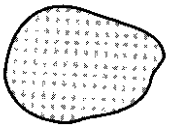
Weathering, Erosion and Deposition

Weathering: _____

_____

Types of Weathering: _____ and _____

Physical Weathering



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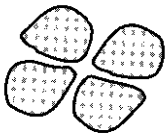
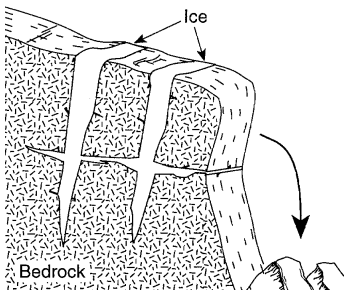
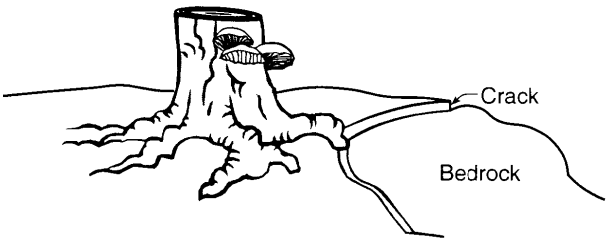
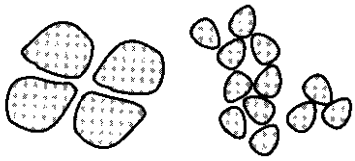
_____



_____

_____

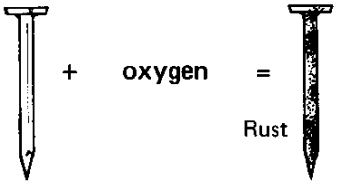
Types of Physical Weathering:

Frost Wedging 	Root Action 
Abrasion 	Exfoliation

Chemical Weathering

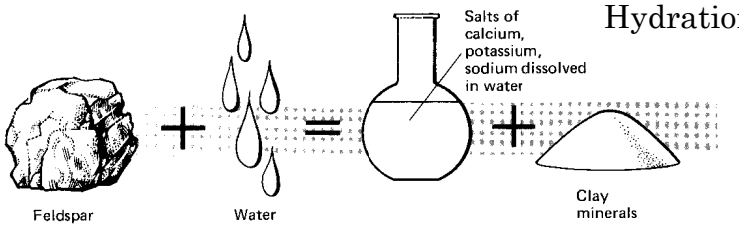
Types of Chemical Weathering:

Oxidation

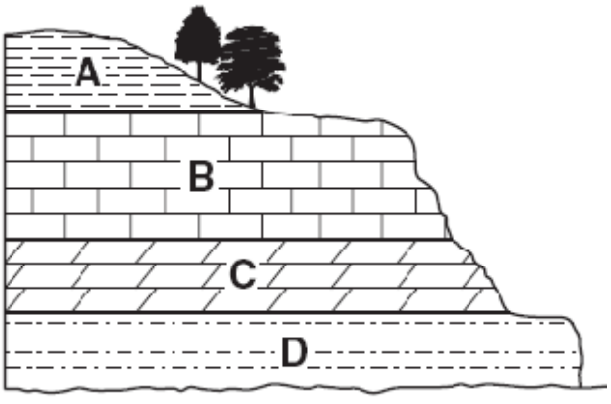


Carbonation

Hydration



Chemical weathering of feldspar by water.



Composition of the Rocks

Factors that Effect Weathering

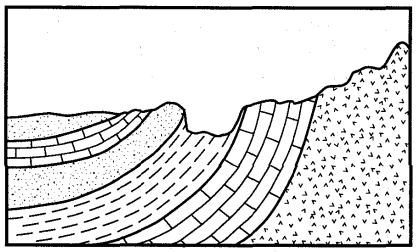
Factor	Physical Weathering	Chemical Weathering
Climate		
Exposure		
Composition		

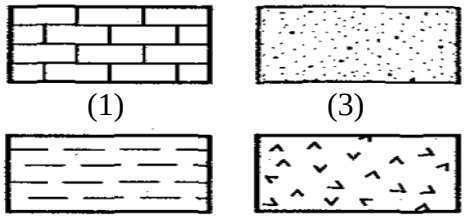
1. In which type of climate would the rate of chemical weathering be the greatest?
   (1) warm and dry (2) cold and dry (3) warm and moist (4) cold and moist

2. In which climate does physical weathering by frost action most easily occur?
   (1) dry and hot (2) dry and cold (3) moist and hot (4) moist and cold

3. Chemical weathering will occur most rapidly when rocks are exposed to the
   (1) hydrosphere and lithosphere
   (2) mesosphere and thermosphere
   (3) hydrosphere and atmosphere
   (4) lithosphere and atmosphere

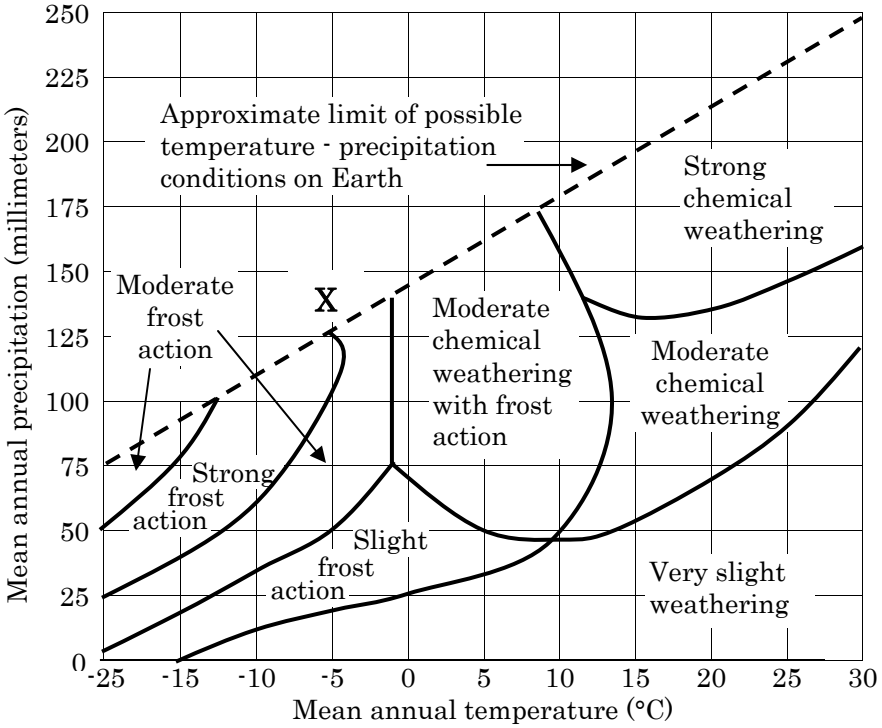
4. The diagram below represents a geologic cross section. Which rock layer is least resistant to weathering?





5. Why will a rock weather more rapidly if it is broken into smaller particles?
   (1) the mineral structure of the rock has changed
   (2) the smaller particles are less dense
   (3) the total mass of the rock and the particles is reduced
   (4) there is more surface area exposed

Base your answers to questions 6 through 9 on the diagram below, which represents the dominant type of weathering for various climatic conditions.



6. Which climate conditions would produce very slight weathering?
   (1) a mean annual temperature of 25 °C and a mean annual precipitation of 100 mm
   (2) a mean annual temperature of 15 °C and a mean annual precipitation of 25 mm
   (3) a mean annual temperature of 5 °C and a mean annual precipitation of 50 mm
   (4) a mean annual temperature of -5 °C and a mean annual precipitation of 50 mm

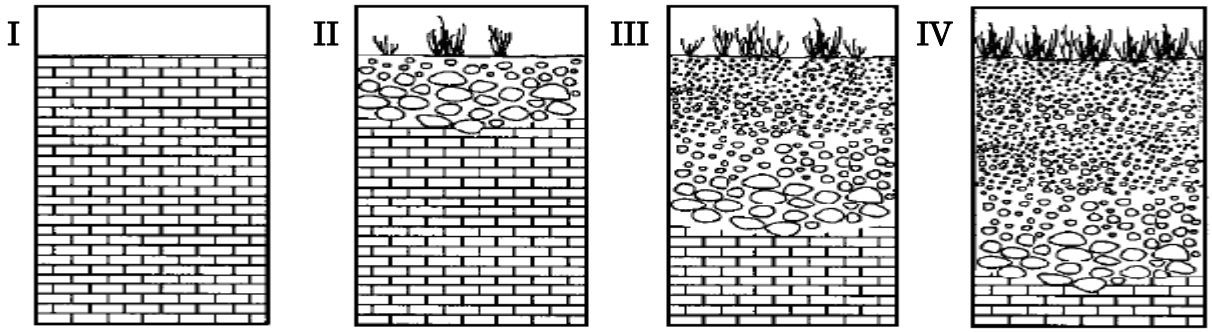
7. Why is no frost action shown for locations with a mean annual temperature greater than 13 °C?
   (1) Very little freezing takes place at these locations.
   (2) Large amounts of evaporation take place at these locations.
   (3) Very little precipitation falls at these locations.
   (4) Large amounts of precipitation fall at these locations.

8. There is no particular type of weathering or frost action given for the temperature and precipitation values at the location represented by the letter X. Why is this the case?
   (1) Only chemical weathering would occur under these conditions.
   (2) Only frost action would occur under these conditions.
   (3) These conditions create both strong frost action and strong chemical weathering.
   (4) These conditions probably do not occur on Earth.

9. What type of weathering dominates when the mean annual temperature of -5 °C and a mean annual precipitation of 60 mm?
   (1) moderate frost action
   (2) moderate chemical weathering
   (3) slight frost action
   (4) very slight weathering

Soil

Soil -

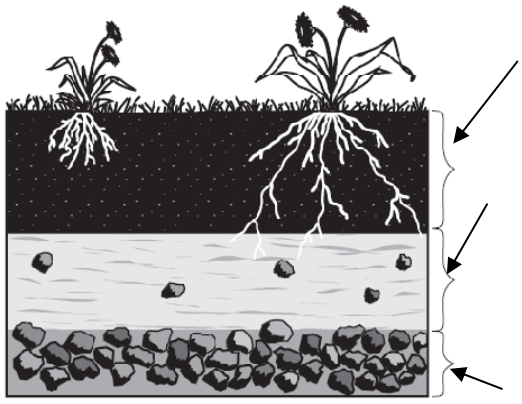


I

II

III

IV



Residual soil _____

_____

_____

_____

Transported soil _____

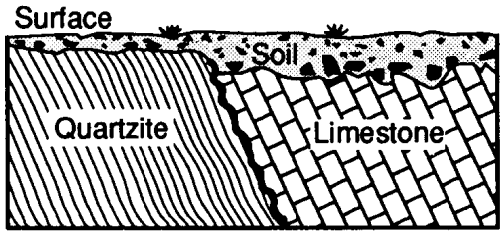
_____

_____

_____

1. Which factors most directly control the development of soils?
   (1) soil particle sizes and method of deposition
   (2) bedrock composition and climate characteristics
   (3) direction of prevailing winds and storm tracks
   (4) earthquake intensity and volcanic activity.

2. The cross section to the right shows the residual soils that developed on rock outcrops of metamorphic quartzite and sedimentary limestone. Which statement best explains why the soil is thicker above the limestone than it is above the quartzite?
   (1) The quartzite formed from molten magma
   (2) The limestone is thicker that the quartzite.
   (3) The quartzite is older than the limestone.
   (4) The limestone is less resistant to weathering than the quartzite.



3. Which is the best example of physical weathering?
   (1) the cracking of rock caused by the freezing and thawing of water
   (2) the transportation of sediment in a stream
   (3) the reaction of limestone with acid rainwater
   (4) the formation of a sandbar along the side of a stream

4. At high elevations in New York State, which is the most common form of physical weathering?
   (1) abrasion of rocks by the wind
   (2) oxidation by oxygen in the atmosphere
   (3) dissolving of minerals into solution
   (4) alternate freezing and melting of water

5. Soil horizons develop as a result of
   (1) evaporation and transpiration
   (2) compacting and cementing
   (3) weathering and biological activity
   (4) faulting and folding

6. Which substance has the greatest effect on the rate of weathering of rock?
   (1) nitrogen (2) hydrogen (3) water (4) argon

7. Equal masses of two identical rock samples. Sample A is one large block, while sample B was cut into four smaller blocks of equal size.

If subjected to the same environmental conditions, sample B will weather more quickly than sample A. The best explanation for this is that the

(1) volume of Sample B is greater than that of Sample A
(2) surface area of Sample B is greater than that of Sample A
(3) density of Sample A is greater than that of Sample B
(4) hardness of Sample A is greater than that of Sample B

8. Which change would cause the topsoil in New York State to increase in thickness?
(1) an increase in slope
(2) a decrease in rainfall
(3) an increase in biologic activity
(4) a decrease in air temperature

9. Which change in the climate of New York State would most likely cause the greatest increase in chemical weathering of local bedrock?
(1) lower temperature in the winter
(2) lower humidity in the winter
(3) higher atmospheric pressure in the summer
(4) greater precipitation in the summer

10. Humus, which is formed by the decay of plant and animal matter, is important for the formation of most
(1) surface bedrock (2) minerals (3) sediment (4) soils

11. Which factor has the least effect on the weathering of a rock?
(1) climatic conditions
(2) composition of the rock
(3) exposure of the rock to the atmosphere
(4) the number of fossils found in the rock

12. Solid bedrock is changed to soil primarily by the process of
(1) erosion (2) weathering (3) infiltration (4) transpiration

13. Water is the major agent of chemical weathering because water
(1) cools the surrounding air when it evaporates
(2) dissolves many of the minerals that make up rocks
(3) has density of about one gram per cubic centimeter
(4) has the highest specific heat of all common earth materials

14. How does chemical weathering help to increase the amount of physical weathering?
(1) by creating more surface area
(2) by weakening the rock
(3) by exfoliation
(4) frost wedging

Erosion & Deposition

Erosion: _____

_____

Agents of Erosion _____

_____

_____

Deposition: _____

_____

1. The composition of sediments on Earth's surface usually is quite different from the composition of the underlying bedrock. This observation suggests that most
   (1) bedrock is formed from sediments
   (2) sediments are residual
   (3) bedrock is resistant to weathering
   (4) sediments have been transported

2. On Earth's surface, transported materials are more common than residual materials. This condition is mainly the result of
   (1) recrystallization (2) erosion (3) folding (4) subduction

3. Most of the surface materials in New York State can be classified as
   (1) igneous rock
   (2) coastal plain deposits
   (3) metamorphic rocks
   (4) transported soils

4. Granite pebbles are found on the surface in a certain area where only sandstone bedrock is exposed. Which is the most likely explanation for the presence of these pebbles?
   (1) The granite pebbles were transported to the area from a different region.
   (2) Some of the sandstone has been changed into granite.
   (3) The granite pebbles were formed by weathering of the exposed sandstone bedrock.
   (4) Ground water tends to form granite pebbles within layers of sandstone rock.

5. By which processes are rocks broken up and moved to different locations?
   (1) evaporation and condensation
   (2) weathering and erosion
   (3) burial and cementation
   (4) compaction and transportation

6. Transported rock materials are more common than residual rock materials in the soils of New York State. Which statement best explains this observation?
   (1) Solid rock must be transported to break.
   (2) Weathering changes transported rock materials more easily than residual rock materials.
   (3) Most rock materials are moved by some agent of erosion at some time in their history.
   (4) Residual rock materials form only from bedrock that is difficult to change into soil.

Factors that affect deposition

Velocity of medium

Shape

Size

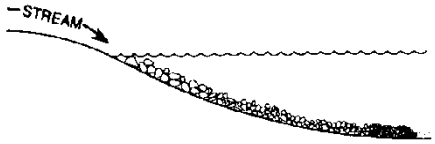
Density

Sorting of Sediments

- Sorted

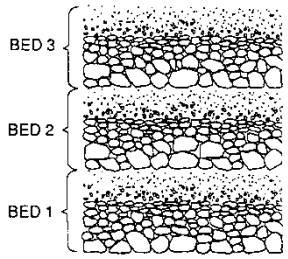
- Unsorted

Horizontal sorting:



Vertical sorting:

Graded Bedding –



Base your answers to questions 1 through 4 on the diagrams below and descriptions of the two laboratory activities below. The particles used in these activities are described below.

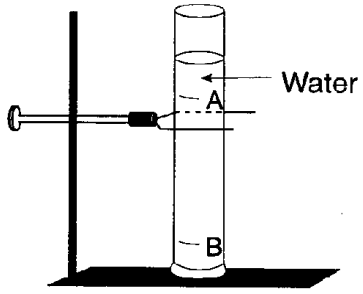
Particles Used in Activites

Particle	Diameter	Density
●	15 mm Al (aluminum)	2.7 g/cm^3
●	10 mm Al (aluminum)	2.7 g/cm^3
●	5 mm Al (aluminum)	2.7 g/cm^3

Particle	Diameter	Density
●	15 mm Fe (iron)	7.9 g/cm^3
●	15 mm Pb (lead)	11.4 g/cm^3

Activity 1

Three different particles of different sizes were released in a plastic tube filled with water. The length of time each particle took to drop from point A to point B is shown in data table 1.

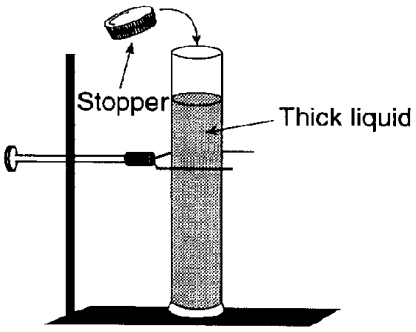


Data Table 1

Particle Size	Time of Settling
15 mm Al	3.2 sec
10 mm Al	5.4 sec
5 mm Al	7.2 sec

Activity 2

Different combinations of particles were placed in a tube filled with a thick liquid and allowed to fall to the bottom. The tube was then stoppered and quickly turned upside down, allowing the particles to settle. The different combinations of particles are shown in data table 2. The diagram of the partical sorting in data table 2 has been omitted intentially.

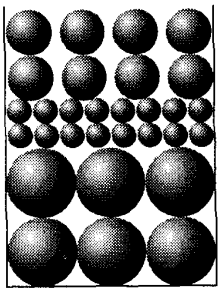


Data Table 2

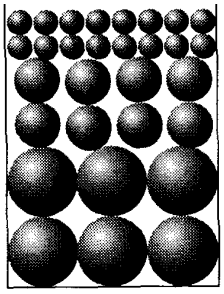
Combination	Particles Mixed	Diagram of Sorting
A	15 mm Al 10 mm Al 5 mm Al	
B	15 mm Al 15 mm Fe 15 mm Pb	

1. During Activity 1, as the 10 millimeter aluminum particles drops from *A* to *B*, the potential energy of the particle.
   (1) decreases (2) increases (3) remains the same

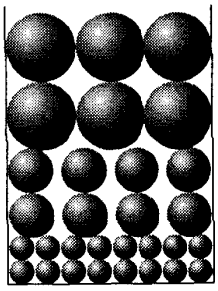
2. The diagrams below represent where each of the spheres would most likely be found once they settled to the bottom of the tube. In Activity 2, when the tube is turned upside down, the aluminum particles , labeled "Combination A," are allowed to settle. Which diagram below represents the sorting that is most likely to occur? _____ Explain your reasoning. _____



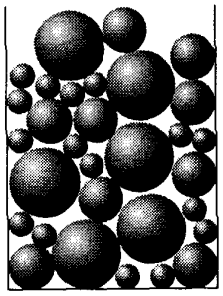
(1)



(2)

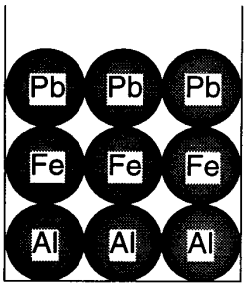


(3)

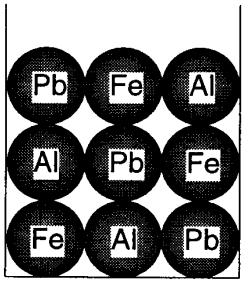


(4)

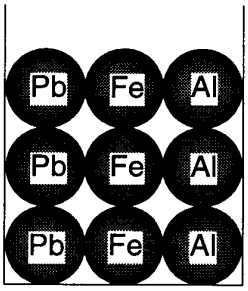
3. In Activity 2, when the tube is turned upside down, the particles of three different metals, labeled "Combination B," are allowed to settle. Which diagram below represents the sorting that is most likely to occur? _____ Explain your reasoning.



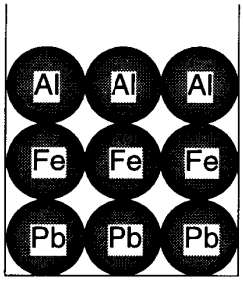
(1)



(2)



(3)



(4)

4. A third activity, similar in setup to Activity 1 was done using flat, oval, and round aluminum particles with identical masses. Which table shows the most likely results of this third activity?

Particle Shape	Settling Time
Round	3.2 sec
Oval	5.1 sec
Flat	6.7 sec

(1)

Particle Shape	Settling Time
Round	5.1 sec
Oval	3.2 sec
Flat	6.7 sec

(2)

Particle Shape	Settling Time
Round	5.1 sec
Oval	5.1 sec
Flat	5.1 sec

(3)

Particle Shape	Settling Time
Round	6.7 sec
Oval	5.1 sec
Flat	3.2 sec

(4)

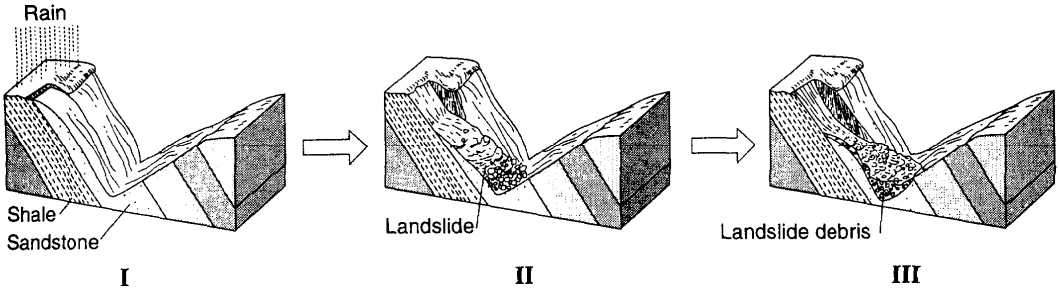
Gravity

1. The best evidence that erosion has taken place would be provided by
   (1) deep residual soil observed on a hill side
   (2) sediment observed at the bottom of a cliff
   (3) tilted rock layers observed on a mountain
   (4) faulted rock layers observed on a plateau

2. Which erosional force acts alone to produce avalanches and landslides?
   (1) gravity (2) running water (3) winds (4) sea waves

3. Which movement of earth materials is gravity NOT the main force?
   (1) sediments flowing in a river
   (2) boulders carried by a glacier
   (3) snow tumbling in an avalanche
   (4) moisture evaporating from an ocean

4. The diagram below shows the sequence of events leading to the deposition of landslide debris.



   What was the primary force that caused this landslide?
   (1) gravity (2) moving ice (3) prevailing winds (4) stream discharge

5. Glacial movement is caused primarily by
   (1) Earth's rotation (2) gravity (3) erosion (4) global winds

6. The primary force responsible for the flow of water in a stream is
   (1) solar energy (2) magnetic fields (3) wind (4) gravity

Running Water

Ways in which sediment is carried in a stream:

Solution -

Suspension –

Floatation –

Bedload -

Streams

Stream: _____

Includes: _____

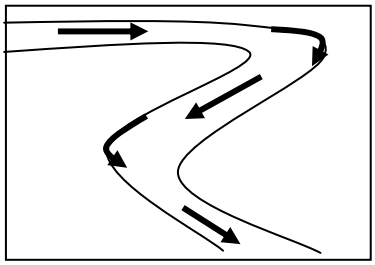
Velocity of a stream is influence by the following:

(1) Gradient : _____

(2) Volume: _____

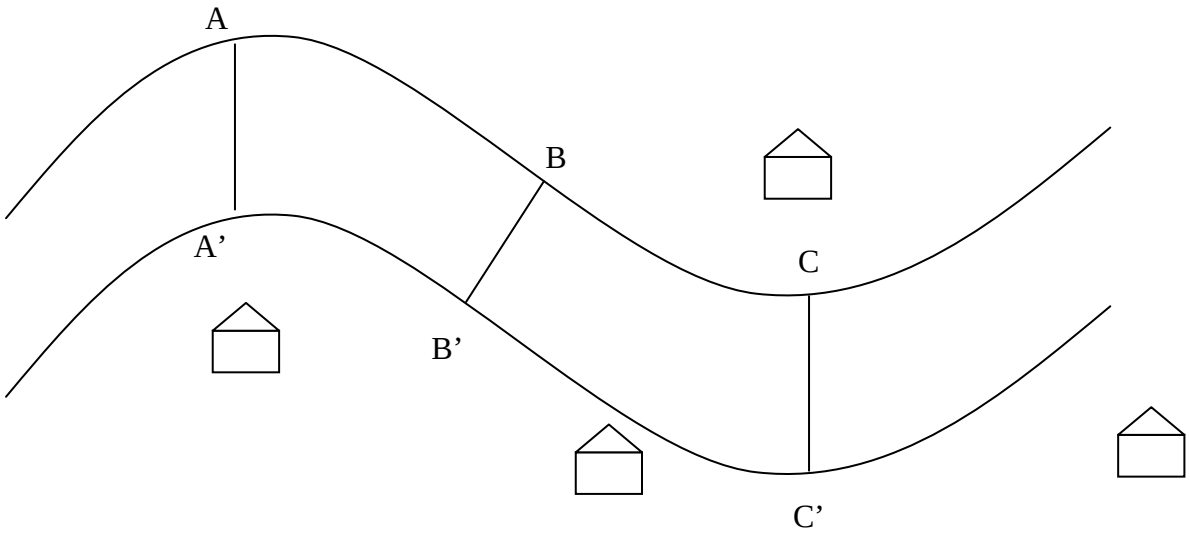
- discharge _____

(3) Channel Shape _____



Meander – _____

(4) Large Sediment _____



Plot the data from the three tables below on to the corresponding graphs on page 15. Create a profile for each section by connecting the plotted points. On the lines to the right, explain the processes that caused each profile to look as it does.

A to A'

Distance (m)	0	5	10	15	20	25	30	35	40	45	50
Depth (m)	0	4.0	6.5	6.0	5.0	3.0	1.5	1.0	.75	.5	0

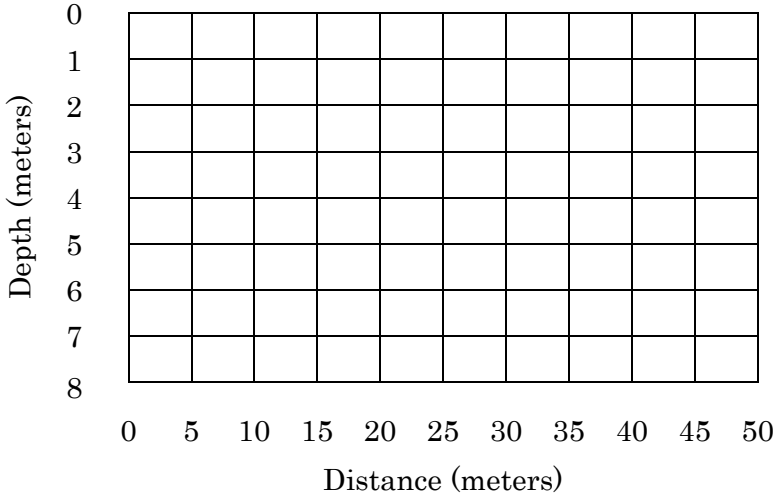
B to B'

Distance (m)	0	5	10	15	20	25	30	35	40	45	50
Depth (m)	0	2.0	4.0	5.5	6.0	6.5	6.0	5.0	4.0	2.0	0

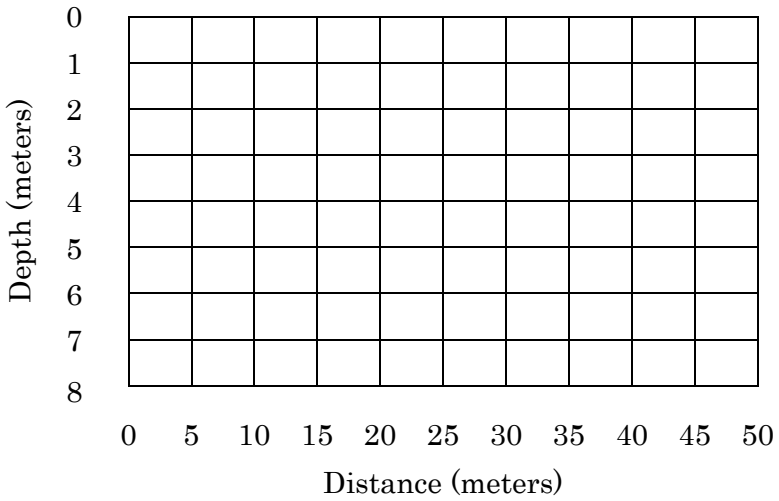
C to C'

Distance (m)	0	5	10	15	20	25	30	35	40	45	50
Depth (m)	0	.5	.75	1.0	1.5	3.0	4.5	6.0	6.5	4.5	0

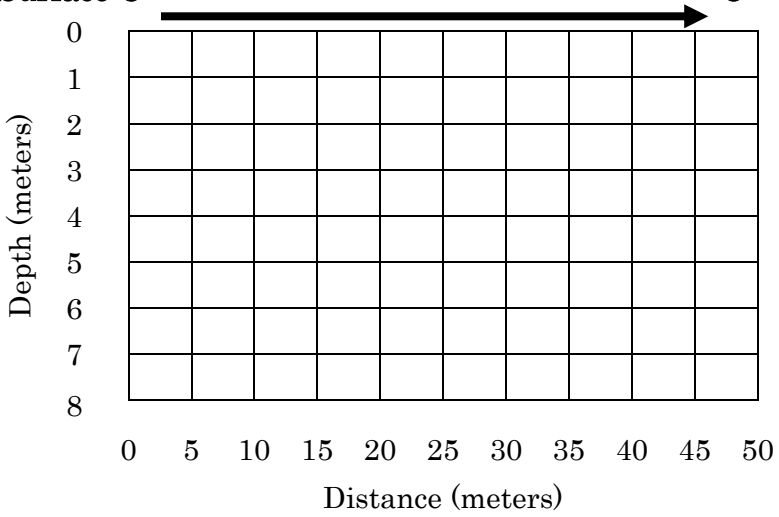
Surface A → A'



Surface B → B'



Surface C → C'



ESRT Page 6: Relationship of Transported Particle Size to Water Velocity

1. What is the largest rock particle that can be transported by a stream with a velocity of 250 centimeters per second?
   (1) silt (2) pebbles (3) sand (4) cobbles

2. What is the approximate minimum stream velocity needed to keep a particle with a diameter of .2 centimeters moving?
   (1) 10 cm/sec (2) 20 cm/sec (3) 50 cm/sec (4) 30 cm/sec

3. Which is the largest sediment that could be carried by a stream flowing at a velocity of 75 centimeters per second?
   (1) silt (2) pebbles (3) sand (4) cobbles

4. The velocity of a stream is 100 centimeters per second. What is the largest diameter particle that can be transported?
   (1) 0.1 cm (2) 0.01 cm (3) 1.0 cm (4) 0.0001 cm

5. What is the maximum size particle that can be carried by a stream having a velocity of 250 centimeters per second?
   (1) 0.0004 cm (2) 6.4 cm (3) 0.01 cm (4) 9.0 cm

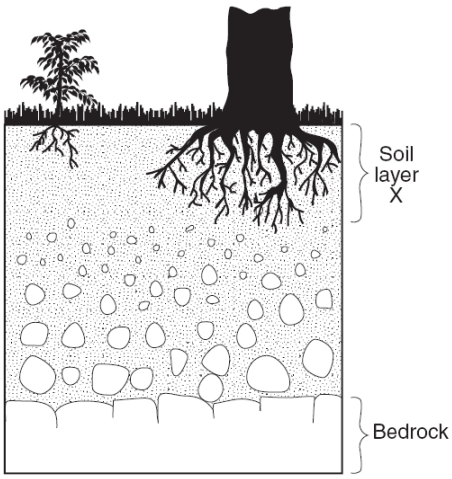
6. A mixture of the sediments listed below is being carried by a river that empties into a lake. Assuming that all four sediments arrived at the mouth of the river together, which sediment will probably be carried farthest into the lake by the river current?
   (1) clay (2) sand (3) pebbles (4) silt

7. A pebble is being transported in a stream by rolling. How does the velocity of the pebble compare to the velocity of the stream?
   (1) The pebble is moving slower than the stream.
   (2) The pebble is moving faster than the stream.
   (3) The pebble is moving at the same velocity as the stream.

8. The cross section to the right shows soil layer X, which was formed from underlying bedrock.

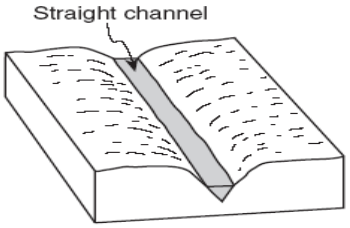
   Which change would most likely cause soil layer X to increase in thickness?

   (1) an increase in slope
   (2) a decrease in rainfall
   (3) an increase in biologic activity
   (4) a decrease in air pressure



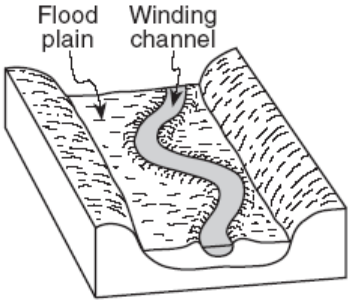
Life of a Stream

Youth



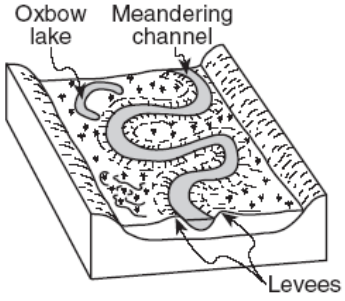
Narrow, V-shaped valley

Mature



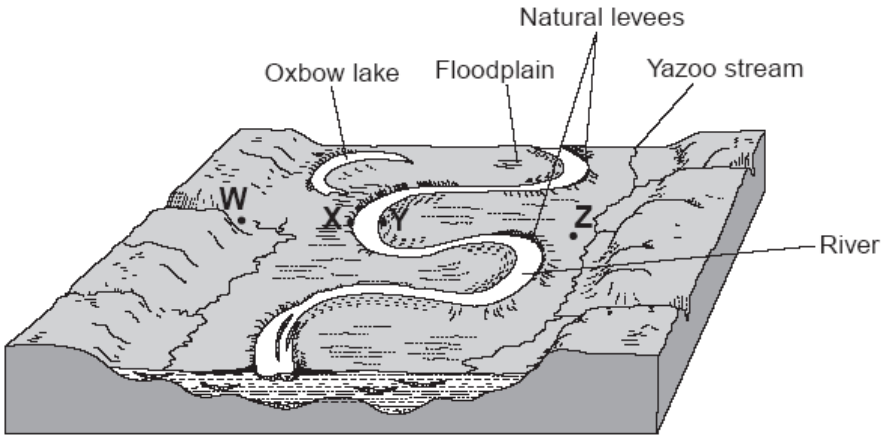
Wider valley with sloping walls

Old Age

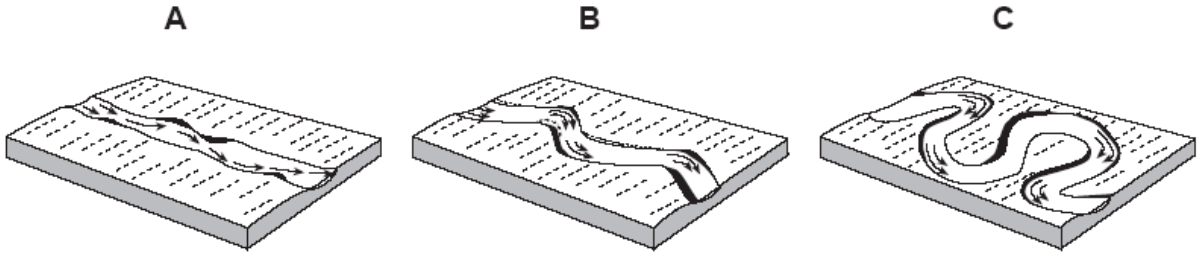


Broad valley with wide, swampy flood plain

Base your answers to questions 1 through 5 on the diagram below. The diagram represents the landscape features associated with a meandering river. Letters *W*, *X*, *Y*, and *Z* represent locations on the floodplain.



1. The diagram below represents stages in the formation of this meandering river.



Which sequence best represents the usual changes over time?
(1) A → B → C (2) A → C → B (3) C → A → B (4) C → B → A

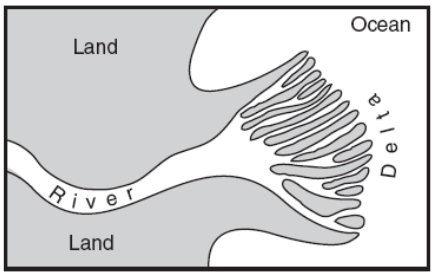
2. At which location is erosion the greatest?
(1) W (2) X (3) Y (4) Z

3. The natural levees are ridges of sediment that slope away from the riverbank toward the floodplain. Which process most likely formed these levees?
(1) weathering of the soil on the riverbanks
(2) erosion on the inside of curves of the meanders
(3) deposition by the Yazoo stream
(4) deposition when the river overflowed its banks

4. During transport by this river, a sediment particle will most likely become
(1) more rounded (2) more dense (3) heavier (4) larger

5. Which change would most likely increase the velocity of the river?
(1) A decrease in the slope of the river
(2) A decrease in the temperature of the river
(3) An increase in the river's discharge
(4) An increase in the width of the river

Formation of Deltas

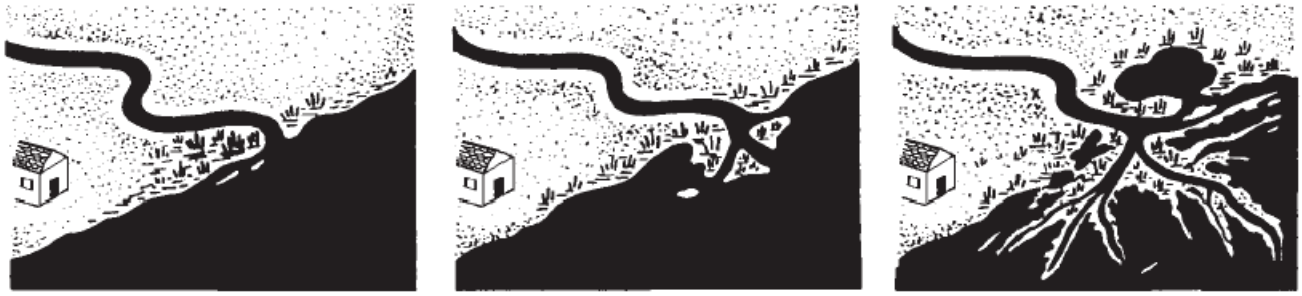


Drainage basin _____

Watershed - _____

Tributary - _____

1. The diagrams below show gradual stages 1, 2, and 3 in the development of a river delta where a river enters an ocean.



Which statement best explains why the river delta is developing at this site?
(1) The rate of deposition is less than the rate of erosion.
(2) The rate of deposition is greater than the rate of erosion.
(3) Sea level is slowly falling.
(4) Sea level is slowly rising.

2. An environmental scientist needs to prepare a report on the potential effects that a proposed surface mine in New York State will have on the watershed where the mine will be located. In which reference materials will the scientist find the most useful data with which to determine the watershed's boundaries?
(1) topographic maps
(2) tectonic plate maps
(3) geologic time scales
(4) planetary wind maps

Base your answers to questions 3 through 5 on the map below, which shows the drainage basin of the Mississippi River system. Several rivers that flow into the Mississippi River are labeled. The arrow at location *X* shows where the Mississippi River enters the Gulf of Mexico.

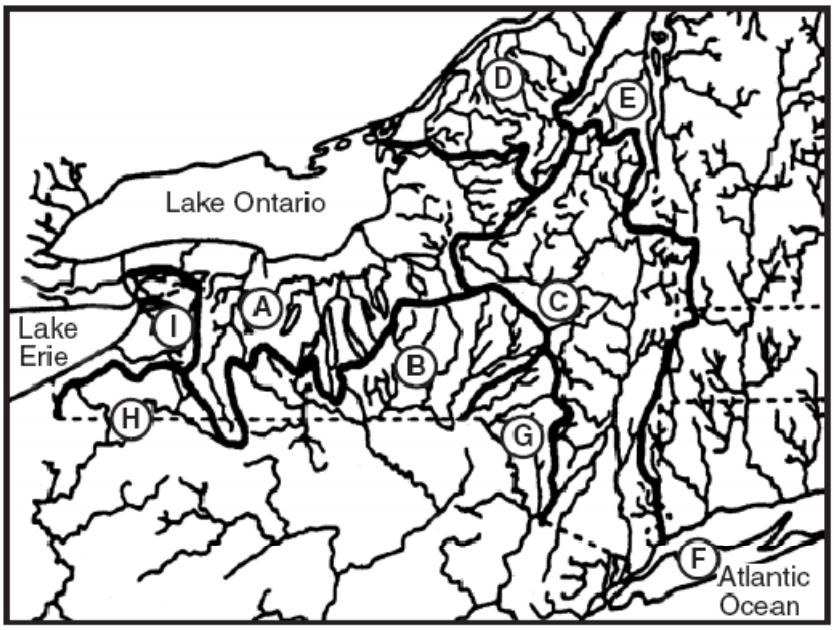
3. The entire land area drained by the Mississippi River system is referred to as a
   (1) levee (2) meander belt (3) watershed (4) floodplain

4. Sediments deposited at location *X* by the Mississippi River most likely have which characteristics?
   (1) angular fragments arranged as mixtures
   (2) rock particles arranged in sorted beds
   (3) rocks with parallel scratches and grooves
   (4) high-density minerals with hexagonal crystals

5. The structure formed by the deposition of sediments at location *X* is best described as a
   (1) moraine (2) delta (3) tributary (4) drumlin

6. Most New York State sandstone bedrock was formed
   (1) in Earth's interior where temperatures exceeded the melting point of quartz
   (2) on Earth's surface from the cooling of molten lava
   (3) in a delta from sand grains deposited, buried, and cemented together by minerals
   (4) in a desert when heat and metamorphic pressure caused quartz crystals to fuse together

7. The map below shows major streams in the New York State area. The bold lines mark off sections *A* through *I* within New York State.

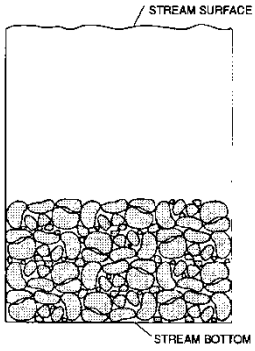


The best title for the map would be
(1) "Tectonic Plate Boundaries in New York State"
(2) "Bedrock Geology Locations of New York State"
(3) "Landscape Regions of New York State"
(4) "Watershed Areas of New York State"

8. Which river is a tributary branch of the Hudson River?
(1) Delaware River
(2) Susquehanna River
(3) Mohawk River
(4) Genesee River

9. Which evidence best supports the inference that the meltwater river that once occupied the Cayuta Creek valley was larger than the modern Cayuta Creek?
(1) The modern Cayuta Creek occupies a V shaped valley.
(2) The valley floor is wider than the modern Cayuta Creek.
(3) The modern Cayuta Creek lacks meanders and a flood plain.
(4) The tributary streams meet the modern Cayuta Creek at nearly right angles.

10. The diagram below represents a vertical cross section of sediments deposited in a stream. Which statement best explains the mixture of sediments?



(1) The velocity of the stream continually decreased.
(2) The stream discharge continually decreased.
(3) The particles have different densities.
(4) Smaller particles settle more slowly than larger particles.

Ocean Waves

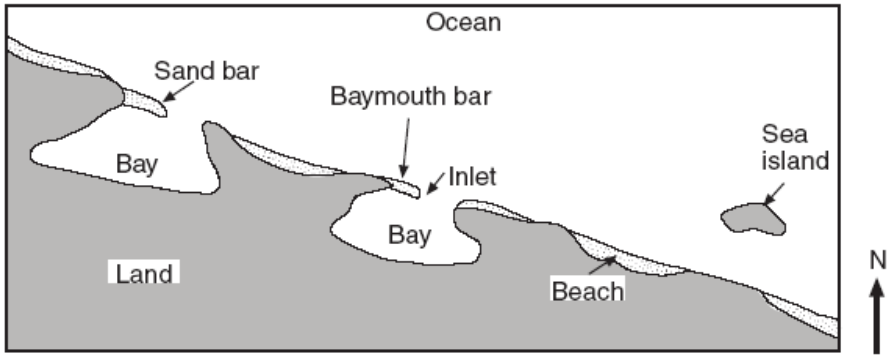
Creates beaches -

Forms sandbars -

Barrier island -

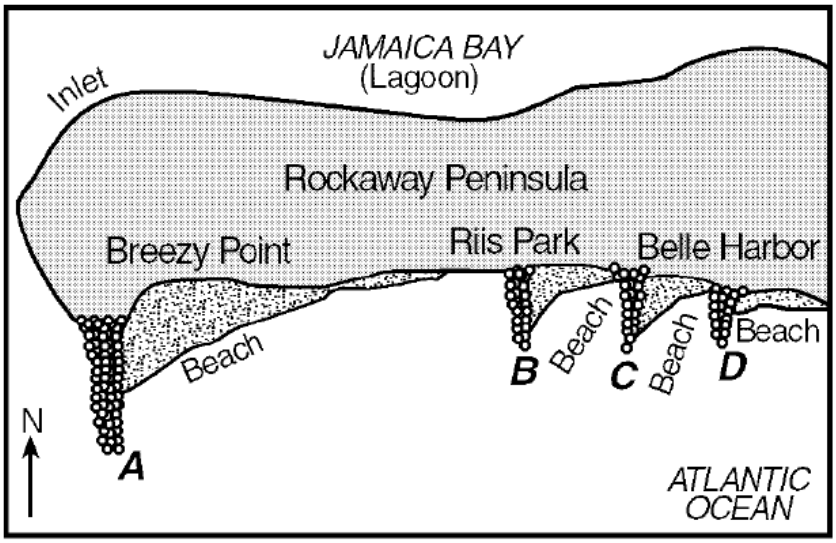
Waves approaching a shoreline -

1. The map below shows some features along an ocean shoreline. In which general direction is the sand being moved along this shoreline by ocean (longshore) currents?

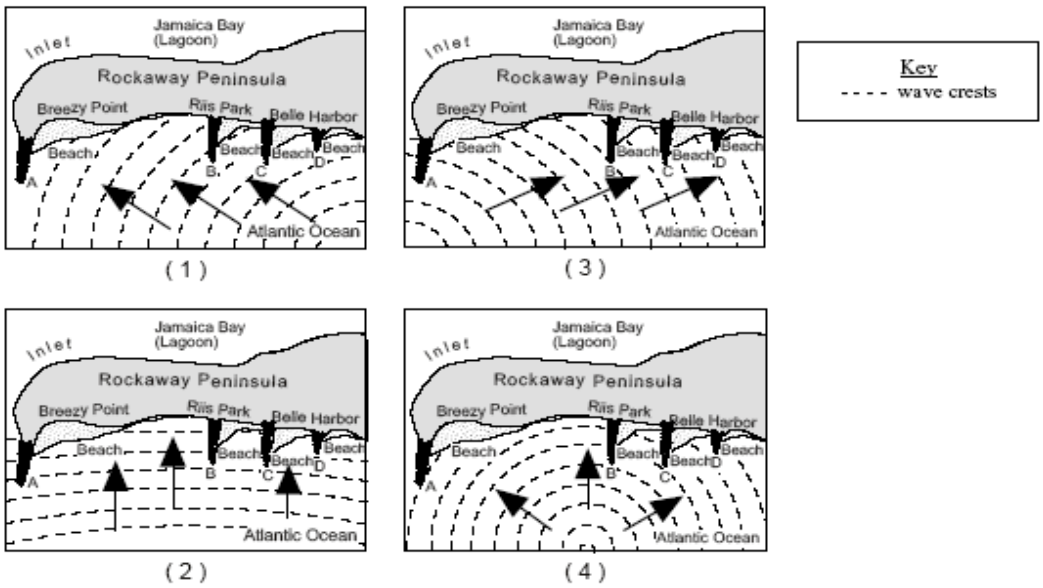


(1) northeast (2) northwest (3) southeast (4) southwest

2. The map to the right shows Rockaway Peninsula, part of Long Island's south shore, and the location of several stone barriers, *A, B, C*, and *D*, that were built to trap sand being transported along the coast by wave action.



On which map do the arrows best show the direction of wave movement that created the beaches in this area?

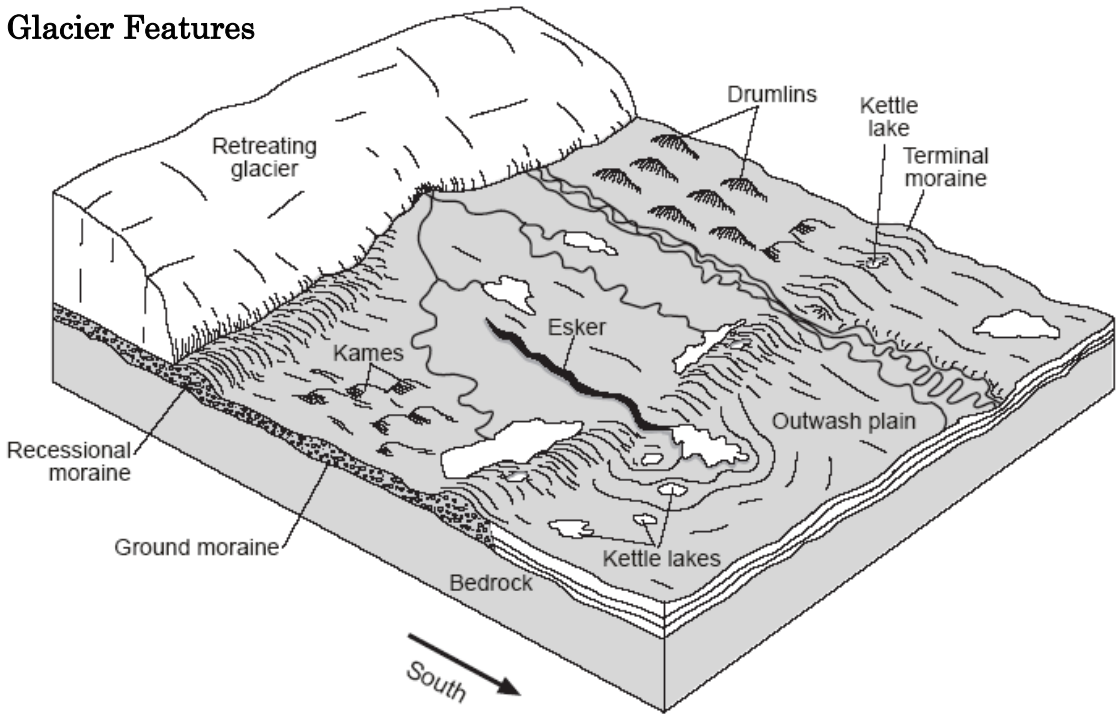


3. The long, sandy islands along the south shore of Long Island are composed mostly of sand and rounded pebbles arranged in sorted layers. The agent of erosion that most likely shaped and sorted the sand and pebbles while transporting them to their island location was
(1) glaciers (2) wind (3) landslides (4) ocean waves

4. The major source of sediments found on the deep ocean bottom is
(1) erosion of continental rocks
(2) submarine landslides from the mid-ocean ridges
(3) icebergs that have broken off continental glaciers
(4) submarine volcanic eruptions

Glaciers

Continental Glacier Features



Esker _____

Till

Erratic

Moraine

Terminal Moraine

Recessional moraine

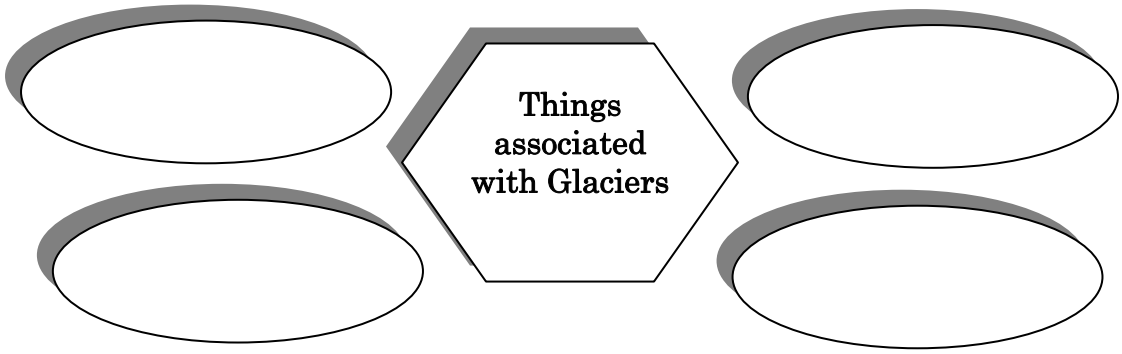
Outwash plain

Drumlins

Kames

Kettle hole

Valley Glacier Features

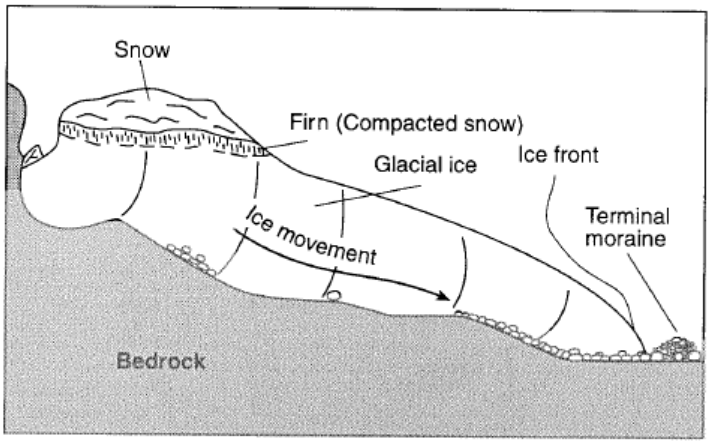


1. Which statement identifies a result of glaciation that has had a positive effect on the economy of New York State?
   (1) Large amounts of oil and natural gas were formed.
   (2) The number of usable water reservoirs was reduced.
   (3) Many deposits of sand and gravel were formed.
   (4) Deposits of fertile soil were removed.

2. Large igneous boulders have been found on surface sedimentary bedrock in Syracuse, New York. Which statement best explains the presence of these boulders?
   (1) Sedimentary bedrock is composed of igneous boulders.
   (2) Boulders were transported to the area by ice.
   (3) The area has had recent volcanic activity.
   (4) The area was once part of a large mountain range.

3. Which rock material was most likely transported to its present location by a glacier?
   (1) rounded sand grains found in a river delta
   (2) rounded grains found in a sand dune
   (3) residual soil found on a flat plain
   (4) unsorted loose gravel found in hills

Base your answers to questions 4 through 8 on the diagram to the right. The diagram represents a profile of a mountain glacier in the northern United States.



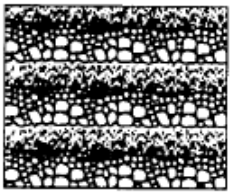
4. The downhill movement of mountain glaciers such as the one shown in the diagram is primarily caused by
   (1) evaporation of ice directly from the glacier
   (2) snow blowing across the top of the glacier
   (3) the force of gravity pulling on the glacier
   (4) water flowing over the glacier

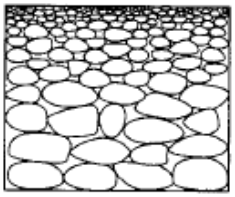
5. The velocity of the ice movement is primarily controlled by the
   (1) Slope of the bedrock surface
   (2) Amount of sediment at the terminal moraine
   (3) Length of the glacier
   (4) Size of the sediment transported by the glacier

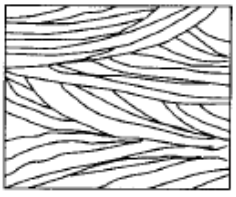
6. If the climate warms, causing the glacier to melt away, the region that the glacier formerly occupied will be a
   (1) U - shaped valley with polished bedrock
   (2) V - shaped valley with jagged bedrock
   (3) Flat plain with bedrock that has been metamorphosed
   (4) Deep ocean trench with bedrock that has been melted and cooled

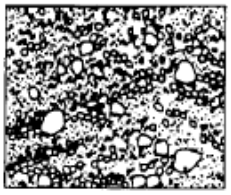
7. Over a period of years, this glacier gains more snow mass than it loses. What will be the most likely result?
   (1) The glacier will decrease in size, and the ice front will retreat.
   (2) The glacier will decrease in size, and the ice front will advance.
   (3) The glacier will increase in size, and the ice front will retreat.
   (4) The glacier will increase in size, and the ice front will advance.

8. Which cross section best represents the sediment that was transported and deposited by this glacier?

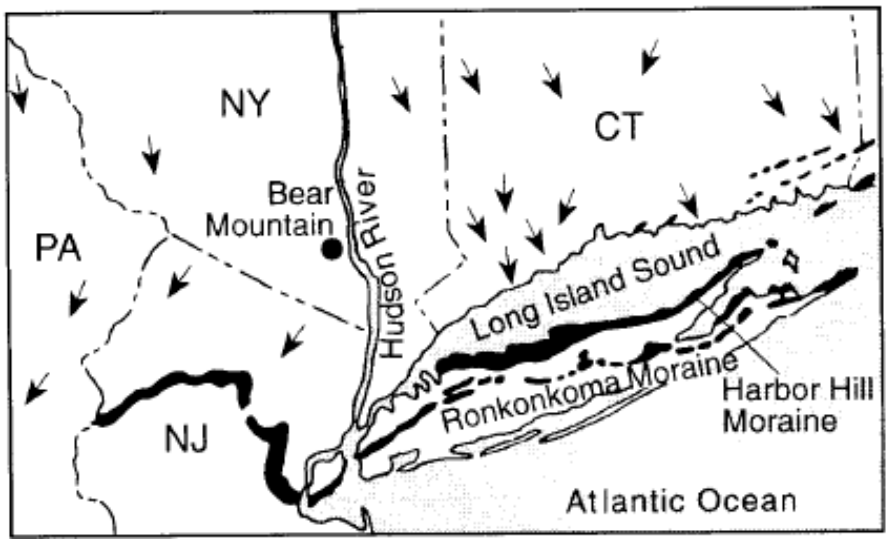

(1)


(2)


(3)


(4)

Base your answers to question 9 through 13 on the map below. The arrows on the map show the location and orientation of glacial striation on the surface bedrock. Dark shading shows the locations of large moraines (glacial deposits)



9. The striations indicate that the movement of glacial ice was toward the -
   (1) northeast and northwest
   (2) southeast and northwest
   (3) northeast and southwest
   (4) southeast and southwest

10. The Harbor Hill Moraine and the Ronkonkoma Moraine are believed to have formed during the
   (1) Jurassic Period
   (2) Pleistocene Epoch
   (3) Cambrian Period
   (4) Pennsylvanian Epoch

11. Observations of which feature would be most useful in determining the thickness of the ice sheet?
   (1) grooved bedrock near the top of Bear Mountain
   (2) glacial soils in southern Connecticut
   (3) glacial boulders at the bottom of Long Island Sound
   (4) scratches on loose rock at the mouth of the Hudson River

12. How were the striations made?
   (1) Frost action cracked the bedrock during the ice age.
   (2) Rocks at the bottom of the glaciers were dragged over the bedrock.
   (3) Particles carried by winds scratched the bedrock during the ice age.
   (4) Particles carried by glacial melt water eroded the bedrock.

13. The moraines are recognized as glacial deposits because they are composed of rock materials that are
   (1) uniform in size and layered
   (2) many different sizes and layered
   (3) uniform in size and not layered
   (4) many different sizes and not layered

14. Because of glaciation, New York State presently has soils that are best described as
   (1) deep and residual
   (2) unchanged by glaciation
   (3) rich in gemstone minerals
   (4) thin and rocky

15. The bedrock at a certain location is deeply scratched, and in some places is covered by a layer of unsorted sediment. Which erosional agent was probably responsible for these features?
(1) ocean waves (2) running water (3) wind (4) glaciers

Finger Lakes: _____

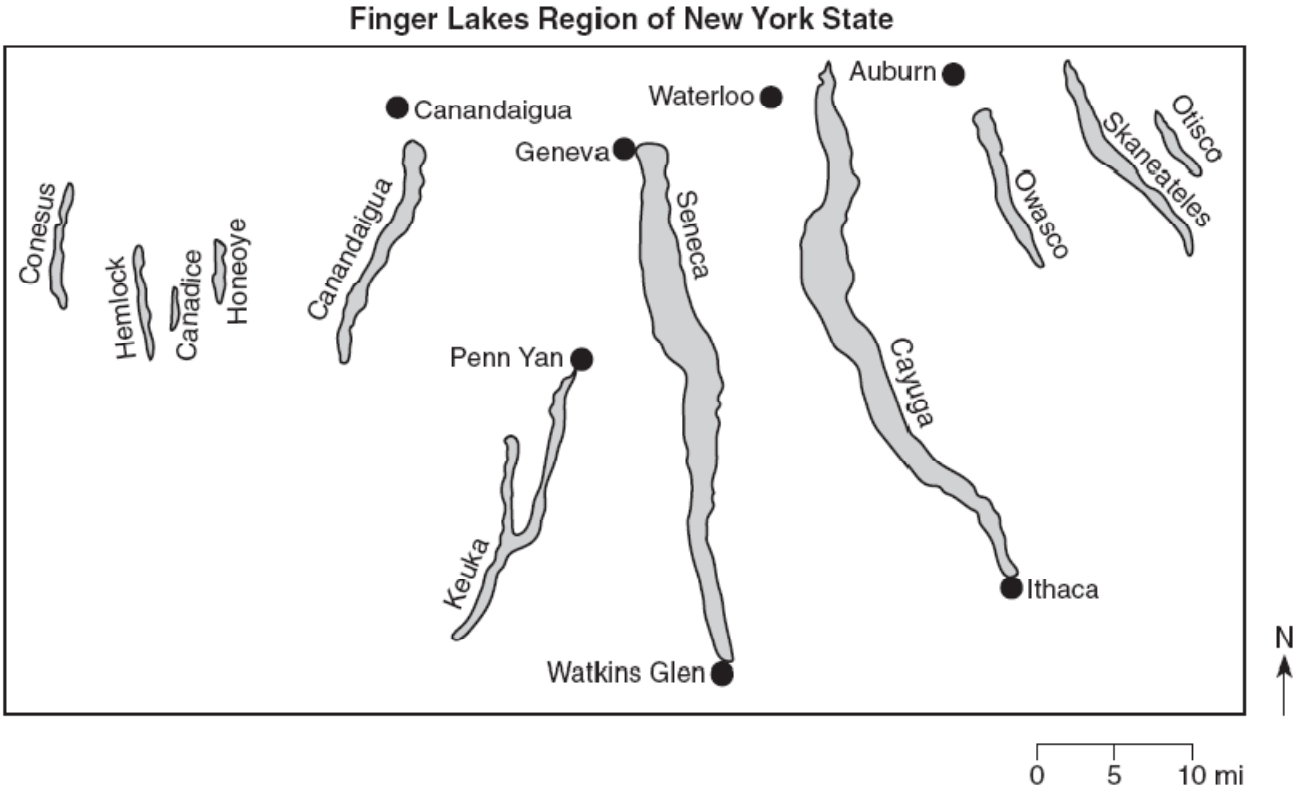
Great Lakes: _____

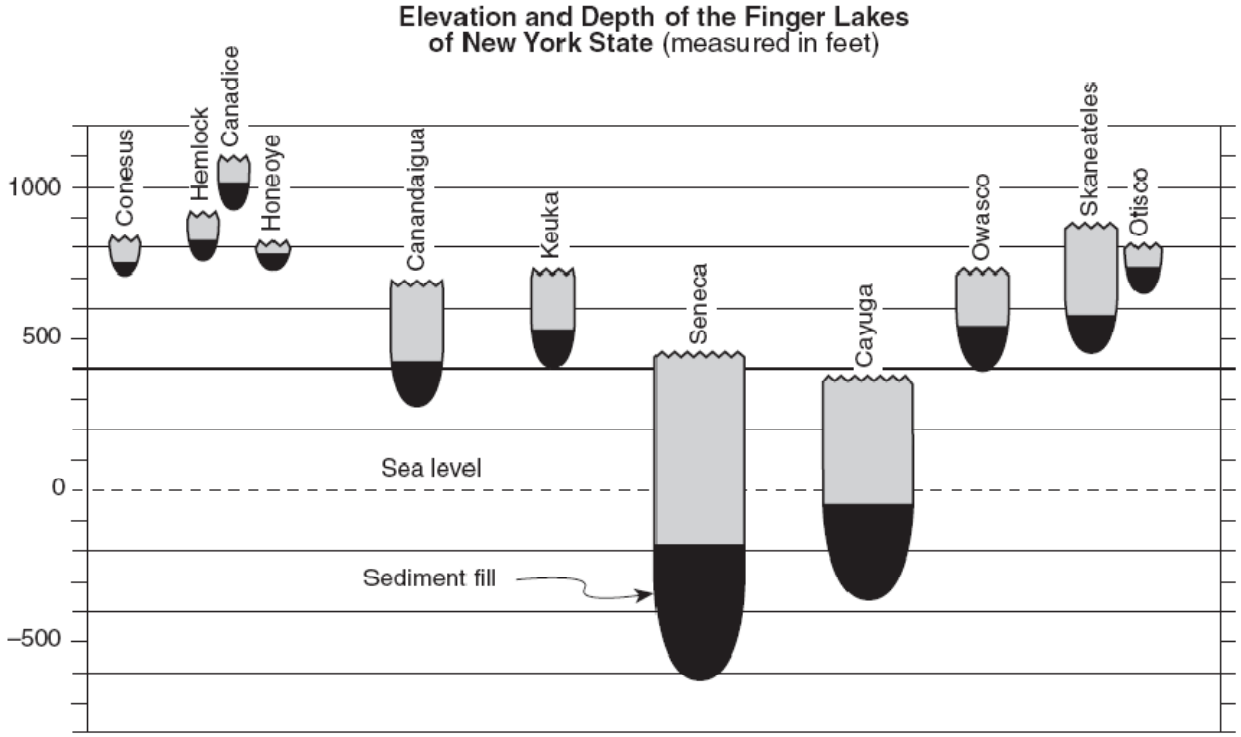
1. Which statement provides the best evidence that New York State's Finger Lakes formed as a result of continental glaciation?
(1) The lake surfaces are above sea level.
(2) The lakes fill long, narrow U-shaped valleys.
(3) The lakes are partially filled with sorted beds of sediment.
(4) The lakes are surrounded by sharp, jagged peaks and ridges.

2. What is the age of the most abundant surface bedrock in the Finger Lakes region of New York State?
(1) Cambrian (2) Pennsylvanian (3) Devonian (4) Permian

3. On a field trip 40 kilometers east of the Finger Lakes, students observed a boulder of gneiss on the surface bedrock. This observation best supports the inference that the
(1) surface sedimentary bedrock was weathered to form a boulder of gneiss
(2) surface sedimentary bedrock melted and solidified to form a boulder of gneiss
(3) gneiss boulder was transported from its original area of formation
(4) gneiss boulder was formed from sediments that were compacted and cemented together

Base your answers to questions 4 through 7 on the map and cross section of the Finger Lakes Region shown below and on your knowledge of Earth science.





4. According to the cross section, how thick from top to bottom is the sediment fill in Seneca Lake? _____

5. State *one* possible explanation for the north-south orientation of the Finger Lakes.

_____

_____

_____

6. During some winters, a few of the Finger Lakes remain unfrozen even though the land around the lakes is frozen. Explain how the specific heat of water can cause these lakes to remain unfrozen. _____

_____

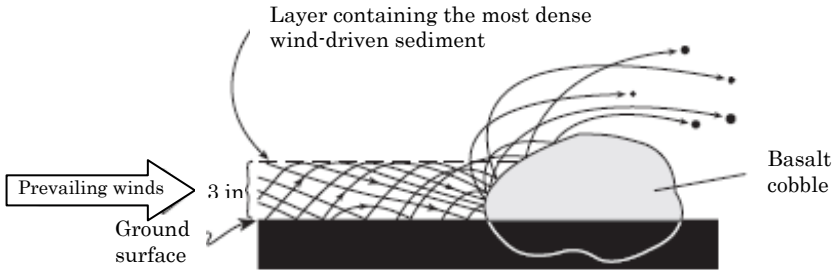
_____

7. Identify *two* processes that normally occur to form the type of surface bedrock found in the Finger Lakes Region _____ and _____

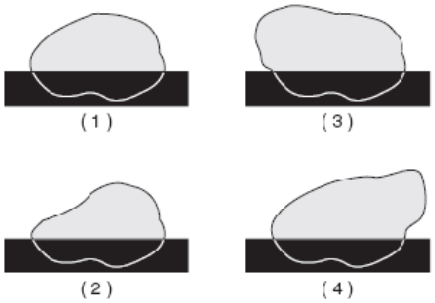
Wind Erosion

1. The particles in a sand dune deposit are small, very well sorted and have surface pits that give them a frosted appearance. This deposit most likely was transported by
(1) ocean currents (2) gravity (2) glacial ice (4) wind

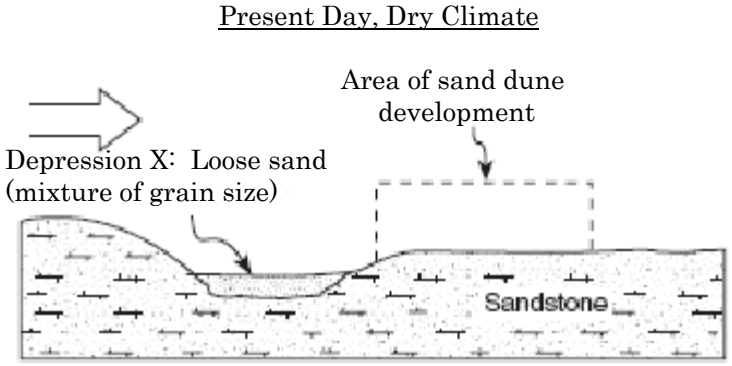
2. The cross section below shows the movement of wind-driven sand particles that strike a partly exposed basalt cobble located at the surface of a windy desert.



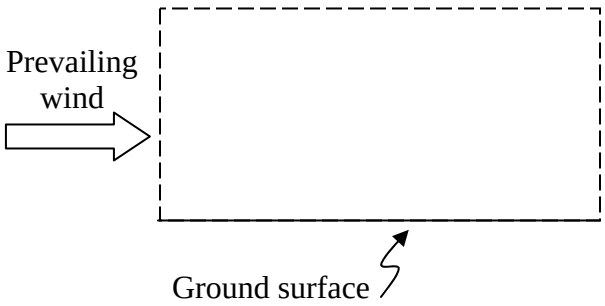
Which cross section to the right best represents the appearance of this cobble after many years of exposure to the wind-driven sand?



3. The cross section represents a part of Texas where weakly cemented sandstone is exposed at the surface. The mineral cement holding the sandstone grains together is calcite. Area *X* is a circular depression of loose sand that has been partially removed by prevailing winds. Sand dunes have developed downwind from depression *X.*



On the diagram of the area of sand dune development provided to the right, draw a sketch showing the general side view of a sand dune formed by a wind blowing in the direction indicated. Your sketch should clearly show any variations in the slope of the sides of the dune.

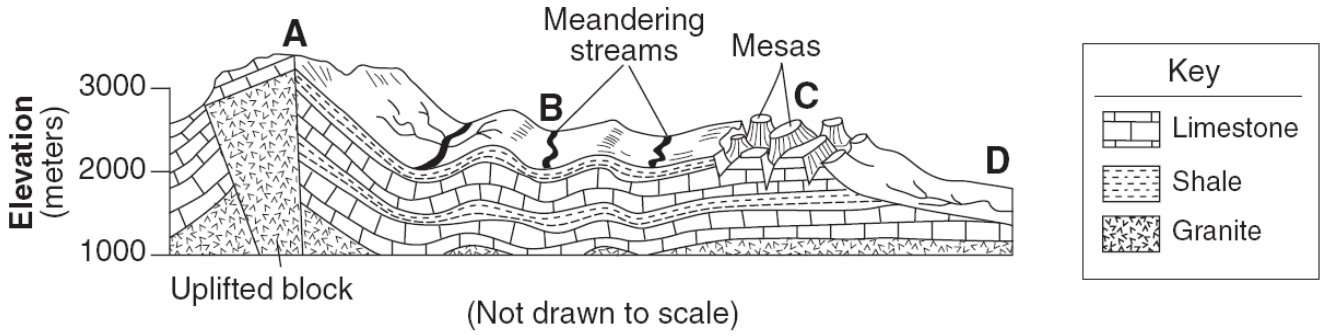


LANDSCAPE REGIONS

Landscape _____

_____

_____



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

Geologic Factors that influence landscape:

1) _____

_____

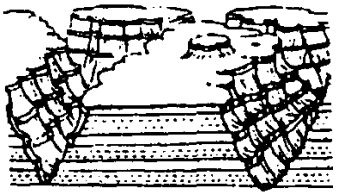
_____

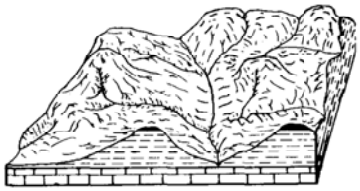
2) _____

_____

_____

3) _____





Use the map of Generalized Landscape Regions of New York State and the Generalized Bedrock Geology map found in the *Earth Science Reference Tables* to complete the tables below.

Plateau (highlands)	Plains (low lands)
Mountains	

Location	Landscape Region	Location	Landscape Region
Albany		Niagara Falls	
Binghamton		Old Forge	
Buffalo		Oswego	
Elmira		Plattsburg	
Ithaca		Riverhead	
Jamestown		Rochester	
Kingston		Slide Mountain	
Massena		Syracuse	
Mr. Marcy		Utica	
New York City		Watertown	
Connecticut		Pennsylvania	
Massachusetts		Vermont	
New Jersey		Long Island	

1. The major landscape regions of the United States are identified chiefly on the basis of
   (1) similar surface characteristics
   (2) similar climatic conditions
   (3) nearness to major mountain regions
   (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
   (2) Atlantic Coastal Plain
   (3) Adirondacks Mountains
   (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
   (2) Bedrock erosion and stream velocity
   (3) Hilltop elevations and bedrock age
   (4) Soil thickness and benchmark movement

6. Which New York State landscape region contains the oldest surface bedrock?
   (1) Erie- Ontario Lowlands
   (2) Allegheny Plateau
   (3) Adirondack Mountains
   (4) Tug Hill Plateau

7. In which type of landscape are meandering streams most likely found?
   (1) regions of waterfalls
   (2) gently sloping plains
   (3) steeply sloping hills
   (4) V-shaped valleys

8. Which evidence best indicates that a landscape has been eroded by streams?
   (1) parallel sets of U-shaped valleys
   (2) sand dunes
   (3) thick residual soil
   (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
    (2) major cities
    (3) population density
    (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: _____

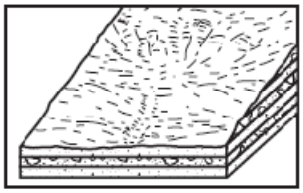
_____

_____

Drainage Patterns

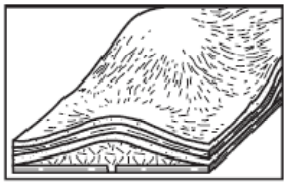
Drainage patterns-

Dendritic:

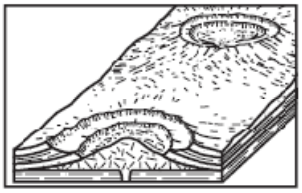


- usually on undisturbed, horizontal rock layers

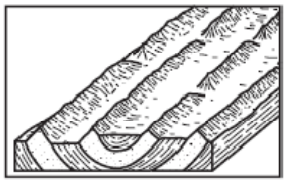
Radial:

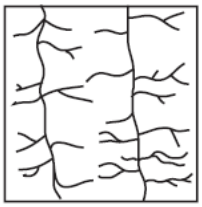


Annular:

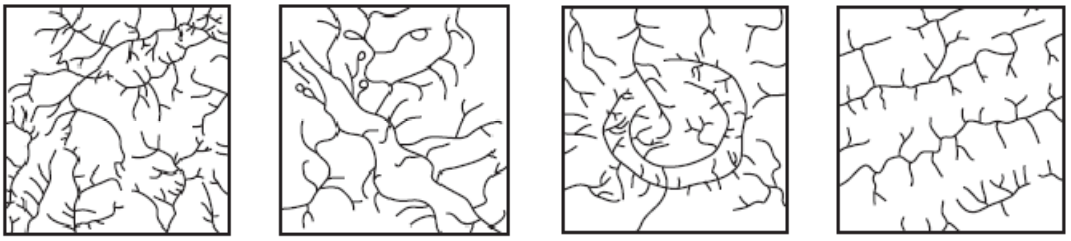


Rectangular:



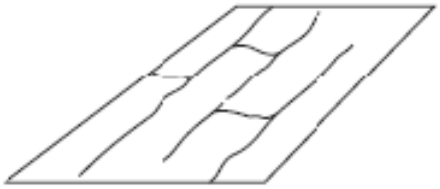


1. The cross section below shows the rock structure of a deeply eroded, domed mountain region. Which map shows the stream drainage pattern that will most likely develop as the bedrock is weathered and eroded from this igneous dome?

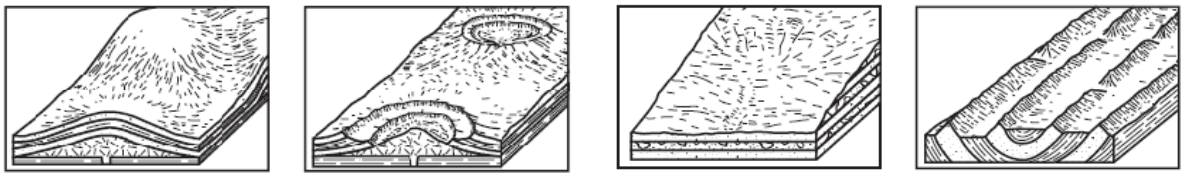


(1) (2) (3) (4)

2. The diagram below represents a map view of a stream drainage pattern.

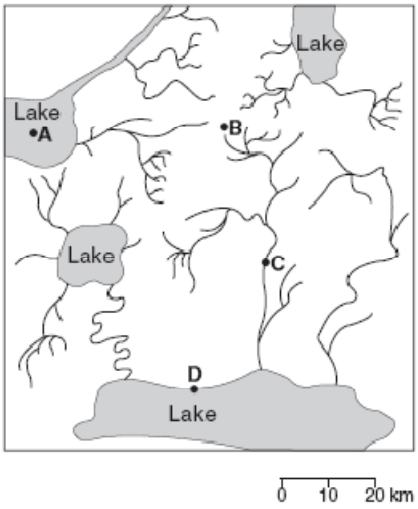


Which underlying bedrock structure most likely produced this stream drainage pattern?



(1) (2) (3) (4)

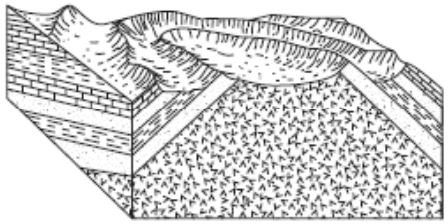
3. The map below shows the stream drainage patterns for a region of Earth's surface. Points *A, B, C,* and *D* are locations in the region.



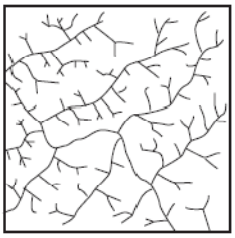
3. The highest elevation most likely exists at point

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

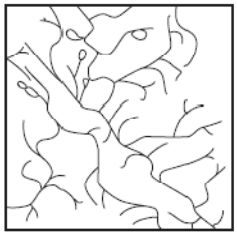
4. The block diagram below represents a deeply eroded dome.



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

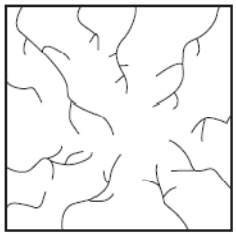


(1)



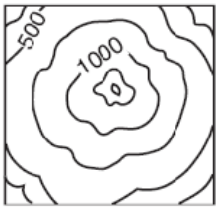
(2)

(3)



(4)

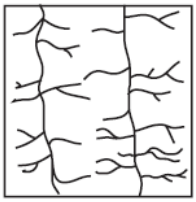
5. The topographic map to the right shows a particular landscape. Which map best represents the stream drainage pattern for this landscape?



(1)

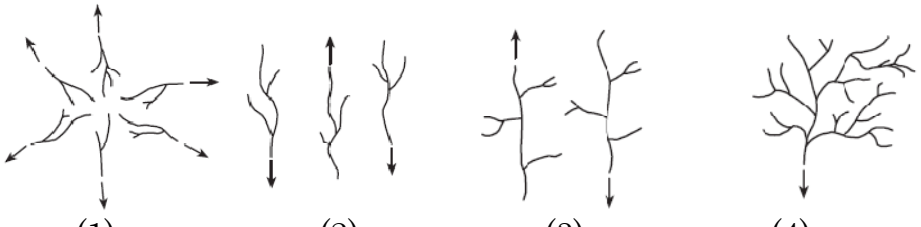
(2)

(3)



(4)

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

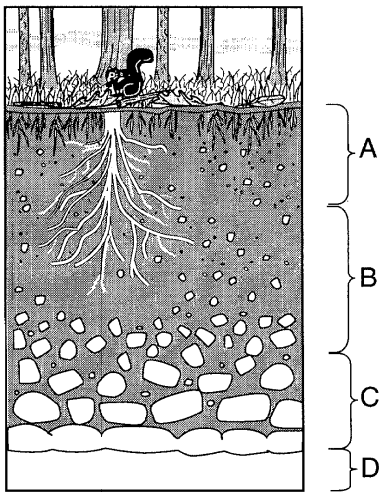


(1) (2) (3) (4)

Unit Review

1. Particles of soil often differ greatly from the underlying bedrock in color, mineral composition, and organic content. Which conclusion about these soil particles is best made from this evidence?
   (1) They are residual sediments.
   (2) They are uniformly large-grained.
   (3) They are transported sediments.
   (4) They are soluble in water.

2. The diagram below shows a soil profile formed in an area of granite bedrock. Four different soil horizons., *A, B, C* and *D* are shown.

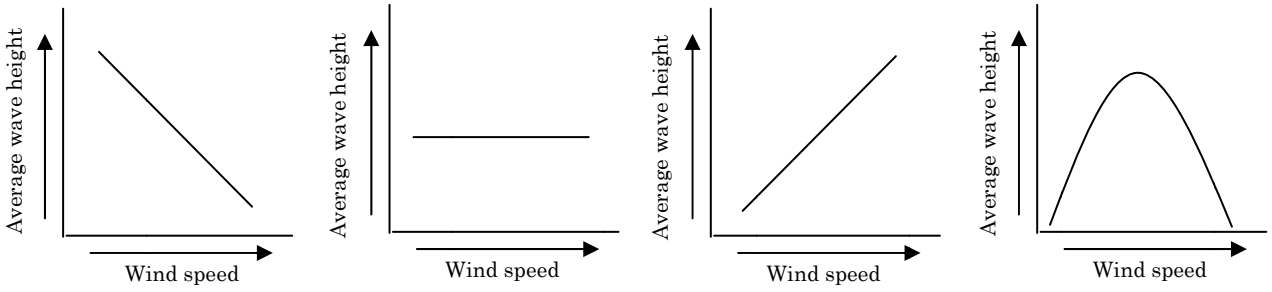


Which soil horizon contains the greatest amount of material formed by biological activity?

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

3. Which characteristic of a particle would usually result in the longest settling time for the particle in calm water?
   (1) low density and round shape
   (2) high density and round shape
   (3) low density and flat shape
   (4) high density and flat shape

4. Which graph best shows the relationship between wind speed and the average height of ocean waves formed by the wind?



(1) (2) (3) (4)

5. Which particles are the last to settle as a river's velocity decreases?
   (1) flattened clay particles
   (2) rounded sand particles
   (3) rounded silt particles
   (4) flattened pebbles

6. The chart to the right indicates the densities of four different minerals. If spheres 5 millimeters in diameter of these four minerals are dropped at the same time into a large tube filled with water, which would settle to the bottom first?
(1) calcite (3) diamond
(2) hematite (4) quartz

Mineral	Density (g/cm^3)
Calcite	2.8
Diamond	3.5
Hematite	5.3
Quartz	2.7

7. A glass sphere and a lead sphere have the same volume. Each sphere is dropped into a container of water. Which statement best explains why the lead sphere settles faster?
(1) The lead sphere has a higher density.
(2) The glass sphere has a smoother surface.
(3) The lead sphere takes up less space.
(4) The glass sphere has more surface area.

8. The chart to the right shows the results of an activity in which three samples of copper (A, B, and C) of equal mass were timed as they settled to the bottom of a column of water. The differences in the settling time of the three samples are probably due to differences in their
(1) density (2) composition (3) color (4) shape

Sample A	Sample B	Sample C
13.10 sec	13.75 sec	13.50 sec

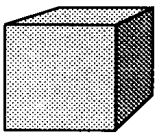
9. When particles of uniform shape and density are dropped into a calm lake, silt will settle faster than
(1) sand (2) clay (3) cobbles (4) pebbles

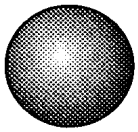
10. Where is the most deposition likely to occur?
(1) on the side of a sand dune facing the wind
(2) at the mouth of a river, where it enters an ocean
(3) at a site where glacial ice scrapes bedrock
(4) at the top of a steep slope in a streambed

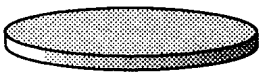
11. Four samples of aluminum, A, B, C, and D, have identical volumes and densities, but different shapes. Each piece is dropped into a long tube filled with water. The time each sample takes to settle to the bottom of the tube s shown in the table to the right.

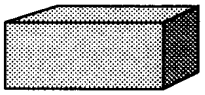
Sample	Time to Settle (sec)
A	2.5
B	3.7
C	4.0
D	5.2

Which diagram most likely represents the shape of sample A?

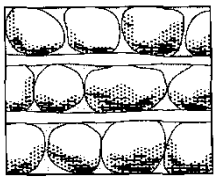

(1)


(2)


(3)

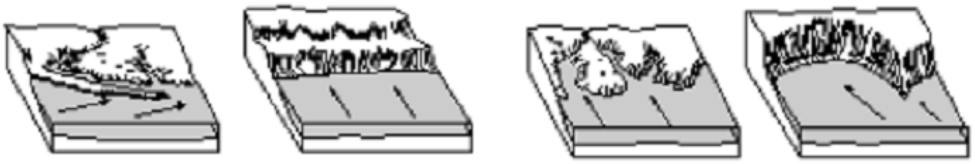

(4)

12. The diagram below shows cobbles used in the construction of the walls of a cobblestone building. The shape and size of the cobbles suggest that they were collected from


(Not actual size)

(1) the channel of a fast-flowing stream
(2) volcanic ash deposits
(3) a desert sand dune
(4) the base of a cliff

13. The diagrams below represent landscape features found along the seacoast. The arrows show ocean-wave direction. Which shoreline has been shaped more by deposition than by erosion?



(1) (2) (3) (4)

14. The surface bedrock of the Tug Hill Plateau landscape region is mostly composed of
(1) igneous rock of Silurian age
(2) sediments of Tertiary age
(3) metamorphic rock of Precambrian age
(4) sedimentary rock of Ordovican Age

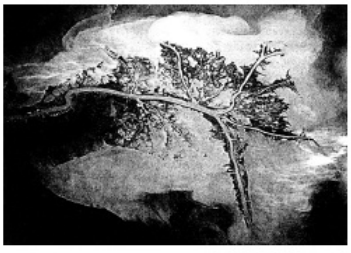
15. The diagram below shows a sedimentary rock sample.


(Shown actual size)

Which agent of erosion was most likely responsible for shaping the particles forming this rock?
(1) mass movement
(2) wind
(3) glacial ice
(4) running water

16. The occurrence of parallel scratches on bedrock in a U-shaped valley indicates that the area has most likely been eroded by
(1) a glacier (2) waves (3) a stream (4) wind

17. The satellite photograph below shows a geologic feature composed of silt, sand, and clay.



The geologic feature shown in the photograph was primarily deposited by which agent of erosion?

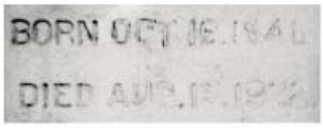
(1) glaciers
(2) wind
(3) wave action
(4) running water

18. In which landscape region is Ithaca, New York located?
(1) Allegheny Plateau
(2) Adirondacks Highlands
(3) The Catskills
(4) St. Lawrence Lowlands

19. Match the agent of erosion that corresponds to the identifying characteristic surface features described below.

Agent of Erosion	Surface Feature Formed
_____ Glaciers	A. Beach, sandbars, barrier islands
_____ Mass movement	B. Loss of topsoil, dunes
_____ Running water (streams)	C. U-shaped valley, moraines, drumlins
_____ Waves	D. V-shaped valley, deltas, meanders
_____ Wind	E. Landslides, slumps

20. The two photographs to the right show dates on tombstones found in a cemetery in St. Remy, New York. The tombstones were 5 meters apart and both faced north. Tombstone *A* had dates cut into the rock in 1922. Tombstone *B* had dates cut into the rock in 1892.



Tombstone A (1922)

Tombstone B (1892)

Which statement best explains why the dates are more difficult to read on tombstone *A* than on tombstone *B*?

(1) Tombstone *A* was exposed to less acid rain than tombstone *B*.
(2) Tombstone *A* has undergone a longer period of weathering than tombstone *B*.
(3) Tombstone *A* experienced cooler temperatures than tombstone *B*.
(4) Tombstone *A* is composed of minerals less resistant to weathering than tombstone *B*.

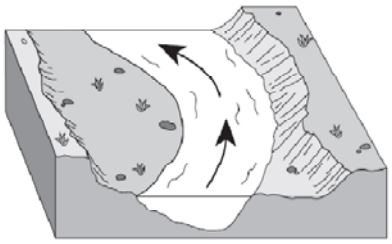
21. The Adirondacks Mountains landscape region was formed primarily by
(1) Changes in the water levels of the Great Lakes
(2) Erosion by the Hudson and Mohawk Rivers
(3) Mountain building and erosion
(4) Wind erosion in an arid climate

22. What does Plattsburgh, New York and Massena, New York have in common?
(1) They are located in the same landscape region.
(2) They have the same latitude.
(3) They have the same longitude.
(4) Their surface bedrock formed during the same geologic time period.

23. 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

24. Which agent of erosion is mainly responsible for the formation of the depressions occupied by both the kettle lakes and finger lakes found in New York State?
(1) wind (2) streams (3) waves (4) glaciers

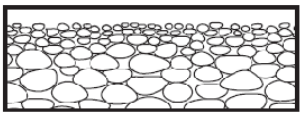
25. The diagram below shows a section of a meander in a stream. The arrows show the direction of stream flow.



The streambank on the outside of this meander is steeper than the streambank on the inside of this meander because the water on the outside of this meander is moving

(1) slower, causing deposition
(2) faster, causing deposition
(3) slower, causing erosion
(4) faster, causing erosion

26. The cross section below shows a profile of a sediment deposit.

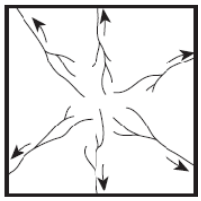


(Drawn to scale)

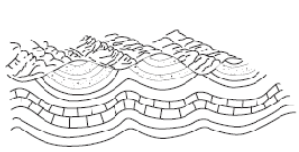
The pattern of sediment size shown indicates that these sediments were most likely deposited within a

(1) landslide (2) moraine (3) drumlin (4) delta

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

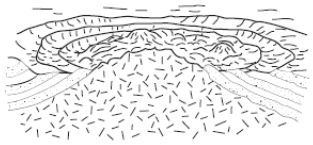


On which landscape region did this drainage pattern most likely develop?

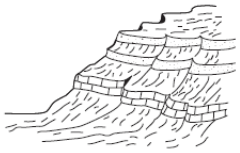


(1)

(2)



(3)

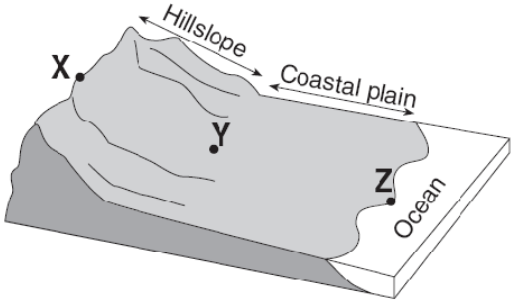


(4)

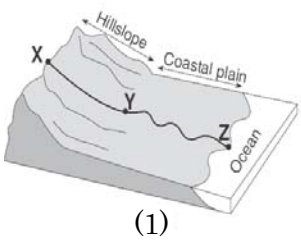
28. A stream flowing at a velocity of 75 centimeters per second can transport
(1) clay, only
(2) pebbles, only
(3) pebbles, sand, silt, and clay, only
(4) boulders, cobbles, pebbles, sand, silt, and clay

29. What will be the most probable arrangement of rock particles deposited directly by a glacier?
(1) sorted and layered
(2) unsorted and layered
(3) sorted and not layered
(4) unsorted and not layered

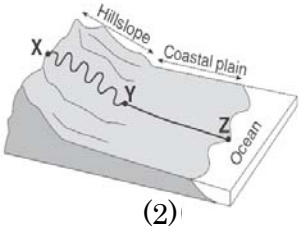
Base your answers to questions 30 through 32 on the diagram below, which shows a coastal region in which the land slopes toward the ocean. Point *X* is near the top of the hill, point *Y* is at the base of the hill, and point *Z* is a location at sea level. The same type of surface bedrock underlies this entire region. A stream flows from point *X* through point *Y* to point *Z*. This stream is not shown in the diagram.



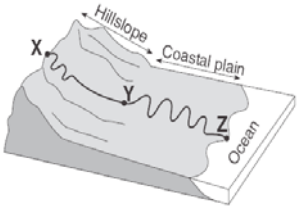
30. Which diagram best shows the most probable path of the stream flowing from point *X* to point *Z*?



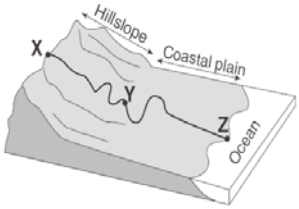
(1)



(2)



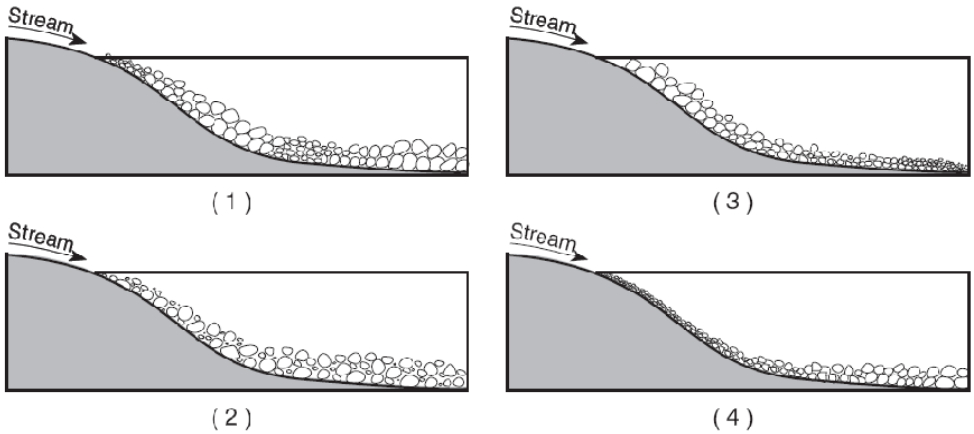
(3)



(4)

31. Compared to the stream velocity between point *X* and point *Y*, the stream velocity between point *Y* and point *Z* is most likely
    (1) greater, since the slope of the land decreases
    (2) greater, since the slope of the land increases
    (3) less, since the slope of the land decreases
    (4) less, since the slope of the land increases

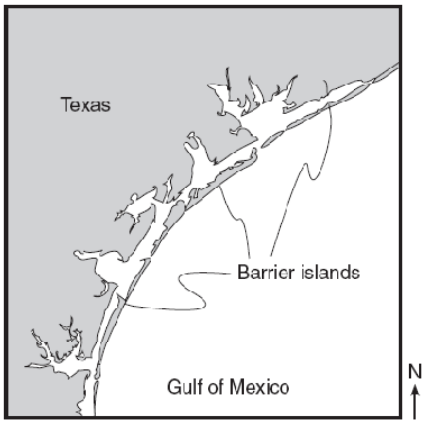
32. Which cross section best shows the pattern of sediments deposited by the stream as it enters the ocean near point *Z*?



33. The map to the right shows barrier islands in the ocean along the coast of Texas.

Which agent of erosion most likely formed these barrier islands?

(1) mass movement
(2) wave action
(3) streams
(4) glaciers

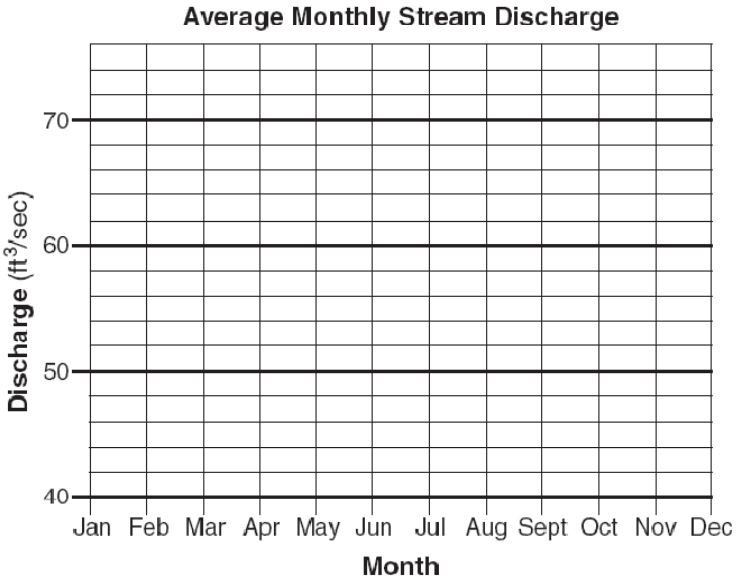


Base your answers to questions 34 through 36 on the data table below and on your knowledge of Earth science. The data table shows the average monthly discharge, in cubic feet per second, for a stream in New York State.

Data Table

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Discharge (ft^3/sec)	48	52	59	66	62	70	72	59	55	42	47	53

34. On the grid to the right, plot with an **X** the average stream discharge for *each* month shown in the data table. Connect the **X**s with a line.



35. State the relationship between this stream's discharge and the amount of suspended sediment that can be carried by this stream.

_____

_____

_____

_____

_____

_____

_____

36. Explain *one* possible reason why this stream's discharge in April is usually greater than this stream's discharge in January.

_____

_____

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