

# Life on an Ocean Planet

How do we study the oceans?



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## Earth Is an Ocean World

Beneath a very thin atmosphere, most of Earth's surface (ca. \_\_\_\_%) is covered by a liquid-water ocean averaging \_\_\_\_ meters (\_\_\_\_ feet) deep.



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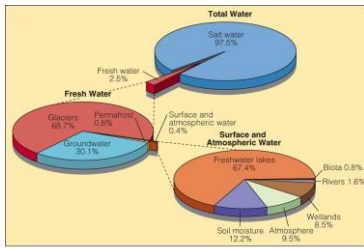
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## Earth Is an Ocean World



The relative amount of water in various locations on or near Earth's surface. More than \_\_\_\_% of the water lies in the ocean.

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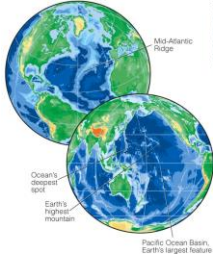
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## Earth Is an Ocean World

Average ocean \_\_\_\_\_ is \_\_\_\_\_ times as \_\_\_\_\_ as average land elevation.



**Some Statistics for the World Ocean**  
 Area: 361,320,000 square kilometers (139,490,000 square miles)  
 Depth: 3,741 meters (12,274 feet) (average)  
 Volume: 1,370,300,000 cubic kilometers (329,000,000 cubic miles)  
 Average depth: 3,708 meters (12,163 feet)  
 Average temperature: 3.9°C (39°F)  
 Average salinity: 34,400 grams per kilogram (0.36 ounce per pound), 3.4%  
 Average wind velocity: 840 meters (2,757 feet)  
 Age: About 4 billion years  
 Future: Uncertain

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## Marine Scientists Use the Logic of Science to Study the Ocean

Marine Science (or oceanography) integrates many different types of science:

- \_\_\_\_\_ study Earth's crust and composition.
- \_\_\_\_\_ study of waves, currents, and climate prediction.
- \_\_\_\_\_ study the ocean's dissolved gases and solids in the ocean.
- \_\_\_\_\_ investigate the ocean's role in Earth's changing climate.
- \_\_\_\_\_ study the nature and distribution of marine organisms.
- \_\_\_\_\_ design and construct structures used in or on the ocean.

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Marine scientists use the logic of science and modern technology to study the ocean



Oceanographers deploy a mooring containing temperature probes from the deck of R/V *Oceanus* during a gale off Cape Hatteras.

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## Science and Technology

**Science:** a body of \_\_\_\_\_ and organized \_\_\_\_\_ used to gain knowledge about the observable universe.

**Technology:** the practical \_\_\_\_\_ of \_\_\_\_\_ to accomplish a task.

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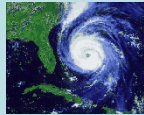
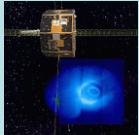
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## Examples of technology in oceanography...

- Submersibles
- Satellites
- Radar
- Computerized acoustic instrumentation
- High resolution cameras...



<http://image.gsfc.nasa.gov/gallery/>

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## Tried and true methods

- The Scientific Method (since ca. 1500 A.D.)
- 1. Identify the problem or \_\_\_\_\_
- 2. Make a \_\_\_\_\_ (after research)
- 3. \_\_\_\_\_ the hypothesis (experiment)
- 4. Interpret and \_\_\_\_\_ data/results
- 5. Report results, procedures and conclusions

This is still the basis for scientific investigations and development of new technology.

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## The Scientific Method

The Scientific Method



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## The Scientific Method

➤The **scientific method** is the only scientific way to accept or reject a hypothesis.

➤This is the method on which all research projects (including your science fair project) should be based.

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


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## The Scientific Method



The Scientific Method involves 5 steps:

-  \_\_\_\_\_ (requires research)
-  \_\_\_\_\_ (procedure)
-  \_\_\_\_\_ (data)
-  \_\_\_\_\_ and communicate

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## The Scientific Method



**Observation**- You observe something in the material world,

which are basically extensions of those senses.



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## The Scientific Method



**Question**- You ask a question about what you observe. State the problem or question.



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## The Scientific Method

**Hypothesis**- You predict what you think the answer to your question might be (based on your knowledge or research). If \_\_\_\_\_, then \_\_\_\_\_, because \_\_\_\_\_.



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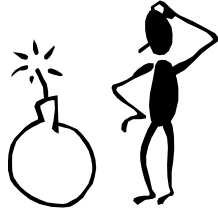
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## The Scientific Method

**Experiment** – You test whether your hypothesis is correct using a systematic procedure. The outcome must be measurable (quantifiable). Record **and analyze** data.



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## The Scientific Method

**Result**- You **carefully** record the results you observe. You repeat the experiment to confirm your results by retesting.



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## The Scientific Method

**State Conclusion**- You state whether your prediction was confirmed or not and try to **explain** your results (this is where you show your cognitive brilliance!).



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## Important terminology

**Hypothesis** – tentative \_\_\_\_\_ for the observation or measurement that can be \_\_\_\_\_ and \_\_\_\_\_ by further observations and **controlled** experiments  
An **experiment** is a

\_\_\_\_\_ or in the laboratory by controlling the conditions under which the observations are made (may use a **model** to represent events in nature).

**Theory** – a \_\_\_\_\_ by experimental \_\_\_\_\_.

**Laws** – larger constructs that summarize consistent experimental observations.  
A law \_\_\_\_\_ while a theory provides an explanation for the observations.

What about a **belief**?

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## Independent and dependent variables

**Independent** and **dependent variables** are quantities that are related to one another. The independent part is what you, the experimenter, \_\_\_\_\_ or enacts in order to do your experiment. The dependent variable changes in response to the independent variable – i.e., the dependent variable \_\_\_\_\_ of the independent variable.

A **control** is used for \_\_\_\_\_, to test for unknown environmental effects or variables.

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