

Deep-Sea Exploration Activity

Background: This activity is designed to encourage reading comprehension skills as students explore the ocean world, from its surface to its deepest depths. Their mission is to secure safe passage for their research crew traveling across the ocean to explore the Mariana Trench, located in the western Pacific Ocean near Guam. The journey begins at a PBS website entitled, **Savage Seas** which can be found at the web address noted below. This activity provides a nice follow-up to concepts related to oceanography, hydrothermal vents, ocean zones, and technology used in deep-sea exploration.

Materials/Resources:

- Computer stations with Internet access
- Websites: <http://www.pbs.org/wnet/savageseas/index.html>
<http://www.ocean.udel.edu/extreme2004/geology/trieste.html>
http://www.pmel.noaa.gov/vents/nemo/dive/dive_large.html

Classroom Set-up: This activity is designed to be completed in one 60-minute class with students working independently or in pairs.

Follow-up Activities: Prompt students to generate inferences in response to the following concepts:

- Life on earth beginning in the sea
- Organisms surviving in extreme environments on other planetary bodies (e.g., Mars, Europa, Iona)
- Importance of technology in discovery and understanding of our oceans

<http://www.pbs.org/wnet/savageseas/index.html>

Welcome to PBS's *Savage Seas* website. Take a minute to look around this page and note the various links to the topics included in this website. Our mission will not allow us time to explore each of these topics today but feel free to return to this site later and explore other links that interest you. Begin your journey at the ocean's surface by clicking the **Crow's Nest** link and learn about the affect of wind, waves, and currents on the ocean.

It's always a good idea to check the weather forecast before heading out to sea. Storms can create strong winds and these winds can create large waves. Open the **Wave Machine** link to determine the affect of wind on waves. Read the directions on the screen, click the **Start** button, and conduct the following experiment.

Question: Which variable (e.g., wind speed, fetch, or duration) has the most influence on wave height?

Hypothesis:

Procedures: Read the directions provided with the **Wave Machine** on each page. Start by selecting the Wind Speed for TEST 1. Next, select the fetch and then the duration. Observe and record the size and type of wave created in TEST 1. To see the wave more than once, press the **Repeat** button on the Wave Machine. To locate the type of wave created, click the **Wave Type** bar in the lower left corner of the Wave Machine. When you have completed TEST 1, click the **Variables** button to change your speed, fetch and duration for TESTS 2, 3, 4, and 5. Once you have completed your experiment, record your data analysis and conclusion. The information found in the Wave Type bar will also be helpful when you complete your data analysis and conclusion.

The Effect of Wind Speed, Fetch, and Duration on Waves

VARIABLE	TEST 1	TEST 2	TEST 3	TEST 4	TEST 5
Wind Speed (knots)	10	20	20	20	50
Fetch (naut. miles.)	10	10	75	75	75
Duration (hours)	10	10	10	23	23
Size of Wave (feet)					

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Data Analysis: Answer the following questions to assist you in analyzing your data.

1. What was the resulting wave when the wind speed increased in TEST 2 and the fetch and duration remained constant? _____
2. What was the difference in wave height when the wind speed and fetch remained constant and duration was increased between TEST 3 and TEST 4? _____
3. What was the resulting wave when the wind speed increased in TEST 5 and the fetch and duration remained constant? _____

Conclusion: (Be sure your conclusion addresses each variable, your results, and your original hypothesis.)

The winds are calm, the sea is flat. Let's go diving!! Locate the **ANIMATIONS: Deep Sea Simulator** link beneath the Wave Machine. Follow this link and allow a few seconds for the simulator to load. Your next experiment will assist you in learning more about the changes in pressure as you travel beneath the ocean surface. Read the introductory paragraph and complete the following:

The pressure exerted as you dive deeper in the ocean is called _____ pressure and the amount of pressure increase by _____ for each foot of depth.

Click the **Depth Chart** button and use the information provided to complete the table.

ZONE	DEPTH (feet)	PRESSURE (psi)
EPIPELAGIC		
MESOPELAGIC		
BATHYPELAGIC		
ABYSSOPELAGIC		
HADAL		

According to your Depth and Pressure Table, as you sink below the Epipelagic Zone, pressure _____ *increases/decreases* _____ as depth _____ *increases/decreases* _____. (Circle the correct responses.)

<http://www.pbs.org/wnet/savage seas/index.html>

Locate and click the **Main Menu** button in the upper left corner of the Depth Chart to observe the affect of ocean depth and pressure on various objects and organisms. Record your observations below:

OBJECT	CUP	DIVER	SQUID	TRIESTE
DEPTH (feet)				

Which object/organism achieved the greatest depth in your experiment?

Your final mission is to dive to the deepest depths of the ocean with the crew of the Trieste. Locate and click the **ANIMATION: TRIESTE** link and allow a few seconds for the animation to load. Launch the Trieste and retrace the 1960 voyage of this submersible to the Mariana Trench. If the animation does not load, type this address into the address bar for a pictorial summary of this historic dive:

<http://www.ocean.udel.edu/extreme2004/geology/trieste.html>

For another deep sea dive, follow this link and explore the Juan de Fuca Ridge, off the northwest Pacific coast, using an unmanned submersible called ROPOS:

http://www.pmel.noaa.gov/vents/nemo/dive/dive_large.html

Read and listen to the introduction and then select the deep sea dive you want to complete:

Dive 1: Smoker Vents

Dive 2: New Lava Flow

Dive 3: Instrument Rescue