



Ocean Exploration: Map the ocean floor; Explore Underwater Volcanoes; Discover Ancient Shipwrecks

Students explore ocean science and learn about the world-famous oceanographer Dr. Robert Ballard and his team aboard the Exploration Vessel Nautilus. STEM topics include the history of ocean exploration, buoyancy, density, remotely operated vehicles, marine geology, marine biology and careers. Featured STEM Professionals include:

Dr. Robert Ballard - resident of the Ocean Exploration Trust; Director of the Center for Ocean Exploration, Graduate School of Oceanography URI

Dr. Katy Croff Bell - Founder & President Ocean Discovery League; National Geographic Fellow

- **Activity 1: Exploring the Blue Unknown** - Explore an imaginary ocean and compare it to real ocean exploration.
- **Activity 2: Buoyancy Challenge** - Investigate buoyancy while building a model submersible.
- **Activity 3: Underwater Exploration Tools** - Design & build tools to retrieve samples from the bottom of a model ocean.
- **Activity 4: What's Up with Water** - Explore the densities of several common objects and liquids.
- **Activity 5: Searching with Sonar** - Simulate exploration sonar methods to locate shipwrecks and other targets.
- **Activity 6: Ancient Mysteries** - Decorate, break, and reassemble a model archaeological artifact.
- **Activity 7: Seeping Sea Floor** - Explore what happens when water, oil, and gas mix.
- **Activity 8: Critters of the Ocean** - Create an imaginary organism with adaptations to help it survive in a specific zone of the ocean.

Cross-Curricular Connections

Reading & Writing for Technical Subjects:

LST.1: Read and comprehend science and technical texts independently and proficiently and write effectively for a variety of discipline-specific tasks, purposes, and audiences

LST.2: Extract and construct meaning from science and technical texts using a variety of comprehension skills

LST.2.2: Determine the central ideas or conclusions of a text; provide an accurate, objective summary of the text.

LST.2.3: Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

LST.3.1: Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to texts and topics.

LST.4.1: Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

LST.7.1: Conduct short research assignments and tasks to answer a question (including a self-generated question), or test a hypothesis, drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

Book Selections: *At the Sea Floor Cafe: Odd Ocean Critter Poems; Diving to a Deep-Sea Volcano; The Eternal Darkness: A Personal History of Deep-Sea Exploration; Mapping the Seas; Robert Ballard: Oceanographer Who Discovered the Titanic; How Do Big Ships Float?; The Magic School Bus Ups and Downs: A Book About Floating and Sinking; The Incredible Submersible Alvin Discovers a Strange Deep-Sea World; Mapping the Seas; Archaeology for Kids: Uncovering the Mysteries of Our Past; Diving to a Deep-Sea Volcano; Extremophiles: Life in Extreme Environments*

Math: Algebraic Problem Solving

Social Studies: Mediterranean, Black, and Aegean Seas; Ancient Greek sailing; Ancient Shipwrecks; Archeology and Ancient Roman amphorae; Tectonic Plates

Art: Ceramics, 3-dimensional design, Photography

Grades K-3 Science Content Standards

- K.PS.1** Plan and conduct an investigation using all senses to describe and classify different kinds of objects by their composition and physical properties. Explain these choices to others and generate questions about the objects. (Activities: 2, 3, 4)
- K.PS.2** Identify and explain possible uses for an object based on its properties and compare these uses with other students' ideas. (Activities: 3, 5, 6)
- K.LS.2** Describe and compare the physical features of common living plants and animals. (Activity 8)
- K.LS.3** Use observations to describe patterns of what plants and animals (including humans) need to survive. (Activity 8)
- K-2.E.1** Pose questions, make observations, and obtain information about a situation people want to change. Use this data to define a simple problem that can be solved through the construction of a new or improved object or tool. (Activities: 1, 3, 5)
- K-2.E.2** Develop a simple sketch, drawing, or physical model to illustrate and investigate how the shape of an object helps it function as needed to solve an identified problem. (Activities: 2, 3)
- K-2.E.3** Analyze data from the investigation of two objects constructed to solve the same problem to compare the strengths and weaknesses of how each performs. (Activities: 2, 3)
- 1.LS.2** Develop a model mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs. Explore how those external parts could solve a human problem. (Activity 8)
- 1.LS.3** Make observations of plants and animals to compare the diversity of life in different habitats. (Activity 8)
- 2.ESS.4** Obtain information to identify where water is found on Earth and that it can be solid or liquid. (Activities: 1, 7)
- 3.LS.3** Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. (Activity 8)
- 3.LS.4** Construct an argument that some animals form groups that help members survive. (Activity 8)

Grades 4-5 Science Content Standards

- 3-5.E.1** Identify a simple problem with the design of an object that reflects a need or a want. Include criteria for success and constraints on materials, time, or cost. (Activities: 1, 3, 5)
- 3-5.E.2** Construct and compare multiple plausible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem. (Activities: 3, 5)
- 3-5.E.3** Construct and perform fair investigations in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved. (Activities: 3, 5)
- 4.PS.1** Investigate transportation systems and devices that operate on or in land, water, air and space and recognize the forces (lift, drag, friction, thrust and gravity) that affect their motion. (Activities: 1, 2, 3, 5)
- 4.PS.3** Investigate how multiple simple machines work together to perform everyday tasks. (Activities: 2, 3)
- 4.ESS.3** Describe how geological forces change the shape of the land suddenly and over time. (Activity 7)
- 4.LS.3** Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction in different ecosystems. (Activity 8)
- 5.ESS.4** Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. (Activity 7)

Grades 6-8 Science Content Standards

- 6.PS.4** Investigate the properties of light, sound, and other energy waves and how they are reflected, absorbed, and transmitted through materials and space. (Activity 5)
- 6.LS.4** Investigate and use data to explain how changes in biotic and abiotic components in a given habitat can be beneficial or detrimental to native plants and animals. (Activity 8)
- 6-8.E.1** Identify the criteria and constraints of a design to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. (Activities: 1, 2, 3, 5)
- 6-8.E.2** Evaluate competing design solutions using a systematic process to identify how well they meet the criteria and constraints of the problem. (Activities: 2, 3, 5)
- 6-8.E.3** Analyze data from investigations to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. (Activities: 2, 3, 5)
- 6-8.E.4** Develop a prototype to generate data for repeated investigations and modify a proposed object, tool, or process such that an optimal design can be achieved. (Activities: 2, 3)
- 7.ESS.3** Using simulations or demonstrations, explain continental drift theory and how lithospheric (tectonic) plates have been and still are in constant motion resulting in the creation of landforms on the Earth's surface over time. (Activity 7)
- 7.ESS.5** Construct a model, diagram, or scale drawing of the interior layers of the Earth. Identify and compare the compositional (chemical) layers to the mechanical (physical) layers of the Earth's interior including magnetic properties. (Activity 7)