Unit Map

How can a sea turtle survive in the ocean after being released by an aquarium?

Working in their role as marine scientists, students apply their understanding of plant and animal defense structures as they explain to aquarium visitors how a sea turtle or other sea animals at the aquarium could defend themselves from ocean predators once they are released back into the wild.

Chapter 1: How does Spruce the Sea Turtle do what she needs to do to survive?

Students figure out: Sea turtles have body parts that help them get food, air, and water. In the ocean, there are predators that might try to eat the sea turtle. To survive in the ocean, she needs to avoid being eaten by predators.

How they figure it out: By watching videos of animals eating, reading about animals catching their meals in the wild, watering a plant, and closely observing their partners chewing and swallowing, students figure out that living things (including humans) use their body structures to meet their needs. Students review the basic survival needs of organisms through a game and are introduced to a new idea: to survive, animals and plants must avoid being eaten by other animals.

Chapter 2: How can Spruce the Sea Turtle survive where there are sharks?

Students figure out: The sea turtle has a shell and camouflage that enable her to defend herself from predators. The shell is hard, so predators can't eat her when they try to bite her. The camouflage allows her to blend in with her habitat, which makes it hard for predators to see her.

How they figure it out: Students read to find out that animal and plant structures perform specific functions. They observe photographs and videos of animals and plants defending themselves using shells, spines, and camouflage, then create models explaining their ideas about how these defenses work. The chapter ends with a biomimicry workshop in which students, informed by real animal and plant defenses, design ways to protect the sea turtle's food.

Chapter 3: How can Spruce the Sea Turtle's offspring survive where there are sharks?

Students figure out: When the sea turtle has offspring, they will not look exactly alike, but they will grow up to have hard shells and camouflage, just like their parents. These structures allow them to defend themselves from predators in the same way that the mother sea turtle does. This is because offspring defend themselves in the same way their parents do.

How they figure it out: Students use evidence from photos to compare offspring to parent organisms, then role-play interactions between parents and offspring. They read to find out that many animals need their parents to survive while they are young, and that plants grow up without parental care.

Chapter 4: How can aquarium scientists explain animal defenses to visitors?

Students figure out: Models highlight the important parts of what we are trying to explain and help communicate ideas clearly. A model of sea turtle defenses should either show how a hard shell stops a predator from biting and eating a sea turtle or how camouflage makes a sea turtle difficult to see so predators cannot find and eat it. Models do not need to show the parts of a sea turtle that are not part of its defense.

How they figure it out: Students read about and evaluate a model of frog defenses for effectiveness and clarity. Keeping these criteria in mind, they design and build their own models that will communicate to visitors how one of four sea animals defends itself. Students showcase their ideas by explaining their models at an exhibition held for classroom visitors.

Unit Map

How can we use light and sound to design shadow scenery and sound effects for a puppet theater?

Students take on the dual role of light engineers and sound engineers for a puppet-show company as they investigate cause-and-effect relationships and learn about the nature of light and sound. They apply what they learn to designing shadow scenery and sound effects for a puppet show.

Chapter 1: How do we make brighter or darker areas on a surface?

Students figure out: Without light, we cannot see. Light comes from a source and travels to a surface. Light from the source must be getting to the surface in order to make some parts of the surface look bright. If there is no light source, a surface looks dark.

How they figure it out: The class attempts, in vain, to make the classroom completely dark, identifying light sources at each failed attempt. Students read a book about whether one can see in the dark, and then they hunt for light sources in their school and in the pictures of a book. Students investigate a series of questions with their own light source (a flashlight), investigating how light gets to a surface.

Chapter 2: How do we make a dark area in a bright puppet show scene?

Students figure out: A dark area is the result of putting an object between a light source and a surface. When an object blocks a light source, the surface behind the object looks darker. This dark area is called a shadow.

How they figure it out: Students explore by making shadows on different surfaces. They then investigate how to make a dark area on the surface by using different materials to block light from reaching a surface.

Chapter 3: How do we make bright, medium bright, and dark areas in a puppet show scene?

Students figure out: Different materials let different amounts of light pass through. Bright areas are the result of all or almost all the light passing through an object and reaching a surface. This happens if there is no object or if the object is transparent. Medium-bright areas result when only some of the light passes through and reaches the surface. Dark areas happen because no light passes through an object. Light is blocked, so the surface looks dark.

How they figure it out: Students refine their understanding of how light interacts with different materials and work as light engineers to plan, make, and test shadow scenery. Based on what they learn, students revise their own shadow scene to meet a set of design goals. Students write explanations of their scenes for the puppet-show company.

Chapter 4: How do we design a sound source to go with a puppet show scene?

Students figure out: Sound has a source, just like light does. Sound is made when an object vibrates. The object that vibrates is the source of the sound. Like light, sound also travels. Sound travels from the source to our ears. You can start and stop sound by starting and stopping the vibration of an object.

How they figure it out: Working as sound engineers, students hunt for sound sources, investigate how sounds are made, and explain what vibrates in a particular sound source. They plan, make, and test different ways of making sound effects. They read a book about sound and share what they learn in a mini-book they create for the puppet-show company.

Unit Map

Why doesn't the sky always look the same?

As sky scientists, students explain why a boy living in a nearby place sees different things in the sky than his grandma who lives in a faraway place. Students record, organize, and analyze observations of the sun and other sky objects as they look for patterns and make sense of the cycle of daytime and nighttime.

Chapter 1: Why did the sky look different to Sai than to his grandma?

Students figure out: Sai and his grandma saw different things at the same time because they live in different places. When it is daytime for Sai, it is nighttime for his grandma. When Sai sees the sun, Sai's grandma sees the stars.

How they figure it out: Students make observations of the daytime sky and read about observations of the nighttime sky. They use evidence from live webcams to compare and contrast what people in different places on Earth see in the sky at the same time. They begin to notice patterns in what they see in the sky.

Chapter 2: Why was it daytime for Sai when it was nighttime for his grandma?

Students figure out: It was daytime for Sai when it was nighttime for his grandma because Earth is shaped like a ball, and Sai and his grandma live on different parts of Earth. When the place where Sai lives is facing the sun, the place where his grandma lives is facing away from the sun.

How they figure it out: Students watch videos of Earth to develop an understanding that Earth's shape is round like a ball. Students use globes and their own heads as models of Earth to observe how different parts of Earth face the sun at different times. They conclude that it is daytime in places on Earth that are facing the sun and nighttime in places on Earth that are not facing the sun.

Chapter 3: Why did daytime change to nighttime while Sai talked on the phone?

Students figure out: It changed from daytime to nighttime because Earth is spinning. When Sai and his grandma started talking, he saw the sun because the place on Earth where he lives was facing the sun. As Earth spins, the place where Sai lives moves to face away from the sun, so it changes to nighttime.

How they figure it out: Students observe the position of the sun through the course of a day and record this data on their Sky Mural. They use these observations and view time-lapse videos to develop an understanding that Earth spins. Students then engage in a hands-on activity to conclude that, as Earth spins, we face different directions, so what we see in the sky changes.

Chapter 4: What will Sai see in the sky when he calls his grandma tomorrow?

Students figure out: When Sai talks on the phone to his grandma at the same time tomorrow, he will see the same thing he saw in the sky today. The sun makes the same pattern in the sky every day because Earth spins one full time every day. This pattern lets us predict that Sai will see the sunset in the evening.

How they figure it out: Students make additional observations of the sky, both at the same time as previous observations and at sunset. They then record this new data on the Sky Mural. They organize this data in a new way in order to arrive at the understanding that the sun makes the same pattern in the sky every day because Earth spins one full time every day.

Chapter 5: Why was it nighttime for Sai when he called his grandma during the winter?

Students figure out: It was nighttime when Sai called his grandma during the winter because in winter, daytime is shorter and nighttime is longer than in other seasons.

How they figure it out: Students gather evidence about the seasons by reading and discussing a series of texts. They observe that there is a seasonal pattern to the length of daytime and nighttime over the course of a year.