

Your Name _____

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:

- 2.1s Weathering is the physical and chemical breakdown of rocks at or near Earth's surface. Soils are the result of weathering and biological activity over long periods of time.
- 2.1t Natural agents of erosion, generally driven by gravity, remove, transport, and deposit weathered rock particles. Each agent of erosion produces distinctive changes in the material that it transports and creates characteristic surface features and landscapes. In certain erosional situations, loss of property, personal injury, and loss of life can be reduced by effective emergency preparedness.
- 2.1u The natural agents of erosion include:
 - *Wave Action:* Erosion and deposition cause changes in shoreline features, including beaches, sandbars, and barrier islands. Wave action rounds sediments as a result of abrasion. Waves approaching a shoreline move sand parallel to the shore within the zone of breaking waves.
 - *Mass Movement:* Earth materials move downslope under the influence of gravity.
- 2.1v Patterns of deposition result from a loss of energy within the transporting system and are influenced by the size, shape, and density of the transported particles. Sediment deposits may be sorted or unsorted.



Associated Press

Granite profile of the Old Man of the Mountain is shown before the collapse, and after

Mini Lesson 1: Weathering

Weathering is the breakdown of rock material. The first type we will investigate is physical (mechanical) weathering. During physical weathering the rocks are simply broken up into fragments. It does not change the composition of the rock but it does create more *surface area*. The dominant climate condition for physical weathering is cold and moist. Chemical weathering occurs on the surface of rocks and changes the composition of the material. This causes the rocks to weaken and makes it easier for them to break apart. Chemical weathering dominates in warm moist climates and occurs on the surface of the rocks. Usually both types of weathering work together but the dominant type depends on the climate of the area.

Need to know:

1. What is weathering? _____
2. What is another name for physical weathering? _____
3. What does physical weathering do? _____
4. Does physical weathering change the composition of the rock? _____
5. What does physical weathering create? _____
6. What are the dominant climate conditions for physical weathering? _____ and _____
7. What does chemical weathering do? _____
8. What does chemical weathering cause? _____
9. Where on the rock does chemical weathering occur? _____
10. What are the dominant climate conditions for chemical weathering? _____ and _____
11. Explain how physical weathering helps chemical weathering occur. **** Use a complete sentence.**

12. Explain how chemical weathering helps physical weathering occur. **** Use a complete sentence.**

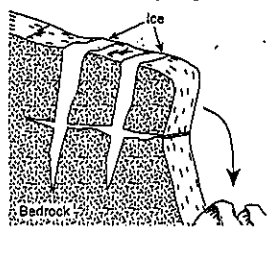
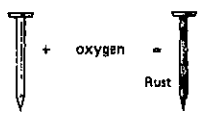
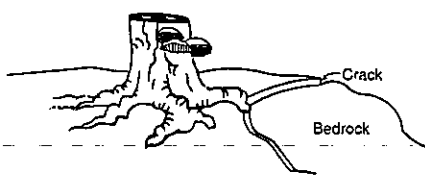
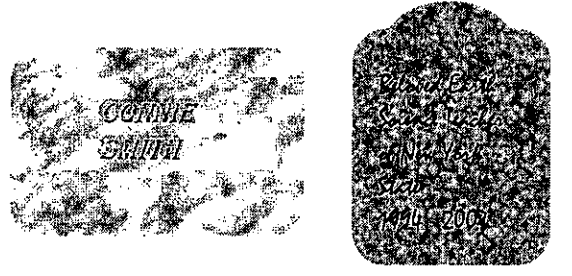
13. What climate factor aids in both chemical and physical weathering? _____

Show what you know:

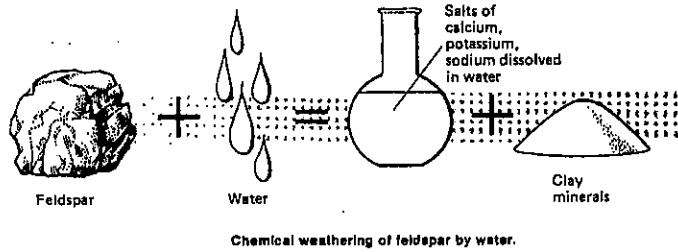
Weathering

The information below gives a short description of different types of weathering. Read each description very carefully. Determine if the type of weathering listed is physical weathering or chemical weathering. Write the word "physical" or "chemical" in the space provided, next to each description.

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

<p>Frost Wedging</p> 	<ul style="list-style-type: none"> • occurs in climates with freezing and thawing temperatures • water gets into cracks and crevases of rock • expands when it freezes • causes the cracks to get bigger • pieces break off • example: pot holes
<p>Oxidation</p> 	<ul style="list-style-type: none"> • iron atoms combine with oxygen to form iron oxide (rust)
<p>Exfoliation</p>	<ul style="list-style-type: none"> • surface of the rock "peels" off • unloading - caused by uplift and exposure of rock that was once deep underground • decreases the pressure on the rocks
<p>Root Action</p> 	<ul style="list-style-type: none"> • roots grow into and under rocks • roots pry the rock apart • causes cracks to get bigger • example: cracks in the sidewalk
<p>Carbonation</p> <ul style="list-style-type: none"> • carbonic acid in rain causes minerals to dissolve • ex. marble gravestones 	

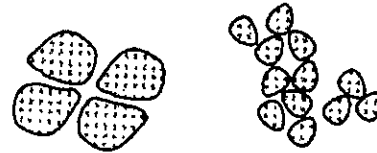
Hydration



- water weakens the rock and the rock crumbles
- ex. feldspar becomes clay

Abrasion

- bumping and breaking up of rocks as they collide
- rocks become smaller, smoother and rounder

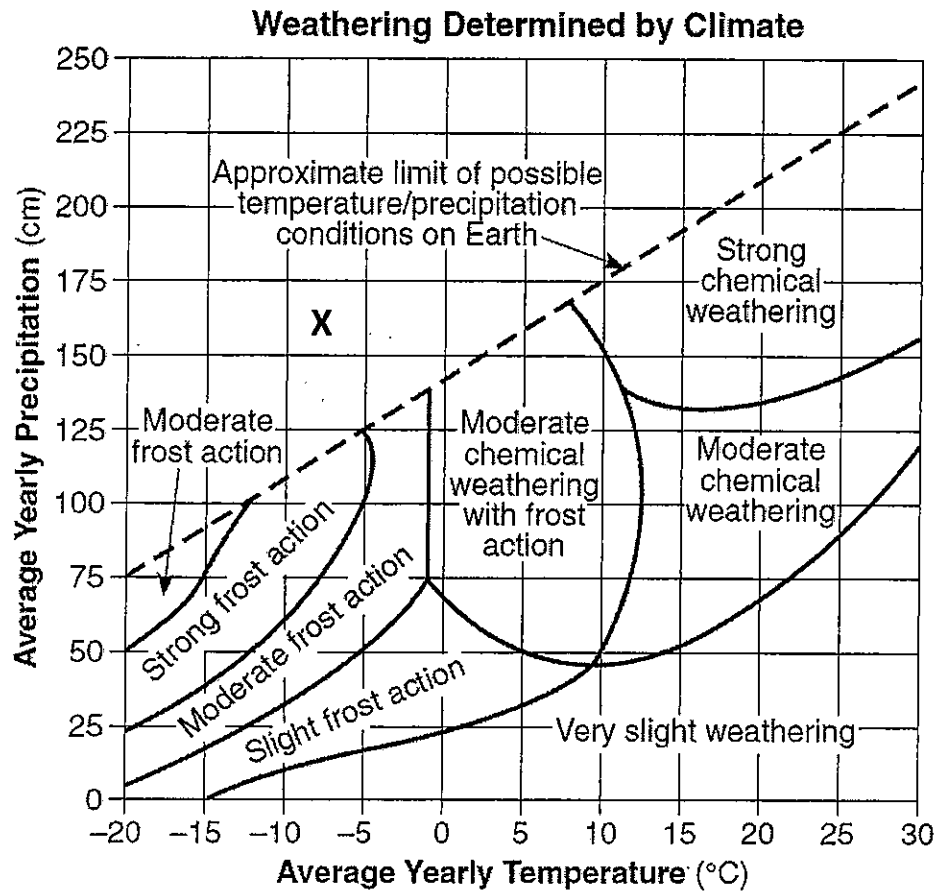


The rate at which rocks weather is dependent on three basic factors: time of exposure, composition of the rock material and climate.

- a. Time of exposure refers to the amount of time the rocks surface is exposed to the atmosphere and hydrosphere. The longer the rock is exposed the elements, the *(greater / less)* the weathering that takes place.
- b. Composition of rock material refers to what type of rock it is, the minerals and elements that make up or hold the rock together. For each set of rocks below, circle the least resistant rock and give an explanation to why you know that rock is weaker than the other.

Rock name	Why is that rock less resistant to the other?
Limestone or Granite	
Marble or Pegmatite	
Marble or Gneiss	
Shale or Diorite	

c. Climate: Base your answers to questions 1 through 4 on the diagram below, which represents the dominant type of weathering for various climatic conditions.



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

2. 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.

3. What type of weathering dominates when the mean annual temperature of -5 °C and a mean annual precipitation of 60 cm?

(1) moderate frost action	(3) slight frost action
(2) moderate chemical weathering	(4) very slight weathering

- ___4. 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.

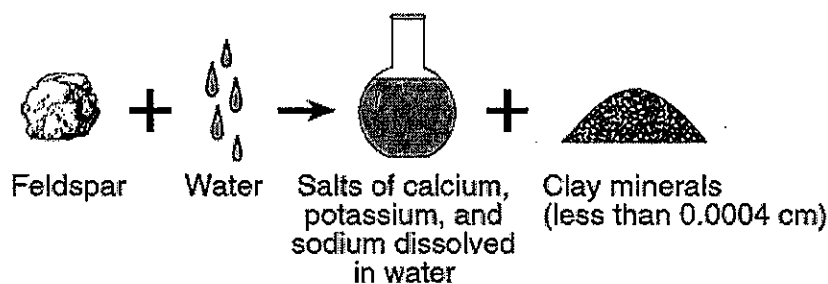
- ___5. Landscapes will undergo the most chemical weathering if the climate is
- (1) cool and dry
 - (2) cool and wet
 - (3) warm and dry
 - (4) warm and wet

- ___6. Which factor has the greatest influence on the weathering rate of Earth's surface bedrock?
- (1) local air pressure
 - (2) angle of insolation
 - (3) age of the bedrock
 - (4) regional climate

- ___7. Which activity demonstrates chemical weathering?
- (1) freezing of water in the cracks of a sandstone sidewalk
 - (2) abrasion of a streambed by tumbling rocks
 - (3) grinding of talc into a powder
 - (4) dissolving of limestone by acid rain

- ___8. What is the main factor that causes the bedrock to weather at different rates?
- (1) elevation above sea level
 - (2) mineral composition
 - (3) age of rock layers
 - (4) environment of formation

- ___9. The diagram below represents a naturally occurring geologic process.



Which process is best illustrated by the diagram?

- (1) cementation
 - (2) erosion
 - (3) metamorphism
 - (4) weathering
- ___10. Which geologic feature is caused primarily by chemical weathering?
- (1) large caves in limestone bedrock
 - (2) a pattern of parallel cracks in a granite mountain
 - (3) blocks of basalt at the base of a steep slope
 - (4) the smooth, polished surface of a rock in a dry, sandy area

Mini Lesson 2: Erosion and Deposition

Erosion is the transportation of weathered material. Gravity is the primary agent of erosion that can work alone or in combination with other agents. Erosion by gravity alone is called mass movement. It is the process whereby sediments move down hill. The term "landslide" is sometimes used when referring to mass movement. Other agents of erosion include running water, glaciers, wave-action, and wind. Deposition is the process by which sediment is deposited. The same agents that pick up and move sediments are the same agents that drop sediments out.

Factors that affect erosion and deposition are velocity of the transportation medium (the agent moving the sediment), size, shape, and density of the material.

Need to know:

1. What is erosion? _____
2. What is the primary agent of erosion? _____
3. What is erosion by gravity called? _____
4. List the four other agents of erosion mentioned in the passage. _____ , _____ , _____ , _____
5. What is deposition? _____

Think

Circle the correct choice that describes how the factors listed above in the passage affect erosion and deposition.

6. The faster the velocity of the medium the [more or less] sediment it can carry.
7. As the velocity of the medium slows down [more or less] sediment is deposited.
8. The larger the particle size the [easier or more difficult] it is moved.
9. The larger the particle size the [faster or slower] it is deposited.
10. The rounder the shape the [easier or more difficult] it is moved.
11. The rounder the shape the [faster or slower] it is deposited.
12. The more dense the particle size the [easier or more difficult] it is moved.
13. The more dense the particle size the [faster or slower] it is deposited.

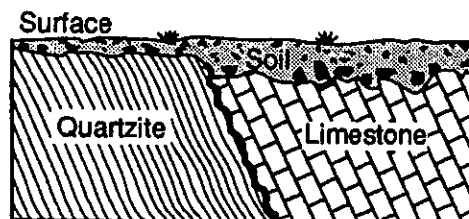
Soil Questions

Regents Questions:

____ 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?



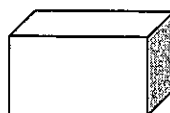
- (1) The quartzite formed from molten magma
- (2) The limestone is thicker than the quartzite.
- (3) The quartzite is older than the limestone.
- (4) The limestone is less resistant to weathering than the quartzite.

____ 3. Soil horizons develop as a result of

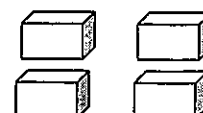
- | | |
|-----------------------------------|--|
| (1) evaporation and transpiration | (3) weathering and biological activity |
| (2) compacting and cementing | (4) faulting and folding |

____ 4. 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



Sample A



Sample B

- (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

____ 5. 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 | (3) higher atmospheric pressure in the summer |
| (2) lower humidity in the winter | (4) greater precipitation in the summer |

____ 6. The surface bedrock of a region of eastern New York State is shale. Which statement best explains why the soil that covers the shale in this region contains abundant garnet and gneiss pebbles?

- (1) Volcanic lava flowed over the shale bedrock.
- (2) A meteor impact scattered garnet and gneiss pebbles over the area.
- (3) The soil consists of rock materials transported to this region by agents of erosion.
- (4) The soil formed from the chemical and physical weathering of shale.

Transportation

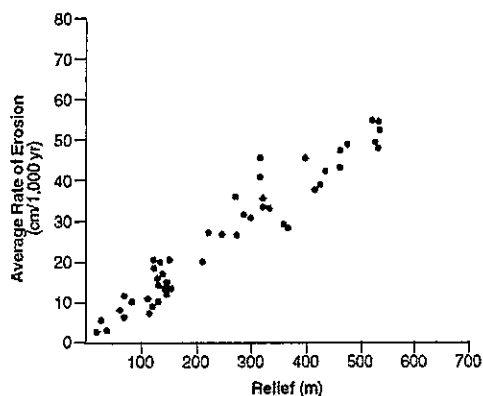
Questions

Regents Questions:

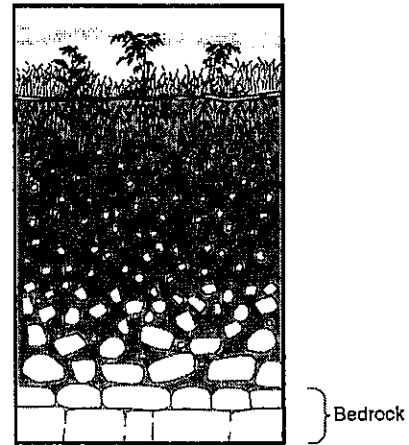
- _____ 1. On Earth's surface, transported materials are more common than residual materials. This condition is mainly the result of
(1) recrystallization (2) erosion (3) folding (4) subduction
- _____ 2. The composition of sediments on Earth's surface usually is quite different from the composition of the underlying bedrock. This observation suggests that most
(1) bedrock is formed from sediments (3) bedrock is resistant to weathering
(2) sediments are residual (4) sediments have been transported
- _____ 3. Most of the surface materials in New York State can be classified as
(1) igneous rock (3) metamorphic rocks
(2) coastal plain deposits (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 (3) burial and cementation
(2) weathering and erosion (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.
- _____ 7. Each dot on the graph below shows the result of separate scientific studies of the relationship between the rates of erosion in regions of different relief. Relief is the local difference between the highest and the lowest elevations.

The results of these combined studies indicate that with each 100-meter increase in relief, the rate of erosion generally

- (1) decreases at a rate of 10 cm/1,000 years
(2) decreases at a rate of 20 cm/1,000 years
(3) increases at a rate of 10 cm/1,000 years
(4) increases at a rate of 20 cm/1,000 years



- ___7. The cross section to the right shows a soil profile. This soil was formed primarily by
- (1) erosion by glaciers
 - (2) erosion by running water
 - (3) capillarity and human activity
 - (4) weathering and biological activity



- ___8. Which substance has the greatest effect on the rate of weathering of rock?
- (1) nitrogen
 - (2) water
 - (3) hydrogen
 - (4) argon

- ___9. 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

- ___10. Solid bedrock is changed to soil primarily by the process of
- (1) erosion
 - (2) weathering
 - (3) infiltration
 - (4) transpiration

- ___11. 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

- ___12. How does chemical weathering help to increase the amount of physical weathering?
- (1) creates more surface area
 - (2) weakens the rock
 - (3) by exfoliation
 - (4) frost wedging

- ___13. 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

- ___14. 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

- ___15. 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

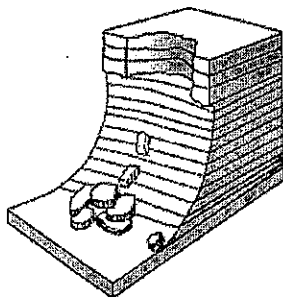
Mini Lesson 3: Erosion by Gravity

Landslide is a general term that includes rock falls, slides and flows. Any of these landslides can occur when the angle of the slope, type of soil or rock and amount of moisture are in the correct combination. They can happen abruptly or over a long period of time. Landslides can be brought on by excessive rain, earthquakes and even human impact. Avalanches are also caused by gravity and are considered a form of erosion as well.

Mass wasting:

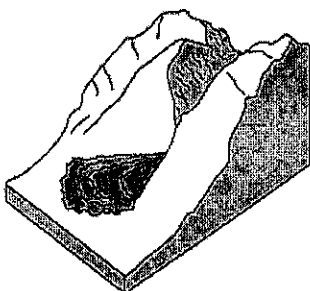
- The steeper the slope the greater the mass wasting
- Weak sediments and fractured rocks increase the chance of mass wasting
- Water loosens the rocks and sediments to allow movement to occur easily

Rock falls



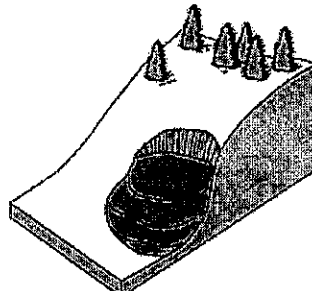
Rapid falling of pieces of rock from a cliff or steep slope

Mud flow



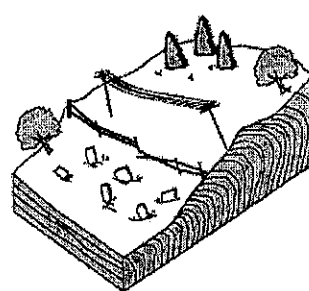
Downward flow of fine particles (mud) and large amounts of water

Debris flow



Rapid downslope flow of debris

Soil Creep



gradual downhill movement of soil

Reading Review

1. What does the term landslide include? _____

2. What can cause a landslide? _____

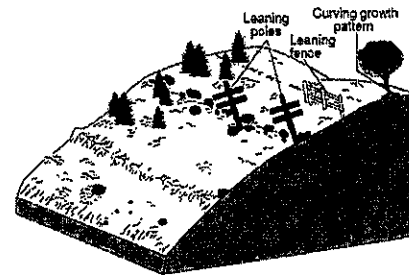
3. List the three things that make mass wasting easier.
 - (a) _____
 - (b) _____
 - (c) _____

Regents Questions:

_____ 1. The diagram below shows the surface features of a landscape.

Based on the features shown, which erosional agent had the greatest effect on tree growth and the structures that humans have built on this landscape?

- (1) running water (3) prevailing wind
- (2) moving ice (4) mass movement



_____ 2. 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

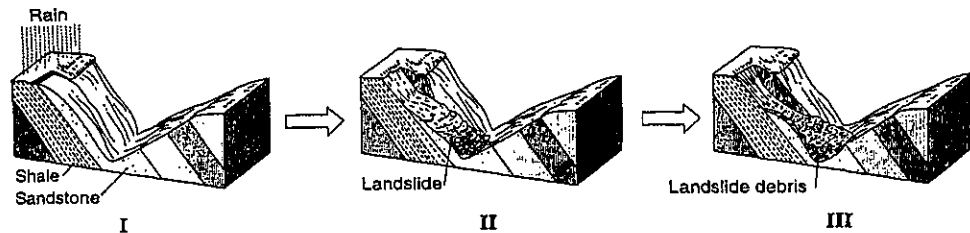
_____ 3. Which erosional force acts alone to produce avalanches and landslides?

- (1) gravity (2) running water (3) winds (4) sea waves

_____ 4. Which movement of earth materials is gravity NOT the main force?

- (1) sediments flowing in a river (3) snow tumbling in an avalanche
- (2) boulders carried by a glacier (4) moisture evaporating from an ocean

_____ 5. 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

_____ 6. Glacial movement is caused primarily by

- (1) Earth's rotation (2) gravity (3) erosion (4) global winds

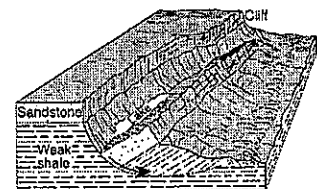
_____ 7. The primary force responsible for the flow of water in a stream is

- (1) solar energy (2) magnetic fields (3) wind (4) gravity

_____ 8. The block diagram below shows a displacement of rock layers.

Which process describes the downward sliding of the rock material?

- (1) tidal changes (3) mass movement
- (2) glacial erosion (4) lava flow



Mini Lesson 4: Wave Action

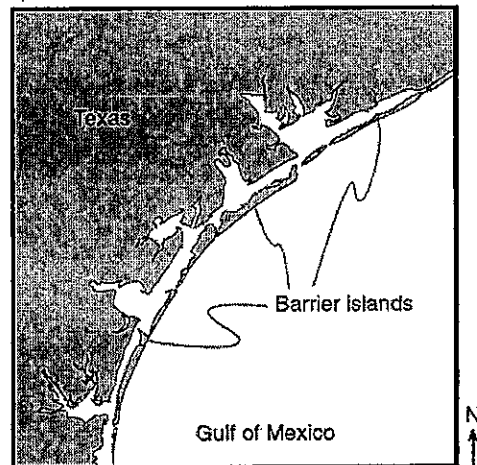
Ocean waves are the driving force that continually shape and reshape our coastlines. They are caused by surface winds blowing across the water. Continuous abrasion cause the sediment to become more round. The waves help to weather and erode continental and oceanic rocks that eventually create beaches. The shores are protected by sand dunes and barrier islands. Barrier islands are long and narrow deposits of sediments that run parallel to the main land. They are built up by the actions of waves, currents and wind that distribute the sand which protect the coast from erosion. Ridges of sand, called sandbars, form along a shore by the action of waves and currents. They protect barrier islands from erosion. As waves approach the coastline they move sand parallel along the shore.

Need to know:

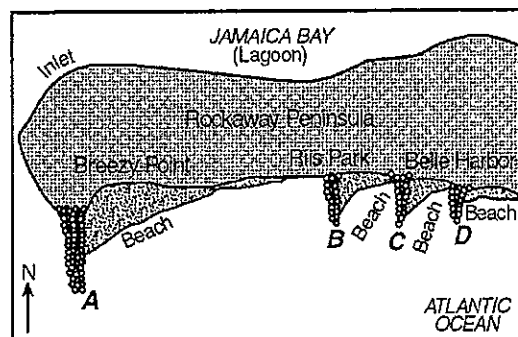
1. What continually reshapes our coastline? _____
2. What is the source of sand on the coastlines? _____
3. Name two features that help protect shores. _____ & _____
4. What are barrier islands? _____

5. What are sandbars?

6. The map to the top right shows barrier islands in the ocean along the coast of Texas.
 - Using a blue color pencil color the Gulf of Mexico and the "white spaces" that represent the water.
 - Using a red color pencil circle the three barrier islands on the map.

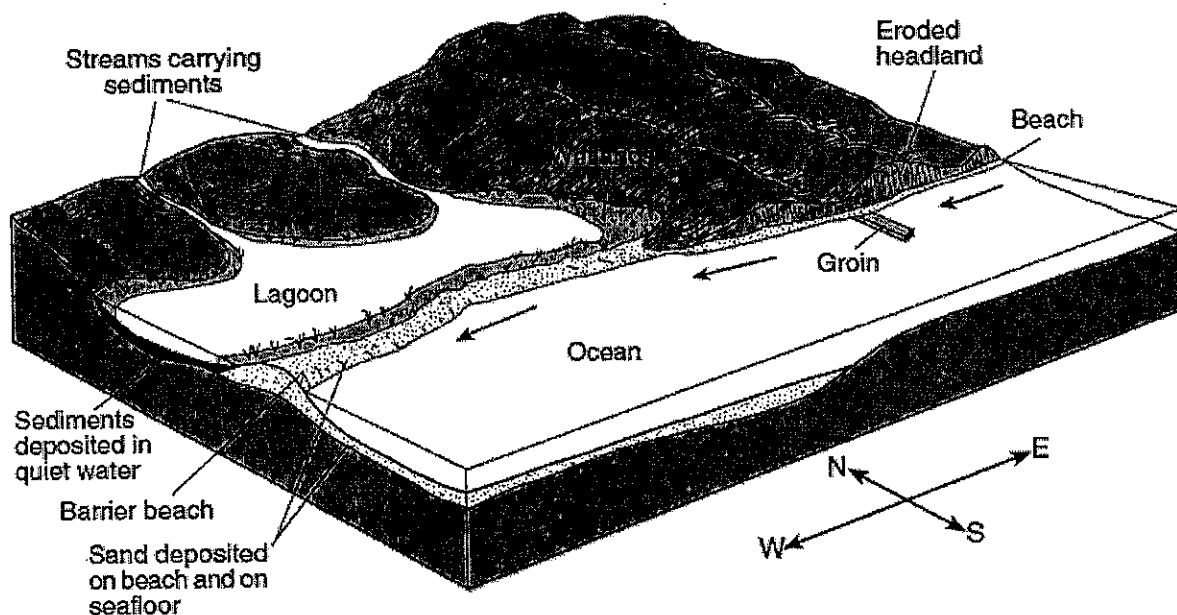


7. The map to the bottom right shows Rockaway Peninsula, part of Long Island's south shore, and the location of several stone barriers, A, B, C, and D, that were built to trap sand being transported along the coast by wave action.
 - Notice where the sand for the beaches are located
 - Using a blue color pencil, draw four arrows to show which way the sand had been moved by the ocean waves



Regents questions:

Base your answers to questions 1 through 4 on the diagram below. The arrows show the direction in which sediment is being transported along the shoreline. A barrier beach has formed, creating a lagoon (a shallow body of water in which sediments are being deposited). The eroded headlands are composed of diorite bedrock. A groin has recently been constructed. Groins are wall-like structures built into the water perpendicular to the shoreline to trap beach sand.



- ___ 1. The groin structure will change the pattern of deposition along the shoreline, initially causing the beach to become

(1) wider on the western side of the groin	(3) narrower on both sides of the groin
(2) wider on the eastern side of the groin	(4) wider on both sides of the groin

- ___ 2. Which two minerals are most likely found in the beach sand that was eroded from the headlands?

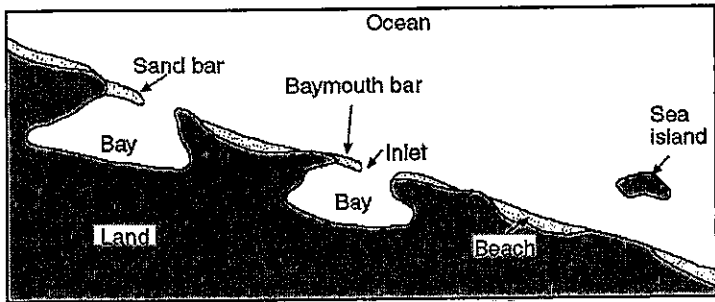
(1) quartz and olivine	(3) potassium feldspar and biotite
(2) plagioclase feldspar and amphibole	(4) pyroxene and calcite

- ___ 3. The sediments that have been deposited by streams flowing into the lagoon are most likely

(1) sorted and layered	(3) unsorted and layered
(2) sorted and not layered	(4) unsorted and not layered

- ___ 4. Which event will most likely occur during a heavy rainfall?
 - (1) Less sediment will be carried by the streams.
 - (2) An increase in sea level will cause more sediments to be deposited along the shoreline.
 - (3) The shoreline will experience a greater range in tides.
 - (4) The discharge from the streams into the lagoon will increase.

5. The major source of sediments found on the deep ocean bottom is
 (1) erosion of continental rocks (3) submarine landslides from the mid-ocean ridges
 (2) submarine volcanic eruptions (4) icebergs that have broken off continental glaciers
6. 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
7. 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?

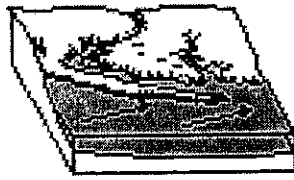


- (1) northeast
 (2) northwest
 (3) southeast
 (4) southwest

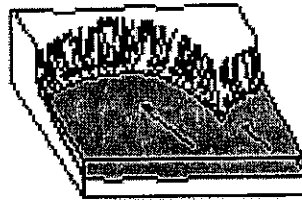
8. The diagrams below represent landscape features found along the seacoast. The arrows show ocean-wave direction. Which shoreline has been shaped more by deposition than by erosion?



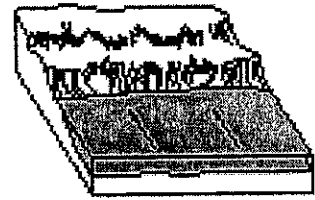
(1)



(2)



(3)

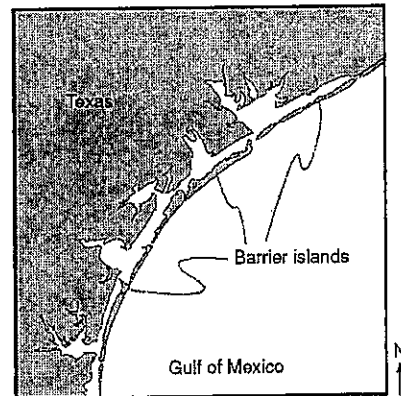


(4)

9. 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

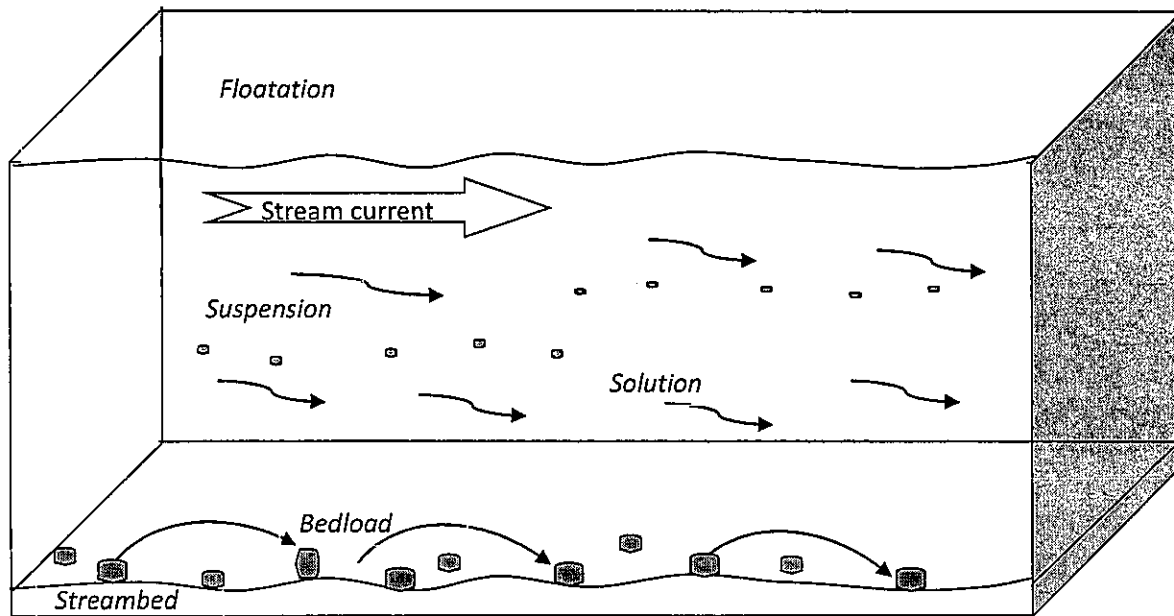


Mini Lesson 1: Erosion by Running Water

A stream is any body of water with a current. It includes brooks, creeks, tributaries and rivers. Running water is the most erosive agent. Gravity causes water to flow downhill. Sediments are weathered by abrasion and become smaller, rounder and smoother. The faster the water moves, the larger the particles it can transport. As the water slows down, the larger, rounder, more dense particles settle out first. Sediments carried in a stream move slower than the water.

Transportation of sediment in a stream

- Floatation - Materials that float on the water (ex. branches)
- Solution - Sediments are dissolved in the water (ex. Salt)
- Suspension - Sediments that remain mixed within the water (ex. clay and silt)
- Bedload - Sediments that bounce (saltation) and roll (traction) on the stream bed (ex. pebbles and sand)



Need to know:

1. What is a stream? _____
2. Give four examples of streams. _____, _____, _____, _____
3. How does gravity affect running water? _____
4. What type of physical weathering occurs as sediments are transported by a stream? _____
5. What happens to the size, shape, and texture of a sediment as it is transported by a stream? _____

_____ size

_____ shape

_____ texture

ES Reference Tables page 6 "Relationship of Transported Particle Size to Water Velocity"

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.

1. What page is this chart located on, in the Earth Science Reference Tables? _____

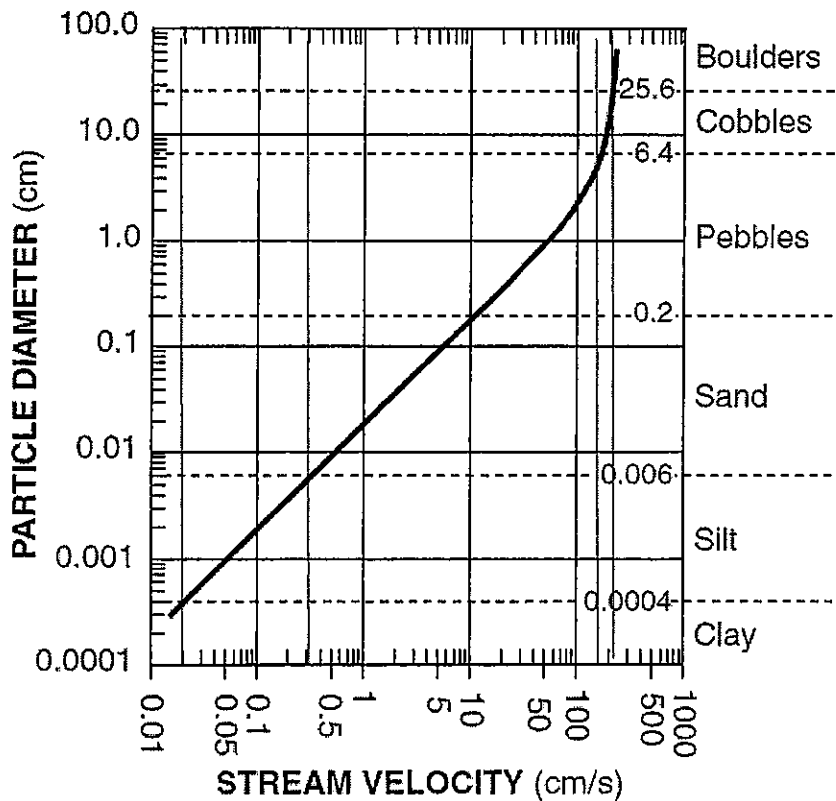
2. Highlight the vertical thin lines that have been added to the chart on the right.

3. For each of the lines highlighted, write in the approximate streams velocity at the bottom of the chart. The first thin line on the left is .02 cm/s.

4. For each of the following particle sizes, write the minimum stream velocity needed to maintain movement.

- Clay < 0.02 cm/s
- Silt _____ cm/s
- Sand _____ cm/s
- Pebbles _____ cm/s
- Cobbles _____ cm/s
- Boulders _____ cm/s

Relationship of Transported Particle Size to Water Velocity



This generalized graph shows the water velocity needed to maintain, but not start, movement. Variations occur due to differences in particle density and shape.

5. State the relationship between stream velocity and particle size moved by the stream. Write it out completely.

6. In order to keep particles suspended in the stream, what is true about its velocity?

Regents Questions:

- ____ 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 25.6 centimeters moving?
(1) 100 cm/sec (2) 200 cm/sec (3) 300 cm/sec (4) 400 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) 0.001 cm (2) 0.01 cm (3) 0.1 cm (4) 1.0 cm
- ____ 5. What is the maximum size particle that can be carried by a stream having a velocity of 300 centimeters per second?
(1) 0.002 cm (2) 0.02 cm (3) 0.2 cm (4) 20 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. What is the largest particle that can be kept in motion by a stream that has a velocity of 100 centimeters per second?
(1) silt (2) pebbles (3) sand (4) cobbles
- ____ 9. A stream with a water velocity of 200 centimeters per second decreases to a velocity of 100 centimeters per second. Which sediment size will most likely be deposited?
(1) pebbles (2) boulders (3) sand (4) cobbles
- ____ 10. What is the minimum rate of flow at which a stream of water can maintain the transportation of pebbles 1.0 centimeter in diameter?
(1) 50 cm/sec (2) 100 cm/sec (3) 150 cm/sec (4) 200 cm/sec

Velocity of a stream is influenced by gradient (slope), the amount of water in the stream - volume (discharge), shape of the channel and amount of sediment in the stream.

1. Complete the statements below by circling the correct word or words that describes the conditions necessary for the stream to flow faster.

(a) Gradient : The (*steeper / gentler*) the slope, the faster the water flows.

(b) Volume: (discharge - the amount of water flowing past a fixed point each second)

The (*less water / greater the amount of water*) in the stream, the faster the water flows.

(c) Amount of sediment in the stream:

- A stream with a lot of sediment in it will flow (*faster / slower*) than a stream without a lot of sediment.

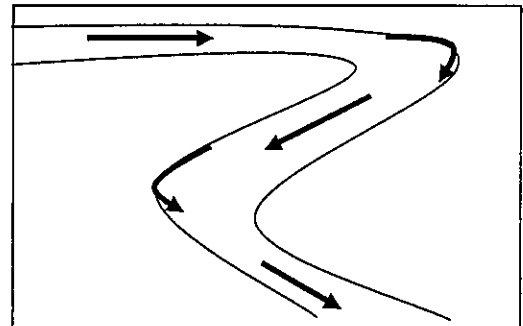
- The sediment in the stream will always flow (*faster than / slower than / at the same rate as*) the water that carries it.

(d) Shape of stream channel

The arrows shown in the diagram below illustrates where the velocity of the stream is the greatest. The curves in a stream are called meanders.

____ 1. Water moves quickest through the
(1) straight smooth section of the stream
(2) meanders - curves

____ 2. In a straight section of a stream the water moves fastest
(1) at the top of the water
(2) just below the surface
(3) at the bottom of the channel



____ 3. Weathering and erosion takes place where the water flows the
(1) fastest (2) slowest

4. Water flows fastest on the (*outside / inside*) of a meander.

5. Erosion takes place primarily on the (*outside / inside*) of a meander.

6. Water flows slowest on the (*outside / inside*) of a meander.

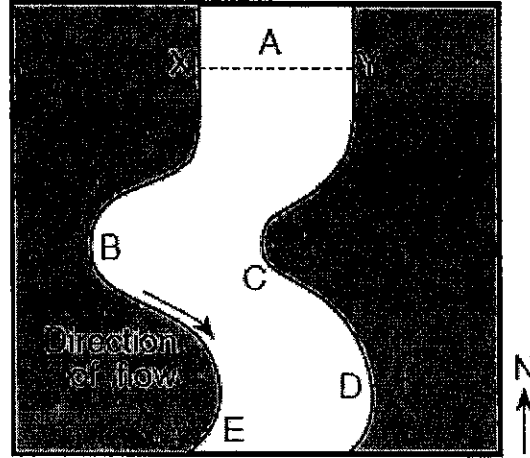
7. Deposition takes place primarily on the (*outside / inside*) of a meander.

8. Place the letter "E" next to the arrows on the outside of the meanders (curves).

9. Place the letter "D" (deposition) next to the inside of the meanders (curves).

Regents Questions:

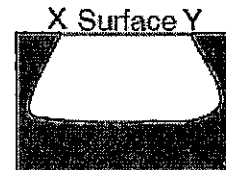
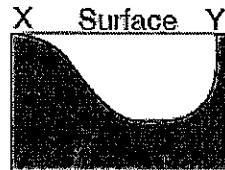
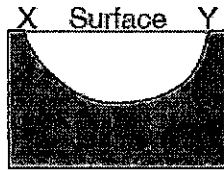
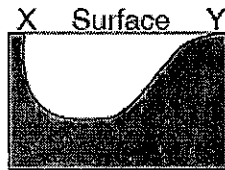
Base your answers to questions 1 through 3 on the map to the right, which shows a portion of a stream in New York State that flows southward. Letters A through E represent locations in the stream. Line XY is the location of a cross section.



1. At which two locations in this stream is deposition normally dominant over erosion?
- (1) A and D (3) C and E
 (2) B and E (4) D and C

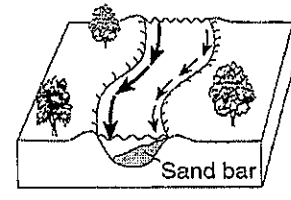
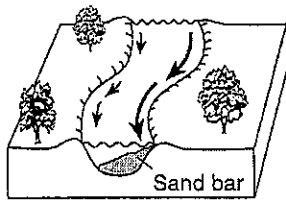
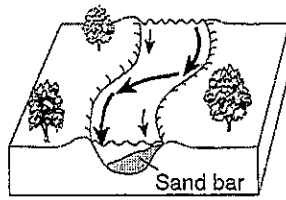
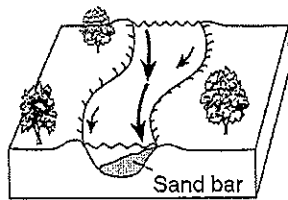
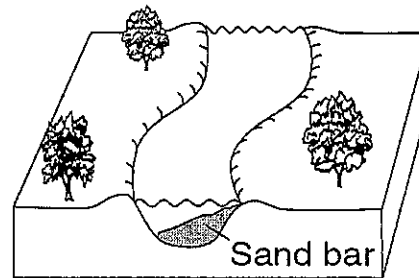
2. Where this stream's velocity decreases from 300 to 200 centimeters per second, which size sediment will be deposited?
- (1) cobbles (2) sand (3) boulders (4) clay

3. Which cross section along line XY best represents the shape of the stream bottom?

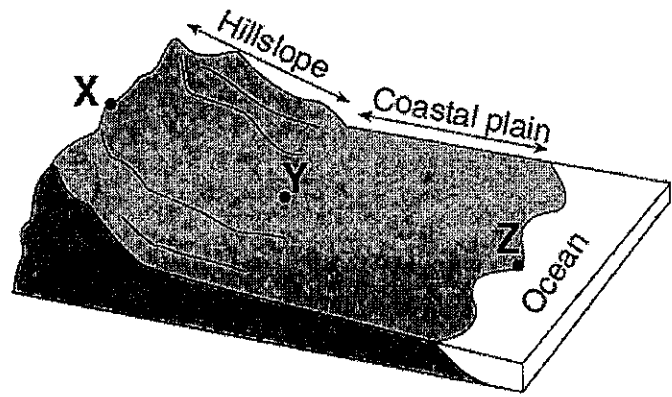


4. The diagram to the right shows a meandering stream flowing across nearly flat topography and over loose sediments.

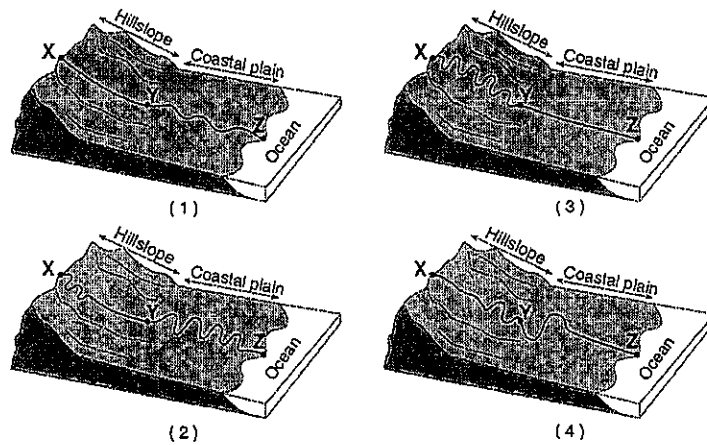
If arrow length represents stream velocity, which diagram best shows the relative stream velocities in this section of the stream?



Base your answers to questions 5 through 7 on the diagram to the right, 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.



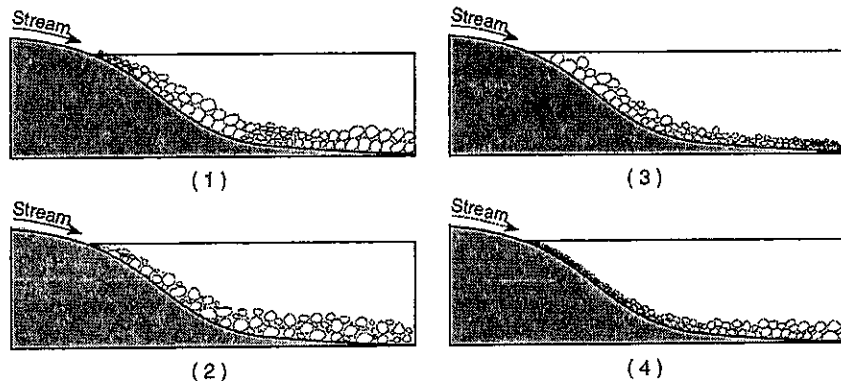
5. Which diagram best shows the most probable path of the stream flowing from point X to point Z?



6. 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

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



Mini Lesson 2: Life and Features of a Stream

Life of a Stream

- **Youth:** high energy, fast moving, steep gradient (slope), a lot of erosion river creates a narrow "V" shaped valley
- **Mature:** gentler gradient, slower moving water, side walls of the "V" shaped valleys collapse, meanders develop, valley becomes wider than the river channel, flood plains develop (where the excess water goes when the river overflows)
- **Old Age:** land is almost flat, levees form - a place around a stream where deposition over time, deposits a mound of sediments
oxbow lake - a cut off meander forms from deposition

Formation of Oxbow Lakes

- Form by erosion along the outside banks of a curve in a meandering stream
- Eventually stream continues on a straight path and sediments are deposited cutting off the meander
- The cut off meander becomes the oxbow lake.

Formation of Deltas

- as a river empties into a larger body of water, deposition occurs
- when deposition exceeds the amount of sediment moved by waves and tidal action, deltas form

- Remove the last page of the packet
- Cut out the diagrams in the section labeled "Stages in Stream Development"
- Glue the diagrams in correct order from Youth through Old Age in the spaces provided below.

Youth	Mature	Old Age

Regents Questions

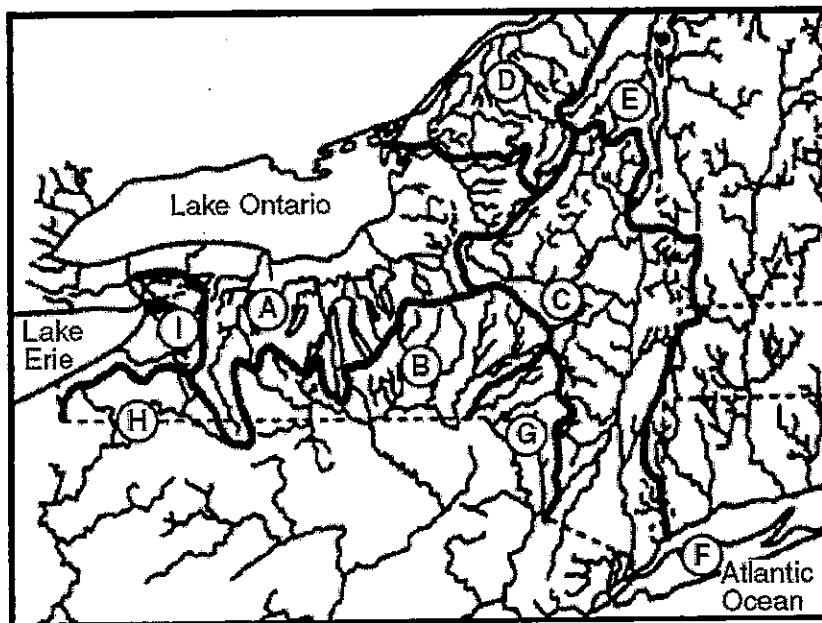
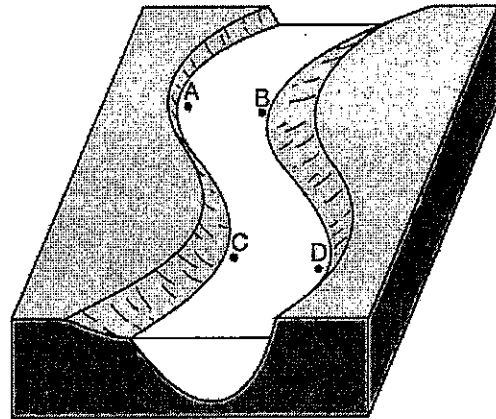
Base your answers to questions 1 through 3 on the diagram below, which shows a meandering stream. Letters A, B, C, and D indicate locations on the streambed.

1. At which two locations is the rate of erosion greater than the rate of deposition?
 - (1) A and B
 - (2) B and C
 - (3) C and D
 - (4) D and A

2. What are the largest particles that this stream can transport when its velocity is 200 centimeters per second?
 - (1) silt
 - (2) sand
 - (3) pebbles
 - (4) cobbles

3. A decrease in the velocity of this stream will most likely cause an increase in
 - (1) the amount of sediment carried by the stream
 - (2) the size of the particles carried by the stream
 - (3) deposition within the stream channel
 - (4) abrasion of the stream channel

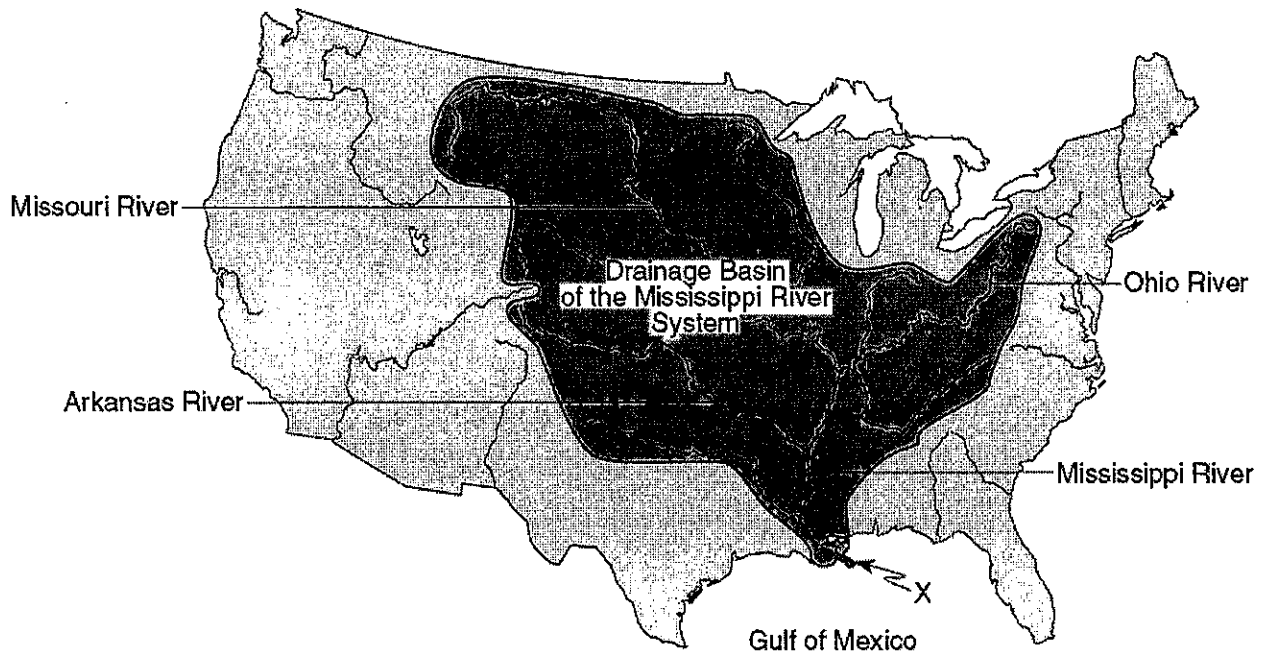
4. The map below shows major streams in the New York State area. The bold lines mark off sections A through I within New York State.



The best title for the map would be

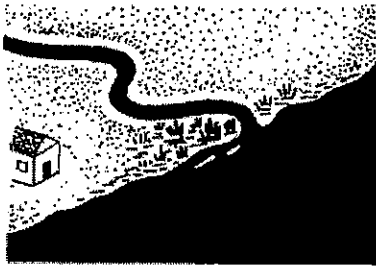
- (1) "Tectonic Plate Boundaries in New York State"
- (2) "Bedrock Geology Locations of New York State"
- (3) "Landscape Regions of New York State"
- (4) "Watershed Areas of New York State"

Base your answers to questions 5 through 9 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.

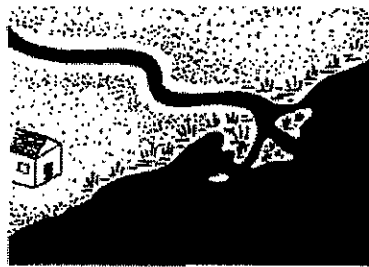


- ___ 5. The entire land area drained by the Mississippi River system is referred to as a
 (1) levee (2) meander belt (3) watershed (4) floodplain
- ___ 6. Sediments deposited at location *X* by the Mississippi River most likely have which characteristics?
 (1) angular fragments arranged as mixtures
 (2) rock particles arranged in sorted beds
 (3) rocks with parallel scratches and grooves
 (4) high-density minerals with hexagonal crystals
- ___ 7. The structure formed by the deposition of sediments at location *X* is best described as a
 (1) moraine (2) delta (3) tributary (4) drumlin
- ___ 8. 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

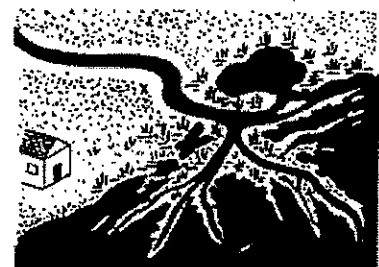
9. The diagrams below show gradual stages 1, 2, and 3 in the development of a river delta where a river enters an ocean.



Stage 1



Stage 2

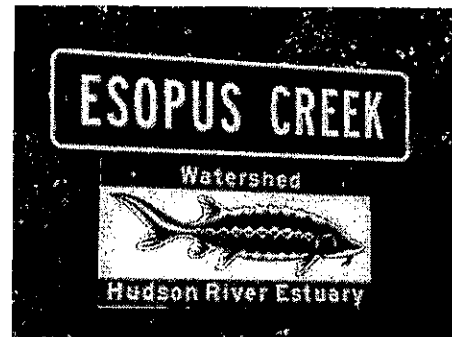


Stage 3

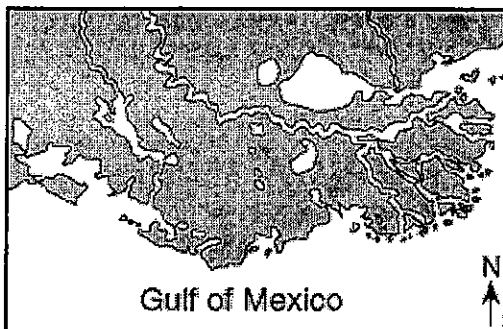
Which statement best explains why the river delta is developing at this site?

- (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.

10. The photograph to the right shows a sign near the Esopus Creek in Kingston, New York. The main purpose of the word "watershed" on this sign is to communicate that the Esopus Creek
- (1) is a tributary of the Hudson River
 - (2) is a flood hazard where it flows into the Hudson River
 - (3) forms a delta in the Hudson River
 - (4) contains ancient fish fossils



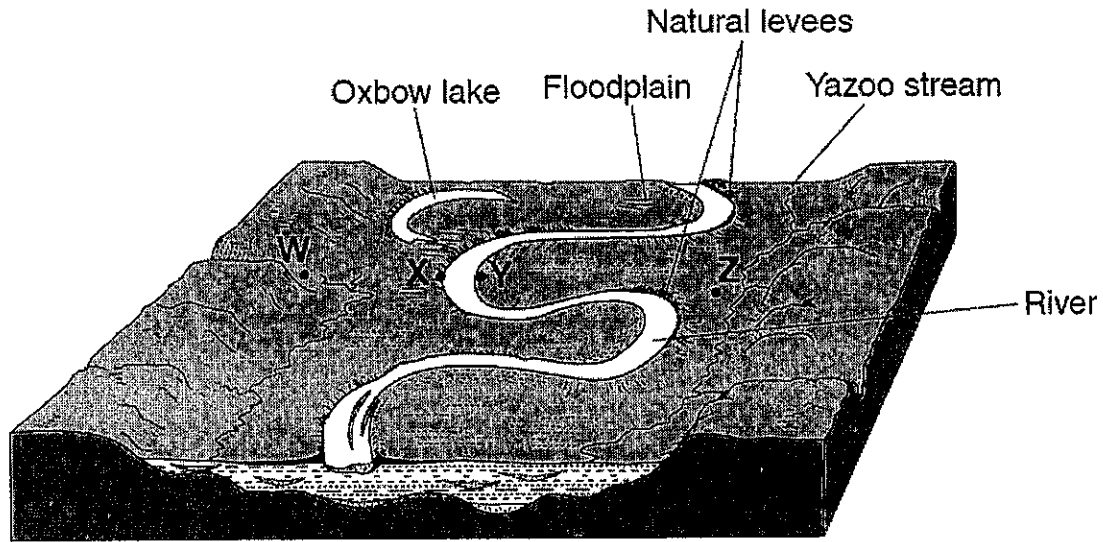
11. The map below shows the large delta that formed as the Mississippi River emptied into the Gulf of Mexico.



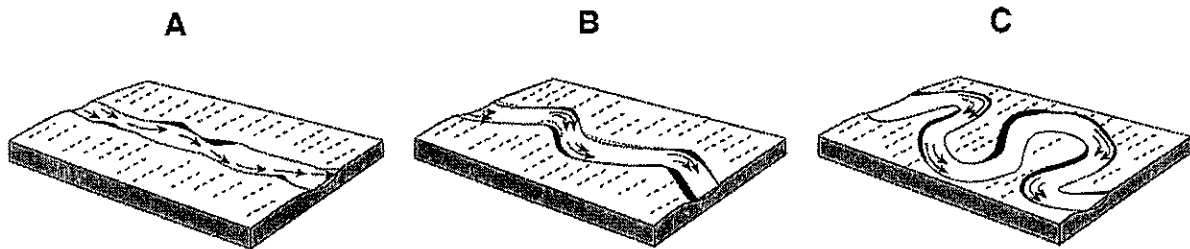
Which process was primarily responsible for the formation of the delta?

- (1) glacial erosion
- (2) cementation of sediment
- (3) deposition of sediment
- (4) mass movement

Base your answers to questions 12 through 16 on the diagram below, and your knowledge of Earth science. The diagram represents the landscape features associated with a meandering river. Letters W, X, Y, and Z represent locations on the floodplain.



12. 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



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

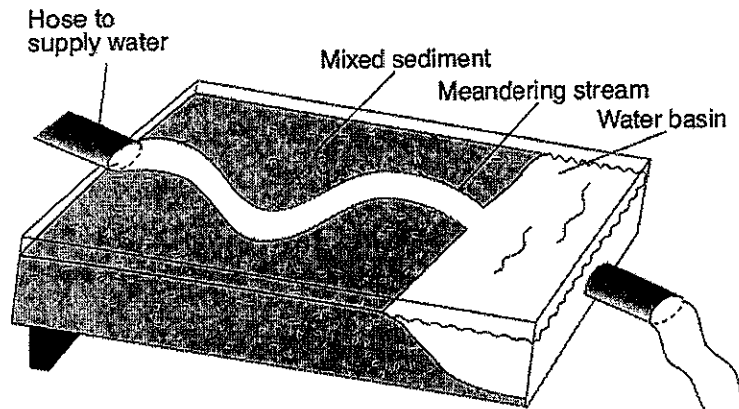
14. The natural levees are ridges of sediment that slope away from the riverbank toward the floodplain. Which process most likely formed these levees?
 (1) weathering of the soil on the riverbanks
 (2) erosion on the inside curves of the meanders
 (3) deposition by the Yazoo stream
 (4) deposition when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

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

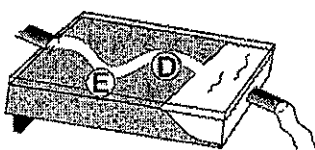
16. Which change would most likely increase the velocity of the river?
 (1) a decrease in the slope of the river (3) a decrease in the temperature of the river
 (2) an increase in the river's discharge (4) an increase in the width of the river

Regents Questions:

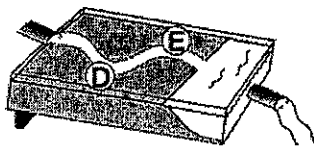
Base your answers to questions 1 through 3 on the diagram below, which shows a model used to investigate the erosional-depositional system of a stream. The model was tilted to create a gentle slope, and a hose supplied water to form the meandering stream shown.



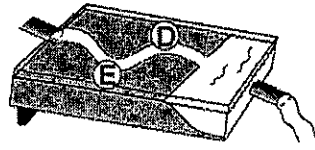
1. Which diagram best represents where erosion, E, and deposition, D, are most likely occurring along the curves of the meandering stream?



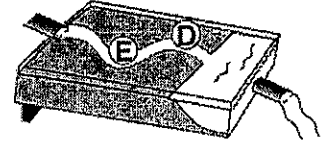
(1)



(2)

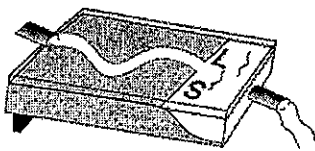


(3)

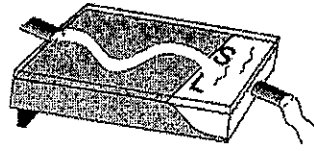


(4)

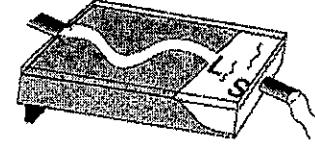
2. Which diagram best represents the arrangement of large, L, and small, S, sediment deposited as the stream enters the water basin?



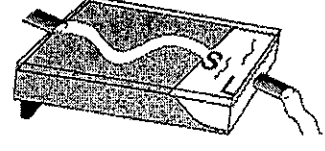
(1)



(2)



(3)



(4)

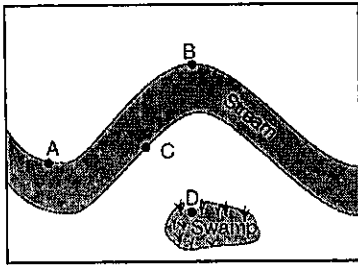
3. How can the model be changed to increase the amount of sediment transported by the stream?

- | | |
|--|---|
| (1) decrease the temperature of the sediment | (3) increase the size of the sediment |
| (2) decrease the slope | (4) increase the rate of the water flow |

4. 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 | (3) geologic time scales |
| (2) tectonic plate maps | (4) planetary wind maps |

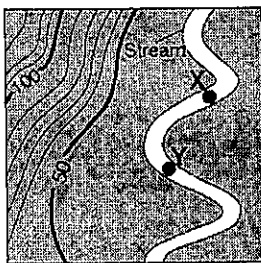
5. The map below shows the area surrounding a meandering stream.



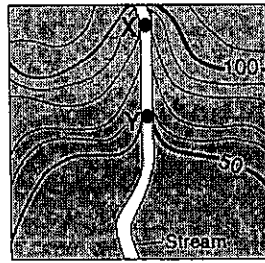
At which point is erosion greatest?

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

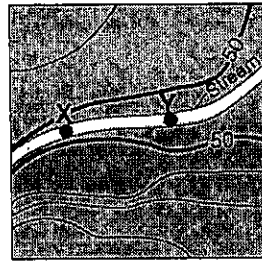
6. The four streams shown on the topographic maps below have the same volume between X and Y. The distance from X to Y is also the same. All the maps are drawn to the same scale and have the same contour interval. Which map shows the stream with the greatest velocity between points X and Y?



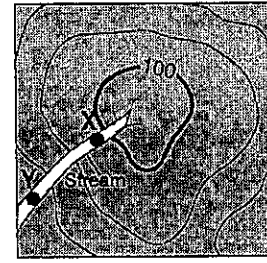
(1)



(2)



(3)



(4)

7. Which river is a tributary branch of the Hudson River?

- (1) Delaware River
- (2) Susquehanna River
- (3) Mohawk River
- (4) Genesee River

8. The table below shows the rate of erosion and the rate of deposition at four stream locations.

Location	Rate of Erosion (tons/year)	Rate of Deposition (tons/year)
A	3.00	3.25
B	4.00	4.00
C	4.50	4.65
D	5.60	5.20

A state of dynamic equilibrium exists at location

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

9. Two streams begin at the same elevation and have equal volumes. Which statement best explains why one stream could be flowing faster than the other stream?

- (1) The faster stream contains more dissolved minerals.
- (2) The faster stream has a much steeper gradient.
- (3) The streams are flowing in different directions.
- (4) The faster stream has a temperature of 10°C, and the slower stream has a temperature of 20°C.

Mini Lesson 3: Glaciers

Glaciers are large, very slow moving ice. They form when more snow falls in the winter than can melt in the summer. They form in high latitudes and high elevations. Gravity causes glaciers to flow down a valley or spread out over a continent. They push, drag and carry sediment from very small to **boulder** size. As they move they create features such as striations (scratches) on the rock and parallel groves in the bedrock. As the ice melts, sediment is dropped out (deposited) and is **unsorted**. **Erratics** are left behind. These are rocks that do not match the size and type of other rocks in the same area. The rocks may be partially rounded.

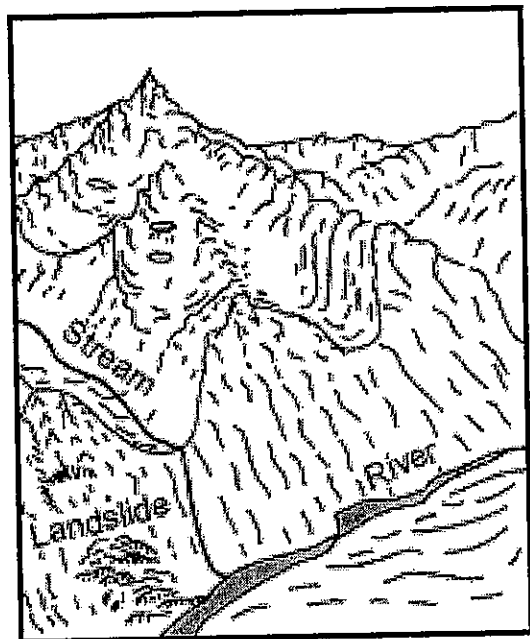
Need to know:

1. What are glaciers? _____
2. How do glaciers form? _____

3. Name two locations glaciers form. _____ & _____
4. What cause glaciers to move? _____
5. How do glaciers move sediment? _____, _____ and _____
6. Name two features left behind by glaciers. _____ & _____
7. Describe the sediment left by a glacier. _____
8. What are erratic? _____

Valley Glacier Features







- As the valley glacier moves down the mountain it cuts out the sides and forms "**U**" shaped valleys. Using a green color pencil, trace the two "U" shape in the valleys.
- They can transport any size sediments, even **boulders**.
- Sediments deposited from a valley glacier are also **unsorted**.
- The rocks have **striations** (scratches) are caused by rubbing and grinding as the glacier moves.



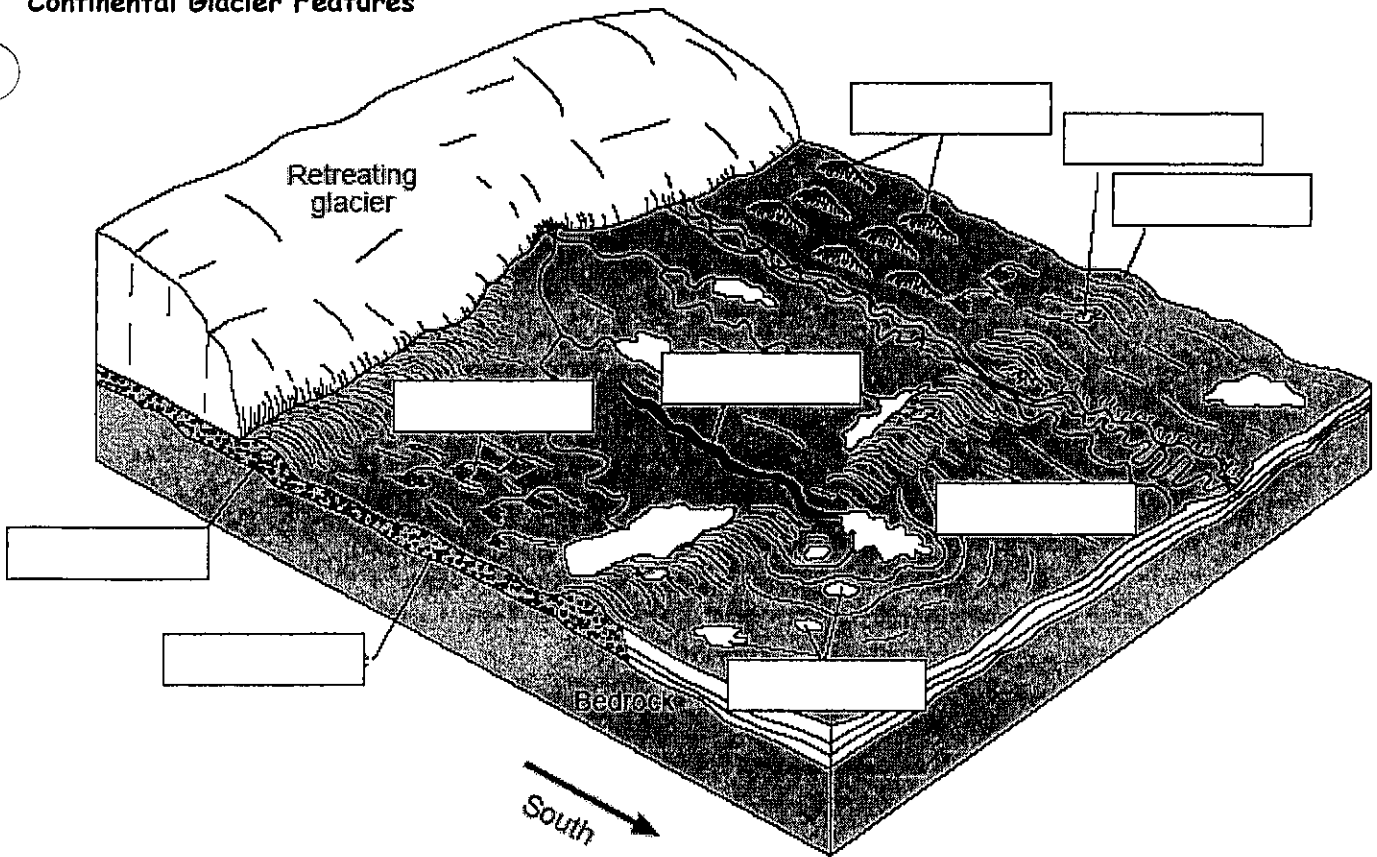
Show what you know:

Glaciers

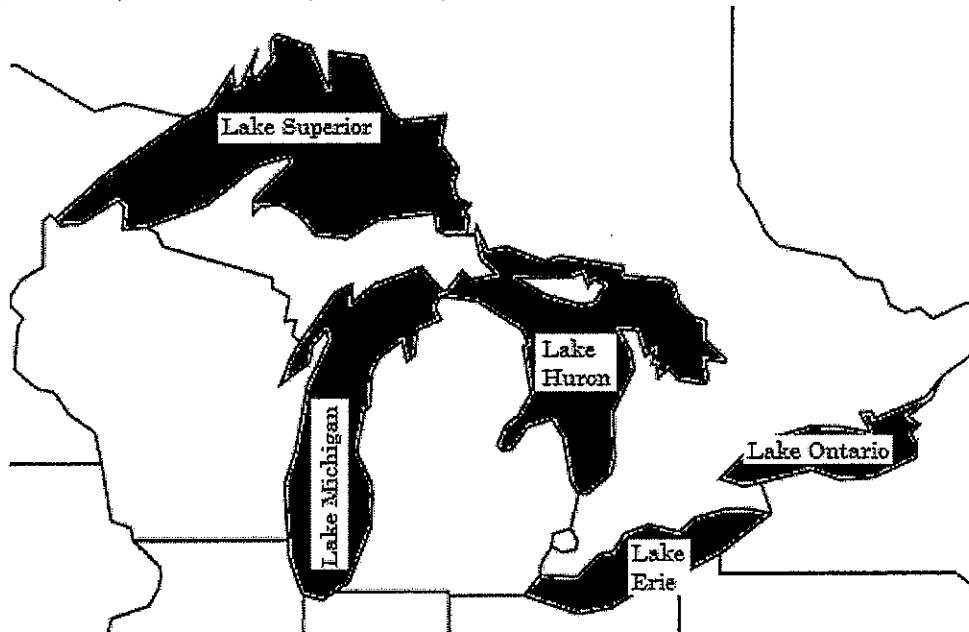
Below is a list of features and descriptions left by a glacier. Match up the features and images below and label the diagram on page 9.

Feature	Description	Image
moraine	large deposits of glacial till (unsorted sediment) that forms when the glacier has stalled or retreated (melted).	
terminal moraine	large ridge of glacial till marking the farthest advancement of the glacier * horizontal rock layers are located immediately next to unsorted sediment	
recessional moraine	mixture of sand, gravel and rock that is deposited as the ice front melts * it is found directly in front of the melting glacier * <i>Glaciers do not actually move backward as the word retreat implies.</i>	Melting ice 
ground moraine	mixture of sand, gravel and rock that is deposited as the ice retreats * a flat area, underground, with unsorted sediments	
esker	long narrow ridge of coarse gravel deposited by a stream flowing in a narrow ice tunnel under the glacier	
drumlin	a glacial hill that is shaped like the back of a spoon by the ice. They indicate the direction of glacial movement, toward the gentle slope	
kames	irregularly shaped hills composed of sorted sand and gravel. They are formed from the melt water of the glacier.	
outwash plain	forms from the meltwater of the glacier. It has horizontal layers of sorted glacial material and is found in front of the glacier.	
kettle hole kettle lake	occurs when a large piece of a glacier drops off the front and becomes partially buried. If the hole fills with water it is a Kettle lake * Write "kettle lake" in two places on the diagram	

Continental Glacier Features

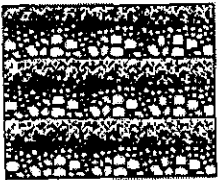
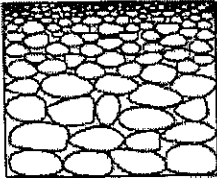

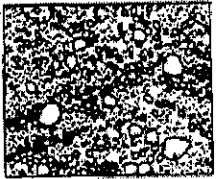


The Great Lakes formed at the end of the ice age, approximately 10,000 years ago. Glaciers carved out the bedrock and glacial melt waters filled the basins. The lakes contain approximately 20 % of the world's fresh surface water.

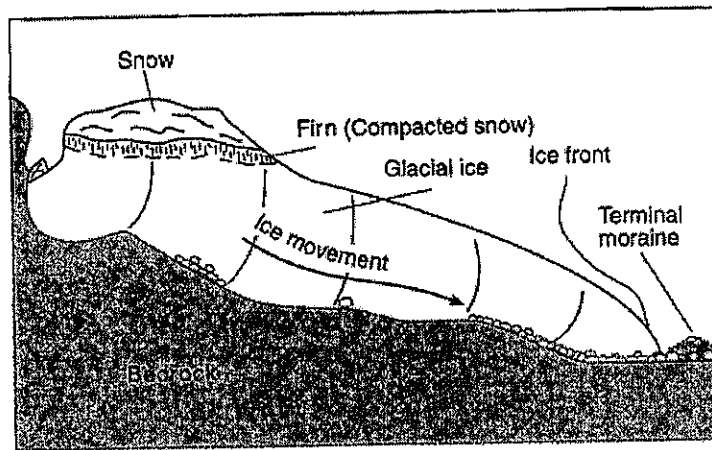


Glaciers Questions

Regents Questions:

- ___ 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 | (3) residual soil found on a flat plain |
| (2) rounded grains found in a sand dune | (4) unsorted loose gravel found in hills |
- ___ 4. The striations indicate that the movement of glacial ice was toward the -
- | | |
|-----------------------------|-----------------------------|
| (1) northeast and northwest | (3) northeast and southwest |
| (2) southeast and northwest | (4) southeast and southwest |
- ___ 5. Which cross section best represents the sediment that was transported and deposited by this glacier?
- | | | | |
|---|---|--|---|
|  |  |  |  |
| (1) | (2) | (3) | (4) |
- ___ 6. The velocity of the ice movement is primarily controlled by the
- (1) Amount of sediment at the terminal moraine
 - (2) Size of the sediment transported by the glacier
 - (3) Slope of the bedrock surface
 - (4) Length of the glacier
- ___ 7. Because of glaciation, New York State presently has soils that are best described as
- | | |
|-----------------------------|-------------------------------|
| (1) deep and residual | (3) rich in gemstone minerals |
| (2) unchanged by glaciation | (4) thin and rocky |

Base your answers to questions 8 through 10 on the diagram to the right. The diagram represents a profile of a mountain glacier in the northern United States.



- ___ 8. 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) the force of gravity pulling on the glacier
 - (3) snow blowing across the top of the glacier
 - (4) water flowing over the glacier
- ___ 9. 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
- ___ 10. 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.
- ___ 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. 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

- ___ 13. 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.
- ___ 14. 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.
- ___ 15. 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
- ___ 16. 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
- ___ 17. 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
- ___ 18. Which map best shows the general surface wind pattern in a low-pressure system located over the eastern United States?



(1)



(2)



(3)



(3)

- ___ 19. Sediments found in glacial moraines are best described as
- (1) sorted and layered
 - (2) sorted and not layered
 - (3) unsorted and layered
 - (4) unsorted and not layered
- ___ 20. Which feature will most likely form when the partially buried ice block melts?
- (1) drumlin
 - (2) moraine
 - (3) kettle lake
 - (4) finger lake

Mini Lesson 4: Wind Erosion

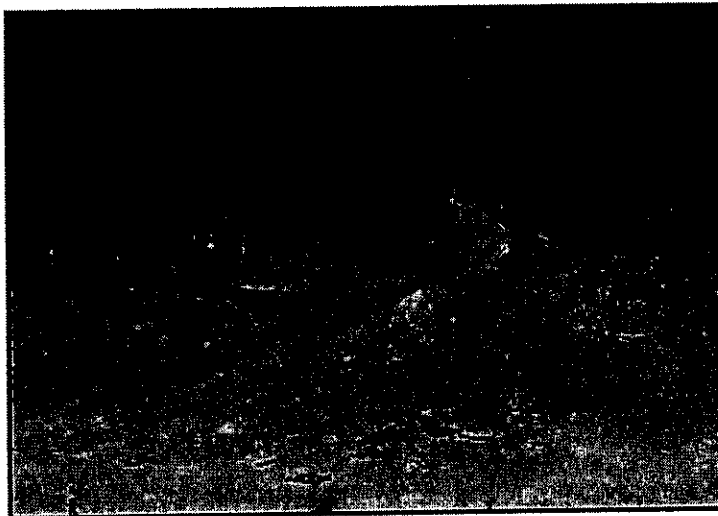
Wind erosion is most common in arid (dry) climates, usually in deserts. Beaches too have wind erosion. The faster the wind blows, the larger the sediment it can carry. Once the wind begins to slow down larger particles settle out first. The main type of weathering is by abrasion. Features may be pitted flat faces and straight edges on the surface of the sediments. Surface features include dunes and sand blasted bedrock.

Need to know:

1. What kind of climate does wind erosion take place? _____
2. Where does most wind erosion take place? _____
3. Where is another place wind erosion may take place? _____
4. Describe how the velocity of the wind affects what sediments are carries or deposited.

5. What is the main type of weathering that takes place? _____
6. Describe the features of the sediments. _____

7. Describe two surface features sediments. _____



Quick Review:

Agent of Erosion	Surface Feature Formed
Waves	Beach, sandbars, barrier islands
Wind	Loss of topsoil, dunes
Glacier	U-shaped valley, moraines, drumlins
Running water (streams)	V-shaped valley, deltas, meanders
Mass movement	Landslides, slumps, mass movement

Regents Questions:

- ___ 1. The diagram to the right shows a sedimentary rock sample. Which agent of erosion was most likely responsible for shaping the particles forming this rock?
- (1) mass movement (3) glacial ice
 (2) wind (4) running water



- ___ 2. 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

- ___ 3. 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

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

- ___ 5. 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 (3) crustal uplift and glacial erosion
 (2) crustal folding and stream erosion (4) crustal folding and glacial erosion.

- ___ 6. 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 feature

- ___ 7. 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

- ___ 8. 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

- ___ 9. Which location is on a plateau landscape?
- (1) Rochester (2) Elmira (3) Old Forge (4) New York City

- ___ 10. 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

Base your answers to questions 11 and 12 on the photograph below, which shows an outcrop of sedimentary rock layers that have been tilted and slightly metamorphosed.

- ___ 11. 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



- ___ 12. 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

13. 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) *A*—mountain, *B*—plain, *C*—plateau (3) *A*—plateau, *B*—mountain, *C*—plain
 (2) *A*—plain, *B*—plateau, *C*—mountain (4) *A*—plain, *B*—mountain, *C*—plateau

14. 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: _____

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

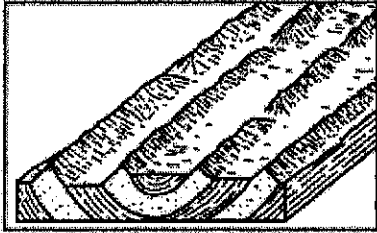
- | <u>Agent of Erosion</u> | <u>Surface Feature Formed</u> |
|-------------------------------|--|
| _____ Glaciers | A. Beach, sandbars, barrier islands |
| _____ Mass movement | B. Loss of topsoil, dunes |
| _____ Running water (streams) | C. U-shaped valley, moraines, drumlins |
| _____ Waves | D.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

Drainage description:

Appearance

Rectangular:

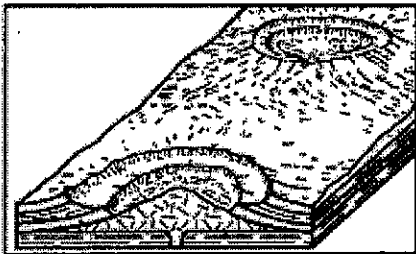
- occurs where drainage flows along folds and faults



- looks like parallel lines with tributaries going into each path

Annular:

occurs on an eroded dome

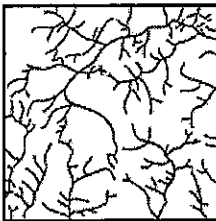


- appears to be a circular pattern with small tributaries that go into each circle

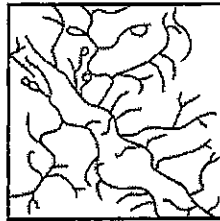
Drainage Questions

Regents Questions:

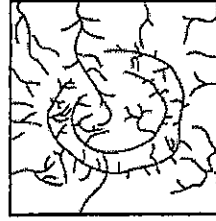
1. The cross section below shows the rock structure of a deeply eroded, domed mountain region. Which map shows the stream drainage pattern that will most likely develop as the bedrock is weathered and eroded from this igneous dome?



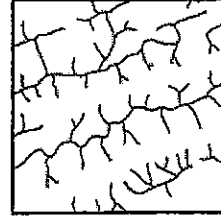
(1)



(2)

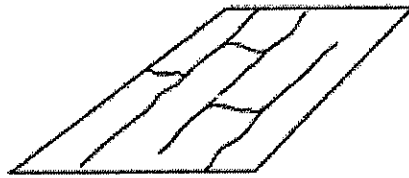


(3)



(4)

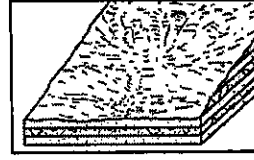
___ 2. The diagram below represents a map view of a stream drainage pattern. Which underlying bedrock structure most likely produced this stream drainage pattern.



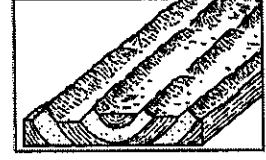
(1)



(2)



(3)

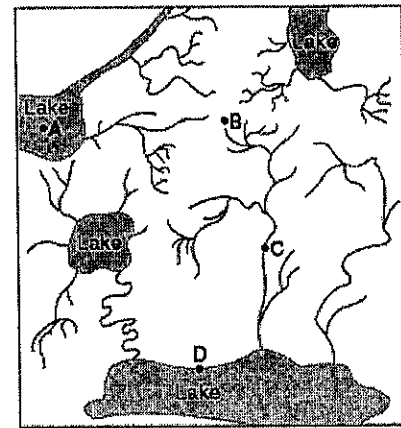


(4)

___ 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

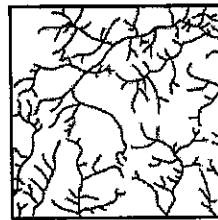
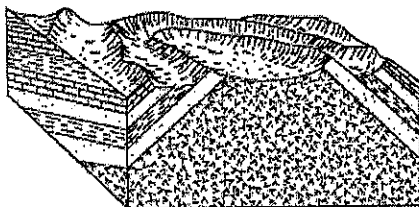
- (1) A (2) B (3) C (4) D



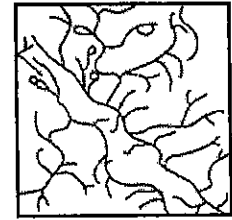
0 10 20 km

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

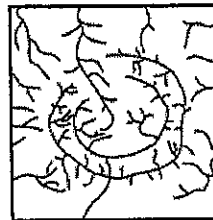
Which map shows the stream drainage pattern that would most likely develop on this feature?



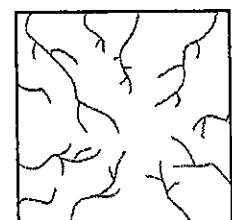
(1)



(2)

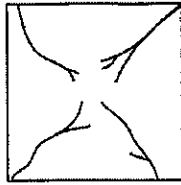
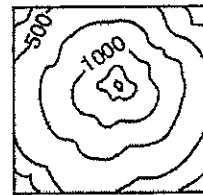


(3)

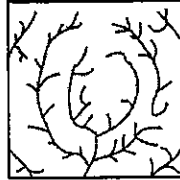


(4)

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



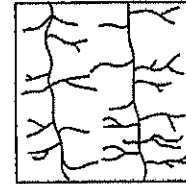
(1)



(2)

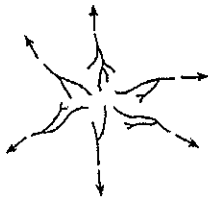


(3)

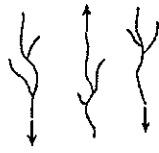


(4)

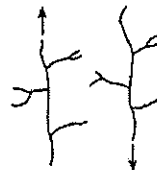
6. Which stream-drainage pattern most likely developed on the surface of a newly formed volcanic mountain?



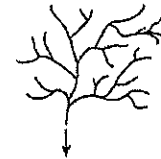
(1)



(2)



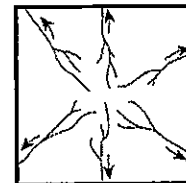
(3)



(4)

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

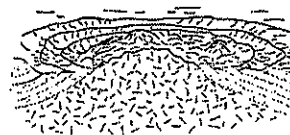
On which landscape region did this drainage pattern most likely develop?



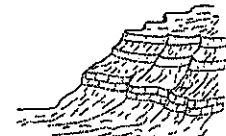
(1)



(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

