Wave Erosion Lab

Purpose

- Students will be able to describe how the density of the sand on the beach affects the erosion
- Students will be able to describe how erosion occurs
- Students will be able to describe what happens to the shoreline when water comes for each density
- Students will be able to describe how the steepness of the sand affects how it erodes.

CA State Standards
Earth Science 2c-d, 3a, 7a-e

Materials
Colored Sand
Pebbles
Small Rocks
Ocean Water
Small, Wide Wooden Paddle
Stream Table

Procedure – Tip from Ms. Steinmetz = do step by step with students via verbal instruction.

1. Use the following setups:
    a. Different size sediments (sand, pebbles, small rocks)
    b. Different slopes (flat – no books, steep – 4 books, medium – 2 books)
2. Measure the volume of each type of sediment before you put it into the stream table. To do this, place the sediment in the rectangular container and measure the height, width, and length of the sediment inside the container. Multiply these dimensions together to get the total volume.
3. Place stream table on a level surface.
4. Check to make sure there is a red line going along the middle of the stream table.
5. Pour sediment in one half of the stream table.
6. Get the paddle ready in one hand and the bucket of water in the other ready to pour into the table in the other.
7. Pour water into the other end of the tub. (The one without the sand).
8. Immediately start paddling the water towards the sand. Make sure the paddle doesn't hit the bottom of the tub or any bit of sand.
9. Keep paddling for 5 minutes and start observing to what happens to the sand. Paddle once every 5 seconds.
10. Once you are done with the lab, take out all the sediment that CROSSED the red line and put in container. Pour out the water. Measure the volume of the sediment. Subtract this volume from the original volume.

Prediction

How much sediment do you think will be eroded? A lot, a little, or not at all.

Variable	Prediction
Flat Slope – Sand	
Flat Slope – Pebbles	
Flat Slope – Small Rocks	
Medium Slope – Sand	
Medium Slope – Pebbles	
Medium Slope – Small Rocks	

Steep Slope – Sand	
Steep Slope – Pebbles	
Steep Slope – Small Rocks	

Data

Flat Slope

Type of Sediment	Volume Before	Volume Eroded	Observations During Wave Action
Sand			
Pebbles			
Small Rocks			

Medium Slope

Type of Sediment	Volume Before	Volume Eroded	Observations During Wave Action
Sand			
Pebbles			
Small Rocks			

Steep Slope

Type of Sediment	Volume Before	Volume Eroded	Observations During Wave Action
Sand			
Pebbles			
Small Rocks			

Analysis/Conclusion Questions:

1. Which type of slope had more erosion?
2. Which type of sediment had the most erosion? Least amount of erosion?
3. How do you think the steepness of the slope affects the amount of erosion?
4. As you or someone in your group was paddling, what did you notice was happening to the "shoreline?" Did some sediment come past the line faster than others? If so, which ones?
5. What do you think would happen if the berm (the pile of sediment) was steeper?
6. What do you think would happen if the waves were bigger?
7. What do you think would happen if more water or more sand was added?

Wave Erosion Lab

Prediction

How much sediment do you think will be eroded? A lot, a little, or not at all.

Variable	Prediction
Flat Slope – Sand	
Flat Slope – Pebbles	
Flat Slope – Small Rocks	
Medium Slope – Sand	
Medium Slope – Pebbles	
Medium Slope – Small Rocks	
Steep Slope – Sand	
Steep Slope – Pebbles	
Steep Slope – Small Rocks	

Data

Flat Slope

Type of Sediment	Volume Before	Volume Eroded	Observations During Wave Action
Sand			
Pebbles			
Small Rocks			

Medium Slope

Type of Sediment	Volume Before	Volume Eroded	Observations During Wave Action
Sand			
Pebbles			
Small Rocks			

Steep Slope

Type of Sediment	Volume Before	Volume Eroded	Observations During Wave Action
Sand			
Pebbles			
Small Rocks			

Analysis/Conclusion Questions:

1. Which type of slope had more erosion?

2. Which type of sediment had the most erosion? Least amount of erosion?

3. How do you think the steepness of the slope affects the amount of erosion?

4. As you or someone in your group was paddling, what did you notice was happening to the "shoreline?" Did some sediment come past the line faster than others? If so, which ones?

5. What do you think would happen if the berm (the pile of sediment) was steeper?

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7. What do you think would happen if more water or more sand was added?

Erosion/Deposition Jigsaw Reading Activity

Purpose: Students will practice their reading comprehension skills and become an expert in their section of the subject allowing them to help/teach their classmates.

Procedure:

PART I

1) The class will be divided into 3 groups ("1", "2", "3"). Each group will have an assigned reading section.
2) Students with the same number will meet in groups of 4-5.
3) Each person will read a paragraph of the assigned section aloud.
4) As a group discuss and write down the main ideas/key terms for each section using the "Erosion/Deposition Jigsaw Table". **Remember:** You are working together to become the expert in your area so that you can help and teach your classmates.
5) As a group, come up with questions (5 minimum) to ask the others you will be helping in Part 2. Write these questions on a separate piece of paper.
6) Answer the guided reading questions on the "Erosion/Deposition Worksheet".

Reading Assignments

Group 1 – p. 224-227
- Wearing Down and Building Up
- Mass Movement

Group 2 – p. 230-234
- Runoff and Erosion
- River Systems
- Erosion by Rivers

Group 3 – p. 235-239
- Deposits by Rivers
- Groundwater Erosion and Deposition

PART II

1) The class will be divided into groups of 3 based on their previous assignment. Each group will consist of a "1", "2", and "3".
2) Do the following by sections:
    a. Each person will read a paragraph in a section aloud.
    b. The "expert" for that section will organize a discussion about the main ideas/key terms. This person must NOT tell the others what the main ideas/key terms are. The "expert" should ask the others questions about what they read.
    c. Each student should write down main ideas/key terms for each section using the "Erosion/Deposition Jigsaw Table".
    d. Answer the guided reading questions on the "Erosion/Deposition Worksheet".

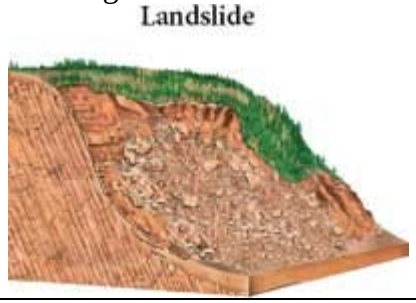
Erosion and Deposition Jigsaw Table

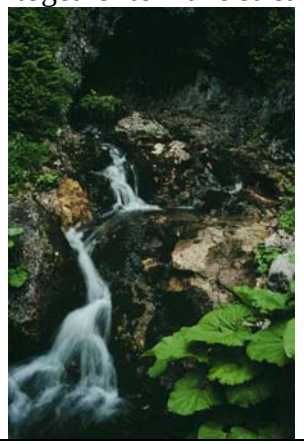
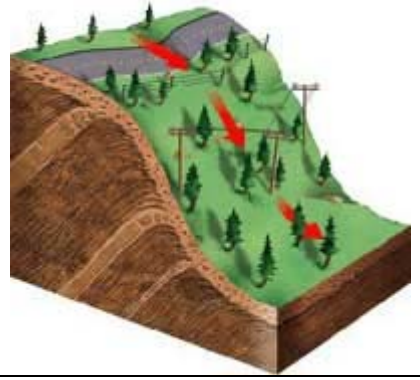
Write down one key idea or term/definition in each box. If you need more room use a separate sheet of paper.

Wearing Down/Building Up	Mass Movement	Runoff/Erosion	River Systems	Erosion by Rivers	Deposits by Rivers	Groundwater Erosion/Deposition

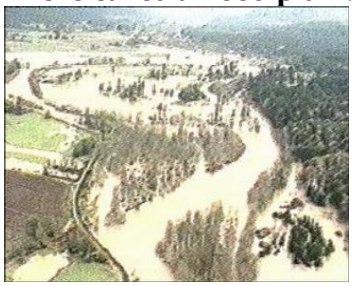
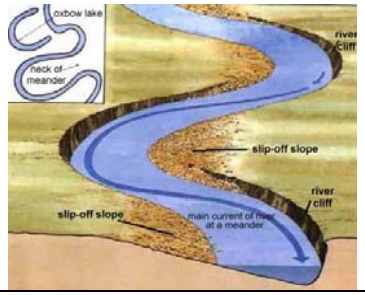
Wearing Down/Building Up	Mass Movement	Runoff/Erosion	River Systems	Erosion by Rivers	Deposits by Rivers	Groundwater Erosion/Deposition

Erosion and Deposition Jigsaw Table

Wearing Down/Building Up	Mass Movement	Runoff/Erosion	River Systems
Erosion = process by which natural forces move weathered rock and soil from one place to another.	**Gravity** is the force that moves rock and other materials downhill. This process is called mass movement.	**Moving water** = the major agent of erosion.	Streams become larger streams or rivers when other streams flow into them. These streams are called **tributaries.**
Examples of things that cause erosion are **gravity, running water, glaciers, waves, and wind**.	**Different types of mass movement** = landslides, mudslides, slumps, and creeps.	**Runoff** = water that moves over the Earth's surface. Carries sediment with it causing erosion.	**Drainage basin** = land area where a river and its tributaries collect their water.
Sediment = material moved by erosion.	**Landslide** = rock and soil move quickly down a steep slope. The rock and soil look like they are rolling downhill. This can be caused by highways that cut through hills or mountains. 	**Rill** = tiny grooves in the soil caused by runoff. 	**Divide** = the high ground between two drainage basins. For example, the Rocky mountains.
Deposition = the process by which sediment is laid down in a new location.	**Mudflows** = rapid downhill movement of a mixture of water, rock, and soil. This can be caused by heavy rains.	**Gully** = larger groove or channel in the soil that carries runoff after it rains. Rills turn into gullies. 	

Weathering, erosion, and deposition work together causing the Earth to be broken down in one place and built up in another place.	**Slump** = big piece of rock and soil suddenly slips down a slope. The rock and soil move together in one big clump downhill. Slump 	**Stream** = channel where water is always flowing down slope. Gills join together to make streams. 
	Creep = very slow downhill movement of rock and soil. It happens so slowly you can barely see it. You only see the changes over months. Creep 	**River** = large stream or channel of flowing water. Streams join to make rivers. 
		Amount of runoff depends on 5 main factors: 1) amount of rain an area receives, 2) vegetation, 3) type of soil, 4) shape of land, 5) how people use the land.

Erosion by Rivers	Deposits by Rivers	Groundwater Erosion/Deposition
Erosion by rivers causes the following land shapes to form: valleys, waterfalls, flood plains, meanders, oxbow lakes.	**Deposition by rivers causes the following landforms:** alluvial fans, deltas, and added soil to a flood plain.	When it rains some of the water goes underground – called **groundwater**.
V-Shaped valleys form when a river cuts through a mountain. It carves out the sediment creating a V-shaped valley. 	**Alluvial fans** are wide, sloping deposit of sediment formed where a stream leaves a mountain range. 	**Groundwater causes chemical weathering** – a type of erosion. CO2 is absorbed by water when it is soaked into the ground. This causes carbonic acid to form in the water which breaks down certain rocks (i.e. limestone). The broken down rocks are carried away in the water.
Waterfalls happen when there is an area of hard rock follow by an area of soft rock. The soft rock is eroded away while the hard rock stays. After time a waterfall is created where the softer rock used to be. 	**Deltas** form when a river flows into a large body of water such as a lake or the ocean. When this happens the river slows down causing the sediment to be deposited. The sediment builds up creating deltas. 	**Stalactites** = deposits of limestone sediment in caves. These deposits hang like icicles on the roofs of caves. 

When a river gets to the bottom of its slope (mountain) it spreads out and erodes the land. This is called a **flood plain**. 	**During heavy rains rivers may overflow the flood plain** – water rises over the sides and spreads out. When the rain stops and the river water level goes back to normal the sediment is deposited wherever there was water.	**Stalagmites** = deposits of limestone in caves. These deposits are created when limestone sediment in water drips from the ceiling – it builds up cones on the cave floor. 
Meanders are loop like bend in the course of a river. 		
An **oxbow lake** is a meander that has been cut off from the river. See above picture.		

Erosion and Deposition Questions p. 224-239

Pages 224-227

1. What is the definition of erosion?

2. What are the 5 main causes of erosion on Earth?

3. The material removed by erosion is called what?

4. What is the definition of deposition?

5. How do weathering, erosion, and deposition act together?

6. True or False Erosion and deposition are never-ending.

7. How does gravity cause erosion?

8. What are the 4 different types of mass movement caused by gravity?

Pages 230-239

1. _____ is a major agent of erosion that has shaped the Earth's surface.

2. What are 4 land features made by erosion?

3. What 5 factors affect the amount of runoff in a region?

4. What are the 5 types of rivers formed through erosion?

5. Explain how an oxbow lake is formed.

6. What are 2 landforms created by deposition?

7. How is an alluvial fan similar to a delta? How is it different?