N O T E S
Hydrology, Weathering,
Erosion & Deposition

OBJECTIVES

Correctly define: abrasion, capillarity, deposition, discharge, erosion, evapotranspiration, hydrology, impermeable, infiltration, meander, permeable, porosity, water table, weathering, zone of aeration, zone of saturation

HYDROLOGY:

➢ Explain what the hydrologic cycle is and correctly label a diagram of the hydrologic cycle.
➢ Explain the difference between permeability, porosity, and capillarity.
➢ Explain the relationship between particle size and each of the following: permeability, porosity, and capillarity.
➢ Describe how slope, particle size, and the state of soil (frozen or unfrozen) affect the rate of infiltration
➢ Describe the factors that affect runoff and stream discharge.

WEATHERING:

➢ Identify the two types of weathering---physical and chemical.
➢ Give two examples of both physical and chemical weathering.
➢ Describe the environment in which chemical weathering would be the greatest.
➢ Explain surface area and composition affect the rate of weathering.
➢ Explain the normal progression of soil profile development.

EROSION:

➢ Identify the greatest force and agents of erosion.
➢ Describe the difference in the shape of valleys carved out by streams and those carved out by glaciers.
➢ Describe the relationship between the rate of erosion and each of the following factors: stream discharge, slope, and location on a meander.
➢ Calculate the minimum of velocity required to move a specific size of sediment.

DEPOSITION:

➢ Describe the relationship between the rate of deposition and each of the following factors: stream velocity, slope, location on a meander, size, density, and shape.
➢ Describe the pattern of deposition for each of the following: streams, wind, glaciers, mass movement.

Vocabulary

Abrasion: _____

Capillarity: _____
_____

Deposition: _____
_____

Discharge: _____
_____

Erosion: _____
_____

Evapotranspiration: _____
_____

Hydrology: _____
_____

Impermeable: _____
_____

Infiltration: _____
_____

Meander: _____
Permeable: _____
Porosity: _____
_____

Water Table: _____
_____

Weathering: _____
_____

Zone of Aeration: _____
_____

Zone of Saturation: _____
_____

Hydrology

The water cycle is also called the _____ cycle.

Water that is stored in the oceans and lakes can _____ and become a gas. As the water rises through the atmosphere, it cools, condenses and becomes _____.   When the water gets heavy enough it can fall to the ground in the form of different types of _____. If the lithosphere (ground) is saturated, the water that has fallen can become _____ and flow directly into streams, rivers, or lakes. If the lithosphere is not saturated, the water will _____ the lithosphere and move into the zone of _____ or the zone of _____. The interface (boundary) between these two zones is called the _____. The roots of plants can reach into the zone of _____, soak up the water, and the water can then re-enter the atmosphere through the process of _____.
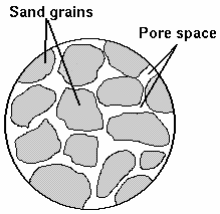
In the diagram below, place the following words in their correct locations:

condensation	evaporation	impermeable bedrock	infiltration	precipitation
runoff	transpiration	water table	zone of aeration	zone of saturation

Hydrology, Weathering, Erosion & Deposition
© **Mark Place, www.LearnEarthScience.com 2007 – 2008**

3
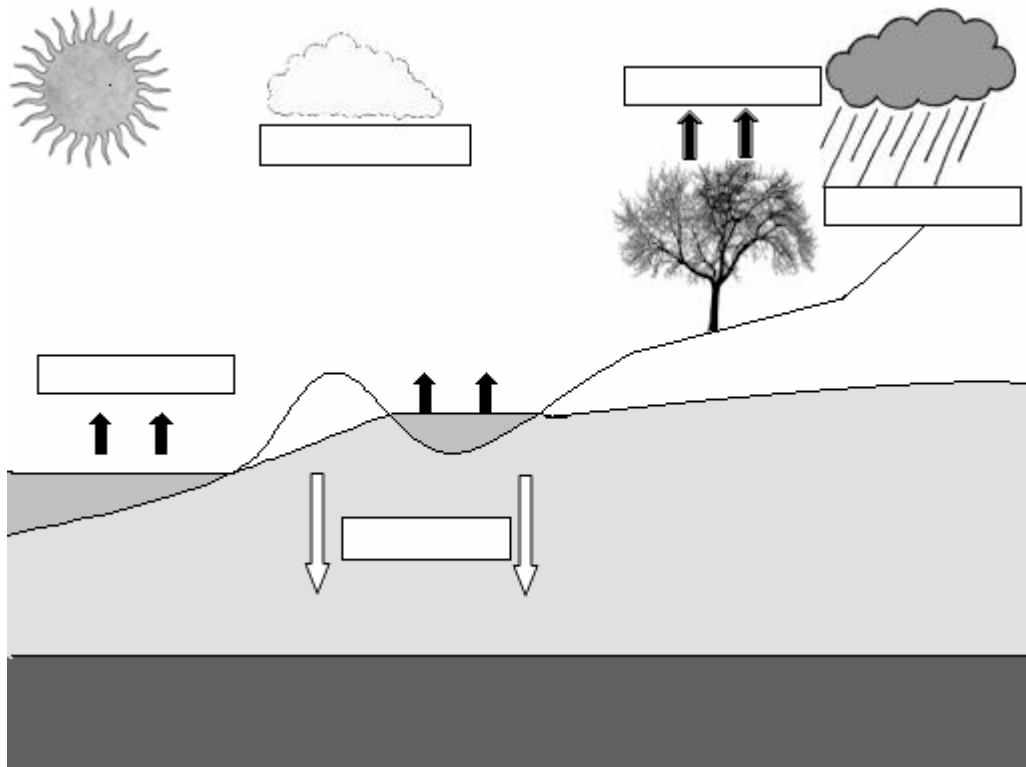
Porosity

Total volume of empty space ÷ total volume of soil = porosity

Sand grains
Pore space

What materials would you need to calculate the porosity of a sample of soil?

## ***Particle size <u>alone</u> does not determine porosity***

Identically shaped samples of increasing particles size will have the same porosity

Porosity
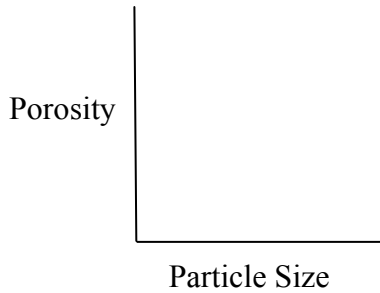
Particle Size

Which is more porous, a container of:

a. round particles	**or**	**angular particles**
b. tightly packed particles	**or**	**loosely packed particles**
c. well-sorted particles	**or**	**unsorted particles**
d. large beads	**or**	**small beads**

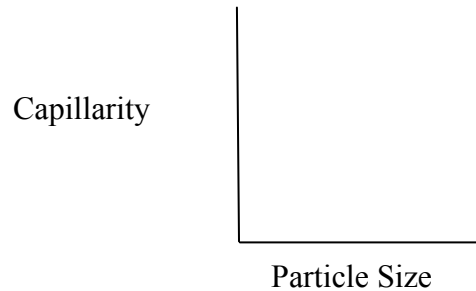
Capillarity
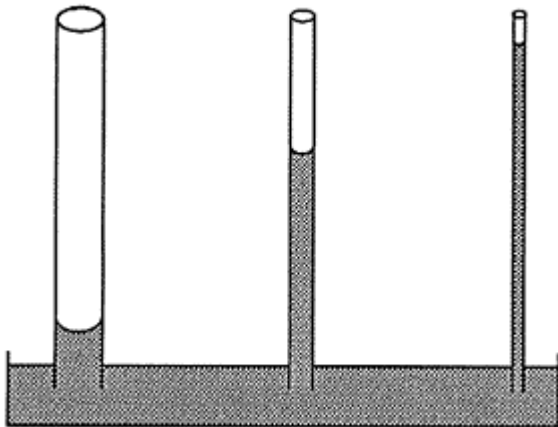
The diagram to the left shows three tubes of with different diameters. Water is placed in the tray at the bottom.
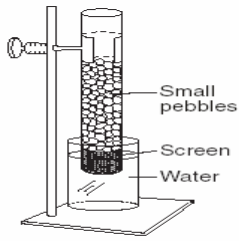
Capillary action draws the water up higher in the smaller tube.

Soils with smaller sized particles can draw water from the zone of saturation higher than those with larger sized particles.
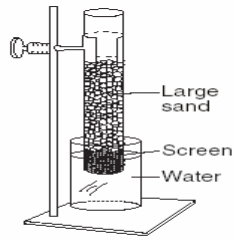
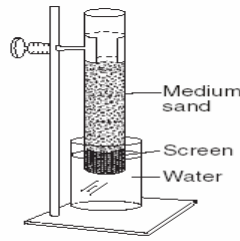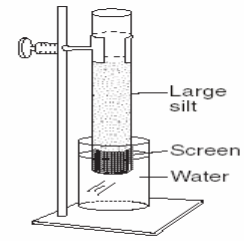Therefore, a _____ relationship exists between particle size and capillarity.

Capillarity

Particle Size

Permeability

Column A — Small pebbles, Screen, Water
Column B — Large sand, Screen, Water
Column C — Medium sand, Screen, Water
Column D — Large silt, Screen, Water

Which column would allow water to flow through fastest?_____ Why? _____

_____

If the sediment in column A and column D were combined in a fifth column, would the new column's permeability be greater, less, or the same as that of A? _____ Why? _____

_____

Permeability

Particle Size

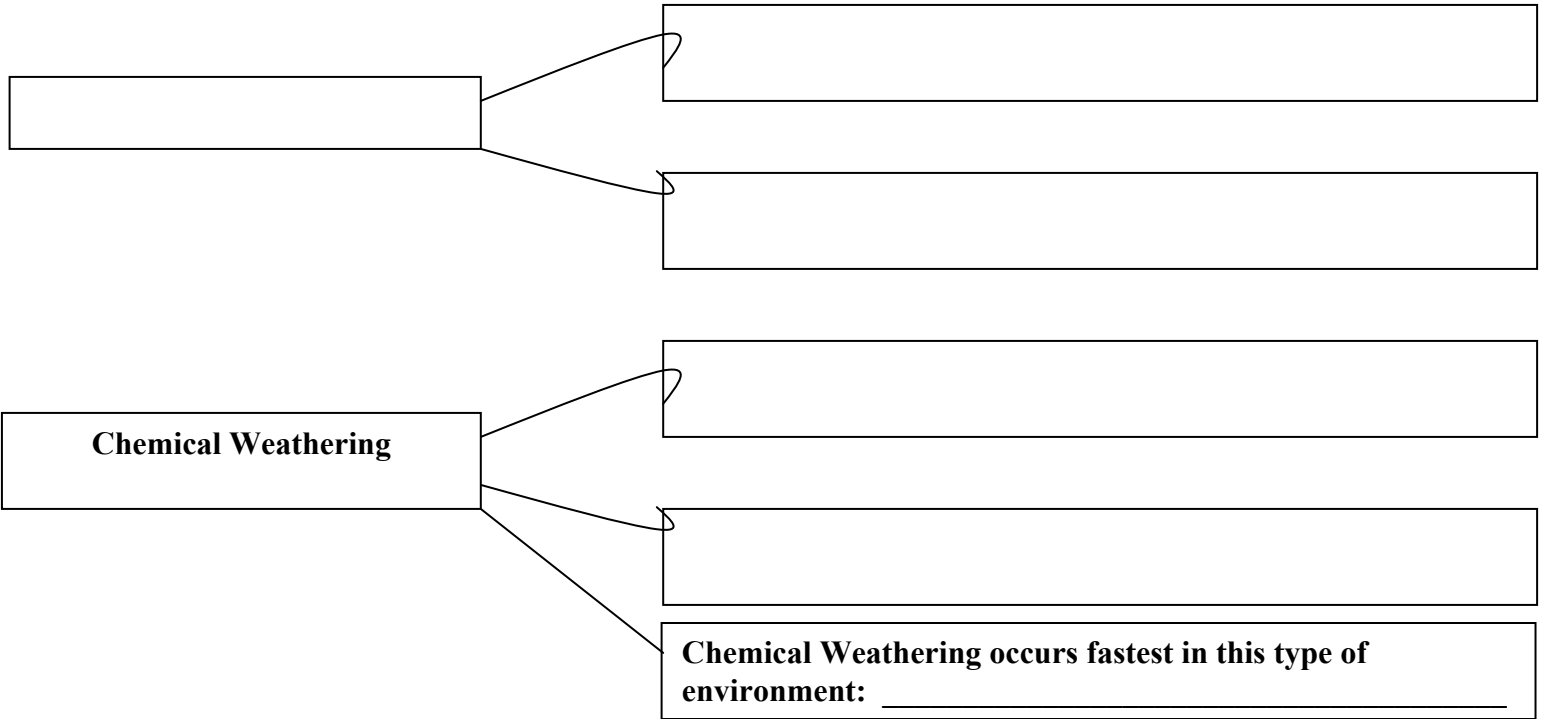> **Which is more permeable?**
> a.   small particles   or   large particles
>
> b.   frozen ground   or   unfrozen ground
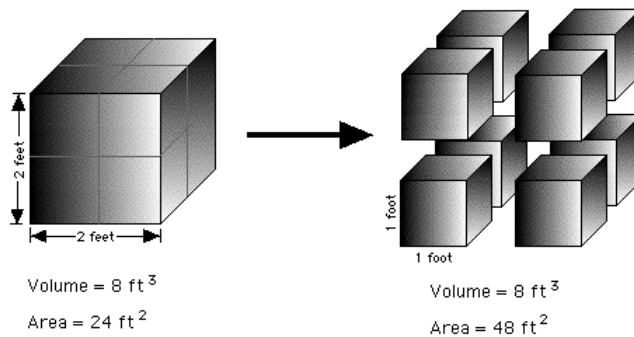
FACTORS AFFECTING RUNOFF AND STREAM DISCHARGE

Which will result in greater runoff and stream discharge?

a. an area that is vegetated   or   **an area that is barren**

b. an area that has a steep slope   or   **an area that is flat**

c. ground that is frozen   or   **ground that is unfrozen**

d. ground that is saturated   or   **ground that unsaturated**

Weathering

```
[                    ]------< [                                    ]

                            [                                    ]


[ Chemical Weathering ]------< [                                    ]

                            [                                    ]

                            [ Chemical Weathering occurs fastest in this type of
                              environment: _____ ]
```

Surface Area and Weathering

Volume = 8 ft^3
Area = 24 ft^2

Volume = 8 ft^3
Area = 48 ft^2

Why will smaller particles weather faster?

Which will weather faster and why?   Pebbles   Sand   Silt   Clay

Soil

Soil Layers

- O Horizon (humus)
- A Horizon (topsoil)
- E Horizon (eluviation layer)
- B Horizon (subsoil)
- C Horizon (regolith)
- R Horizon (bedrock)

©EnchantedLearning.com
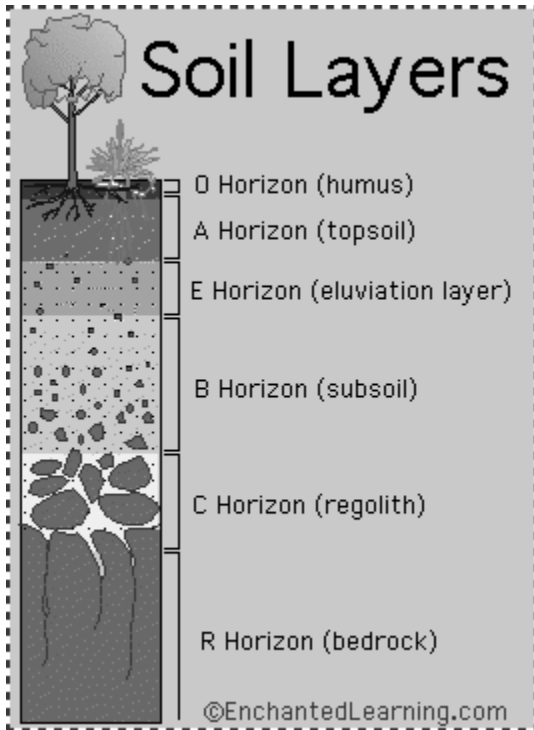
When the bedrock weathers, soil is created. Scientists separate this soil into **horizons.** Water can only infiltrate through horizon C as the R Horizon is solid rock.

Erosion

Greatest **FORCE** of Erosion	Greatest **AGENT** of Erosion
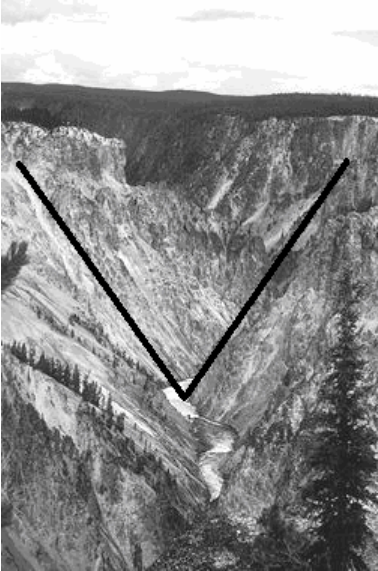
What agent of erosion is responsible for carving out
V-SHAPED valleys such as the above?

What agent of erosion is responsible for carving out
U-SHAPED valleys such as the one above?

Rate of Erosion

For each of the factors below, draw the relationship between that factor and the rate of erosion.
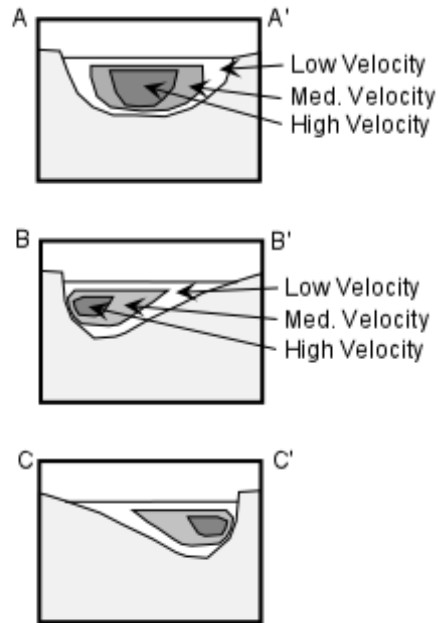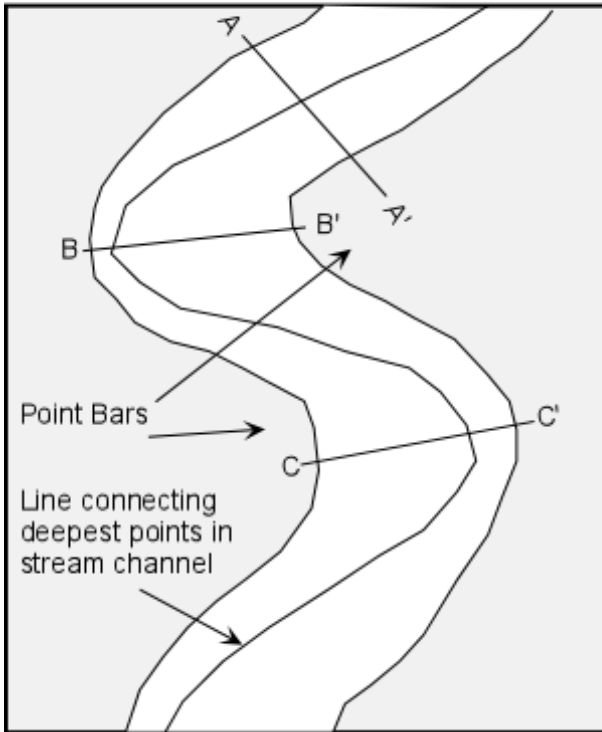
Rate of Erosion
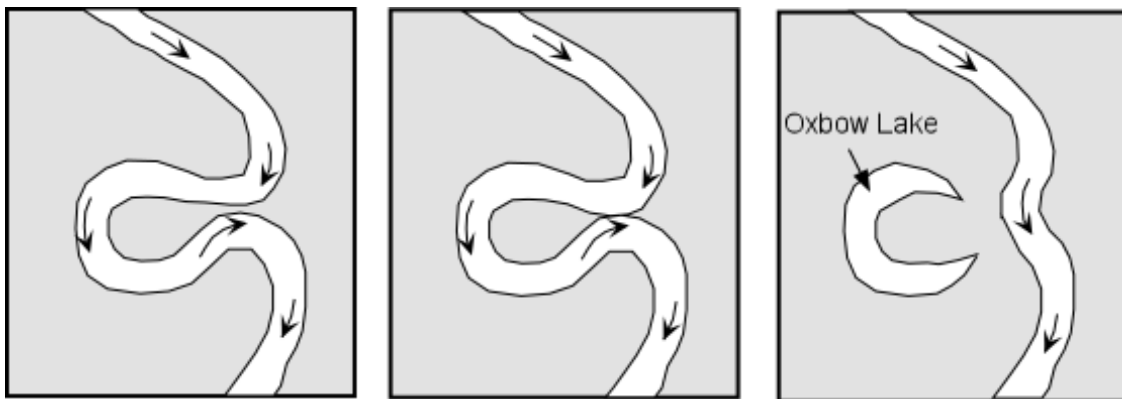
Slope

Rate of Erosion

Stream Discharge

Meandering Channels

Point Bars

Line connecting deepest points in stream channel

A — A'
- Low Velocity
- Med. Velocity
- High Velocity

B — B'
- Low Velocity
- Med. Velocity
- High Velocity
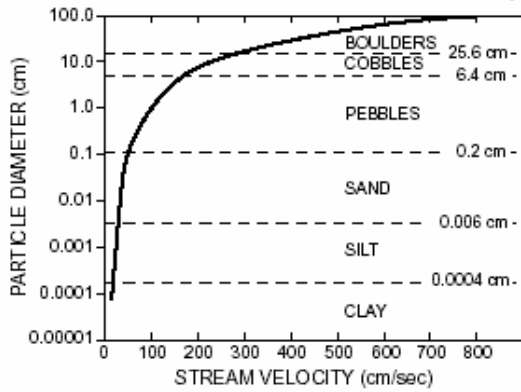
C — C'
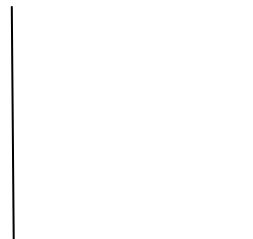
Where is erosion greatest?

Outside of Curve
Inside of Curve

Where does the river flow fastest?

Oxbow Lakes

Oxbow Lake

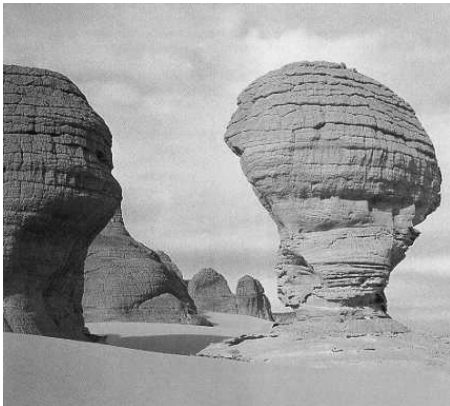Relationship of Transported Particle Size to Water Velocity

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

What page can this graph be found in the ESRTS? _____

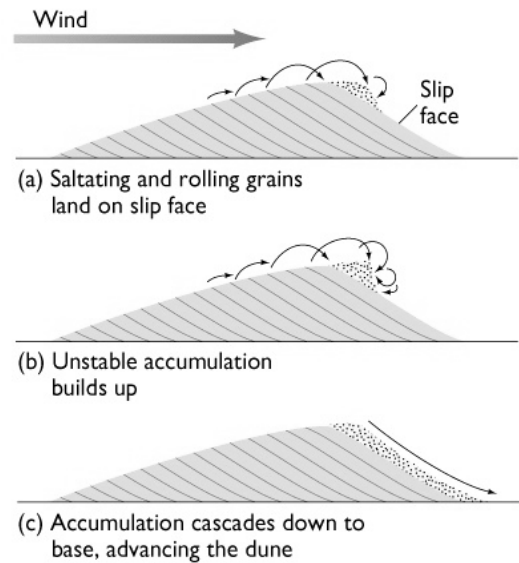What's the minimum speed water need to be moving in order to transport sand? _____

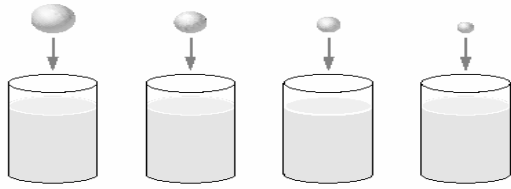In order to move a particle that is 7.0 cm, a stream's velocity would need to be at least _____ cm/sec.

Wind Erosion

desert wind erosion

How sand dunes form

(a) Saltating and rolling grains land on slip face

(b) Unstable accumulation builds up

(c) Accumulation cascades down to base, advancing the dune
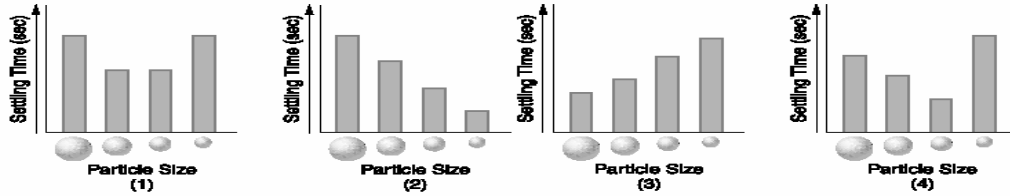

pitted

Deposition

Which graph best shows the relative settling times of the four objects?

The table below shows the density of four mineral samples.

Mineral	Density (g/cm³)
Cinnabar	8.2
Magnetite	5.2
Quartz	2.7
Siderite	3.9

What must you know in order to get this question correct?

If the shape and size of the four mineral samples are the same, which mineral will settle most *slowly* in water?

(1) cinnabar   (3) quartz
(2) magnetite   (4) siderite

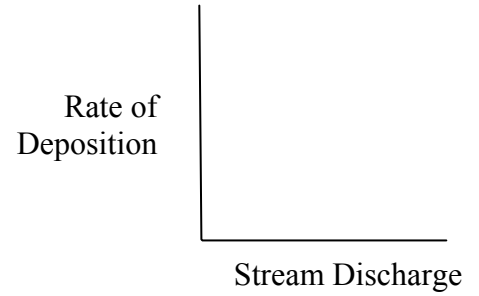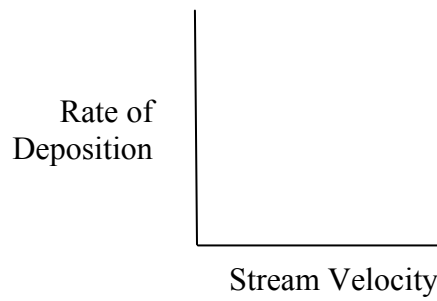
Fast

Rate of Settling
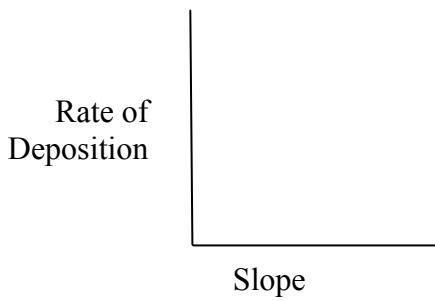
Slow

Particle Shape
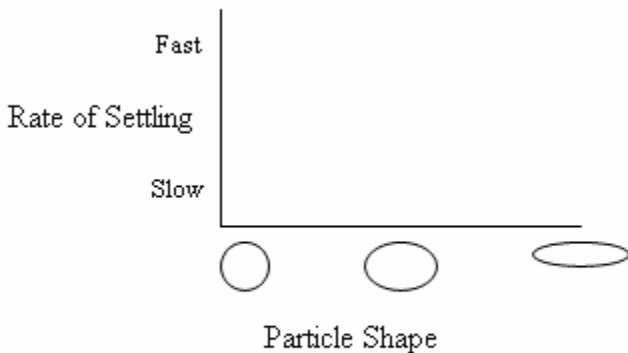
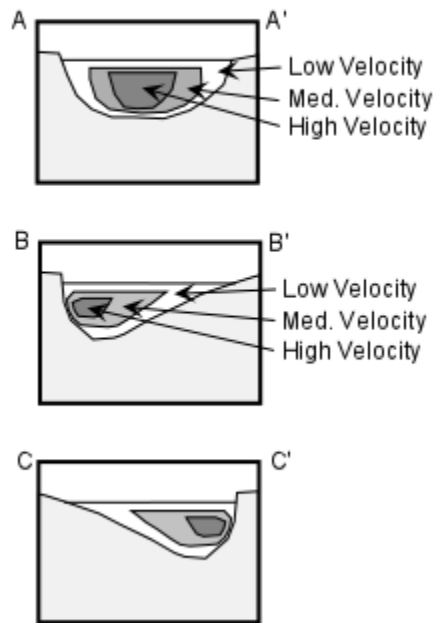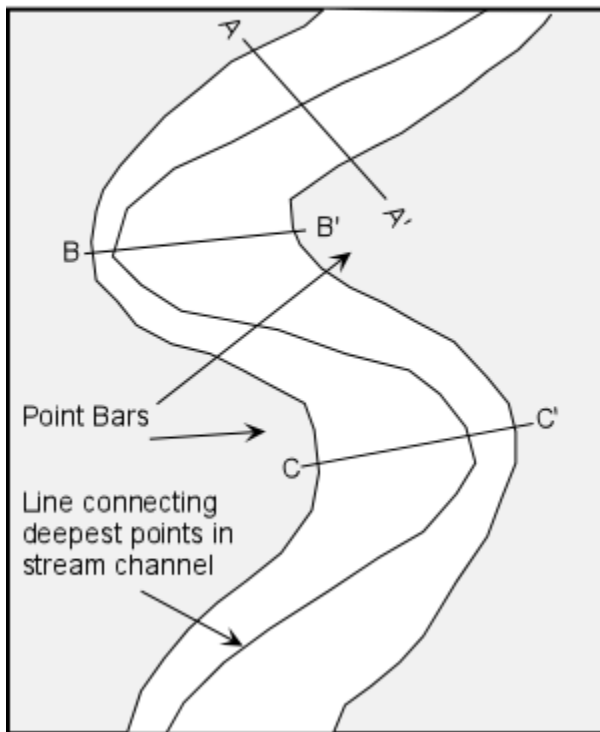Which object will settle the fastest in water?

Why?

Draw the relationship between shape and the rate of settling.

For each of the factors below, draw the relationship between that factor and the rate of deposition.

Rate of Deposition

Slope

Rate of Deposition

Stream Velocity

Rate of Deposition

Stream Discharge

Meandering Channels

Point Bars

Line connecting deepest points in stream channel

A — A'
Low Velocity
Med. Velocity
High Velocity

B — B'
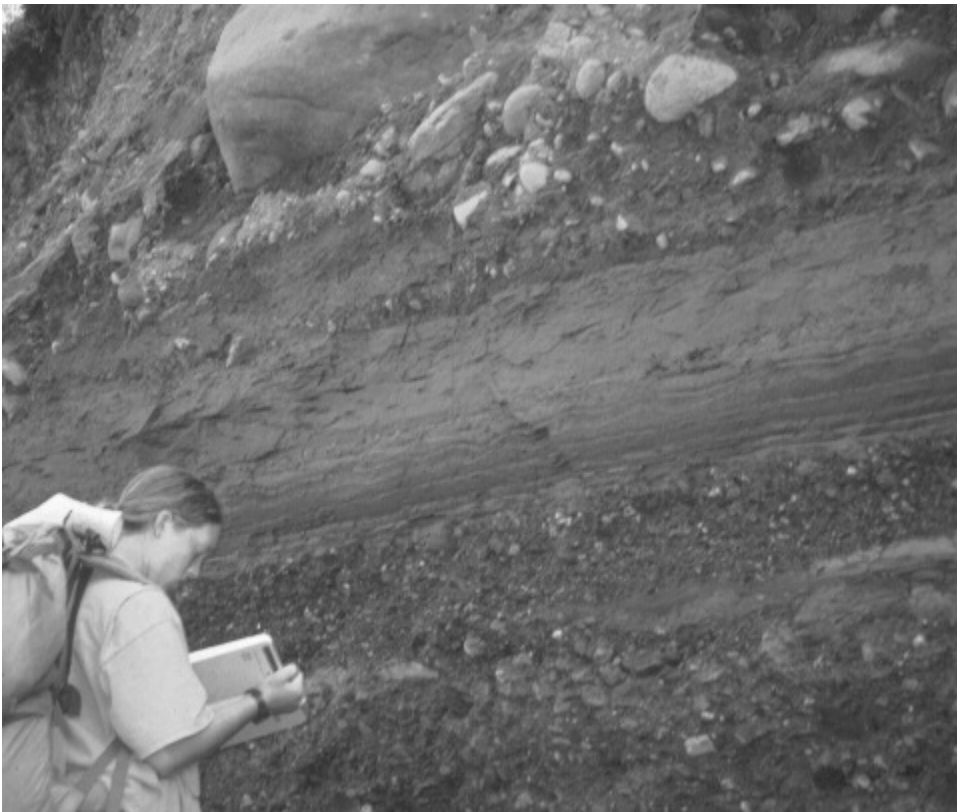Low Velocity
Med. Velocity
High Velocity

C — C'

Where is deposition greatest?

Outside of Curve
Inside of Curve

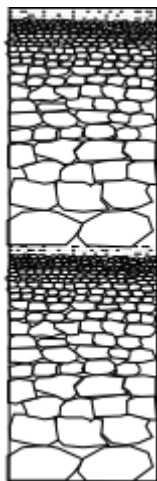Source of River
Mouth of River

Why?

What agent of deposition was probably responsible for depositing these unsorted layers of sediment?

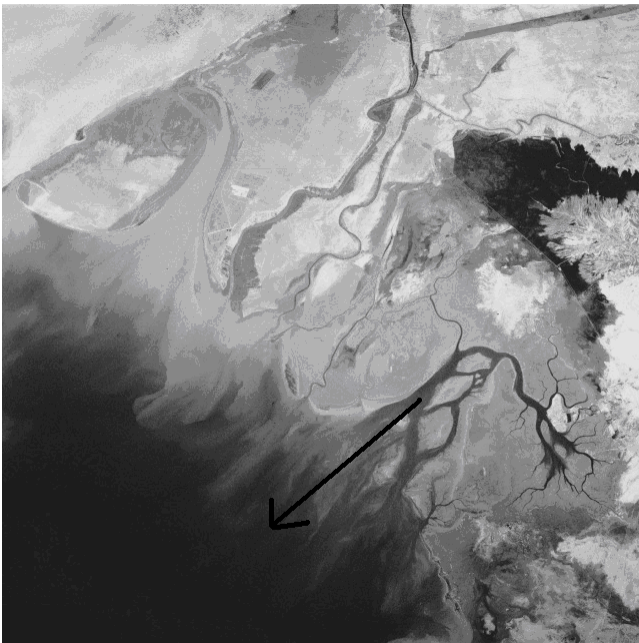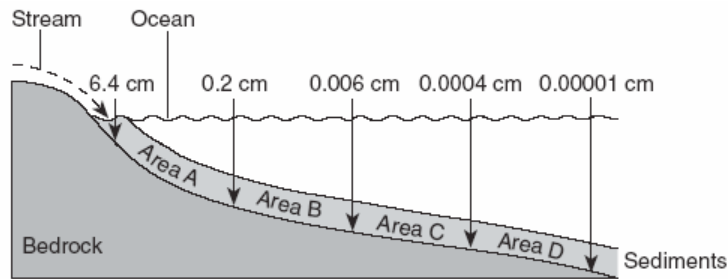# Deposition by Streams: Graded Bedding

Draw a line on the diagram to the left to show where the stream velocity changed.

Write "fastest" on the side of the diagram where the stream would have been flowing the fastest.

Write "slowest" on the side of the diagram where the stream would have been flowing the slowest.

Based on the diagram below, what happens to the size of particles deposited in the ocean as distance from the mouth of a stream increases?

Why?

Stream   Ocean

6.4 cm   0.2 cm   0.006 cm 0.0004 cm 0.00001 cm

Area A
Area B
Area C
Area D   Sediments

Bedrock

What is this type of river deposit called?

Where would the largest sized particles be found?
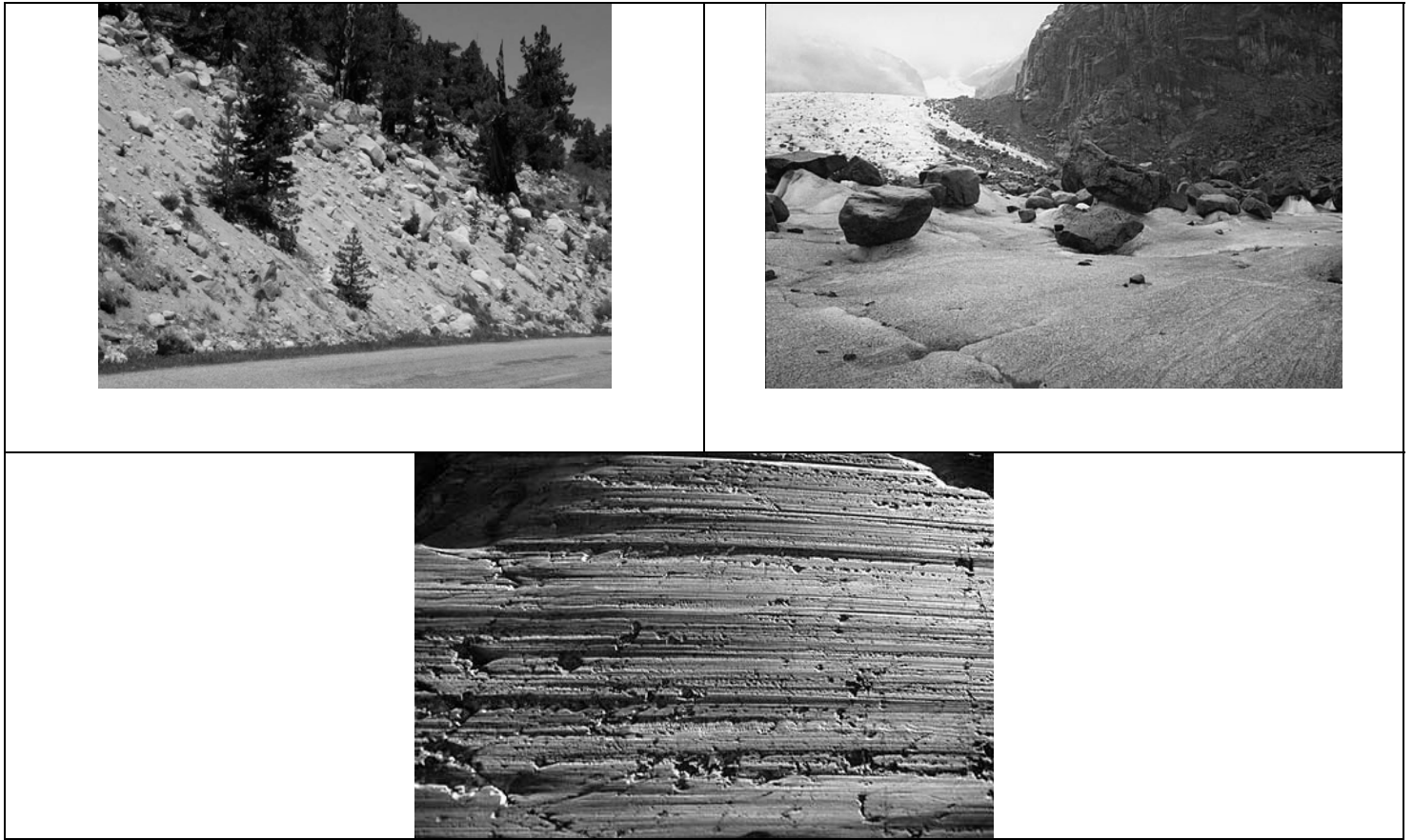
Where would the smallest sized particles be found?

Along the arrow that is drawn, would the sediment size that is deposited decrease, increase or remain the same?

What agent of deposition would have created the image to the left?

What direction was this agent moving?

Glacial Deposits:

Glacial Landforms: