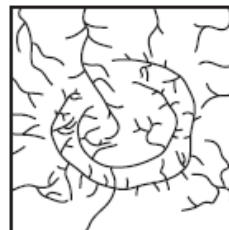
\_\_\_\_ 1. The cross section below shows the rock structure of a deeply eroded, domed mountain region. Which map shows the stream drainage pattern that will most likely develop as the bedrock is weathered and eroded from this igneous dome?



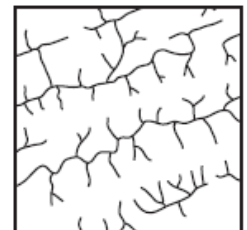
(1)



(2)

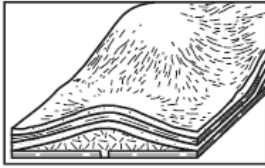
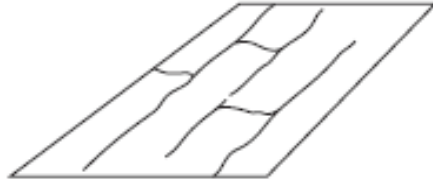


(3)

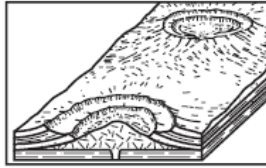


(4)

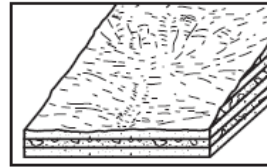
\_\_\_ 2. The diagram below represents a map view of a stream drainage pattern. Which underlying bedrock structure most likely produced this stream drainage pattern.



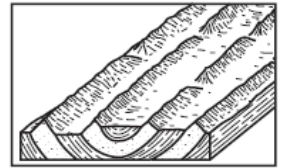
(1)



(2)



(3)

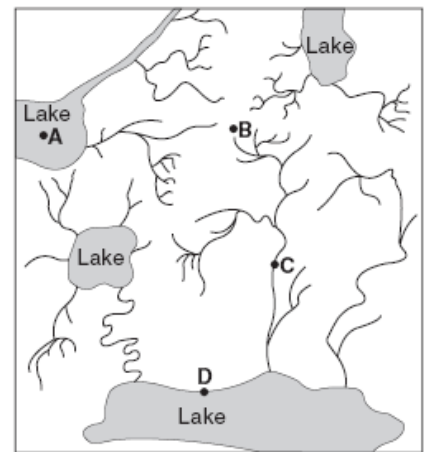


(4)

\_\_\_ 3. The map to the right shows the stream drainage patterns for a region of Earth's surface. Points A, B, C, and D are locations in the region.

The highest elevation most likely exists at point

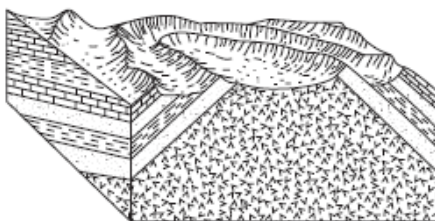
- (1) A      (2) B      (3) C      (4) D



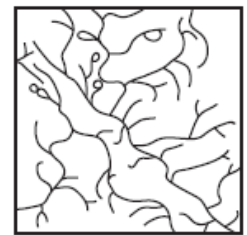
0 10 20 km

\_\_\_ 4. The block diagram below represents a deeply eroded dome.

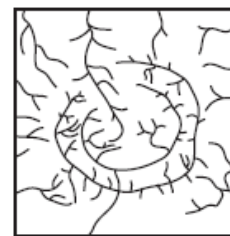
Which map shows the stream drainage pattern that would most likely develop on this feature?



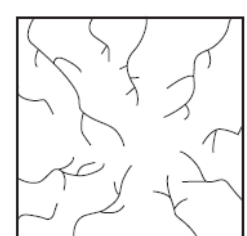
(1)



(2)

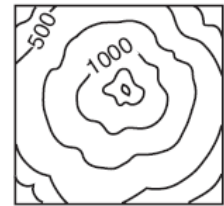


(3)

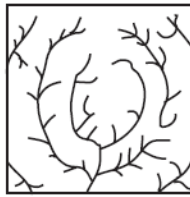


(4)

5. The topographic map to the right shows a particular landscape. Which map best represents the stream drainage pattern for this landscape?



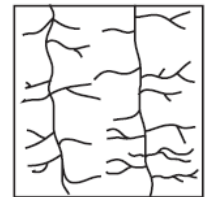
(1)



(2)

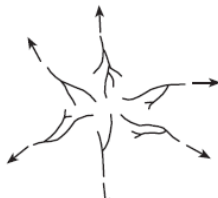


(3)

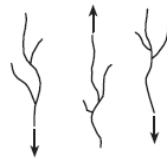


(4)

6. Which stream-drainage pattern most likely developed on the surface of a newly formed volcanic mountain?



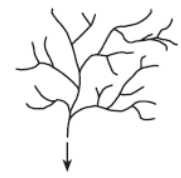
(1)



(2)



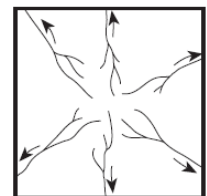
(3)



(4)

7. The map to the right shows a stream drainage pattern. Arrows show the direction of stream flow.

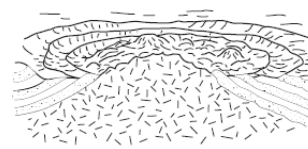
On which landscape region did this drainage pattern most likely develop?



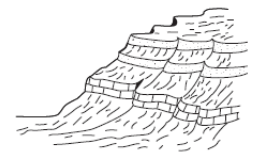
(1)



(2)



(3)



(4)

8. New York State landscape regions are identified and classified primarily by their

- (1) surface topography and bedrock structure
- (2) existing vegetation and type of weather
- (3) latitude and longitude
- (4) chemical weathering rate and nearness to large bodies of water



