

# Earth's Changing Surface

## Teacher Facilitation Notes

### In General . . .

- Project the slide deck in edit mode—do not show it as a slideshow.
- Hide the speaker notes before projecting. (View/Show Speaker Notes)
- Hide the filmstrip to the left. (View/Hide Filmstrip.)
- Hide the toolbar. (Click on the up arrow at the right end of the tool bar.)
- Call on students to read the various content shown on slides.

### Materials Needed Per Group:

#### Explore, Blown Away:

Sand	Straws (cut in half), 1-2 per student
Paint tray*	Large craft sticks, 4-6
Beaker (250 mL)	File folders, 2
Paper towels	Goggles, 1 per student
Bulletin Board paper to cover tables	

#### Explore, Erosion Explosion:

Sand	Small foam cup
Spray bottle of water	Pipette or eyedropper
Beaker of water	Empty beaker (250 mL)
Paint tray*	Paper towels
Bulletin board paper	Goggles, 1 per student

#### Explore, A Glacial Facial:

Beaker (250 mL)1	Bealer (1000 mL)
Stopwatch	Sand
Sandwich baggie	Small pebbles or gravel
Craft sticks, 2-3	Blue food coloring, optional
Paper towels	Goggles

#### Paint Tray

#### Elaborate: More About Landforms

Large index cards, 3 per student	Crayons, colored pencils, or markers
RAFT Cut-outs, 1 per student	Scissors
Glue	

\*Paint trays can be purchased from *Dollar Tree™* for about \$1.25 or *Home Depot™* for about \$2.00 each

# Earth's Changing Surface

## Teacher Facilitation Notes, p. 2

### Other Materials

Student Recording Sheets	Cardstock
Student Summative Evaluation	Science notebooks
Pencils	Sheet protectors

### Advanced Preparations: Explore

- Duplicate the procedures for each of the activities on card stock. Place in sheet protectors for each group.
- Make a “glacier” for each group to use in *A Glacial Facial*:
  - Place 3-4 small pebbles or a small amount of gravel in the sandwich baggie.
  - Fill the baggie about ½ full of water and seal tightly.
  - Place the baggies flat in the freezer until they are completely frozen.

### Introduction

- Read through the introductory material.
- Watch the video. Discuss as desired.
- Have students define *landform* and *Earth* in their science notebooks.
- Discuss the questions to consider.
- Read about four common landforms on Earth’s surface. If desired, click on each picture to take you to a larger picture of the landform.
- Observe and discuss the changes to the sea arch over time.
- Introduce the key question: *What agents of change affect Earth’s landforms?* Ask students to make inferences about what caused the Earth’s surface to look like this in the photographs on the slide.

### Engage: Agents of Change

- Read and discuss how wind, water, and ice lead to weathering, erosion, and deposition.
- Have students define relevant terms in their science notebooks as the students read about each.

# Earth's Changing Surface

## Teacher Facilitation Notes, p. 3

### **Explore: Changing Landforms**

- Read about and watch the video concerning landforms. Have students describe the landforms in the list with which they are familiar.
- Facilitate the three investigations using one of the following options:
  - Option 1: Divide the class into 4-6 groups. Each group works on the same investigation simultaneously, reading and following the procedures independently.
  - Option 2: Divide the class into 4-6 groups. Display the procedures for the class. Each group stays on the same step and discusses observations and answers to the question with the class before proceeding.
  - Option 3: Divide the class into 3 groups. Have the materials for the investigations set up in different areas. Groups rotate through the investigations working independently.
- Discuss each investigation and how the three agents of change form and reform landforms on the Earth's surface.

### **Explain: Our Changing Earth**

- Read and discuss each slide as desired.
- The three articles can be read as part of the lesson or independently.
- Have students complete their recording sheets independently.

### **Elaborate: More About Landforms**

- Guide the students in creating their RAFT postcards as needed.
- Display around the classroom or on a hallway wall.

### **Evaluate**

- Read through the introductory materials. Divide the class into 4-5 groups to play the Password Game. Award points for correct guesses, as desired.
- Call on volunteers to drag and drop the photos to match the descriptions.
- Have students complete the recording sheet for this portion of the lesson.
- Call on volunteers to identify the change agents and the processes that affect each landform as you type them in on the slide. Discuss the C - E - R.
- Have students complete the quiz independently. (This quiz is quite long. If the students don't use the digital file or the online form, display the digital student version of the questions and have students answer on a sheet of notebook paper if it is too much to duplicate.)

# Earth's Changing Surface

Name: KEY

## Evaluation

1. Landscape Arch in Arches National Park had to be closed because it was considered dangerous to visitors hiking near its base. How could an arch made of rock become dangerous?

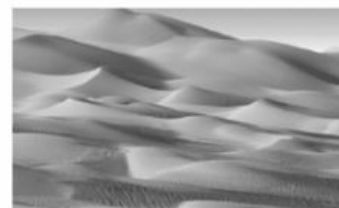


- A** Weathering of its rocky surfaces made it possible for the arch to collapse.
- B** Chunks of ice could fall off of the arch, harming hikers standing near it.
- C** Poisonous snakes are attracted to arches like this in a national park.
- D** The soil around the arch became polluted due to trash left behind by hikers
2. A student made a list of the processes that lead to the formation of sand dunes. Which of the processes in his list does not belong in the formation of sand dunes?

- F** Rocks are weathered into tiny pieces
- G** Blowing wind picks up sediments
- H** Grains of sand fall in one place
- J** Fast water passes over sediments

### Formation of Sand Dunes

- Rocks are weathered into tiny pieces
- Blowing wind picks up sediments
- Grains of sand fall in one place
- Fast water passes over sediments



# Earth's Changing Surface

Name: KEY

## Evaluation

3. The Grand Canyon resulted mainly from two agents of change. What are those agents that formed and shaped the Canyon?



- A** Weathering and erosion
  - B** Erosion and deposition
  - C** Earthquakes and erosion
  - D** Volcanoes and lava
4. Erosion can be caused by which of the following?
- F** Wind
  - G** Water
  - H** Ice
  - J** All of the above
5. Which statement correctly describes how a landform is formed?
- A** A sand dune is formed when waves erode huge amounts of sand off a beach during a hurricane.
  - B** A u-shaped valley is formed as a fast-moving river flows through it following a heavy rainfall.
  - C** A delta is formed when a volcano erupts and the lava hardens to form new rock.
  - D** A canyon is formed when flowing water weathers and erodes the surface of the land over thousands of years.

# Earth's Changing Surface

Name: KEY

## Evaluation

6. The photograph shows hoodoos that formed in a dry desert region over many years. This landform was most likely caused by which of the following processes?



- F** The deposition of large rocks eroded by a glacier
- G** Weathering and erosion caused by windblown sand
- H** The cooling of melted rock and lava flowing from a volcano
- J** Sediments deposited by a river as it slowed down

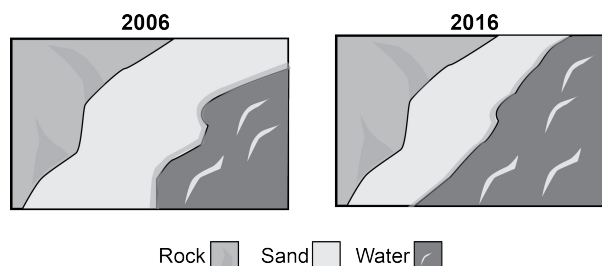
7. Glaciers that form on mountains move slowly downward and change land. They are responsible for what feature that is often observed in these regions?



- A** The pointed peaks of some mountains
- B** Smooth, rounded gravel on mountain tops
- C** U-shaped valleys between mountains
- D** Steep mountain cliffs and flowing rivers

8. A fifth grade student compared a photograph of a beach taken in 2006 to a picture of the same beach taken in 2016. Which of the following best explains the changes in the beach that the student observed?

Changes to a Beach



- F** Rain fall on rock formations created more sand
- G** Heating of the ocean caused the water level to drop
- H** Waves crashing on the beach have eroded the sand
- J** Volcanic eruptions added more rocks to the area

# Earth's Changing Surface

Name: KEY

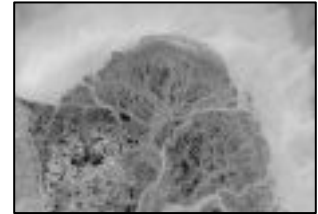
## Evaluation

9. Which of the landforms shown below results from changes to the surface of the Earth caused mostly by wind?

**A** Kettle Lake



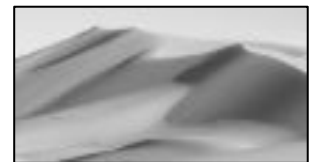
**B** River delta



**C** Mountain



**D** Sand dunes



10. Which of the following best explains the process that transformed the surface of the Earth in order to create the Grand Canyon of Yosemite, Wyoming?



- F** Violent movement of the Earth's crust caused a crack in the surface of the Earth where a river later formed
- G** Wind carried sediments and piled them in layers on either side of the river creating the canyon walls
- H** Several lava flows from nearby volcanoes built up rock along the river banks
- J** The moving water of the river carved out and carried away rock material

11. Read the sentence below. Decide if the change to Earth's surface was caused by wind, water, or ice.

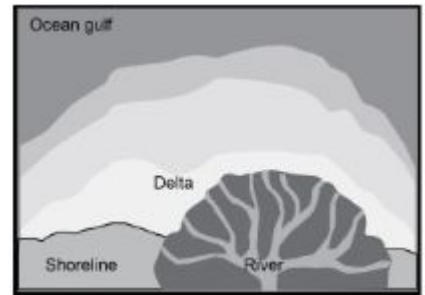
**Glacier National Park in Montana contains U-shaped valleys where large glaciers scraped away rocks and sediment from the side of mountains. These valleys were formed by the force of ice.**

# Earth's Changing Surface

Name: KEY

## Evaluation

12. The illustration shows a landform known as a delta, which formed where a river meets an ocean gulf. Which of the following best explains the formation of a delta?



- F** As the level of the water in the ocean gulf dropped over time, rock formations that were underwater were exposed.
- G** Ocean waves eroded the shoreline and moved the rock materials until they formed a huge pile.
- H** The river carried sediments from somewhere else and deposited them where the river slowed down.
- J** Volcanoes on land erupted, putting out lava which flowed in the path of the river
13. Some landforms, like the ones shown here, are carved out slowly over many years, by blowing sand. What feature must a region have to produce landforms such as these?



- A** Consistent, strong winds
- B** Many tall trees
- C** Very active volcanoes
- D** Fast moving water
14. Read the sentence below. Decide if the change to Earth's surface was caused by wind, water, or ice.

**The Grand Canyon located in Arizona is a steep-sided cut in Earth's surface that is 277 miles long and up to a mile deep. It was mainly formed by the force of water.**



# Earth's Changing Surface

Name: KEY

## Evaluation

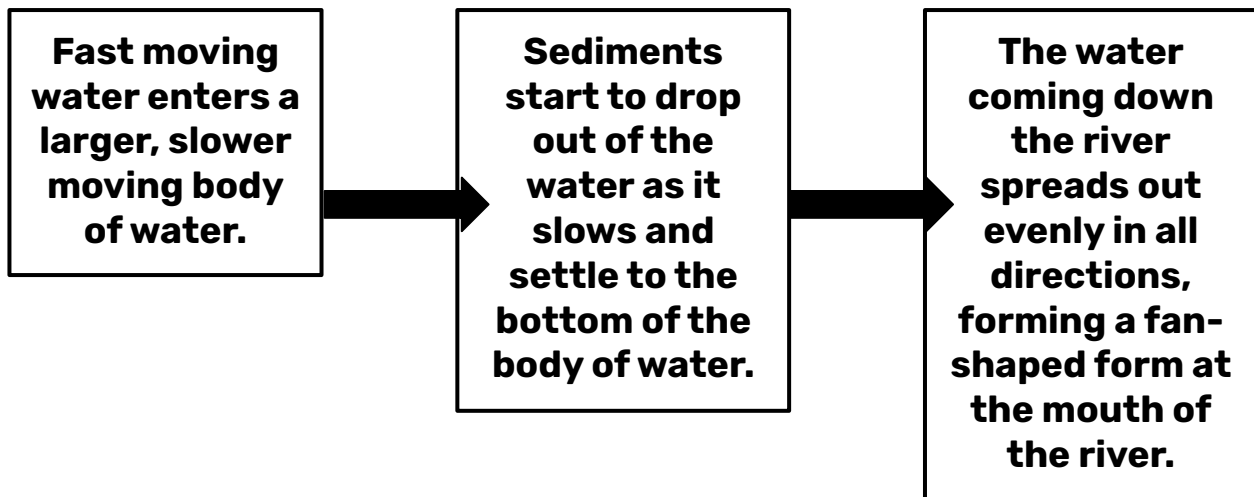
15. Read the sentence below. Decide if the change to Earth's surface was caused by wind, water, or ice.

**Monahans Sandhills State Park in West Texas has sand dunes up to 70 feet high. The dunes were formed by the force of wind.**

16. Read the sentence below. Decide if the change to Earth's surface was caused by wind, water, or ice.

**The Mississippi River Delta on the southern coast of Louisiana has spread 15 to 20 miles into the Gulf of Mexico over the last 5,000 years. It was formed by the force of water.**

17. The timeline shows the sequence of the formation of a landform on Earth's surface.



The statements above describe the formation of which of the following landforms?

- F** River delta
- G** Sand dunes
- H** Canyon
- J** Island

# Earth's Changing Surface

## Landforms and Wind-Blown Away!

**Guiding Question:** How can wind change Earth's surface and create landforms?

1. Using what you know about science, wind, and the Earth, record your hypothesis to answer the question.
2. Put on your safety goggles and leave them on for the entire activity.
3. Cover the desk or table with two layers of paper.
4. Measure and pour 250 mL of sand on the top (raised) portion of the paint tray. Pile the sand up to make a hill, or dune, of sand. Smooth the sand with a craft stick.
5. Stand up the 2 file folders at the end of the paint tray to keep the sand from going all over the place.
6. Complete the following tests by holding your straw at a 45° angle and carefully blowing across the surface of the sand. Observe how the sand travels in the direction of the "wind" you create. Record your observations after each test. Smooth out the sand between each test.
  - a. Test 1–Take turns blowing across the sand very softly and gently to represent a "gentle breeze".
  - b. Test 2–Blow across the sand harder to represent a "stormy wind".
  - c. Test 3–Blow across the sand with ONE huge puff to represent a "hurricane wind".
7. Pile all of the sand back up on the top of the paint tray to make a level prairie-type landform. Repeat the three tests on the smooth ground.
8. Answer the rest of the questions on the recording sheet.

# Earth's Changing Surface

Name: \_\_\_\_\_

## Explore: Blown Away

1. Record your hypothesis to answer the guiding question. \_\_\_\_\_

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2. Describe how a "gentle breeze" changed the sand dune. \_\_\_\_\_

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3. Describe how a "stormy wind" changed the sand dune. \_\_\_\_\_

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4. Describe how a "hurricane wind" changed the sand dune. \_\_\_\_\_

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5. Describe how a "gentle breeze" changed the prairie land. \_\_\_\_\_

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6. Describe how a "stormy wind" changed the prairie land. \_\_\_\_\_

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7. Describe how a "hurricane wind" changed the prairie land. \_\_\_\_\_

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8. What evidence of deposition did you see in the paint tray after each test?

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9. Summarize your conclusions about how wind can change the Earth's surface and affect landforms. \_\_\_\_\_

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# Earth's Changing Surface

## Landforms and Water-Erosion Explosion

**Guiding Question:** How can water change Earth's surface and create landforms?

1. Using what you know about science, wind, and the Earth, record your hypothesis to answer the question.
2. Put on your safety goggles and leave them on for the entire activity.
3. Cover the desk or table with two layers of paper.
4. Put a thick layer of sand in the top portion of the paint tray. Use a craft stick to smooth out the sand. This sand represents an open field without any vegetation or covering.
5. Carefully spray water across the sand at the high end of the tray. Keep spraying until the water starts to run down the surface of the sand to the bottom of the pan. Record your observations on your recording sheet.
6. Using damp sand from the paint tray, fill the foam cup about  $\frac{3}{4}$  full of sand. Pack it down as far as you can. Keep adding sand and packing it down until the cup is almost full.
7. Add a thin layer of sand to the top of the paint tray. Use a craft stick to smooth it out.
8. Carefully place the cup of sand on top of the smooth sand in the paint tray. (It should kind of look like a mountain of sand.)
9. Fill the pipette or eyedropper with water. Slowly drip the water on top of the sand mountain. Do this 4 times. Record your observations on your recording sheet.
10. Carefully spray water across the sand mountain. Keep spraying until the water starts to run down to the bottom of the pan. Record your observations on your recording sheet.
11. Answer the rest of the questions on the recording sheet.

# Earth's Changing Surface

Name: \_\_\_\_\_

## Explore: Erosion Explosion

1. Record your hypothesis to answer the guiding question. \_\_\_\_\_

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2. What do you observe as the water is sprayed on the sand? What do you observe in the bottom as the water runs down to the bottom of the tray?

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3. What do you observe as the water is dripped on the sand mountain?

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4. What do you observe as the water is sprayed on the sand mountain?

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5. What do you see in the bottom of the tray now? Explain. \_\_\_\_\_

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6. Based on what you observed in this investigation, describe how water can change the Earth's surface and create new landforms. \_\_\_\_\_

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7. Summarize your conclusions about how water can change the Earth's surface and affect landforms. \_\_\_\_\_

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# Earth's Changing Surface

## Landforms and Water—A Glacial Facial

**Guiding Question:** How can water change Earth's surface and create landforms?

1. Using what you know about science, wind, and the Earth, record your hypothesis to answer the question.
2. Put on your safety goggles and leave them on for the entire activity.
3. Cover the desk or table with two layers of paper.
4. Completely cover the paint tray with a layer of sand. Use a craft stick to smooth it out.
5. Mound some damp sand at the top of the paint tray. The mound should be about 3 cm high. Smooth out the sides of this "mountain" using a craft stick.
6. Remove the "glacier" from the baggie and set it on top of the mountain. Start the stopwatch and observe the glacier for one minute. DO NOT move the tray or the glacier during the timing period.
7. When the minute is up, predict what you think will happen when the glacier moves down the mountain on your recording sheet.
8. Press the point of your pencil into the center of the glacier. Press down with the pencil and push/pull the glacier down the side of the mountain slowly. Observe carefully and then record your observations on your recording sheet.
9. Carefully
10. Answer the rest of the questions on the recording sheet.

# Earth's Changing Surface

Name: \_\_\_\_\_

## Explore: Erosion Explosion

1. Record your hypothesis to answer the guiding question. \_\_\_\_\_

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2. What do you think will happen when the glacier moves down the mountain? \_\_\_\_\_

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3. What do you observe as the glacier slowly moves down the mountain?

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4. Why did you use a pencil to press down on the glacier as it moved down the mountain? (Hint-glaciers weigh many tons.) \_\_\_\_\_

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5. What natural force will pull a glacier down a mountainside? \_\_\_\_\_

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6. Why do you think there are rocks in your model glacier? \_\_\_\_\_

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7. Summarize your conclusions about how ice in glaciers can change the Earth's surface and affect landforms. \_\_\_\_\_

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# Earth's Changing Surface

Name: \_\_\_\_\_

## Explain: Our Changing Earth

**Directions:** Put an X in the correct column to describe the main way that the landform was created or changed over time.

Landform	ICE		WATER		WIND	
	Weathering from water freezing in cracks of rocks	Weathering by glaciers	Weathering and erosion by moving water	Deposition of eroded sediments	Erosion and deposition of sediments	Banging of rocks against a rocky surface
 Canyon						
 Delta						
 Sand dunes						
 U-shaped Valley						
 V-shaped Valley						

1. The illustration shows a sea arch near a coastline. What will most likely happen to this sea arch over millions of years? Explain your answer.




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2. What are three differences between a sand dune and a mountain? \_\_\_\_\_

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# Earth's Changing Surface

Name: \_\_\_\_\_

## Explain: Our Changing Earth, p. 2

A process called weathering can break down rocks into small pieces called **sediments**. Wind and water can move these sediments to new places through erosion and deposition. Pieces of rock, leaves, twigs and even decayed animal matter can all be sediments that are eroded and deposited in new areas. Sand dunes are an example of how sediments can be eroded by the wind and deposited in new locations.



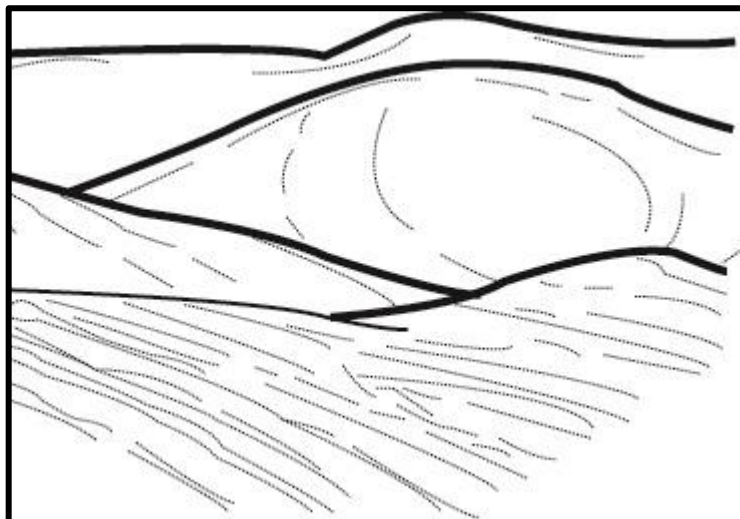
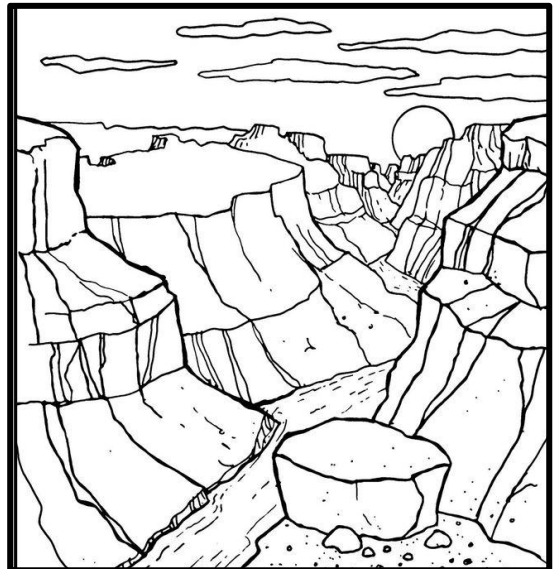
3. What are sediments? \_\_\_\_\_  
\_\_\_\_\_
4. How are sediments moved? \_\_\_\_\_  
\_\_\_\_\_
5. How do you think sand dunes are most likely formed? \_\_\_\_\_  
\_\_\_\_\_

**Directions:** Complete the riddles below with the names of landforms you have studied.

6. This word starts with a "C". It is a deep valley with very steep sides. It often has a river flowing through it. What is this word? \_\_\_\_\_
7. This word starts with an "M". It is a very tall, raised area on Earth's surface. It often has a spiky peak. What is this word? \_\_\_\_\_
8. This two-word phrase starts with an "S". These landforms are really just hills of sand caused by wind erosion and deposition. What is this phrase?  
\_\_\_\_\_
9. This word starts with a "D". It is a large flat area of land at the mouth of a river. This landform is created by the deposition of sediments as the slowing river flows into an ocean or sea. What is this word? \_\_\_\_\_
10. This word starts with a "V." It is a low place between mountains. What is it called? \_\_\_\_\_

# Earth's Changing Surface

## RAFT Cut-outs


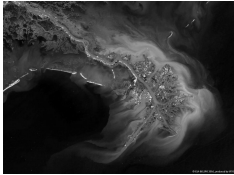
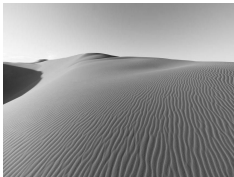



# Earth's Changing Surface

Name: \_\_\_\_\_

## Evaluate: Show What You Know

**Directions:** Identify the agent of change that created and/or changes each landform in the data table. Explain the process by which each is formed.

		<b>Agent of Change (wind, water, ice)</b>	<b>Process of Change (WED)</b>
<b>Canyon</b>			
<b>Delta</b>			
<b>Dune</b>			
<b>U-shaped Valley</b>			

1. Define *weathering* in your own words. \_\_\_\_\_  
\_\_\_\_\_
2. Define *erosion* in your own words. \_\_\_\_\_  
\_\_\_\_\_
3. Define *deposition* in your own words. \_\_\_\_\_  
\_\_\_\_\_
4. What is the difference between erosion and deposition? \_\_\_\_\_  
\_\_\_\_\_

# Earth's Changing Surface

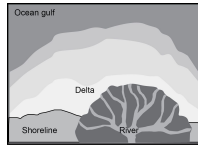
Name: \_\_\_\_\_

## Evaluate: Show What You Know

**Directions:** Use what you learned in this lesson and your knowledge of science to complete the C - E - R graphic organizer.

### Problem

*Some students had to answer the following question on their science homework.*



The illustration shows a landform known as a delta, which has formed where a river meets an ocean gulf. Which of the following best explains the formation of the delta?

- A** As the level of water in the ocean gulf dropped over time, rock formations that were underwater were exposed.
- B** Ocean waves eroded the shoreline and moved the rock materials until they formed a huge pile.
- C** The river carried sediments from somewhere else and deposited them where the river slowed down.
- D** Volcanoes on land erupted, putting out lava which followed the path of the river.

**What is the correct answer for this question?**

### Claim

### Evidence

### Reasoning

# Earth's Changing Surface

Name: \_\_\_\_\_

## Evaluation

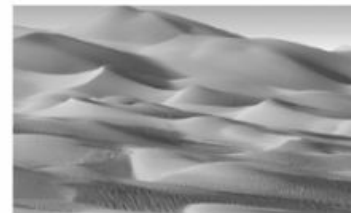
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2. A student made a list of the processes that lead to the formation of sand dunes. Which of the processes in his list does not belong in the formation of sand dunes?
- F** Rocks are weathered into tiny pieces
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### Formation of Sand Dunes

- Rocks are weathered into tiny pieces
- Blowing wind picks up sediments
- Grains of sand fall in one place
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# Earth's Changing Surface

Name: \_\_\_\_\_

## Evaluation

3. The Grand Canyon resulted mainly from two agents of change. What are those agents that formed and shaped the Canyon?

- A** Weathering and erosion
- B** Erosion and deposition
- C** Earthquakes and erosion
- D** Volcanoes and lava



4. Erosion can be caused by which of the following?

- F** Wind
- G** Water
- H** Ice
- J** All of the above

5. Which statement correctly describes how a landform is formed?

- A** A sand dune is formed when waves erode huge amounts of sand off a beach during a hurricane.
- B** A u-shaped valley is formed as a fast-moving river flows through it following a heavy rainfall.
- C** A delta is formed when a volcano erupts and the lava hardens to form new rock.
- D** A canyon is formed when flowing water weathers and erodes the surface of the land over thousands of years.

# Earth's Changing Surface

Name: \_\_\_\_\_

## Evaluation

6. The photograph shows hoodoos that formed in a dry desert region over many years. This landform was most likely caused by which of the following processes?



- F** The deposition of large rocks eroded by a glacier
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- H** The cooling of melted rock and lava flowing from a volcano
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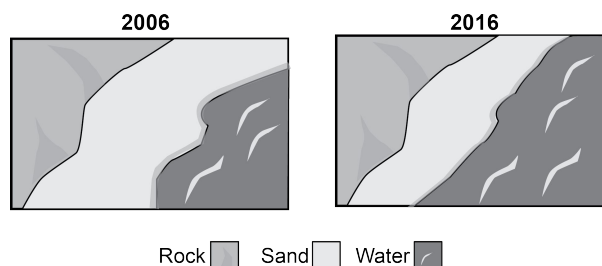
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8. A fifth grade student compared a photograph of a beach taken in 2006 to a picture of the same beach taken in 2016. Which of the following best explains the changes in the beach that the student observed?

Changes to a Beach



- F** Rain fall on rock formations created more sand
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Name: \_\_\_\_\_

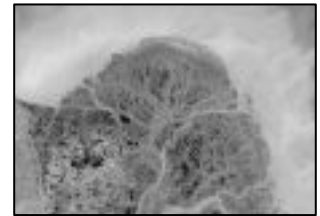
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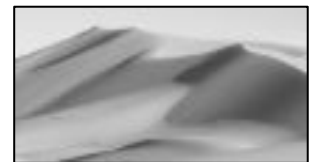
**B** River delta



**C** Mountain



**D** Sand dunes



10. Which of the following best explains the process that transformed the surface of the Earth in order to create the Grand Canyon of Yosemite, Wyoming?



- F** Violent movement of the Earth's crust caused a crack in the surface of the Earth where a river later formed
- G** Wind carried sediments and piled them in layers on either side of the river creating the canyon walls
- H** Several lava flows from nearby volcanoes built up rock along the river banks
- J** The moving water of the river carved out and carried away rock material
11. Read the sentence below. Decide if the change to Earth's surface was caused by wind, water, or ice.

**Glacier National Park in Montana contains U-shaped valleys where large glaciers scraped away rocks and sediment from the side of mountains. These valleys were formed by the force of \_\_\_\_\_.**

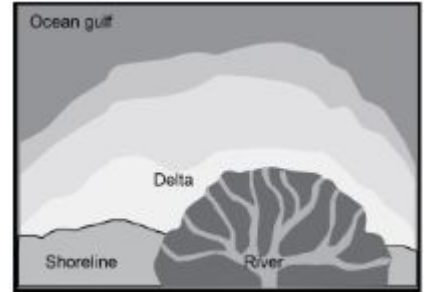


# Earth's Changing Surface

Name: \_\_\_\_\_

## Evaluation

12. The illustration shows a landform known as a delta, which formed where a river meets an ocean gulf. Which of the following best explains the formation of a delta?



- F** As the level of the water in the ocean gulf dropped over time, rock formations that were underwater were exposed.
- G** Ocean waves eroded the shoreline and moved the rock materials until they formed a huge pile.
- H** The river carried sediments from somewhere else and deposited them where the river slowed down.
- J** Volcanoes on land erupted, putting out lava which flowed in the path of the river
13. Some landforms, like the ones shown here, are carved out slowly over many years, by blowing sand. What feature must a region have to produce landforms such as these?



- A** Consistent, strong winds
- B** Many tall trees
- C** Very active volcanoes
- D** Fast moving water
14. Read the sentence below. Decide if the change to Earth's surface was caused by wind, water, or ice.

**The Grand Canyon located in Arizona is a steep-sided cut in Earth's surface that is 277 miles long and up to a mile deep. It was mainly formed by the force of \_\_\_\_\_.**

# Earth's Changing Surface

Name: \_\_\_\_\_

## Evaluation

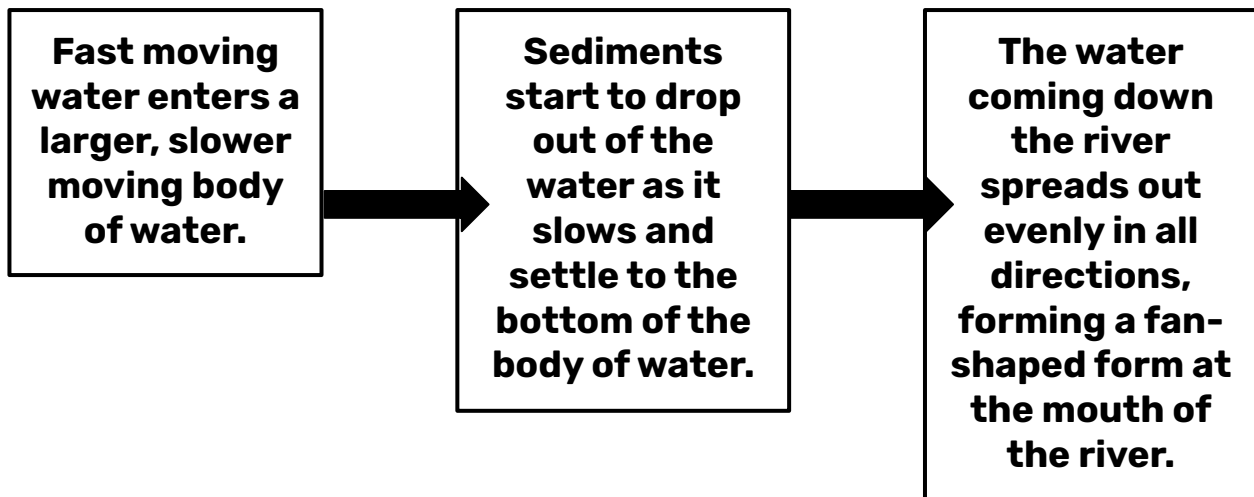
15. Read the sentence below. Decide if the change to Earth's surface was caused by wind, water, or ice.

**Monahans Sandhills State Park in West Texas has sand dunes up to 70 feet high. The dunes were formed by the force of \_\_\_\_\_.**

16. Read the sentence below. Decide if the change to Earth's surface was caused by wind, water, or ice.

**The Mississippi River Delta on the southern coast of Louisiana has spread 15 to 20 miles into the Gulf of Mexico over the last 5,000 years. It was formed by the force of \_\_\_\_\_.**

17. The timeline shows the sequence of the formation of a landform on Earth's surface.



The statements above describe the formation of which of the following landforms?

- F** River delta
- G** Sand dunes
- H** Canyon
- J** Island