

## Landforms and Oceans

### 5-3 The student will demonstrate an understanding of features, processes, and changes in Earth's land and oceans. (Earth Science)

#### 5-3.1 Explain how natural processes (including weathering, erosion, deposition, landslides, volcanic eruptions, earthquakes, and floods) affect Earth's oceans and land in constructive and destructive ways.

**Taxonomy level:** 2.7-B Understand Conceptual Knowledge

**Previous/Future knowledge:** In 3<sup>rd</sup> grade (3-3.8), students illustrated changes in Earth's surface that are due to slow processes (including weathering, erosion, and deposition) and those changes due to rapid features (landslides, volcanic eruptions, floods and earthquakes). The primary focus was to provide examples of such changes. In 8<sup>th</sup> grade (8-3.6) the concept of plate tectonics, the movement of Earth's crustal plates, including its relationship to earthquakes and volcanoes, will be further studied.

**It is essential for students to know** Earth's oceans and land can be affected in constructive ways and destructive ways by natural processes.

#### *Constructive*

- Processes that create landforms (deposition, landslides, volcanic eruptions, floods)

#### *Destructive*

- Processes that destroy landforms (weathering, erosion, landslides, volcanic eruptions, earthquakes, floods)

Natural processes that can affect Earth's oceans and land include:

#### *Weathering*

- Weathering is a general term used to describe processes that break down rocks at or near the surface of the earth.
- Weathering can be either physical or chemical.
- These processes cause the surface of the earth to dissolve, decompose, and break into smaller pieces.
- Water is an important cause of weathering.
- Plants cause weathering when roots break apart rock.
- Changes in temperature can break rock, as well as ice forming inside cracks in the rock causing it to break even more.
- Anything that causes rocks to wear down or break apart is a cause of weathering.

#### *Erosion*

- Erosion is the movement of *sediments* and soil by wind, water, ice, and gravity.

#### *Deposition*

- Deposition is the dropping, or *depositing*, of sediments by water, wind, or ice.
- Deposition builds up new land on Earth's surface, like a delta at the end of a river or the pile up of a sand dune in the desert.
- Shells on the beach are deposition by ocean waves.

## Landforms and Oceans

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#### *Landslides*

- Landslides are mass movements of land due to gravity.
- Landslides can cause buildings to fall, or power and gas lines to break.
- Landslides even occur on the continental slope in the ocean.

#### *Volcanic eruptions*

- Volcanoes are mountains with openings in Earth's crust through which magma, gases, and ash reach Earth's surface.
- Volcanoes can change Earth's surface.
- When the magma erupts from the volcano the top of the mountain can be changed, either built up or exploded off.
- The lava and ash can destroy forests and bury fields.
- Volcanic eruptions can even change Earth's weather patterns.
- Volcanic eruptions also occur under the oceans; these volcanoes that are built up are called *seamounts*.
- If the seamount rises above the ocean surface it is called a *volcanic island* (for example Hawaii or Japan).

#### *Earthquakes*

- Earthquakes are vibrations on Earth's surface caused by sudden movement in Earth, often along a *fault*, a break in Earth's surface.
- Some earthquakes cause little damage and some cause a lot of damage.
- Large earthquakes can cause landslides.
- Earthquakes under the ocean can cause huge waves, called *tsunamis* that destroy land and cause great damage if they come ashore.

#### *Floods*

- Floods occur when a large amount of water covers land that is usually dry.
- When the flood occurs, rapid erosion can take place and move soil and sediments away.
- When the flood recedes, new sediment is left behind and can build up rich soil deposits.

**It is not essential for students to** know about the movement of Earth's plates (the theory of plate tectonics), or how volcanoes, mountains, and earthquakes are produced.

#### **Assessment Guidelines:**

The objective of this indicator is to *explain* the effects natural processes on the Earth's oceans and land; therefore, the primary focus of assessment should be to construct a cause-and-effect model of the various ways that the ocean and land is affected by the processes of weathering, erosion, deposition, landslides, volcanic eruptions, earthquakes and floods. However, appropriate assessments should also require students to *recall* what each of the processes are; *compare* constructive and destructive processes; *illustrate* with pictures or diagrams the changes that take place with these processes; *classify* the processes as constructive or destructive; or *exemplify* ways that the processes affect the land and oceans.

## Landforms and Oceans

### 5-3 The student will demonstrate an understanding of features, processes, and changes in Earth's land and oceans. (Earth Science)

#### 5-3.2 Illustrate the geologic landforms of the ocean floor (including the continental shelf and slope, the mid-ocean ridge, rift zone, trench, and the ocean basin).

**Taxonomy level:** 2.2-B Understand Conceptual Knowledge

**Previous/Future knowledge:** In 3<sup>rd</sup> grade (3-3.6), students illustrated Earth's land features, including volcanoes, mountains, valleys, canyons, caverns, and islands). The concept of the geologic landforms of the ocean floor is new content for this grade. This concept will be further studied in high school Earth Science.

**It is essential for students to know** that the ocean floor contains geologic structures. These features can be illustrated using words descriptions, pictures, or diagrams. These landforms include:

##### *Continental shelf*

- The edges of the continents slope down from the shore into the ocean.
- The part of the continent located under the water is known as the *continental shelf*.
- The width of the continental shelf varies around the edges of the continents.
- In some places the continental shelf is fairly shallow and in other place it becomes very deep, but it is not the deepest part of the ocean.

##### *Continental slope*

- The steep slope where the continental shelf drops to the bottom of the ocean floor is called the *continental slope*.
- The depth of the ocean water increases greatly here.

##### *Mid-ocean ridge*

- On the bottom of the ocean, there is a central ridge, or mountain range, that divides the ocean floor into two parts.
- These underwater volcanic mountains are known as the *mid-ocean ridge*.
- Volcanic mountains not formed on the mid-ocean ridge are called *seamounts*.

##### *Rift zone*

- In the center of the highest part of the mid-ocean ridge is a narrow trench called a *rift*.
- Underwater volcanic activity that adds mountains to either side of the mid-ocean ridge occurs at the *rift zone*.

##### *Trenches*

- There are many steep-sided canyons and deep, narrow valleys in the bottom of the ocean.
- Ocean *trenches* are the deepest part of the ocean basin and are deeper than any valley found on land.

##### *Ocean basin*

- Located on either side of the mid-ocean ridge is the *ocean basin*.
- It is made up of low hills and flat plains.
- The flat area of the ocean basin is called the *abyssal plain*. Seamounts are generally formed on the ocean basin.

## Landforms and Oceans

**5-3 The student will demonstrate an understanding of features, processes, and changes in Earth's land and oceans. (Earth Science)**

**It is not essential for students to** know about ocean floor spreading; continental plates and boundaries; or deep-ocean exploration efforts. Deep ocean-mapping methods are not necessary, but in discussion or activity it may give the students a better idea of how scientists learned about the features on the ocean floor.

### **Assessment Guidelines:**

The objective of this indicator is to *illustrate* geologic landforms of the ocean floor; therefore, the primary focus of assessment should be to give or use illustrations to show aspects of these features (including the continental shelf and slope, the mid-ocean ridge, rift zone, trench, and the ocean basin). However, appropriate assessments should also require students to *recall* information about each landform region of the ocean floor; or *interpret* a diagram showing the ocean floor regions.

## Landforms and Oceans

**5-3 The student will demonstrate an understanding of features, processes, and changes in Earth's land and oceans. (Earth Science)**

### 5-3.3 Compare continental and oceanic landforms.

**Taxonomy level:** 2.6-B Understand Conceptual Knowledge

**Previous/Future knowledge:** In 3<sup>rd</sup> grade (3-3.6), students illustrated Earth's continental landforms, including volcanoes, mountains, valleys, canyons, caverns, and islands. In 5<sup>th</sup> grade (5-3.2), students illustrated landforms found on the ocean floor. Students should be able to make a comparison between these two types of landforms.

**It is essential for students to** know that Earth is made of solid land. Some of the land is located above Earth's water and some is located below the oceans. However, there are similarities and differences between the landforms found on the continents and those found on the ocean floor.

**NOTE TO TEACHER:** Students need to base comparisons of continental and oceanic landforms on content from previous learning and other indicators.

Continental and Oceanic Landforms		
Description	Continental	Oceanic
Low land between hills or mountains	Valley	Rift
Deep valley with high steep sides	Canyon	Trench
An opening in the surface from which lava flows	Volcano	Seamount and Volcanic islands
Land which rises high above the ground	Mountain range	Mid-ocean ridge
Wide, flat areas of land	Plains	Abyssal plains

**It is not essential for students to** know a comparison of other features or compare how these features are made.

#### Assessment Guidelines:

The objective of this indicator is to *compare* continental and oceanic landforms; therefore, the primary focus of assessment should be to detect ways that these objects are alike and different. However, appropriate assessments should also require students to *identify* the landform as continental or oceanic; or *exemplify* the landforms by their locations.

## Landforms and Oceans

### 5-3 The student will demonstrate an understanding of features, processes, and changes in Earth's land and oceans. (Earth Science)

#### 5-3.4 Explain how waves, currents, tides, and storms affect the geologic features of the ocean shore zone (including beaches, barrier islands, estuaries, and inlets).

**Taxonomy level:** 2.7-B Understand Conceptual Knowledge

**Previous/Future knowledge:** In 4<sup>th</sup> grade (4-4.4), students summarized the conditions and effects of severe weather phenomena including thunderstorms and hurricanes. The concept of the geologic features of the ocean shore zone is new content for this grade.

**It is essential for students to know** that the area where the ocean meets the land is called the *ocean shore zone*. The ocean shore zone has distinct geologic features that can be affected by waves, currents, tides, and storms. Beaches, barrier islands, estuaries, and inlets are all affected by these natural processes.

#### *Beaches*

- The *shoreline*, or *coast*, is the area where the land meets the ocean.
- Some shorelines are rocky. Shorelines made of sand are called *beaches*.
- Shorelines are always changing because of wind and water.
- Waves can wear away the land and expose a rocky shore or the waves can deposit sand along the shore and form a beach. If the waves reach the beach at an angle, the sand is moved along the coast.
- Currents, called *longshore currents*, along the shoreline can move sand from one location to another.
- Tides can bring in sand, shells, and ocean sediments at high tide and leave them behind when the tide goes out.
- Storms can cause wave action that removes sand from beaches.

#### *Barrier islands*

- Islands are pieces of land surrounded by water on all sides. Islands with sandy beaches are called *barrier islands*.
- These barrier islands are naturally occurring and function to protect the mainland from the effects of waves on its shore.
- As the waves deposit sand on the beaches, the shapes of the barrier islands change.
- Currents can move the sand from one end of the island to the other.

#### *Estuaries*

- All rivers flow into the oceans.
- The area where a river meets the ocean is known as an *estuary*.
- Estuaries have a mixture of freshwater and saltwater.
- Waves can deposit sand in the estuaries.
- At high tide, ocean water brings in sediments and sea life that feed and nourish life in the estuary.

## Landforms and Oceans

### 5-3 The student will demonstrate an understanding of features, processes, and changes in Earth's land and oceans. (Earth Science)

#### *Inlets*

- *Inlets* are the water-filled spaces between the barrier islands.
- As the tides change, the amount of water in the inlet will change.
- Ocean currents and storms can change the shape of an inlet opening.

Large storms, for example hurricanes, can also cause massive construction or destruction of beaches, barrier islands, estuaries, and inlets because they produce high waves, storm surges, and heavy winds.

NOTE TO TEACHER: Looking at a map of South Carolina with its many beaches, barrier islands, estuaries, and inlets will allow students to visualize these features for better understanding. Pictures of these features on the South Carolina coast would also be helpful.

**It is not essential for students to** know about harbors or sounds as features. The effects of rip currents are not necessary; longshore currents are the primary current studied in this indicator.

#### **Assessment Guidelines:**

The objective of this indicator is to *explain* the effects waves, currents, tides, and storms on the ocean shore zone; therefore, the primary focus of assessment should be to construct a cause-and-effect model of the various ways that beaches, barrier islands, estuaries, and inlets are affected by these events. However, appropriate assessments should also require students to *recall* that beaches, barrier islands, estuaries, and inlets are geologic features of the ocean shore zone; or *infer* changes on the ocean shore zone that occur as a result of waves, currents, tides and storms.

## Landforms and Oceans

### 5-3 The student will demonstrate an understanding of features, processes, and changes in Earth's land and oceans. (Earth Science)

#### 5-3.5 Compare the movement of water by waves, currents, and tides.

**Taxonomy level:** 2.6-B Understand Conceptual Knowledge

**Previous/Future knowledge:** In 3<sup>rd</sup> grade (3-5.4), students explained the relationship between the motion of an object and the pull of gravity. In 4<sup>th</sup> grade, students compared the location of Earth and the Moon in the solar system (4-3.2) and illustrated the Moon's phases and the Moon's effect on ocean tides (4-3.6). In 8<sup>th</sup> grade (8-4.4), students will explain how the motions of Earth and the Moon affect the motion of the tides.

**It is essential for students to know** that water on Earth can be moved in various ways. Three ways that water can be moved are by:

#### *Waves*

- The repeated movement of water is known as a *wave*.
- All waves have the same parts. The highest part is known as the *crest* and the lowest part is known as the *trough*.
- Most ocean waves are caused by winds that are blown across the surface of the water.
- A wave changes shape when it reaches the shore.
- As the top of the wave curls over it forms a *breaker*.
- Sometimes giant sea waves, called *tsunamis*, are caused by underwater earthquakes, volcanic eruptions, or landslides.

#### *Currents*

- Flowing streams of water that move continually through the ocean in a specific direction are called *currents*.
- Some currents flow at the ocean's surface and some are found deeper in the ocean.
- *Surface currents* are caused by the movement of Earth and by the force and direction of wind.
- The movement of Earth and winds causes these currents to flow along curved paths.
- Warm water and cold water are moved to different regions on Earth as a result of currents.
- *Warm surface currents* are driven by Earth's rotation from the tropics to higher latitudes.
- *Cold surface currents* are driven by Earth's rotation from the polar latitudes toward the equator.

#### *Tides*

- Several times during the day, the level of water at the ocean shore changes.
- This regular rise and fall of waters in oceans and seas is called a *tide*.
- Tides are caused by the pull of the Moon's *gravity* on Earth.
- As the Moon moves in relation to Earth, the water on Earth moves too.
- As Earth spins on its axis, the part of the ocean facing the Moon will bulge.
- *High tide* occurs when the water level is at its highest point.
- *Low tide* occurs when the water level is at its lowest point.
- Tides rise and fall about twice a day.

## Landforms and Oceans

**5-3 The student will demonstrate an understanding of features, processes, and changes in Earth's land and oceans. (Earth Science)**

**It is not essential for students to** know about the formation of deep-ocean currents; or explain how the motions of Earth and the Moon affect the motion of the tides, as this will be discussed further in 8<sup>th</sup> grade.

### **Assessment Guidelines:**

The objective of this indicator is to *compare* the ways that waves, currents, and tides move water; therefore, the primary focus of assessment should be to detect ways that water is moved by these ocean movements. However, appropriate assessments should also require students to *identify* a wave, current, or tides based on its description; *classify* a wave, current, or tide by their characteristics; *identify* parts of a wave; *compare* high and low tides; or *compare* warm and cold surface currents.

## Landforms and Oceans

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#### 5-3.6 Explain how human activity (including conservation efforts and pollution) has affected the land and the oceans of Earth.

**Taxonomy level:** 2.7-B Understand Conceptual Knowledge

**Previous/Future knowledge:** In 4<sup>th</sup> grade (4-2.6), students explained how organisms cause changes in their environment. In 7<sup>th</sup> grade (7-4.6), students will explain the implications of the depletion of resources and the importance of conservation of resources.

**It is essential for students to know** that human activities can benefit the land and oceans by preserving the resources that these areas provide.

- *Natural resources* are the materials that people can take or use from Earth.
- Resources may include air, water, trees, rocks and minerals, soil, or coal and oil.

#### *Conservation Efforts*

- The wise use of natural resources is called *conservation*.
- Human activities that help to keep the natural resources of Earth available and clear of pollution are conservation efforts.
- Some efforts involve everyone trying to *reduce* (use less of something), *reuse* (use something over again), and *recycle* (make something new from an old product).
- Other efforts involve trying to save the land and oceans through clean-up projects, installing fence lines to prevent dune erosion or jetties along the entrance to harbors or groins along beaches in an effort to keep sand from washing away.
- Beach renourishment projects help to restore sand on beaches.
- Planting trees, bushes, or grass is a way to improve air quality as well as keep erosion from carrying away soil.

#### *Pollution*

- *Pollution* is anything that harms the natural environment.
- When the taking or using of natural resources causes harm to Earth's air, water including oceans, or land, then the human activity has caused pollution.
- Oceans are rich in food, minerals, and other resources and can be easily polluted.
- Human activities can also harm the land and oceans causing resources to be polluted or destroyed.
- Sometimes people may allow materials to be dumped into rivers not thinking that rivers flow into the estuaries and ocean where they are harmful to life there.
- Careless dumping of trash on land or in oceans pollutes those areas; smoke and fumes from burning fuels pollutes the air; oil spills harm the ocean and can cause life there to be killed.
- Careless human activities in agriculture, industry, construction, or mining can cause pollution on the land, in the water, and in the air.

## Landforms and Oceans

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### **Assessment Guidelines:**

The objective of this indicator is to *explain* the effects of human activity on the land and oceans of Earth; therefore, the primary focus of assessment should be to construct a cause-and-effect model of how the various efforts or activities by people have conserved resulted in harm or pollution to these areas. However, appropriate assessments should also require students to *summarize* conservation efforts that make wise use of the land and oceans; *summarize* activities that pollute the land or oceans; *identify* areas of the land or ocean where resources are being conserved; or *exemplify* ways that the human activities affect land and oceans.