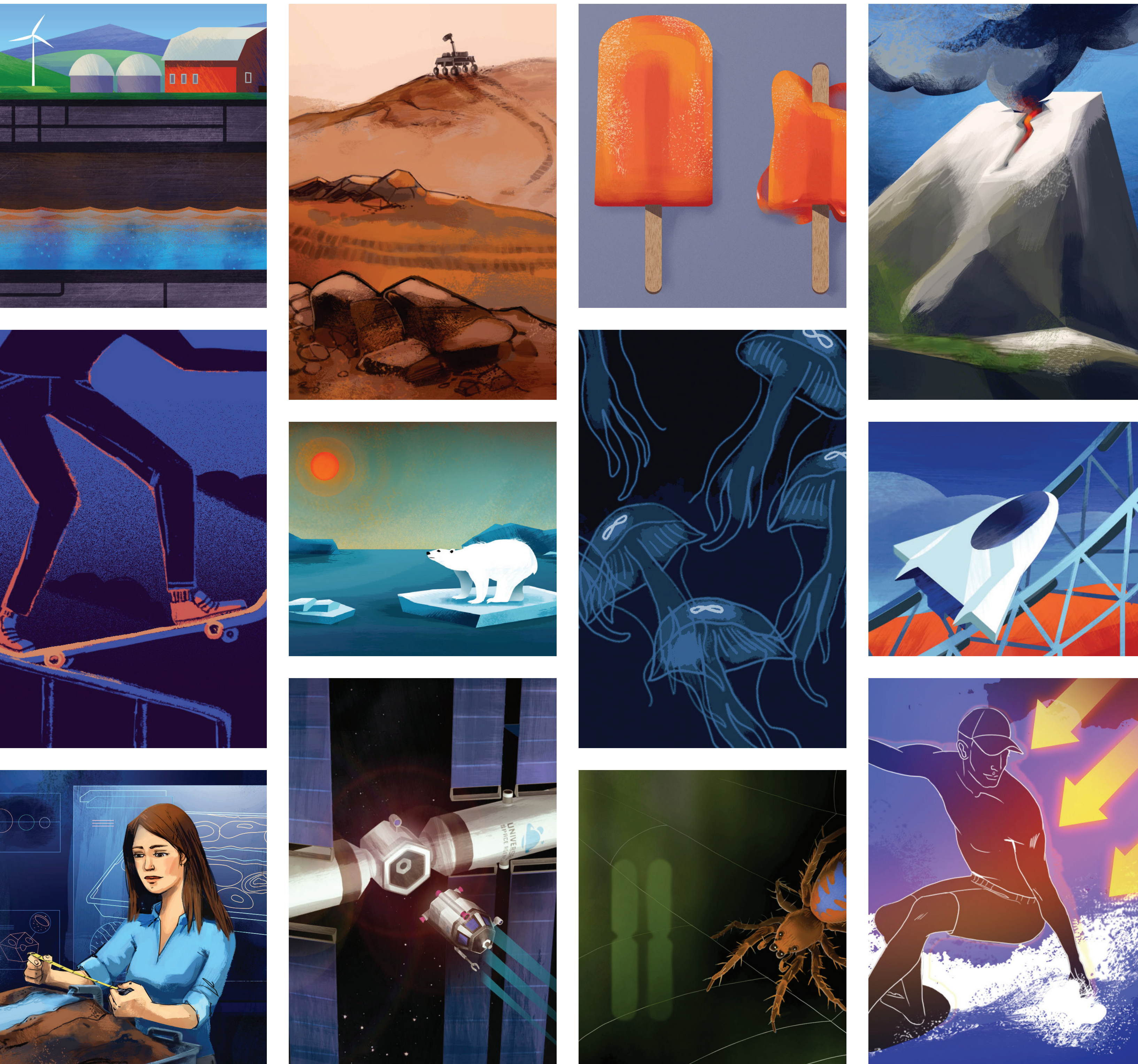
Amplify Science

Phenomena in Grades 6–8

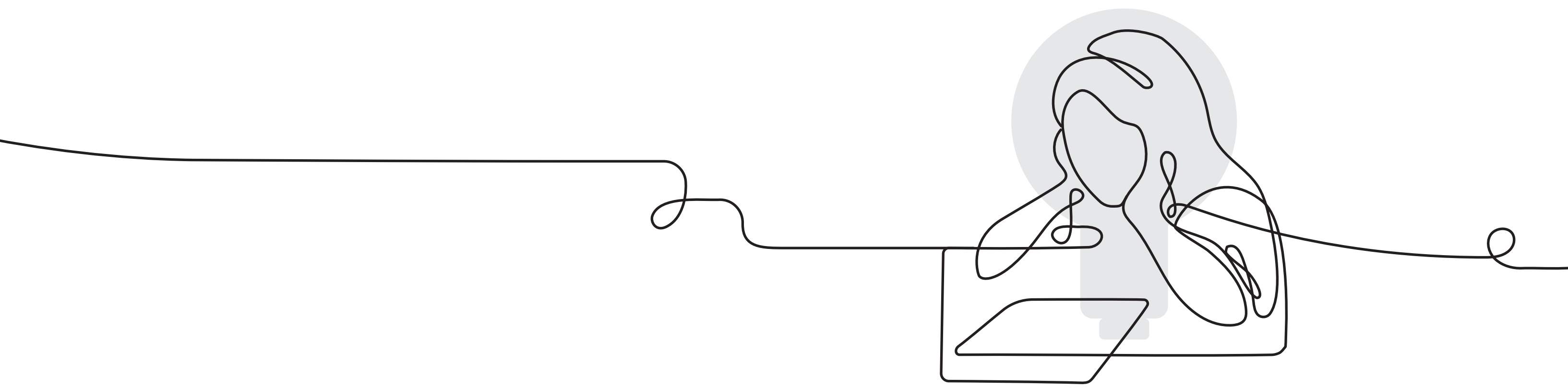


A unique, phenomena-based approach

In each Amplify Science unit, students are asked to inhabit the role of a scientist or engineer in order to investigate a real-world problem. These problems provide relevant, 21st-century contexts through which students investigate different scientific phenomena.

Once the problem context is clear, students collect evidence from multiple sources and through a variety of modalities. They move back and forth from first-hand investigation to second-hand analysis and synthesis, formulating an increasingly complex explanatory capacity for the problem at hand.

At the culmination of each unit, students have an opportunity to apply their newly acquired knowledge to a similar but different problem in novel and exciting circumstances. It is in this step that students demonstrate a deep understanding of the unit's key scientific phenomena.



Amplify.

THE LAWRENCE HALL OF SCIENCE
UNIVERSITY OF CALIFORNIA, BERKELEY

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To allow for the utmost flexibility, Amplify Science offers a customizable scope and sequence to fit classrooms that are using a domain model or an integrated model. The middle school Amplify Science Scope and Sequence below is an example of an integrated approach, but units can be reorganized to meet any scope and sequence needs.

Grade 6

Grade 7

Grade 8

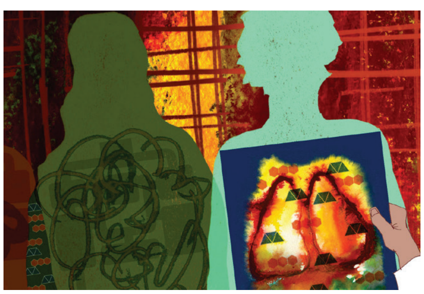
Grade 6

Launch:
Microbiome (Life Science)

How can having 100 trillion microorganisms on and in the human body keep us healthy?

Anchor phenomenon: The presence of 100 trillion microorganisms living on and in the human body may keep the body healthy.

There is evidence to suggest that the approximately 100 trillion bacteria living on and in the human body may correlate to many different health conditions. Further, altering one's microbiome can result in altering one's health for better or worse. Most notably, a treatment known as a fecal transplant—a transplant that involves using microorganisms from one person's healthy gut microbiome to cure another person who is suffering from a potentially deadly infection—has been under review. **Students take on the role of student researchers to figure out why a fecal transplant cured a patient suffering from a *C. difficile* infection.**



Metabolism (Life Science)

What is causing Elisa, a young patient, to feel tired all the time?

Anchor phenomenon: Elisa, a young patient, feels tired all the time.

Through inhabiting the role of medical students in a hospital, students are able to draw connections between the large-scale, macro-level experiences of the body and the micro-level processes that make the body function as they first diagnose a patient and then analyze the metabolism of world-class athletes. They uncover how body systems work together to bring molecules from food and air to the trillions of cells in the human body.

ENGINEERING INTERNSHIP

Metabolism (Life Science)

How can we design health bars that meet the metabolic needs of patients or rescue workers?

Anchor phenomenon: Designing health bars with different molecular compositions can effectively meet the metabolic needs of patients or rescue workers.

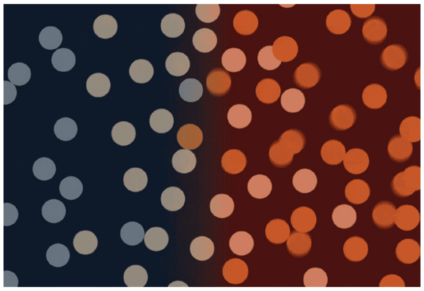
Students act as food engineering interns to design a health bar to feed people involved in natural disasters, with a particular emphasis on two populations who have health needs beyond what can be provided by emergency meals: patients and rescue workers. These plans must meet three design criteria: 1) addressing the metabolic needs of a target population; 2) tasting as good as possible; and 3) minimizing costs while serving as many people as possible. Students focus on the practice of considering trade-offs while designing solutions to deepen their understanding of metabolism. They also consider questions of scale, proportion, and quantity as different proportions of types of molecules affect a body's health and metabolism.

Traits and Reproduction (Life Science)

Why do Darwin's bark spider offspring have different silk flexibility traits even though they have the same parents?

Anchor phenomenon: Darwin's bark spider offspring have different silk flexibility traits, even though they have the same parents.

Scientists and engineers are investigating possible ways spider silk can be used for medical purposes, such as for artificial tendons. **Students act as student geneticists to investigate what causes variation in spider silk traits. Specifically, they explain why parent spiders have offspring with widely varied silk flexibility traits.** They uncover the roles of proteins and genes and the way that genes are inherited.



Thermal Energy (Physical Science)

Which heating system will best heat Riverdale School?

Anchor phenomenon: One of two proposed heating systems for Riverdale School will best heat the school.

In their role as student thermal scientists, students work with the principal of the fictional Riverdale School, in order to help the school choose a new heating system. They compare a system that heats a small amount of water with one that uses a larger amount of cooler groundwater. Students discover that observed temperature changes can be explained by the movement of molecules, which facilitates the transfer of kinetic energy from one place to another. As they analyze the two heating system options, students learn to distinguish between temperature and energy, and to explain how energy will transfer from a warmer object to a colder object until the temperature of the two objects reaches equilibrium.

Ocean, Atmosphere, and Climate (Earth/Space Science)

During El Niño years, why is Christchurch, New Zealand's air temperature cooler than usual?

Anchor phenomenon: During El Niño years, the air temperature in Christchurch, New Zealand is cooler than usual.

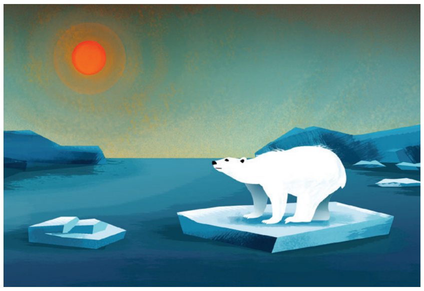
Students act as student climatologists helping a group of farmers near Christchurch figure out the cause of significantly colder air temperatures during the El Niño climate event. To solve the puzzle, students investigate what causes regional climates. They learn about energy from the sun and energy transfer between Earth's surface and atmosphere, ocean currents, and prevailing winds.

Weather Patterns (Earth/Space Science)

Why have recent rainstorms in Galetown been so severe?

Anchor phenomenon: In recent years, rainstorms in Galetown have been unusually severe.

Weather is a complex system that affects our daily lives. Understanding how weather events, such as severe rainstorms, take place is important for students to conceptualize weather events in their own community. **Students play the role of student forensic meteorologists as they discover how water vapor, temperature, energy transfer, and wind influence local weather patterns in a fictional town called Galetown.** They use what they have learned to explain what may have caused rainstorms in Galetown to be unusually severe in recent years.



Earth's Changing Climate (Earth/Space Science)

Why is the ice on Earth's surface melting?

Anchor phenomenon: The ice on Earth's surface is melting.

In the role of student climatologists, students investigate what is causing ice on Earth's surface to melt in order to help the fictional World Climate Institute educate the public about the processes involved. Students consider claims about changes to energy from the sun, to the atmosphere, to Earth's surface, or in human activities as contributing to climate change.

ENGINEERING INTERNSHIP

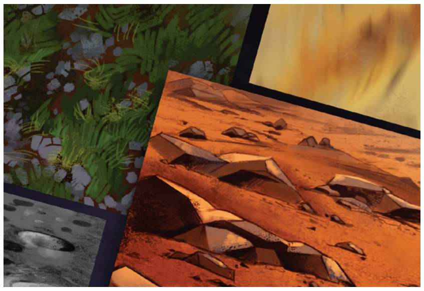
Earth's Changing Climate (Earth/Space Science)

How can we design rooftops to reduce a city's impact on climate change?

Anchor phenomenon: Designing rooftops with different modifications can reduce a city's impact on climate change.

Students act as civil engineering interns to design a plan to modify a city's roofs in order to reduce the city's impact on climate change. These plans must meet three design criteria: 1) reducing impact on the climate; 2) preserving the city's historic character; and 3) minimizing costs. Students focus on the practice of isolating variables in planning and conducting tests to deepen their understanding of climate change. They also learn about the cause-and-effect mechanisms involved as changes to albedo and combustion of fossil fuels affect climate.

Grade 7



Launch:
Geology on Mars (Earth/Space Science)

How can we search for evidence that other planets were once habitable?

Anchor phenomenon: Analyzing data about landforms on Mars can provide evidence that Mars may have once been habitable.

Evidence that water was once present on a planet is evidence that the planet may once have had living organisms. **In their role as student planetary geologists working to investigate the planet Mars, students investigate whether a particular channel on Mars was caused by flowing water or flowing lava.** Along the way, students engage in the practices and ways of thinking particular to planetary geologists, and learn to consider a planet as a system of interacting subsystems.

Plate Motion (Earth/Space Science)

Why are Mesosaurus fossils separated by thousands of kilometers of ocean when the species once lived all together?

Anchor phenomenon: Mesosaurus fossils have been found on continents separated by thousands of kilometers of ocean, even though the Mesosaurus species once lived all together.

Students play the role of geologists working for the fictional Museum of West Namibia to investigate Mesosaurus fossils found both in southern Africa and in South America. They learn that the surface of the Earth has changed dramatically over the Earth's history, with continents and ocean basins changing shape and arrangement due to the motion of tectonic plates. They also learn that as the Earth's surface changes, fossils that formed together may be split apart.

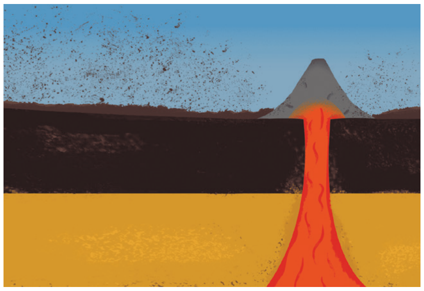
ENGINEERING INTERNSHIP

Plate Motion (Earth/Space Science)

How can we design an effective tsunami warning system?

Anchor phenomenon: Patterns in earthquake data can be used to design effective tsunami warning system.

Students act as mechanical engineering interns to design a tsunami warning system for the Indian Ocean region. These warning systems must meet three design criteria: 1) giving people as much warning time as possible to move to safety; 2) causing as few false alarms as possible; and 3) minimizing costs as much as possible. Students communicate like engineers and scientists do as they use their understanding of plate motion and patterns in data to create and justify their designs.



Rock Transformations (Earth/Space Science)

Why are rock samples from the Great Plains and from the Rocky Mountains composed of such similar minerals, when they look so different and come from different areas?

Anchor phenomenon: Rock samples from the Great Plains and from the Rocky Mountains—regions hundreds of miles apart—look very different, but have surprisingly similar mineral compositions.

Taking on the role of student geologists, students investigate a geologic puzzle: Two rock samples, one from the Great Plains and one from the Rocky Mountains, look very different but are composed of a surprisingly similar mix of minerals. Did the rocks form together and somehow get split apart? Or did one rock form first, and then the other rock form from the materials of the first rock? To solve the mystery, students learn about how rock forms and transforms, driven by different energy sources.

Phase Change (Physical Science)

Why did the methane lake on Titan disappear?

Anchor phenomenon: A methane lake on Titan no longer appears in images taken by a space probe two years apart.

Taking on the role of student chemists working for the fictional Universal Space Agency, students investigate the mystery of a disappearing methane lake on Titan. One team of scientists at the Universal Space Agency claims that the lake evaporated, while the other team of scientists claims that the lake froze. The students' assignment is to determine what happened to the lake. They discover what causes phase changes, including the role of energy transfer and attraction between molecules.

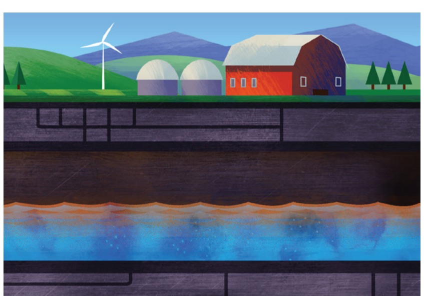
ENGINEERING INTERNSHIP

Phase Change (Physical Science)

How can we design portable baby incubators that use phase change to keep babies at a healthy temperature?

Anchor phenomenon: Designing portable baby incubators with different combinations of phase change materials can keep babies at a healthy temperature.

Students act as chemical engineering interns to design an incubator for low-birthweight babies. Phase change materials (PCMs) are substances that store and release large amounts of energy during the phase changes of melting and freezing. Since they can easily be reused, PCMs are useful for everyday situations that require temperature control. Students select a combination of PCMs and an insulating lining material, applying concepts about phase change and energy transfer. These plans must meet three design criteria: 1) keeping the baby's average temperature as close as possible to 37 degrees Celsius; 2) minimizing the time the baby spends outside the healthy temperature range; and 3) minimizing costs while helping as many babies as possible. Students focus on the practice of using models while designing solutions to deepen their understanding of phase change. They also consider the flow of energy and how it affects the matter in their designs.

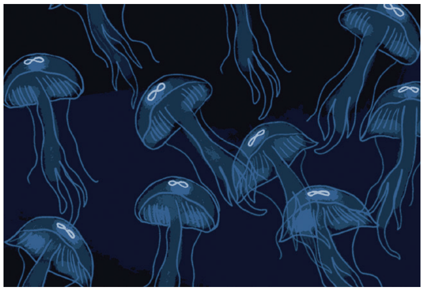


Chemical Reactions (Physical Science)

Why is there a mysterious brown substance in the tap water of Westfield?

Anchor phenomenon: A mysterious brown substance has been detected in the tap water of Westfield.

In the role of student chemists, students explore how new substances are formed as they investigate a problem with the water supply in the fictional town of Westfield. They analyze a brown substance that is in the water, the iron that the town's pipes are made of, and a substance from fertilizer found to have contaminated the wells that are the source of the town's water. Students use their findings to explain the source of the contaminating substance.

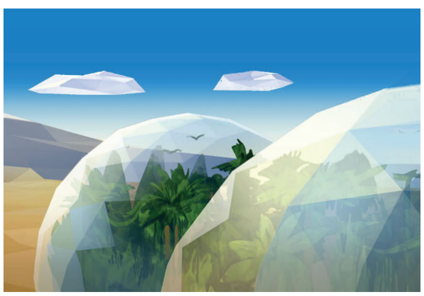


Populations and Resources (Life Science)

What caused the size of the moon jelly population in Glacier Sea to increase?

Anchor phenomenon: The size of the moon jelly population in Glacier Sea has increased.

Glacier Sea has seen an alarming increase in the moon jelly population. **In the role of student ecologists, students investigate reproduction, predation, food webs, and indirect effects to discover the cause.** Jellyfish population blooms have become common in recent years and offer an intriguing context to learn about populations and resources.



Matter and Energy in Ecosystems (Life Science)

Why did the biodome ecosystem collapse?

Anchor phenomenon: The biodome ecosystem has collapsed.

Students examine the case of a failed biodome, an enclosed ecosystem that was meant to be self-sustaining but ran into problems. **In the role of ecologists, students discover how all the organisms in an ecosystem get the resources they need to release energy.** Carbon cycles through an ecosystem due to organisms' production and use of energy storage molecules. Students build an understanding of this cycling—including the role of photosynthesis—as they solve the mystery of the biodome collapse.

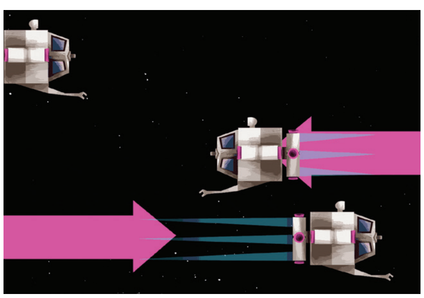
Grade 8

Launch:
Harnessing Human Energy (Physical Science)

How can rescue workers get energy for their equipment during rescue missions?

Anchor phenomenon: Rescue workers can use their own human kinetic energy to power the electrical devices they use during rescue missions.

Energy-harvesting backpacks, rocking chairs, and knee braces are just a few of the devices that have been created to capture human energy and use it to power electrical devices. **Students assume the role of student energy scientists in order to help a team of rescue workers find a way to get energy to the batteries in their equipment during rescue missions.** To do so, students learn about potential and kinetic energy, energy conversions, and energy transformations.



Force and Motion (Physical Science)

What happened in the missing seconds when the space pod should have docked with the space station?

Anchor phenomenon: The asteroid sample-collecting pod failed to dock at the space station as planned.

In the role of student physicists, students help solve a physics mystery from outer space. A pod returning with asteroid samples should have stopped and docked at the space station. Instead, it is now moving back away from the station, and the video feed showing what happened in the seconds during which it reversed direction has been lost. Did the pod reverse before it got to the space station, or did it hit the station and bounced off? Students explore principles of force, motion, mass, and collisions as they solve this mystery.

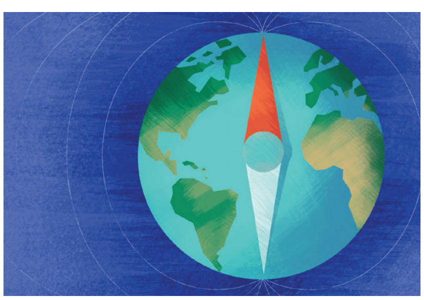
ENGINEERING INTERNSHIP

Force and Motion (Physical Science)

How can we design delivery pods that are damaged as little as possible when dropped?

Anchor phenomenon: Designing emergency supply delivery pods with different structures can maintain the integrity of the supply pods and their contents.

Students act as mechanical engineering interns to design delivery pods—pods of emergency supplies that will be dropped in areas experiencing a natural disaster. These delivery pods must meet three design criteria: 1) limiting the amount of damage to the cargo during the drop; 2) reusing the pod's shell as much as possible (for example, as emergency shelter); and 3) minimizing the cost of the pod as much as possible. Students focus on the practice of analyzing data to deepen their understanding of force and motion. They also learn about how structure and function are interrelated to determine the integrity and, therefore, success of their pods.



Magnetic Fields (Physical Science)

Why did the tests of a magnetic spacecraft launcher not go as planned?

Anchor phenomenon: During a test launch, a spacecraft traveled much faster than expected.

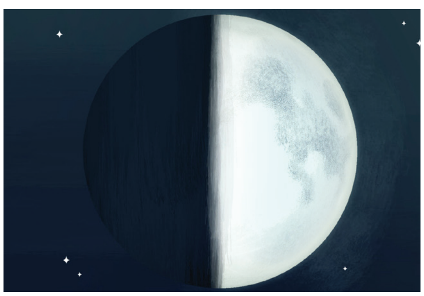
As student physicists consulting for the fictional Universal Space Agency, students work to understand the function of a magnetic spacecraft launcher (a simplified version of real technology currently under development). In particular, they seek to explain why a particular test launched the spacecraft much faster than expected. To do this, they investigate how magnets move some objects at a distance, the source of the energy for that movement, and what causes differences in the energy and forces involved.

Light Waves (Physical Science)

Why is there a higher rate of skin cancer in Australia than in other parts of the world?

Anchor phenomenon: The rate of skin cancer is higher in Australia than in other parts of the world.

Australia has one of the highest skin cancer rates in the world: More than half of the people who live there will be diagnosed with skin cancer in their lifetime. **In their role as student spectroscopists, students gain a deeper understanding of how light interacts with materials, and how these interactions affect our world—from the colors we see, to changes caused by light from the sun such as warmth, growth, and damage.** Students use what they learn about light to explain the causes of Australia's skin cancer problem.



Earth, Moon, and Sun (Earth/Space Science)

How can an astrophotographer plan for the best times to take photos of specific features on the Moon?

Anchor phenomenon: An astrophotographer can only take pictures of specific features on the Moon at certain times.

Students take on the role of student astronomers, advising an astrophotographer who needs to take photographs of the Moon. In order to provide this advice, students investigate where the Moon's light comes from, what causes the characteristic changes in the appearance of the Moon that we observe, and what conditions are required to view phenomena such as particular moon phases and lunar eclipses.

Natural Selection (Life Science)

What caused the newt population in Oregon State Park to become more poisonous?

Anchor phenomenon: The newt population in Oregon State Park has become more poisonous over time.

According to local legend around Oregon State Park, three unfortunate campers were found dead at their campsite and investigators found only one clue—a rough-skinned newt inside the coffeepot that the campers used to make their morning coffee. **Student biologists investigate what caused the rough-skinned newts of Oregon State Park to become so poisonous by uncovering mechanisms of natural selection—investigating variation in populations, survival and reproduction, and mutation.**

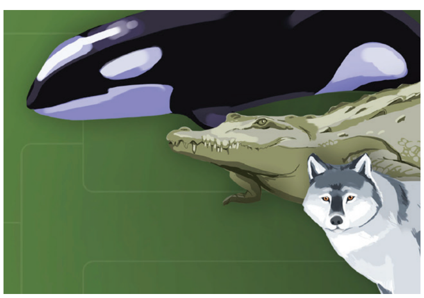
ENGINEERING INTERNSHIP

Natural Selection (Life Science)

How can we design treatments for malaria that don't lead to drug resistance?

Anchor phenomenon: Designing malaria treatment plans that use different combinations of drugs can reduce drug resistance while helping malaria patients.

Students act as biomedical engineering interns to design a malaria treatment plan. These treatment plans must reduce the population of malaria plasmodia while meeting three design criteria: 1) limiting the amount of the drug-resistance trait that develops in the population; 2) minimizing the side effects caused by the treatment; and 3) minimizing the treatment costs while treating as many patients as possible. Students focus on the practice of analyzing data to deepen their understanding of natural selection. They also learn about the cause-and-effect mechanisms involved when rates of death and reproduction can lead to increased drug resistance in the plasmodia population.

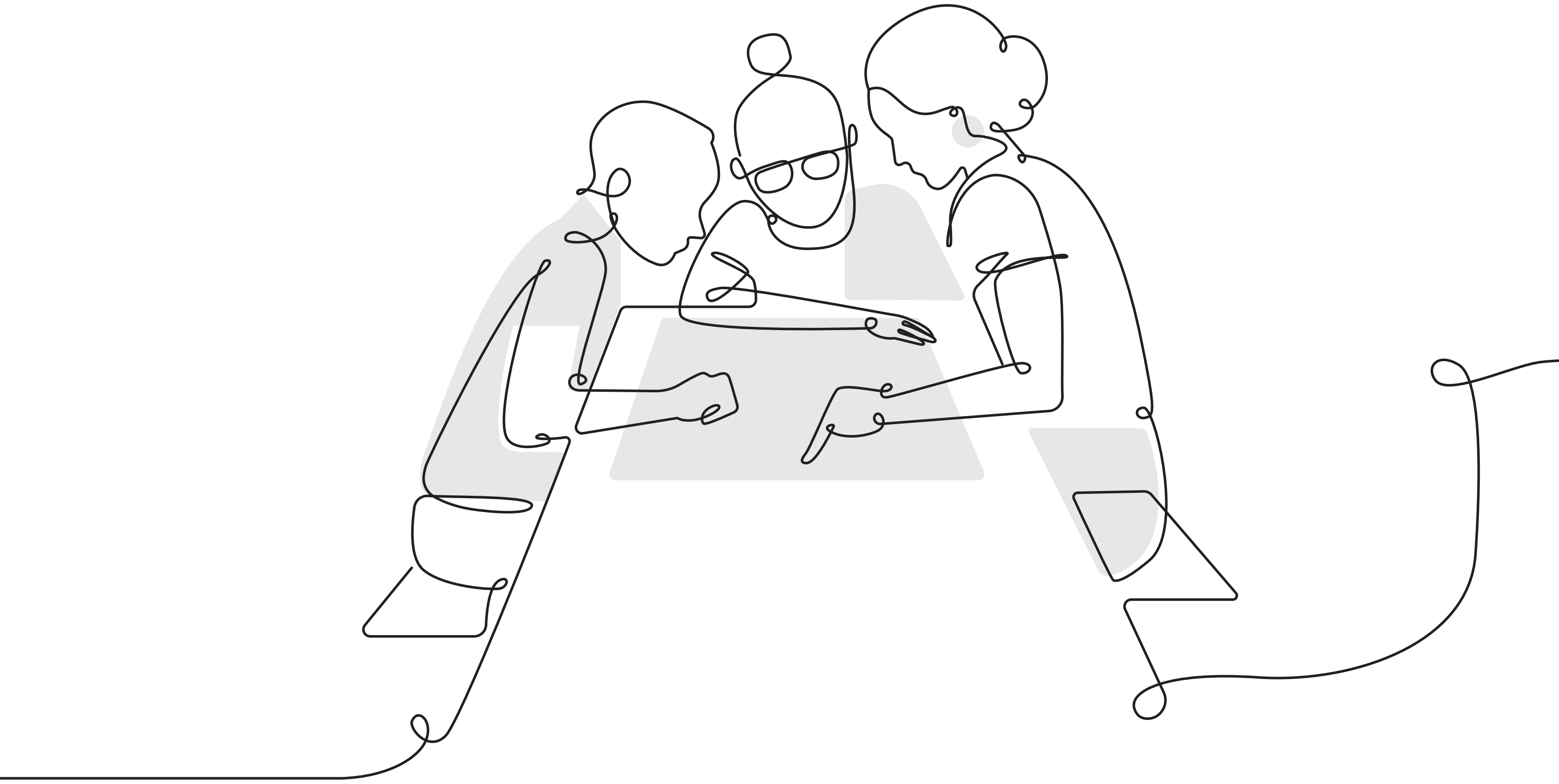


Evolutionary History (Life Science)

Is this mystery fossil more closely related to wolves or to whales?

Anchor phenomenon: A mystery fossil at the Natural History Museum has similarities with both wolves and whales.

Students act as student paleontologists to discover the evolutionary history of a mystery fossil. Is this species more closely related to wolves or whales, and how did all three species change over time? Students learn how to interpret similarities and differences among fossils, investigate how natural selection can lead to one population becoming two different species, and investigate evolution over vast periods of time.



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