



Ocean features

from the Esri GeoInquiries™ collection for Earth Science

Target audience – Earth Science learners

Time required – 15 minutes

Activity

Categorize sections of the oceans and understand their importance.

Science Standards

NGSS:MS-ESS2-3 – Analyze and interpret data on the distribution of fossils, rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

Learning Outcomes

- Students will use the maps and pop-ups to characterize world oceans.
- Students will use remote sensing to identify high-productivity zones and their relationships to ocean regions.

Map URL: <http://esriurl.com/earthgeoinquiry11>



Engage

How much of the earth's surface is covered by oceans?

- Click the URL above to launch the map.
- In the upper-right corner, click the link, Modify Map.
- With the Details button underlined, click the button, Show Contents of Map (Content).
- Click the large green plus sign in the center of South America. Click the image in the pop-up.
- Count the number of squares in the grid that are covered with land. If a grid square is only partially covered, estimate how many other squares it takes to make one full square.
- ? About how many grid squares are covered with land? [*~20 out of 60 grid squares*]
- ? Using the grid square estimate, what percentage of the earth's surface is covered by water? [*~70% of the earth's surface is covered by water (40/60 or 2/3).*]



Explore

Is there variation of depth within the oceans?

- Starting in the Atlantic, click the green line distributed over the oceans for depth cross-sections.
- ? What is the approximate depth of the ocean just offshore from most continents? [*Shallow areas less than 1000 feet are present for quite some distance off non-plate boundary shores. They are much smaller where plate boundaries run along the edge of a continent, like the western Americas.*]
- ? What is the average depth of the ocean? [*It ranges between 10,000 and 20,000 feet.*]
- ? Are there any deep spots? [*There are usually trenches at the edge of plates.*]
- ? How are the deep spots in the ocean shaped? [*Trenches are long but narrow.*]
- ? What happens to the depth in the middle of most oceans? [*Ocean depths are fairly stable, except at ridges or trenches. There is generally a rise or a range of mountains in the ocean floor somewhere in the middle of most oceans.*]

Explain

Can oceans be classified by landforms like continents?

- Continents have landforms (mountains, plains, plateaus), and oceans have general regions of similar depth and ruggedness.
- Click the layer name, Ocean Features. View the legend for that layer.
- ? What are the most common ocean features or landforms? *[These are known as continental shelves, continental slopes, abyssal plains, mid-ocean ridges, and oceanic trenches.]*

Elaborate

How do plate tectonics shape ocean bottoms?

- Click the button, About the Map (About).
- Click the link, Open Presentation.
- View the presentation to see a tour of ocean features and how they were formed.
- Click any image in the pop-up to view it in a larger size.
- ? Do plate motions help explain oceanic features as well as they did for mountains? *[Ocean ridges are on divergent plates, trenches are on convergent, and many (but not all) continents sit on the edge of plates, particularly if there are mountains at the advancing edge. Seamounts generally form in a line as the plate drags over a hotspot, creating a path of volcanoes (e.g. Hawaiian islands, Emperor seamounts).]*

Evaluate

How did the oceanic landforms come to be?

- ? Describe where one of the ocean features discussed generally forms. *[Continental shelves are the edges of continents where ocean water can cover them. Abyssal plain consists of denser ocean crust that sank deeper into the planet than continental crust. Mid-ocean ridges are formed at divergent plates often parallel to continental coastlines. Trenches happen where the ocean crust is being driven under continental crust at convergent plate boundaries. Volcanic islands occur over hotspots or convergent plates and seamounts, now inactive volcanoes that either eroded or never made the surface.]*

PLAY PRESENTATION

- At the top right of the map, click Open Presentation.
- At the bottom center of the presentation, click the right arrow.

VIEW LEGEND WHILE IN CONTENTS

- Hover on a layer name; the layer becomes a link.
- Click the layer name link.

Next Steps

DID YOU KNOW? ArcGIS Online is a mapping platform freely available to public, private, and home schools. A school subscription provides additional security, privacy, and content features. Learn more about ArcGIS Online and how to get a school subscription at <http://www.esri.com/schools>.

THEN TRY THIS...

- Log in to your ArcGIS organization account, save a copy of this map, and click Edit Presentation.
- Highlight some ocean features (for example, the formation of the Hawaiian island chain and seamounts).

TEXT REFERENCES

This GIS map has been cross-referenced to material in the mountain building section of chapters from middle-school texts.

- *Earth Science by Glencoe McGraw Hill – Chapter 19*
- *Earth Science by McDougal Littell – Chapter 3*
- *Earth Science by Holt – Chapter 13*
- *Earth Science by Prentice Hall – Chapter 14*