

Topic IX

Weathering, Erosion, and Deposition

Topic: Weathering, Erosion, and Deposition

Aim:

Weathering - the breakdown of rocks and minerals into smaller pieces weathering, along with biological activity (living things), leads to the formation of sediments (fragments of rocks and minerals), and possibly **soil** (if the right conditions exist).



1. Physical Weathering

Rock is broken into smaller pieces with NO change in its chemical composition

a. ABRASION –

a wearing, grinding, or rubbing away of rock material by friction

b. FROST ACTION (ice wedging) -

water repeatedly seeps into cracks, freezes, expands, and eventually splits the rock
(causes pothole formation in NY)

c. ROOT ACTION -

plant's roots grow into cracks and break apart rock

2. Chemical Weathering

Rock is broken down by chemical reactions with air and water resulting in a change in chemical composition.

a. OXIDATION –

oxygen chemically unites with iron and water to form iron oxide (rust)

b. CARBONATION -

CO₂ dissolved in H₂O makes carbonic acid which dissolves calcite-rich rocks.
(limestone cave and sinkhole formation)

c. ACTION OF ACIDS

(acid rain, organic acids)

Topic: Weathering, Erosion, and Deposition

1.

EXPOSURE

The more exposed a rock is to the forces of nature at the Earth's surface, the faster it weathers

2.

CLIMATE

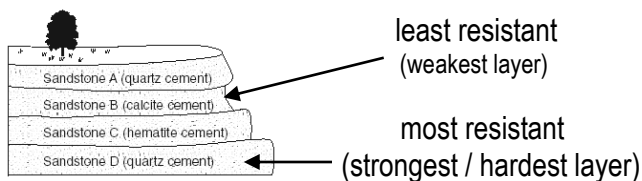
chemical weathering occurs faster in warmer, wetter climates

Aim:

3.

COMPOSITION

harder rocks and minerals are more resistant to weathering and physically break down slower



4.

PARTICLE SIZE

smaller particles have more surface area exposed and weather faster

Weathering Review

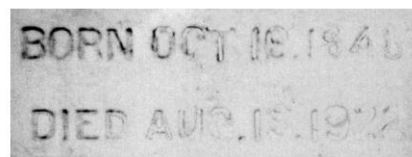
1. Which is the best example of physical weathering?
 - (1) the cracking of rock due to freezing and thawing of water
 - (2) the transportation of sediment in a stream
 - (3) the reaction of limestone with acid rainwater
 - (4) the formation of a sandbar along the side of a stream

2. Chemical weathering occurs most rapidly in climates that are

(1) warm and dry	(3) warm and moist
(2) cool and dry	(4) cool and moist

The two photographs below 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.

3. Which statement best explains why the dates are more difficult to read on tombstone A than on tombstone B?
 - (1) Tombstone A is composed of minerals less resistant to weathering 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 was exposed to less acid rain than tombstone B.



Tombstone A (1922)



Tombstone B (1892)

4. Which property of water makes frost action a common and effective form of weathering?

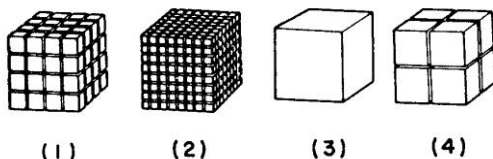
(1) Water dissolves many Earth materials.	(3) Water cools the surroundings when it evaporates.
(2) Water expands when it freezes.	(4) Water contracts when it freezes.

5. Limestone caves are formed as a result of

(1) erosion	(3) chemical weathering
(2) frost action	(4) thermal expansion

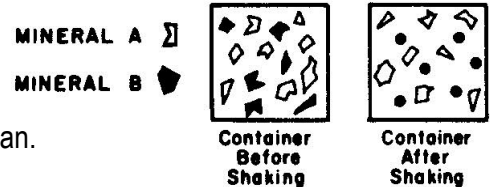
6. Impact craters are more obvious on the Moon and Mercury than on Earth because
 - (1) meteorites have not struck Earth
 - (2) exposure to weathering processes on Earth have removed most craters
 - (3) Earth is younger than Mercury or the Moon
 - (4) all meteorites burn up in Earth's atmosphere

7. Four samples of the same material with identical composition and mass were cut as shown in the diagrams below. When subjected to the same chemical weathering, which will weather the fastest?



8. The weathering of Earth materials is most affected by
 (1) climate (3) topography
 (2) altitude (4) longitude
9. Two different kinds of minerals, A and B, were placed in the same container and shaken for 15 minutes. The diagrams below represent the size and shape of the various pieces of mineral before and after shaking. What caused the resulting differences in shapes and sizes of minerals?

- 1 Mineral B was shaken harder.
- 2 Mineral B had a glossy luster.
- 3 Mineral A was more resistant to weathering.
- 4 Mineral A consisted of smaller pieces before shaking began.



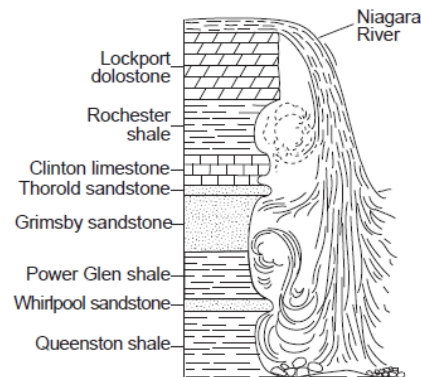
10. Soil develops as a result of
 (1) capillary action and solution (3) erosion and ionization
 (2) leaching and color changes (4) weathering processes and biological activity
11. In which layer of the soil diagram would the most organic material be located?
 (1) topsoil (3) weathered bedrock
 (2) subsoil (4) all layers have organic material



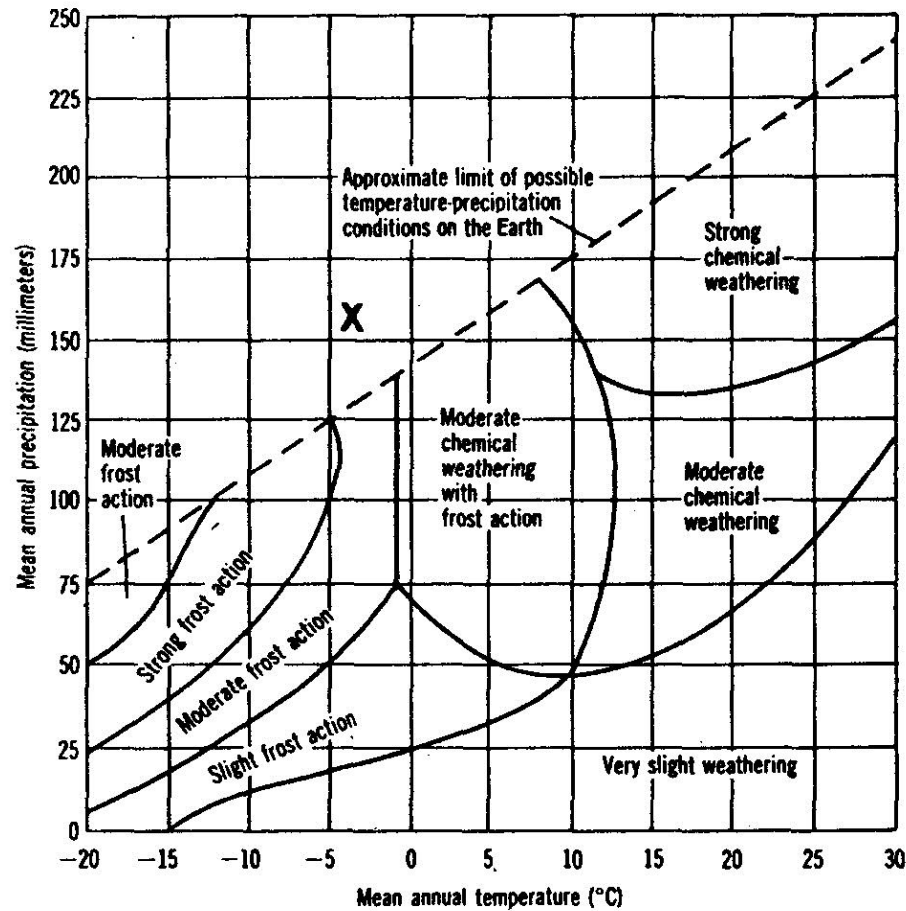
12. The generalized cross section below shows the sedimentary rock layers at Niagara Falls in western New York State.

Which rock layer appears to be most resistant to weathering?

- (1) Lockport dolostone
- (2) Rochester shale
- (3) Grimsby sandstone
- (4) Queenston shale



Use the diagram below to answer questions 13-15.



13. Which climatic 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 -10°C and a mean annual precipitation of 75mm

14. Which climatic conditions would produce strong frost action?
 - (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 -15°C and a mean annual precipitation of 50mm

15. The graph shows that as the both temperature and amount of precipitation increase, the amount of chemical weathering
 - (1) increases
 - (2) decreases
 - (3) remains the same

Topic: Weathering, Erosion, and Deposition

Aim:

Erosion - the movement of weathered material

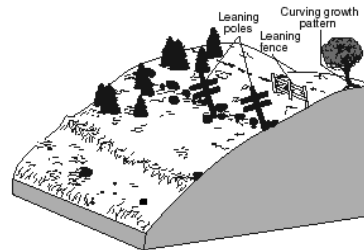
1. Erosion by Gravity – a.k.a. mass movement

Gravity is the driving force behind all erosion

Evidence of Gravity Erosion - unsorted (mixed) sediments found at the bottom of a steep slope

Examples:

- a. landslides
- b. mudslides
- c. avalanches

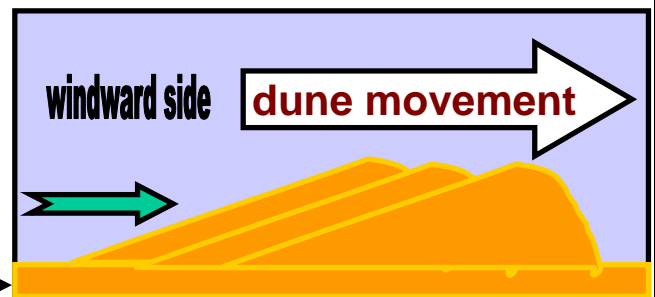


2. Erosion by Wind –

- dominant force of erosion in deserts
- contributes to beach erosion

Evidence of Wind Erosion –

- a. mushroom rocks
- b. dune formation and migration



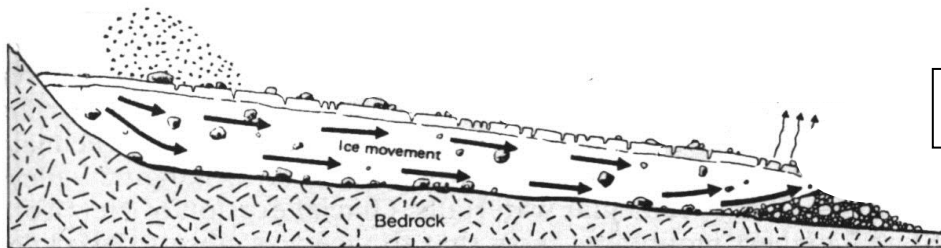
3. Erosion by Glaciers - large masses of moving ice

Today, glaciers are found on Earth: high latitudes (near the poles) and high elevations

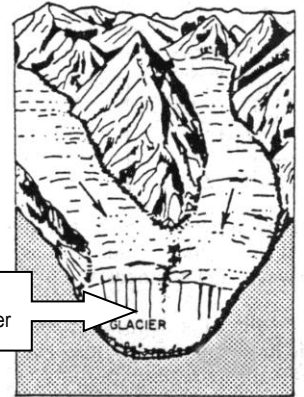
Glacial Movement

Glacial ADVANCE - snow accumulation > ice melting ... glacier grows when it's very cold

Glacial RETREAT - ice melting > snow accumulation ... glacier shrinks during warm periods



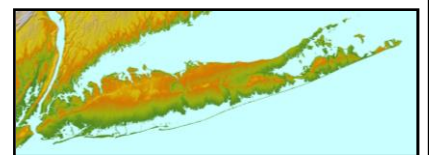
Ice moves fastest in the middle the glacier



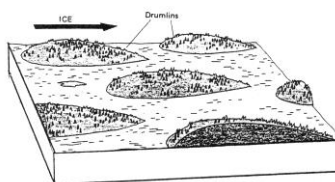
Evidence of Glacier Erosion –

- a. U-shaped valleys
- b. hills of unsorted / unlayered sediments
- c. polished bedrock with parallel grooves (scratches or striations)
- d. erratics – random boulders dropped off by glaciers

e. **moraines** - elongated hills of glacial till (unsorted deposits) dropped off directly by glacier when it melts (hills on Long Island's north shore)

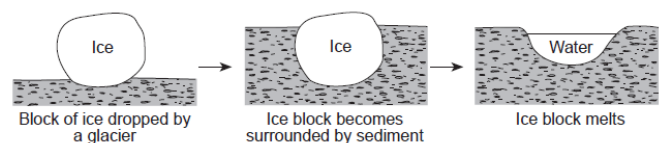


f. **drumlins** - unsorted teardrop-shaped hills that point in direction of glacier movement



g. **outwash plain** – sorted rock material deposited by glacial meltwater (Long Island's flat south shore)

h. **kettle lakes** - steep lake left when glacier carves out a hole and then ice from glacier melts to fill it (N.Y.'s Finger Lakes)



4. Erosion by Running Water (streams, rivers, runoff from precipitation, etc..) -

water is the dominant agent of erosion on Earth today

Evidence of Water Erosion –

- rounded, smooth sediments
- sorted and layered sediments
- V-shaped stream valleys (canyons)
- delta formation – triangular landform at the end of a stream where eroded sediments are dropped off

Stream Velocity (speed of water) determines the amount of erosion – **faster = more erosion**

Factors that affect stream velocity:

a. Gradient (slope of the land)

steeper = faster velocity

b. Stream Discharge
(volume of water in the stream)

more discharge = faster velocity
- greatest in the spring when snowcaps on mountains melt and because of excess rainfall
- increases when smaller rivers flow into a bigger one

c. Channel Shape

strighter = faster velocity

Stream Velocity affects Carrying Power

Faster streams can carry more particles, and larger particles.

What is the biggest particle size that can be carried by water moving at...

- 0.1 cm/sec? _____
- 1.0 cm/sec? _____
- 20 cm/sec? _____

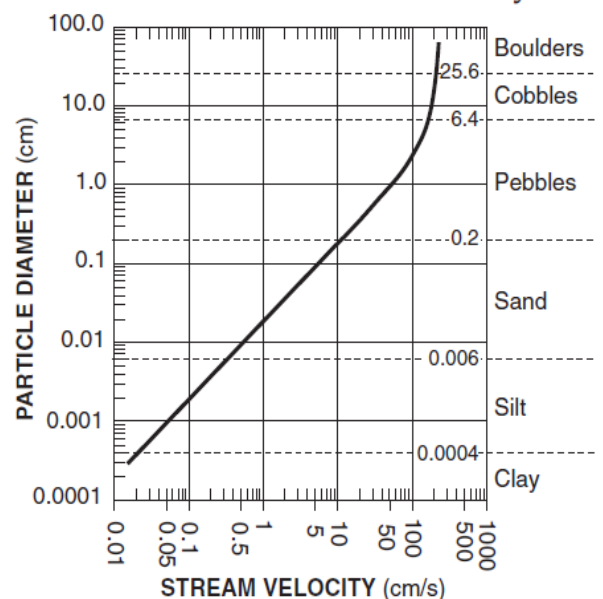
Streams carry sediments in 3 different ways:

rolling on the bottom – larger (coarser), denser particles

suspension – smaller (finer) particles are carried in the water

solution – some minerals dissolve in the water (salt)

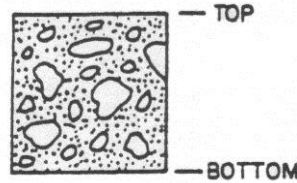
Relationship of Transported Particle Size to Water Velocity



Agents of Erosion

1. On Earth today, which is responsible for moving the greatest amount of material?
- (1) running water (3) wind
(2) groundwater (4) glaciers
2. The diagram below represents a cross section of a soil deposit from a hill in central New York State. The deposition was most likely caused by

- 1 a glacier
2 a wind storm
3 a stream entering lake
4 wave action along a beach



3. Which erosional force acts alone to produce mass movements such as avalanches and landslides?
- (1) gravity (3) wind
(2) running water (4) sea waves

4. Which rock material most likely has been transported by wind?

- (1) large boulders with sets of parallel scratches
(2) jagged cobbles consisting of interlocking crystals
(3) irregularly-shaped pebbles which contain fossils
(4) sand grains in the desert

5. Which agent of erosion was primarily responsible for forming the long, narrow, U-shaped valleys in the Finger Lakes region of New York State?

- (1) wind (3) continental glaciers
(2) landslides (4) meandering streams

6. Which property would best distinguish sediment deposited by a river from sediment deposited by a glacier?

- (1) mineral composition of the sediment (3) amount of sediment sorting
(2) thickness of sediment layers (4) age of fossils found in the sediment

7. The photograph shows a sand dune that formed in a coastal area.

This sand dune was most likely formed by

- (1) water flowing from the left
(2) water flowing from the right
(3) wind blowing from the left
(4) wind blowing from the right



8. The photograph below shows a large boulder of metamorphic rock in a field in New York State. The boulder was most likely moved to this location by

- (1) glacial ice (3) a stream
(2) wind (4) volcanic action



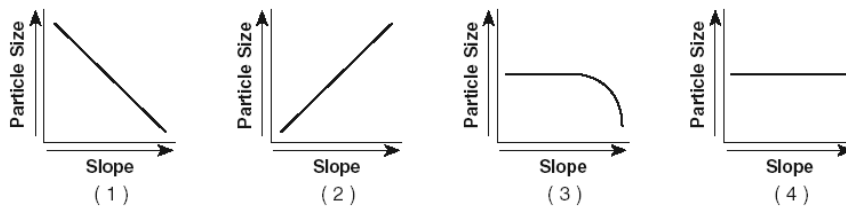
9. What change will a pebble usually undergo when it is transported a great distance by streams?

- (1) It will become jagged and its mass will decrease.
- (2) It will become jagged and its volume will increase.
- (3) It will become rounded and its mass will increase.
- (4) It will become rounded and its volume will decrease.

10. A stream flowing at a velocity of 100 cm/sec can transport

- 1 silt, but not sand, pebbles, or cobbles
- 2 silt and sand, but not pebbles and cobbles
- 3 silt, sand, and pebbles, but not cobbles
- 4 silt, sand, pebbles, and cobbles

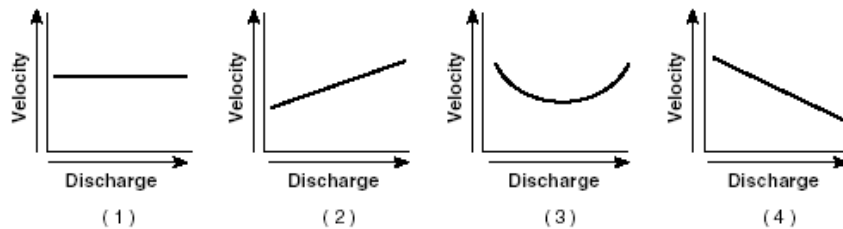
11. Which graph best represents the relationship between the slope of a river and the particle size that can be transported by that river?



12. Which agent of erosion most likely formed the drumlins found in New York State?

- (1) running water
- (2) moving ice
- (3) wave action
- (4) mass movement

13. Which graph best represents the relationship between the discharge of a stream and the velocity of stream flow?



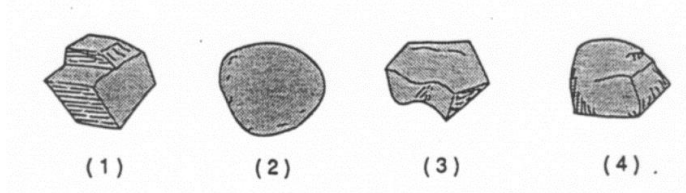
14. A brief, heavy rainstorm occurs in the mountains. How will the volume of water and the rate of erosion in the stream change shortly after the rainstorm?

- (1) The volume of water will decrease and the rate of erosion will increase.
- (2) The volume of water will increase and the rate of erosion will decrease.
- (3) Both the volume of water and the rate of erosion will decrease.
- (4) Both the volume of water and the rate of erosion will increase.

15. Which landscape characteristic indicates a landscape has been formed primarily by streams?

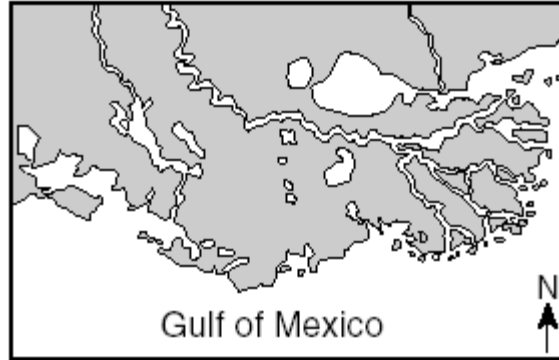
- (1) residual soil covering a large area
- (2) coastal sand dunes
- (3) V-shaped valleys
- (4) parallel hills of unsorted sediments

16. Which of the particles below was eroded by a stream for the longest period of time?



17. 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



18. 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

19. Parallel grooves etched in bedrock is evidence of erosion by

- (1) gravity
- (2) glaciers
- (3) wind
- (4) water

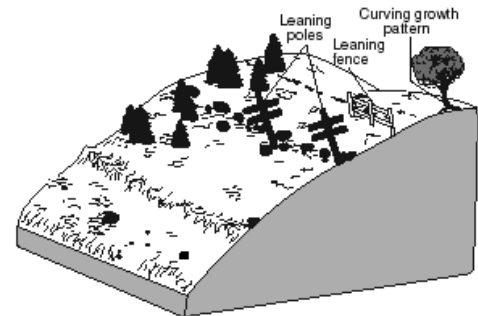
20. Which material could best be carried in solution (dissolved) by a stream?

- 1 sand
- 2 salt
- 3 clay
- 4 silt

21. The diagram 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
- (2) moving ice
- (3) prevailing wind
- (4) mass movement



1.

STREAM
VELOCITY

Topic:

Weathering, Erosion,
and Deposition

3.

PARTICLE
DENSITY

2.

PARTICLE SIZE

4.

PARTICLE SHAPE

Aim:

Deposition -

the dropping off of sediments

Setting Rate	Setting Time
how fast a particle settles (cm/sec)	how long it takes for a particle to settle (seconds)

Topic: Weathering, Erosion, and Deposition

Aim:

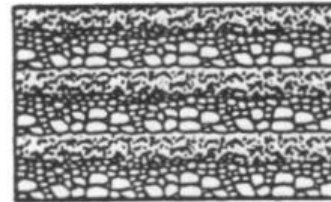
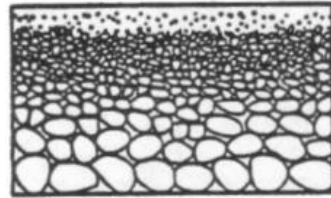
Sorting Patterns -

the natural separation of sediments based on size, shape and density

1.

Vertical Sorting

- occurs when there is a sudden depositional event in water
- larger particles fall first, followed by smaller ones on top



Layering →
indicates multiple
depositional events

2. HORIZONTAL SORTING

When a stream enters a body of still water (lake or ocean) it loses kinetic energy (slows down) dropping off bigger particles right at the mouth (end of stream). Smaller particles are carried farther into the still water. Leads to formation of a delta (triangular depositional feature at the mouth of a stream).

stream flow

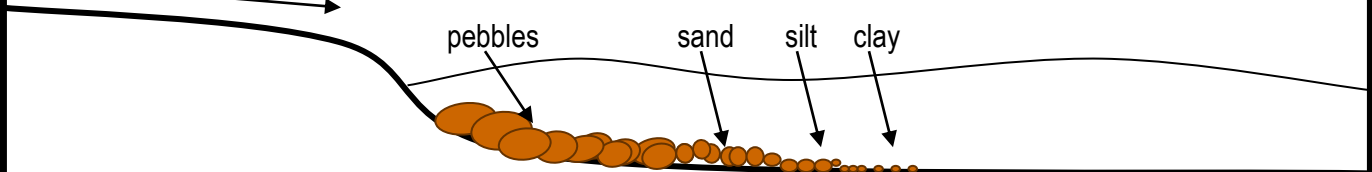
still water

pebbles

sand

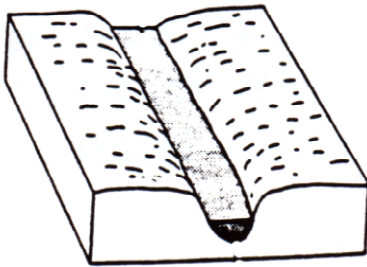
silt

clay

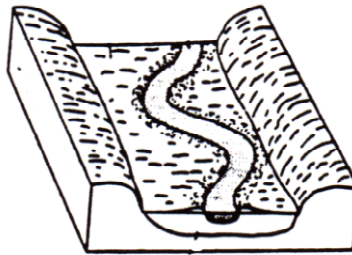


Topic: Weathering, Erosion, and Deposition

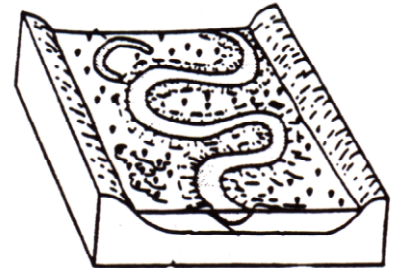
Aim:



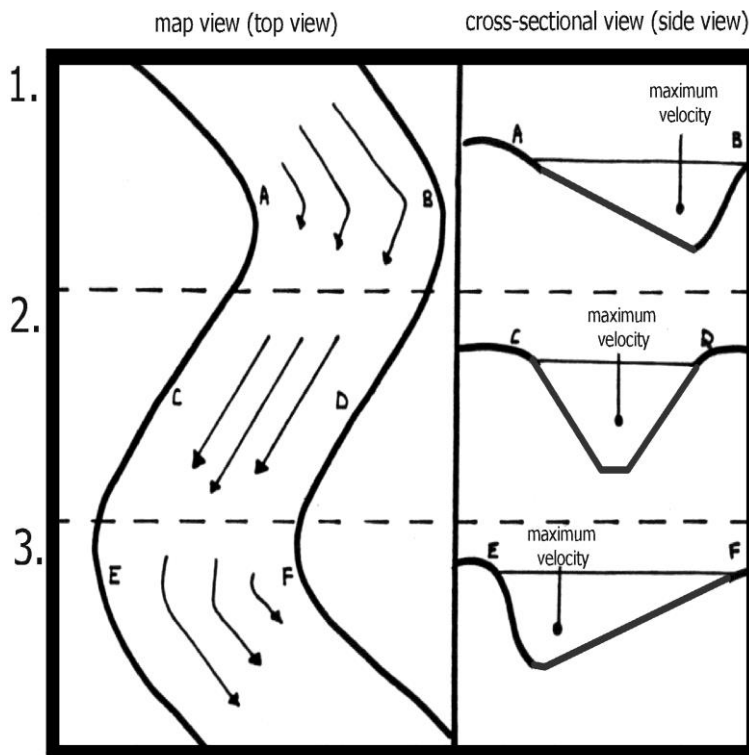
- Straight and narrow channels
- Steep slopes (canyons)
- Waterfalls and rapids
- V-shaped valleys



- Some meanders (curves)
- Slopes less steep (stream slows down)
- Development of a **floodplain** (flat area surrounding stream that gets covered with water during flood stage)



- many meanders
- much flatter terrain
- large floodplain
- **oxbow lakes** (horseshoe-shaped cut-offs of stream channel)



In the straight part of the stream (C-D) equilibrium exists between erosion and deposition (they occur equally)

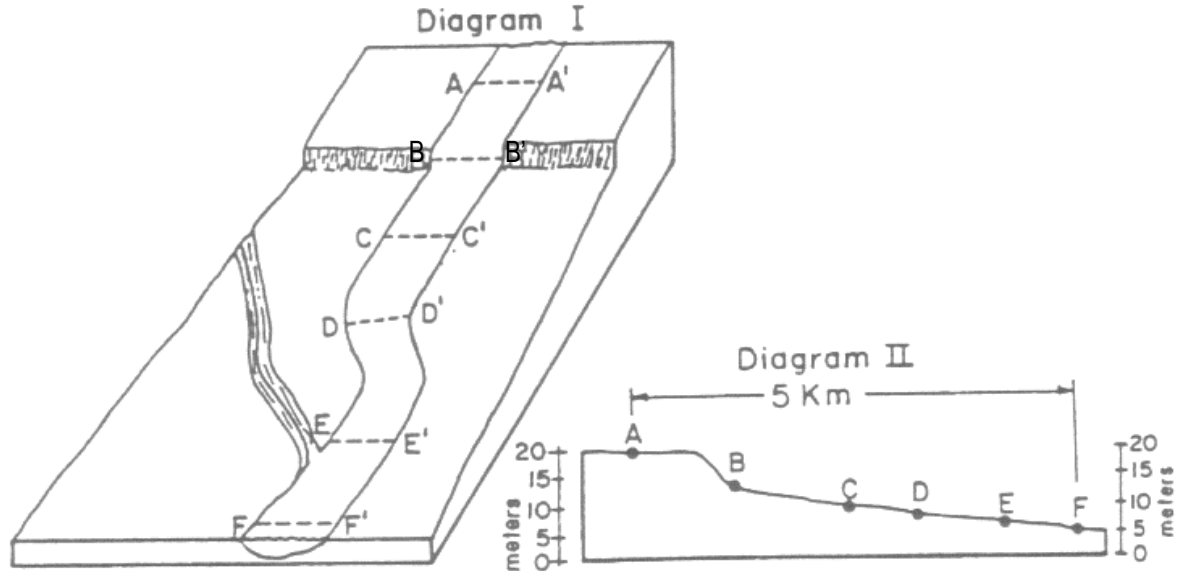
Water moves faster on the outside curve causing more erosion. B and E are outside curves –water moves faster causing more erosion.

On the inside curve water moves slower depositing (dropping off) sediments. A and F are inside curves – water slows down and sediment is deposited.

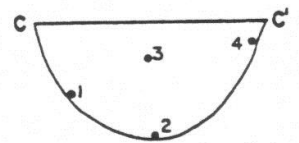
point bars – “mini-beaches” formed by deposition on the inside curve of a stream where the water slows down

Stream Erosion and Deposition

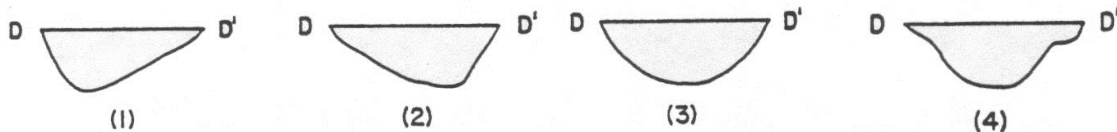
Questions 1-4: Diagram I shows the paths of two streams over the Earth's surface. Diagram II shows the side-view profile of the major stream.



- At which location would the stream velocity be the greatest?
 - A
 - B
 - C
 - D
- The greatest volume of water would most likely be moving past which location?
 - F-F'
 - B-B'
 - C-C'
 - D-D'
- The diagram to the right shows the cross-section of the stream at C-C'. At which position in the stream channel would the velocity of the water be the greatest?
 - 1
 - 2
 - 3
 - 4

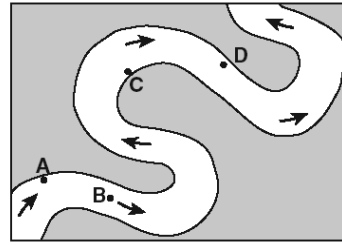


- Which cross section best represents the shape of the stream at D-D'?



- A decrease in the velocity of a stream will most likely cause an increase in
 - the amount of sediment carried by the stream
 - the size of the particles carried by the stream
 - deposition within the stream channel
 - abrasion of the stream channel

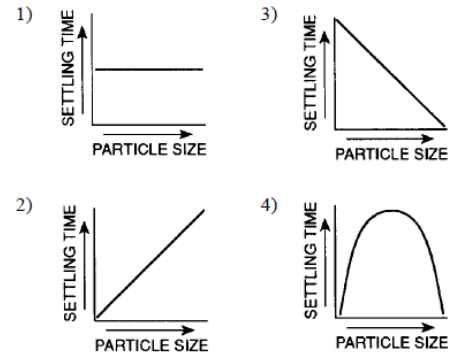
6. The map to the right shows a meandering stream. Points A, B, C, and D represent locations along the stream bottom.



At which location is the greatest amount of sediment most likely being deposited?

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

7. In a soil sample, the particles have the same shape but different sizes. Which graph best represents the relationship between particle size and settling time when these particles are deposited in a quiet body of water?



8. Clay, silt, and sand are added to a jar of water. The jar is shaken and then allowed to stand quietly for a number of hours. The result of this demonstration could be best used as a model to show that

- (1) particles with the lowest density settle the fastest
(2) particles with the largest diameter settle the fastest
(3) water has a higher specific gravity than clay, silt, and sand
(4) the bottom layer of a series of sediments is the youngest



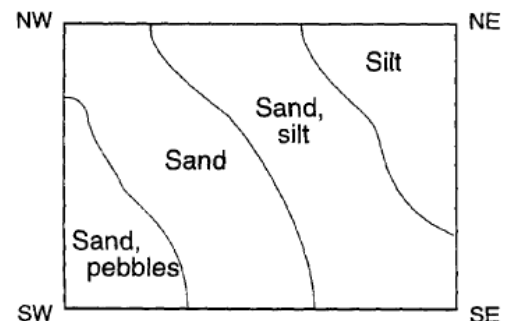
9. The four particles shown in the table below are of equal volume and are dropped into a column filled with water. Which particle would usually settle most rapidly?

Particle	Shape	Density
A	flat	2.5 g/cm ³
B	flat	3.0 g/cm ³
C	round	2.5 g/cm ³
D	round	3.0 g/cm ³

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

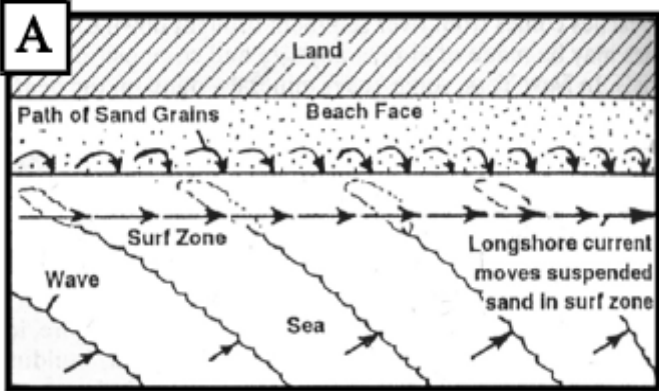
10. A stream entering a lake deposits sediments on the lake bottom in the pattern shown on the map below. Which corner of the map is nearest to the point where the stream flows into the lake?

- (1) northeast (NE) (3) southeast (SE)
(2) northwest (NW) (4) southwest (SW)

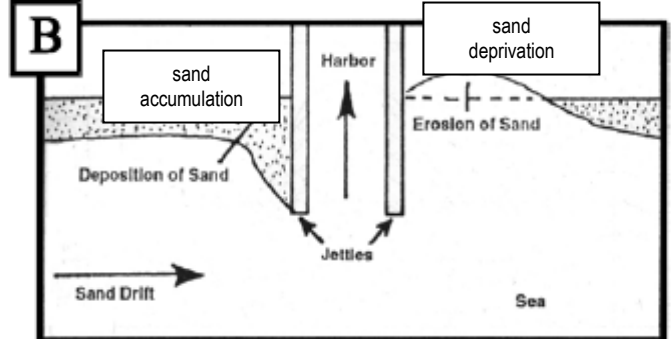


Topic: Weathering, Erosion, and Deposition

Aim:

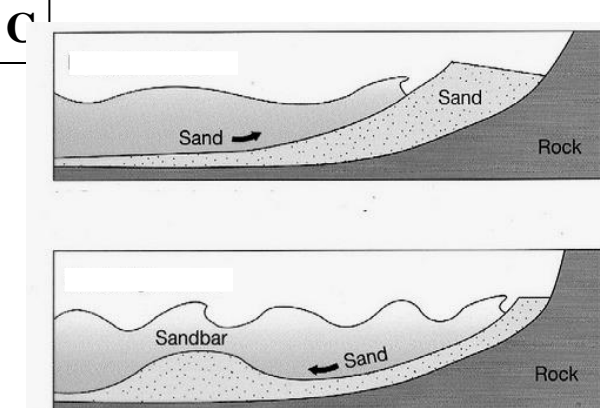


Longshore Drift – movement of sand parallel to the shoreline as waves strike the beach at an angle



Jetties and Groins – man-made walls built perpendicular to the beach to try and slow the effects of longshore drift

change the coastal landscape by preventing sand from moving down shore



sandbars – waves pull sand away from the shoreline and builds up under water

barrier island – forms when a sandbar accumulates enough sand to rise above sea level (Jones Beach Island, Fire Island)

Name _____

Date _____

Weathering, Erosion, Deposition Review

1. 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 winter	3 higher atmospheric pressure in summer
2 lower humidity in winter	4 higher precipitation in summer
2. On Earth today, which is responsible for moving the greatest amount of material?

1 groundwater	3 wind
2 glaciers	4 running water
3. The photograph below shows a U-shaped valley.

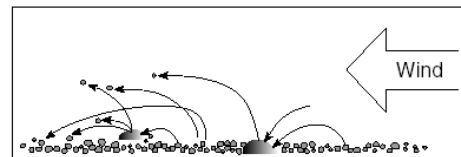


Which agent of erosion most likely produced this valley's shape?

- | | |
|-----------------|-------------------|
| (1) wave action | (3) blowing wind |
| (2) moving ice | (4) flowing water |
4. The diagram below shows sand particles being moved by wind.

At which Earth surface locations is this process usually the most dominant type of erosion?

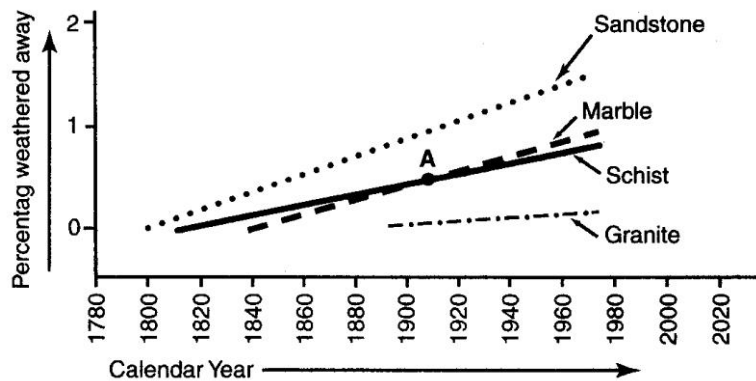
- (1) deserts and beaches
- (2) deltas and floodplains
- (3) glaciers and moraines
- (4) mountain peaks and escarpments



5. The principal cause of the frost action of rocks on the Earth's surface is
 - 1 rock abrasion
 - 2 the heating and cooling of surface rock
 - 3 mineral reactions with air and water
 - 4 the expansion of water as it freezes
6. A quartz pebble is transported by a stream for a long period of time. Which property of the pebble is least likely to change?

1 volume	3 mass
2 density	4 shape

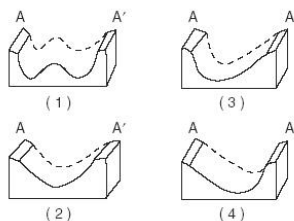
Base your answers to **questions 7 through 9** on the graph below which was prepared from the results of a study of four different types of cemetery stones. The graph shows the relationship between the ages of four cemetery stones and the percentage of each stone which had weathered away.



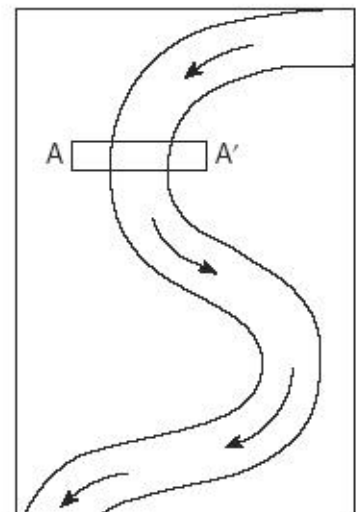
7. Which rock was found to have been exposed to weathering for the least number of years?
 - 1 granite
 - 2 schist
 - 3 marble
 - 4 sandstone
8. In this study, which rock was most resistant to weathering?
 - 1 marble
 - 2 schist
 - 3 granite
 - 4 sandstone
9. Studies have shown that pollutants added to the atmosphere in recent years are accumulating to cause an increase in the rate of weathering of marble. This factor should cause the line in the graph for marble in the future to
 - 1 increase in slope (curve upward)
 - 2 decrease in slope (curve downward)
 - 3 remain at the same slope
10. If the gradient of a stream increases at a certain location, the amount of erosion will
 - 1 decreases
 - 2 increases
 - 3 remains the same

Use the diagram to the right to answer **questions 11 and 12**.

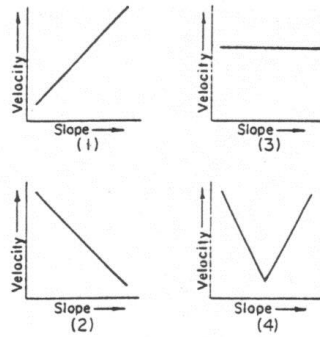
11. Which cross-section best represents the profile from A to A'?



12. Which landscape feature would this meandering stream most likely be associated?
 - 1 a steep canyon
 - 2 a large area of rapids
 - 3 a gently sloping landscape
 - 4 a mountainous area



13. Which graph best illustrates the relationship between stream velocity and the slope of the stream channel?

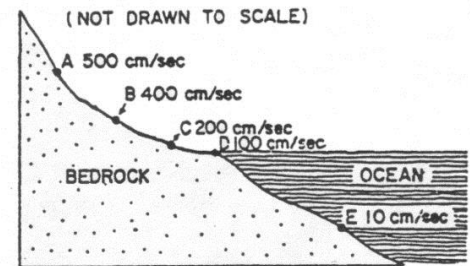


14. As stream discharge increases, the velocity of a stream will generally
 (1) increase (2) decrease (3) remain the same

Base your answers to **questions 15 through 17** on the diagram below. The diagram shows the profile of a stream carrying particles which have a range of diameters from 0.0001 to 50 centimeters. The velocity of the stream is indicated at locations A through E.

15. Between points A and D, the velocity of the stream
 1 increase
 2 decrease
 3 remain the same

16. At point E, what are the largest particles being carried?
 1 sand 3 cobbles
 2 pebbles 4 clay



17. At the end of this river, deposition of sediment will eventually create a landform known as a
 1 delta 3 sandbar
 2 moraine 4 drumlin

18. More deposition than erosion will take place in a streambed when
 1 density of the rock particles carried by the stream decreases
 2 slope of the stream increases
 3 discharge of the stream increases
 4 velocity of the stream decreases

19. As particle size decreases, its rate of weathering
 1 increases 2 decreases 3 remains the same

20. Water and air chemically combine with iron to form rust. This is a description of a process known as
 (1) frost action (3) carbonation
 (2) hydrolysis (4) oxidation

21. In which climate would the chemical weathering of limestone occur most rapidly?
 (1) cold and dry (3) warm and dry
 (2) cold and humid (4) warm and humid

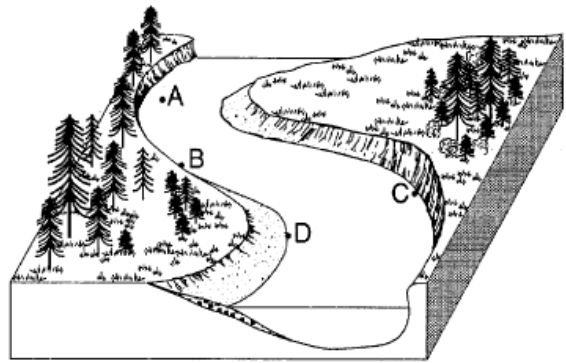
Based your answers to **questions 22 and 23** on the diagram below

22. Which material is most likely to be transported in suspension during the slowest stream velocity?

- 1 pebbles
- 2 sand
- 3 silt
- 4 clay

23. At which point is the amount of deposition greater than the amount of erosion?

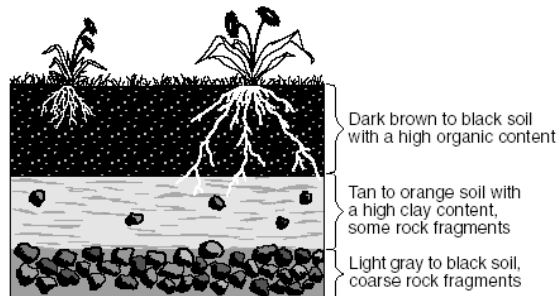
- | | |
|-----|-----|
| 1 A | 3 C |
| 2 B | 4 D |



24. The cross section below shows layers of soil.

Which two processes produced the layer of dark brown to black soil?

- (1) melting and solidification of magma
- (2) erosion and uplifting
- (3) weathering and biologic activity
- (4) compaction and cementation



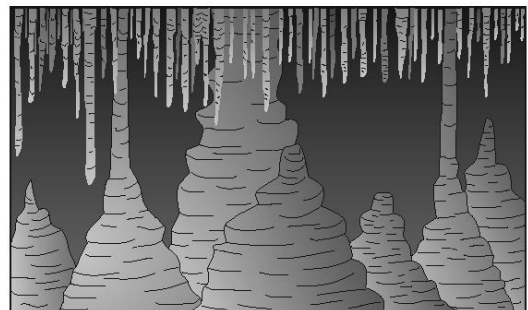
24. Which event will most likely occur during the spring thawing of ice and snow?

- (1) Less sediment will be carried by 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 streams will increase.

25. The diagram to the right shows some features in a cave.

Which type of rock was chemically weathered by acidic groundwater to produce the cave and its features?

- | | |
|---------------|---------------|
| (1) siltstone | (3) quartzite |
| (2) basalt | (4) limestone |



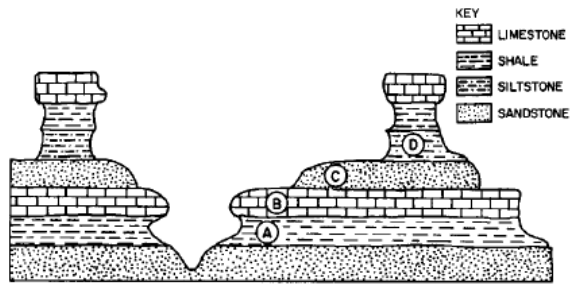
26. The principal cause of the chemical weathering of rocks on the Earth's surface is

- (1) rock abrasion
- (2) the heating and cooling of surface rock
- (3) mineral reactions with air and water
- (4) the expansion of water as it freezes

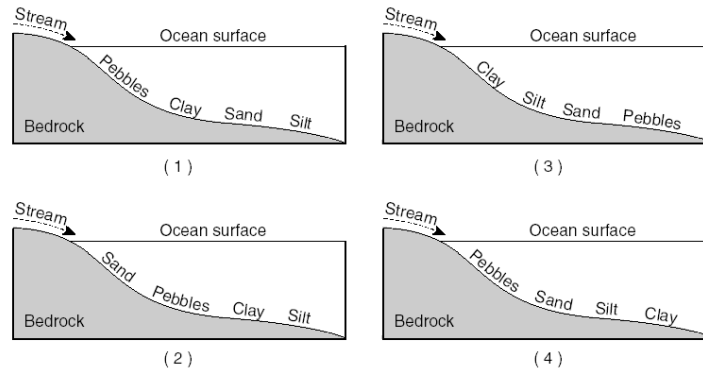
27. The diagram below shows an outcrop of different layers of sedimentary rock located on the Earth's surface.

Which layer appears to be the most resistant to weathering?

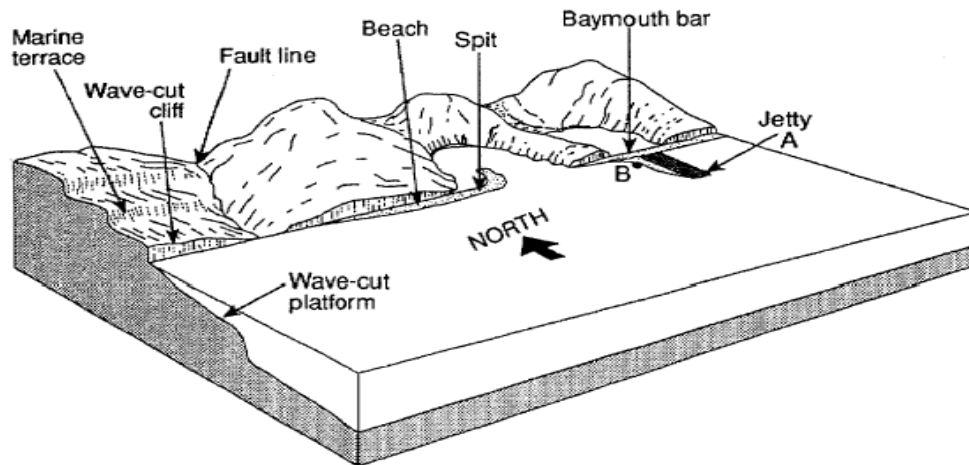
- (1) A (3) C
(2) B (4) D



28. Which profile best shows the general depositional pattern that occurs when water from a stream enters the ocean?



29. Which statement best describes the longshore current that is modifying this coastline?



- 1 The current is flowing northward at a right angle to the shoreline.
- 2 The current is flowing southward at a right angle away from the shoreline.
- 3 The current is flowing eastward parallel to the shoreline.
- 4 The current is flowing westward parallel to the shoreline.

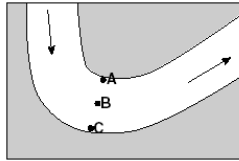
30. Which agent of erosion was most likely responsible for shaping the particles in this sedimentary rock?

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



(Shown actual size)

31. The map below shows the bend of a large meandering stream. The arrows show the direction of stream flow. Letters A, B, and C are positions on the streambed where erosion and deposition data were collected.



Which table best represents the locations where erosion and deposition are dominant and where an equilibrium (balance) exists between the two processes?

	Erosion	Equilibrium	Deposition
A		✓	
B			✓
C	✓		

(1)

	Erosion	Equilibrium	Deposition
A	✓		
B		✓	
C			✓

(3)

	Erosion	Equilibrium	Deposition
A			✓
B	✓		
C		✓	

(2)

	Erosion	Equilibrium	Deposition
A			✓
B		✓	
C	✓		

(4)

Diagrams A, B, and C represent three different river valleys.

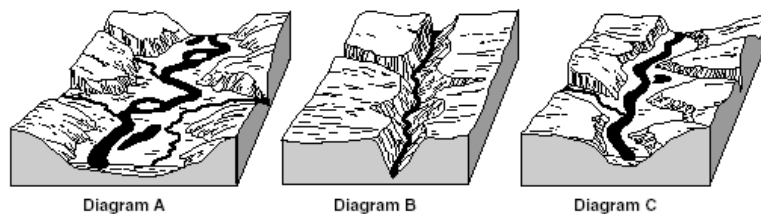
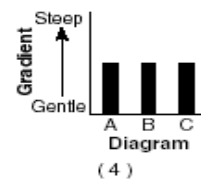
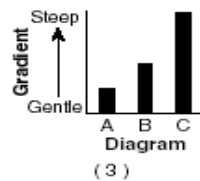
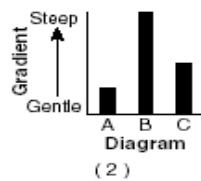
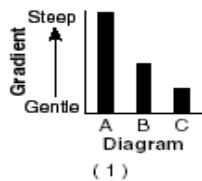


Diagram A

Diagram B

Diagram C

32. Which bar graph best represents the relative gradients of the main rivers shown in diagrams A, B, and C?



33. Name the agent of erosional-depositional force (wind, streams, waves, glaciers, gravity) most related to the word or phrase given.

- a. polished and grooved bedrock _____
- b. landslide _____
- c. sand dunes _____
- d. moraines _____
- e. barrier islands _____
- f. mass movement _____
- g. V-shaped valleys _____