Geology on Mars

Unit storyline

In their roles 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.

Featured activity:
Observing the Flowing Water Model (Lesson 2.2)

In Lesson 2.2, the class uses a Flowing Water Model — a stream table with water flowing over sand — to gather evidence about whether landforms remain on Mars after the geologic processes that formed them stop happening. Students can then apply what the parts of the model represent in the real geologic process on Earth in which water flows across the land.

FLEX

Plate Motion

Unit storyline

Students play the roles 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. As the Earth's surface changes, fossils that formed together may be split apart.

Featured activity:
Plate Modeling

Students develop their own physical models showing how plate motion can create mountain ranges. Students compare the models they create to how the *Plate Motion* sim shows mountains forming during plate motion. Next, students apply their understanding by exploring locations near plate boundaries in Google Earth™. Students choose one location and write a short argument about the type of plate boundary they think is at that location, based on landforms they observe.

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Plate Motion: Engineering Internship

Unit storyline

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: one, giving people as much warning time as possible to move to safety; two, causing as few false alarms as possible; and three, minimizing cost 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.

Featured activity:
Modeling a Tsunami Wave (Day 2)

In this lesson, students explore tsunami waves through a physical tsunami tank model. Using the model, they compare the effects of normal, wind-driven waves, and a tsunami wave caused by underwater plate motion. Students begin by setting up buildings on the shore of the tsunami tank before each test, and then take turns testing how to generate each wave type.

Rock Transformations

Unit storyline

Taking on the roles 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.

Featured activity:
Energy's Role in Forming Rocks (Lesson 2.3)

In Lesson 2.3 of *Rock Transformations*, students return to hard candy rock models they made earlier in the unit to investigate whether both sedimentary and igneous rock can turn into sediment. Students simulate weathering by shaking candy models of sedimentary rocks (made in an earlier lesson) and igneous rock (whole pieces of candy) in a jar. Students discover that both sedimentary and igneous rock can become sediment through weathering.

Phase Change

Unit storyline

Taking on the roles 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.

Featured activity:
Dry Ice

Students explore dry ice, frozen carbon dioxide, which is unusual in that it changes phase directly from solid to gas without passing through a liquid phase. Students then design and conduct investigations to gather evidence about their own questions about dry ice.

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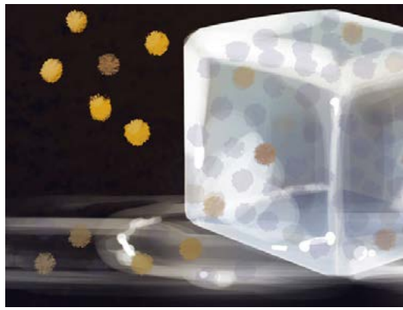
INTEGRATED-SPECIFIC MODEL | GRADE 7

Phase Change: Engineering Internship

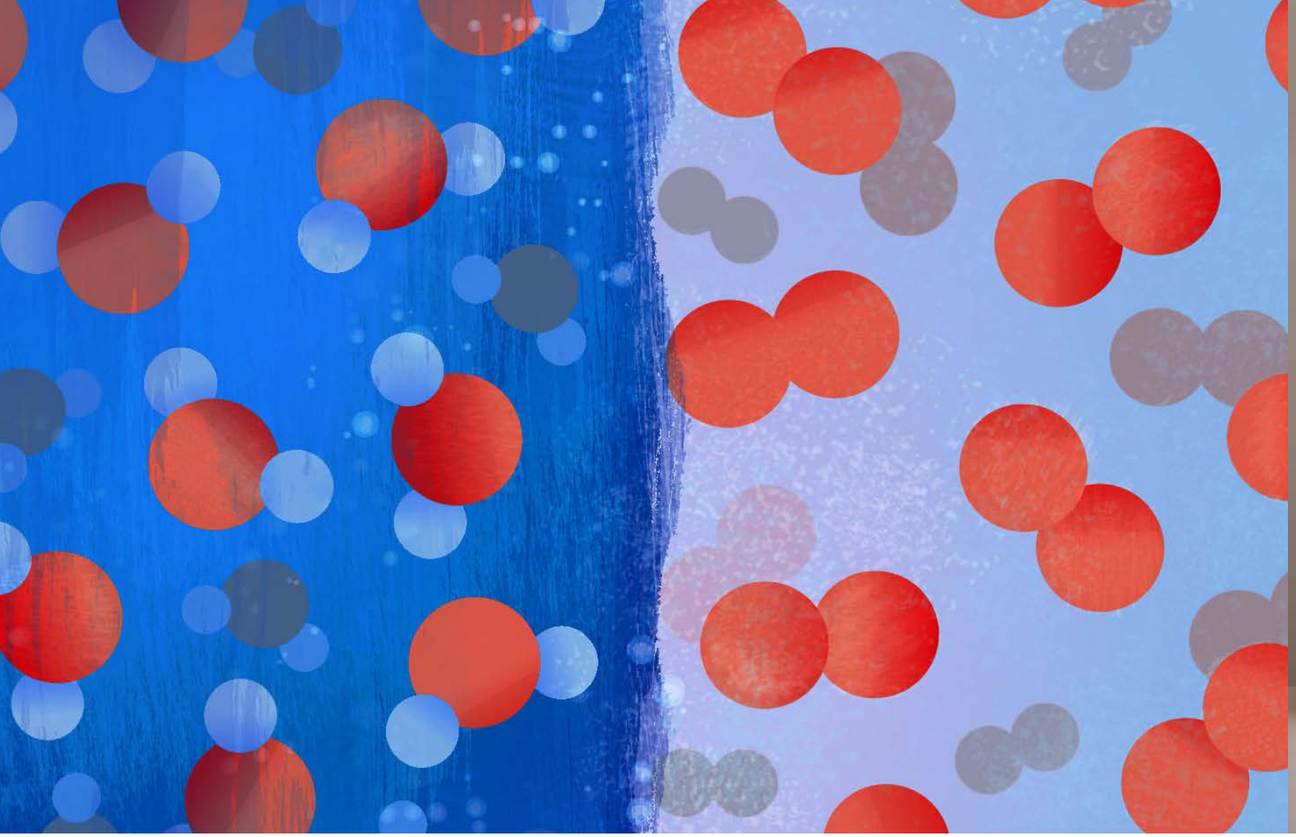


Unit storyline

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: One, keeping the baby's average temperature as close as possible to 37°C; two, minimizing the time the baby spends outside the healthy temperature range; and three, minimizing costs so as many babies can be helped as possible. Students focus on the practice of using models while designing solutions to deepen their understanding of phase change; students also consider the flow of energy and how it affects the matter in their designs.

Featured activity:
Modeling Thermal Energy Transfer (Day 2)

In this lesson, explore thermal energy transfer through a hands-on activity with hand warmers. In this activity, hand warmers serve as a model that helps interns see how thermal energy is transferred out of PCMs during a change from liquid to solid, and transferred into PCMs during a change from solid to liquid.



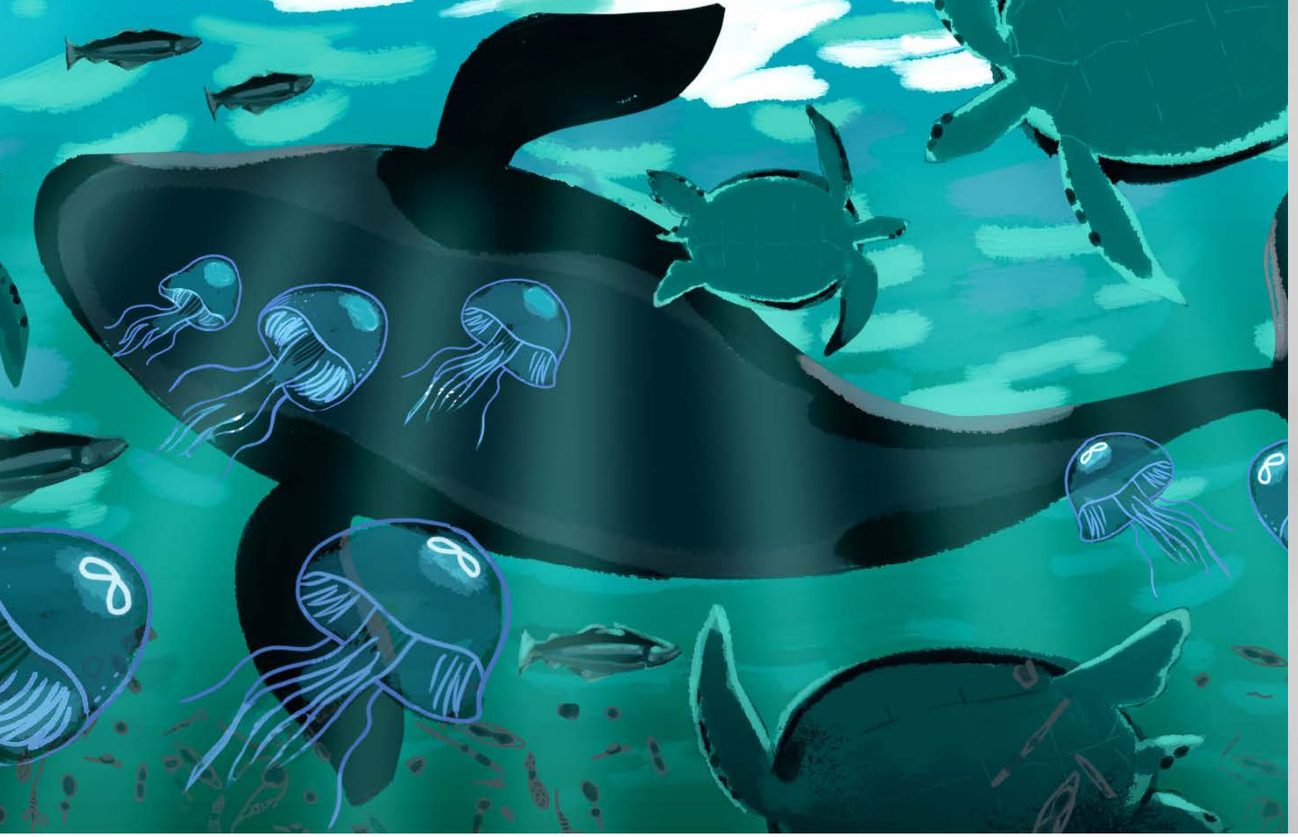
Chemical Reactions

Unit storyline

In the roles 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 reddish-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, and use their findings to explain the source of the contaminating substance.

Featured activity:
Investigating Substance Changes (Lesson 2.1)

In Lesson 2.1 of *Chemical Reactions*, students gather evidence by observing the chemical reaction that is produced when two substances — calcium chloride ($CaCl_2$) and sodium carbonate (Na_2CO_3) — are mixed together. First, students mix these substances and observe them, recording the change in properties that occurs. Then, students are introduced to Laboratory A mode of the *Chemical Reactions* sim, which they explore before using it to recreate the same chemical reaction between calcium chloride and sodium carbonate. This sim activity allows students to observe the changes that occur at the atomic scale. By the end of these activities, students should have enough evidence to conclude that substances can change into different substances.



Populations and Resources

Unit storyline

Glacier Sea has seen an alarming increase in the moon jelly population. In the roles 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.

Featured activity:
Energy Storage Molecules (Lesson 2.2)

In Lesson 2.2 of *Populations and Resources*, students gain firsthand experience with the relationship between energy storage molecules and an organism's ability to release energy for reproduction. Students give yeast different amounts of sugar (an energy storage molecule). Students observe that the more sugar the yeast gets the more bubbles they produce. Student use this as evidence that the more energy storage molecules an organism has the more energy they can release for reproduction.

Matter and Energy in Ecosystems

Unit storyline

Students examine the case of a failed biodome, an enclosed ecosystem that was meant to be self-sustaining but which 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.

Featured activity:
Biodome

Students apply their understanding of ecosystems to planning and building a miniature biodome that can sustain living organisms. After reviewing the components of a healthy ecosystem, students evaluate the available materials and select the best prospects for building a successful biodome. Working together, student groups plan and build their biodomes, and over the next few weeks, they observe the biodomes on a regular basis. Students assess their level of success and critique how well they were able to sustain a model ecosystem within the sealed environment. They suggest possible design changes if they were given a future chance to create another model ecosystem.

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