SCIENCE 3D

MASTERS OF THE DEEP: SPERM WHALES

SCIENCE PERFORMANCE EXPECTATIONS AND DISCIPLINARY CORE IDEAS

In the Elementary School Mission (NGSS Grade 5), students will address the general topics below. For a complete list of NGSS standards covered in each segment of the Mission, continue reading after the general standards. *Note: Be sure to complete the **Mission Reader** and **Mission Research** before viewing the full **Mission Video**. Explore How to Use Science 3D to get suggestions on how to pace the Mission and options for the order of activities. Math and Language Arts standards will be added shortly.*

- In the **Mission Reader**, *Masters of the Deep: Sperm Whales*, students will learn about sperm whale ecology, whale evolution, social behavior, and the basics of light waves and sound waves. They will also learn about engineering's role in science.
- During **Mission Research**, students dive deeper into sperm whale ecology based on information they learned from the **Mission Reader**. A selection of these questions or activities can be completed to address specific standards (science or language arts) that you want to emphasize.
- In the **Science Mission**, students will use their knowledge from the **Mission Reader** and **Mission Video** to unravel the roles of organisms in sperm whale ecosystems. Then, they will use data to determine where sperm whale prey is found, and formulate and test hypotheses about sperm whale location and behavior. Finally, they will use their evidence-based knowledge to suggest where marine protected areas should be established.
- In the **STEM Project**, students will investigate the role of technology in science, define criteria and constraints involved in sperm whale research, and design solutions to help scientists put cameras on different animals.
- Using the **Explore Your Backyard** activity, students will reinforce their understanding of energy flow in ecosystems and roles of organisms in ecosystems. They will also gain an understanding of how certain patterns are similar across different systems.

SCIENCE/ENGINEERING AND DESIGN DISCIPLINARY CORE IDEAS AND PERFORMANCE EXPECTATIONS

MISSION READER

5-LS-1	Support an argument that plants get the materials they need for growth chiefly from air and water.
LS1.C	Organization for matter and energy flow in organisms.
5-LS2 -1	Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment
LS2.A	Interdependent relationships in ecosystems.
LS2.B	Cycles of matter and energy transfer in ecosystems.
5-PS3-1	Use models to describe that energy in animals' food was once energy from the sun.
PS3.D	Energy and chemical processes and everyday life. This touched on lightly in the Mission Mission Reader. The Mission Reader can be used as a bridge to this content.
ESS3.C	Human impacts on earth systems. This focuses on human impacts on whales through hunting and pollution.

Additional content: Light/electromagnetic radiation, sound and sound waves, behavior.

MISSION RESEARCH

5-LS2 -1	Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment
LS2.A	Interdependent relationships in ecosystems.
LS1.C	Organization for matter and energy flow in organisms.

This background research is very open ended for teachers to explore the standards that are of interest. It could be applied to the Mission Reader standards as well.

SCIENCE MISSION

5-LS-1	Support an argument that plants get the materials they need for growth chiefly from air and water.
LS1.C	Organization for matter and energy flow in organisms.
5-LS2 -1	Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
LS2.A	Interdependent relationships in ecosystems.

*ELA and Math standards to come

LS2.B	Cycles of matter and energy transfer in ecosystems.
5-PS3-1	Use models to describe that energy in animals' food was once energy from the sun.
5-ESS3-1	Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. This activity asks students to locate protected areas to help sperm whales. This lesson could be extended to facilitate research, and present different ways to protect sperm whales and other animals.
ESS3.C	Human impacts on Earth systems. This focuses on human impacts on whales through hunting and pollution.
5-PS3-1	Use models to describe that energy in animals' food was once energy from the sun.
PS3.D	Energy and chemical processes and everyday life. This is in the context of energy in ecosystems and used in technology.

Additional content: Human impacts on organisms; developing solutions for environmental challenges.

STEM PROJECT

PS3.D	Energy and chemical processes and everyday life. This is included in terms of energy needed by cameras in order to function.
3-5-ETS1-1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5-ETS1-2	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
ETS1.B	Developing possible solutions: communicating with peers about proposed solutions is important and can improve design.
ETS1.A	Defining and delimiting engineering problems.
ETS1.C	Optimizing the design.

EXPLORE YOUR BACKYARD

4-LS-1	Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior and reproduction.
LS1.A	Structure and function.

CROSS CUTTING CONCEPTS

Cause and effect: mechanisms and predictions: Mission Reader, Science Activity, Explore Your Backyard
Patterns: Mission Reader, Science Activity, STEM Project
Scale, proportion and quantity: Science Mission
Energy and matter flow: Mission Reader, Science Activity, Mission Research, Explore Your Backyard
System and system models: Mission Reader, Science Activity, STEM Project, Explore Your Backyard
Structure and function: Mission Reader, STEM Project
Stability and change: Mission Reader, Mission Research, Science Mission

CONNECTION TO ENGINEERING, TECHNOLOGY AND APPLICATIONS OF SCIENCE

Interdependence of Science, Engineering and Technology: Mission Reader, Science Mission, STEM Project
Influence of Science, Engineering and Technology on Society and the Natural World: Mission Reader, Science Mission, STEM Project

CONNECTION TO NATURE OF SCIENCE

Scientific investigations use a variety of methods: Mission Reader, Science Mission, STEM Project
Scientific knowledge is based on empirical evidence: Mission Reader, Science Mission
Science models, laws, mechanisms and theories explain natural phenomena: Mission Reader, Science Mission, STEM Project, Explore Your Backyard
Science is a way of knowing: Mission Reader, Science Mission, STEM Project
Scientific knowledge assumes an order and consistency in natural systems: Mission Reader, Mission Research, Explore Your Backyard
Science addresses questions about the natural and material world: Mission Reader, Science Mission, STEM Project

SCIENCE AND ENGINEERING PRACTICES

Asking questions and defining problems: Mission Reader, Science Mission, STEM Project
Analyzing and interpreting data: Science Mission
Constructing explanations and designing solutions: Science Mission, STEM Project, Explore Your Backyard
Engaging in argument from evidence: Mission Research, Science Mission, STEM Project
Obtaining, evaluating and communicating information: Mission Research, Science Mission, STEM Project, Explore Your Backyard
Planning and carrying out investigations: Mission Reader, Science Mission, STEM Project
Using mathematics: Science Mission

*ELA and Math standards to come