

DOK PROGRESSION GUIDE • NGSS SCIENCE

Grade 8 Science

Every NGSS performance expectation in the middle school (grades 6–8) PEs, tested in grade 8, with a Test Bank question at DOK 1, DOK 2 and DOK 3, and the clicks to find more.

DOK 1 Recall

DOK 2 Skills & concepts

DOK 3 Strategic thinking

DOK 4 Extended thinking

For grade 8 science teachers. Organized by domain, core idea (DCI) and performance expectation (PE), the way the Test Bank files science.

achievetricstestbank.com •
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How to use this booklet

Depth of Knowledge (DOK) describes the kind of thinking a question asks for, not how hard it is. For each performance expectation (PE), this booklet shows one question at DOK 1, DOK 2 and DOK 3, so you can see the climb from recalling an idea to using evidence and reasoning with it, and then pick questions at the level your students need next.

The four DOK levels

DOK 1 • Recall

Recall a fact, term or property, or carry out a routine one-step procedure. Read a value straight from a table or graph.

DOK 2 • Skills & concepts

Decide how to approach it and use two or more steps: compare, classify, interpret data, or move between representations.

DOK 3 • Strategic thinking

Reason and plan: justify an answer, critique an argument, use evidence, or solve a problem with no routine path.

DOK 4 • Extended thinking

Carry out an extended investigation that connects several ideas, conditions or sources. The Test Bank tags science questions DOK 1 to 3, so this booklet shows those three levels.

Reading a PE page

1. The heading names the disciplinary core idea (DCI), the performance expectation (PE) code and its wording.
2. The DOK ladder shows the levels this guide gives an example for. Every PE has a DOK 1, DOK 2 and DOK 3 example.
3. One example question at each level, lowest first, with the answer shown. Read them top to bottom to see how the thinking climbs.
4. "Why DOK n" explains in one sentence what makes the question that level, so you can spot the same thing in your own questions.
5. "Find more like this" lists the exact Test Bank clicks that generate more questions for the same PE at the same level.

The state science test item specifications do not assign DOK levels to PEs, so the levels here come from the Test Bank's own DOK tags. Every example was then checked by hand against the DOK definitions above. Where no Test Bank question truly fit a level, we wrote one; those are marked "Written for this guide."

Finding these questions in the Test Bank

Every example page ends with the exact clicks. Science is filed by course, subject, core idea and PE. The courses are Grade 8 Life, Physical and Earth Science.

One PE at one DOK level

[Create questions](#) › [Course](#) › [Subject](#) › [Disciplinary core idea \(DCI\)](#) › [Performance expectation \(PE\)](#) ›
[Practice and crosscutting concept \(optional\)](#) › [Options: DOK 1, 2 or 3](#) › [Generate](#)

Pick a practice and crosscutting concept to narrow the questions further, or leave them open for any.

Engineering Design (ETS1)

Engineering Design is not tied to one course.

[Create questions](#) › [Course: All](#) › [MS Engineering Design](#) › [ETS1](#) › [PE](#) › [Options: DOK](#) › [Generate](#)

Questions you have saved

Saved questions are filed the same way in your Item Bank.

[More](#) › [Item Bank](#) › [Course](#) › [Discrete or task](#) › [Subject](#) › [Core idea \(DCI\)](#) ›
[Performance expectation \(PE\)](#) › [DOK](#)

Tip: to move a class up the ladder, generate the same PE at the next DOK level. To check that an idea is secure before going further, generate a set at DOK 1.

All performance expectations at a glance

Every PE has an example question at DOK 1, DOK 2 and DOK 3 in this booklet.

Life Science

PE		DOK 1	DOK 2	DOK 3	DOK 4
MS-LS1-1	Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells	●	●	●	—
MS-LS1-2	Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function	●	●	●	—
MS-LS1-3	Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells	●	●	●	—
MS-LS1-4	Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively	●	●	●	—
MS-LS1-5	Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms	●	●	●	—
MS-LS1-6	Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms	●	●	●	—
MS-LS1-7	Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism	●	●	●	—
MS-LS1-8	Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories	●	●	●	—
MS-LS2-1	Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem	●	●	●	—
MS-LS2-2	Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems	●	●	●	—
MS-LS2-3	Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem	●	●	●	—
MS-LS2-4	Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations	●	●	●	—
MS-LS2-5	Evaluate competing design solutions for maintaining biodiversity and ecosystem services	●	●	●	—
MS-LS3-1	Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism	●	●	●	—
MS-LS3-2	Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation	●	●	●	—
MS-LS4-1	Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms	●	●	●	—

PE		DOK 1	DOK 2	DOK 3	DOK 4
	throughout the history of life on Earth under the assumption that natural laws operate today as in the past				
MS-LS4-2	Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships	●	●	●	—
MS-LS4-3	Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy	●	●	●	—
MS-LS4-4	Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment	●	●	●	—
MS-LS4-5	Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms	●	●	●	—
MS-LS4-6	Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time	●	●	●	—

Physical Science

PE		DOK 1	DOK 2	DOK 3	DOK 4
MS-PS1-1	Develop models to describe the atomic composition of simple molecules and extended structures				—
MS-PS1-2	Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred				—
MS-PS1-3	Gather and make sense of information to describe that synthetic materials come from natural resources and impact society				—
MS-PS1-4	Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed				—
MS-PS1-5	Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved				—
MS-PS1-6	Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes				—
MS-PS2-1	Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects				—
MS-PS2-2	Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object				—
MS-PS2-3	Ask questions about data to determine the factors that affect the strength of electric and magnetic forces				—
MS-PS2-4	Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects				—
MS-PS2-5	Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact				—
MS-PS3-1	Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object				—
MS-PS3-2	Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system				—
MS-PS3-3	Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer				—
MS-PS3-4	Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample				—
MS-PS3-5	Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object				—

PE		DOK 1	DOK 2	DOK 3	DOK 4
MS-PS4-1	Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave				—
MS-PS4-2	Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials				—
MS-PS4-3	Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals				—

Earth & Space Science

PE		DOK 1	DOK 2	DOK 3	DOK 4
MS-ESS1-1	Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons	●	●	●	—
MS-ESS1-2	Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system	●	●	●	—
MS-ESS1-3	Analyze and interpret data to determine scale properties of objects in the solar system	●	●	●	—
MS-ESS1-4	Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history	●	●	●	—
MS-ESS2-1	Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process	●	●	●	—
MS-ESS2-2	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales	●	●	●	—
MS-ESS2-3	Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions	●	●	●	—
MS-ESS2-4	Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity	●	●	●	—
MS-ESS2-5	Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions	●	●	●	—
MS-ESS2-6	Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates	●	●	●	—
MS-ESS3-1	Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes	●	●	●	—
MS-ESS3-2	Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects	●	●	●	—
MS-ESS3-3	Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment	●	●	●	—
MS-ESS3-4	Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems	●	●	●	—
MS-ESS3-5	Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century	●	●	●	—

Engineering Design

PE		DOK 1	DOK 2	DOK 3	DOK 4
MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision 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				—
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem				—
MS-ETS1-3	Analyze data from tests 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				—
MS-ETS1-4	Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved				—

NGSS DOMAIN

Life Science

21 performance expectations, grouped by disciplinary core idea. In the Test Bank, choose the Grade 8 Life course, then MS Life Science.

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MS-LS1-1 Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cellsExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 · Recall****Why DOK 1:** Students only need to recognize which single note is a microscope observation of cells, a direct recall of what counts as evidence of cells.

Isabel wrote these notes about a leaf she studied in science class. Select the note that is evidence that the leaf is made of cells.

- ☐ The leaf came from a green plant in the schoolyard.
- ☒ At 400x, the leaf showed many green, box-shaped units with walls. ✓
- ☐ The leaf felt soft and bent easily between my fingers.
- ☐ The leaf was about 3 cm long and 1 cm wide.

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Test Bank question

Why DOK 2: Students must decide to divide strand length by cell length for each organism and use the table, a two-step skill applied to investigation data.

Students use a microscope to investigate whether strands from three organisms contain one cell or many adjoining cells. They measure each strand and the length of a membrane-bounded unit within it. Use the measured lengths to estimate how many cells make up each observed strand. Choose the missing values from the drop-down menus.

Chain Organism	Chain Length (mm)	Length of One Cell (mm)	Cells in the Chain
Spirogyra strand	5	0.1	Blank 1
Anabaena chain	0.2	0.004	Blank 2
Oscillatoria thread	1	0.005	Blank 3

Blank 1 (Row 1 (Chain Organism: Spirogyra strand) — Cells in the Chain): 50 ▼

Blank 2 (Row 2 (Chain Organism: Anabaena chain) — Cells in the Chain): 50 ▼

Blank 3 (Row 3 (Chain Organism: Oscillatoria thread) — Cells in the Chain): 200 ▼

Drop-down 1 choices: 5 **50 ✓** 500

Drop-down 2 choices: 0.8 **50 ✓** 800

Drop-down 3 choices: 20 **200 ✓** 2,000

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students weigh size, cell count and cell types from the investigation to judge which explanations are supported, drawing a conclusion from several pieces of evidence.

A student uses a microscope to compare two organisms from a pond. Sample A is a paramecium. Sample B is a water flea, a small animal. The student measures that the water flea is about 10 times longer than the paramecium. Under the microscope, the paramecium is a single cell, while the water flea's body shows muscle cells, gut cells, and eye cells. The student wants to explain why the water flea is so much larger. Which statements are supported by this investigation? Select all that apply.

- ☐ The paramecium is too small to see structures inside it, so it cannot be considered a cell.
- ☒ The water flea is larger mainly because it is built from many cells working together. ✓
- ☐ The water flea is 10 times longer, so each of its cells must be about 10 times larger.
- ☒ The water flea has several types of cells, while the paramecium is one cell doing every job. ✓
- ☒ Both organisms are made of cells, even though one is a single cell and the other has many. ✓
- ☐ Only the water flea is made of cells, since the paramecium is too simple to be a true cell.

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Test Bank question

MS-LS1-2 Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function

Examples at: **DOK 1** **DOK 2** **DOK 3** **DOK 4**

DOK 1 · Recall

Why DOK 1: Students match each part of a bakery model to the cell part with the same job, which is recall of basic cell part functions.

Lucía models a plant cell as a bakery. Choose the cell part that each bakery part models.

	Cell wall	Cell membrane	Nucleus	Mitochondria
Bakery Part: Brick walls of the building — What It Does: Keep the building's shape	☒	☐	☐	☐
Bakery Part: Front door with a clerk — What It Does: Lets some people in and turns others away	☐	☒	☐	☐
Bakery Part: Head baker's recipe book — What It Does: Holds the instructions for all the work	☐	☐	☒	☐
Bakery Part: Ovens that burn fuel — What It Does: Release energy to run the bakery	☐	☐	☐	☒

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Test Bank question

Leo soaks two raw eggs in vinegar until their shells dissolve. Each egg is now held in only a thin, soft layer. He weighs the eggs, then soaks egg 1 in water and egg 2 in corn syrup for a day. Egg 1 goes from 75 g to 88 g. Egg 2 goes from 76 g to 52 g.

Part A: What does the thin layer around each egg model, and what does it do?

Choose one answer.

- ☐ A cell wall that keeps water from ever leaving
- ☐ A cell membrane that lets no water pass either way
- ☐ A nucleus that decides how large the egg grows
- ☒ A cell membrane that lets water move in or out ✓

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ☐ Both eggs lost their hard shells when soaked in vinegar.
- ☐ Corn syrup is much thicker and stickier than water.
- ☒ Egg 1 gained 13 g in water, and egg 2 lost 24 g in syrup. ✓
- ☐ Egg 2 weighed about the same as egg 1 at the start.

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students build a claim, cite data from three jars including controls, and reason about which cell part released energy without light, a full evidence-based explanation.

Students put soaked bean seeds in a sealed jar in a dark closet. They set up a second jar with boiled seeds and a third jar with no seeds. After 48 hours, the first jar was 4.0°C warmer. The boiled-seed jar was 0.1°C warmer, and the empty jar did not change. Make a claim about whether living seed cells release energy in the dark. Support it with data, and explain which cell part is responsible.

Model response: Living seed cells do release energy in the dark. The jar with living seeds warmed by 4.0°C, but the boiled seeds warmed it only 0.1°C and the empty jar did not change. The seeds were in the dark, so their chloroplasts could not work. The mitochondria in the living seed cells released energy from the food stored in the seeds, and some of that energy warmed the jar.

Rubric: 2 points: The response includes all required elements: claim that living seed cells release energy in the dark; evidence citing the data (4.0°C for living seeds compared with 0.1°C for boiled seeds or no change in the empty jar); reasoning that mitochondria release energy from the seeds' stored food, which does not need light.

1 point: The response includes one or two of the three required elements above, but not all three. Credit for "Reasoning: mitochondria release energy from the seeds' stored food, without light" requires "Claim: living seed cells release energy even in the dark".

0 points: no correct part, or credits chloroplasts for the energy. No correct required element; the response is incorrect, too vague to earn credit, irrelevant, blank, or only copies the prompt without answering.

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Test Bank question

MS-LS1-3 Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells

Examples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students name the level of organization for each example and identify the system that delivers oxygen, which is recall of terms and basic facts.

A runner is training for a school race. Choose the missing values from the drop-down menus about how her body is organized and how her body systems work together during the race.

Question	Example or Situation	Answer
Level of organization	One single muscle cell in her leg	Blank 1
Level of organization	Many muscle cells grouped together to form muscle tissue	Blank 2
Level of organization	The heart, built from muscle tissue, nerve tissue, and blood vessel tissue working together	Blank 3
System interaction	While she runs, her leg muscles use more oxygen. Her heart beats faster to move more blood to those muscles. Which system works with the muscular system to deliver the extra oxygen?	Blank 4

Blank 1 (Row 1 (Question: Level of organization) — Answer):

Cell ▼

Blank 2 (Row 2 (Question: Level of organization) — Answer):

Tissue ▼

Blank 3 (Row 3 (Question: Level of organization) — Answer):

Organ ▼

Blank 4 (Row 4 (Question: System interaction) — Answer):

Circulatory system ▼

Drop-down 1 choices: Organ Tissue **Cell ✓** Organ system

Drop-down 2 choices: Organ **Tissue ✓** Cell Organ system

Drop-down 3 choices: **Organ ✓** Tissue Cell Organ system

Drop-down 4 choices: Nervous system **Circulatory system ✓** Excretory system Digestive system

FIND MORE LIKE THIS

DOK 2 · Skills & concepts

Why DOK 2: Students judge each statement about how the lungs, heart, blood and nerves interact during exercise, explaining relationships between systems at a basic level.

A student observes that after sprinting during soccer practice, her heart rate and breathing rate both increase. She also notices her muscles feel warm and she sweats more. Select True or False for each statement about how her body systems work together.

	True	False
The lungs take in oxygen, which the blood then carries to the muscles that are working hard.	☒	☐
Each body system works independently, so the higher heart rate has no link to the faster breathing.	☐	☒
The nervous system senses the muscles' needs and signals the heart and lungs to speed up.	☒	☐
Sweat comes from the lungs sending extra moisture through tubes to the skin.	☐	☒
Blood carries oxygen and nutrients to the muscle cells so they can keep contracting.	☒	☐

FIND MORE LIKE THIS

DOK 3 · Strategic thinking

Why DOK 3: Students use the during and after exercise pattern as evidence and explain why both systems must respond together, a written argument linking several subsystems.

A student checked her heart rate and breathing rate before, during, and after riding her bike up a big hill. Both her heart rate and her breathing rate went up while she rode. After she stopped, both stayed high for a few minutes before slowing back down. Use this evidence to explain how the circulatory system and the respiratory system work together during and after hard exercise. Explain why both systems need to respond to the same problem in the body.

Model response: Both heart and breathing rates rise during cycling and remain high briefly during recovery. Lungs exchange oxygen and carbon dioxide with blood; the heart circulates blood to working muscles and back to lungs. Muscles use oxygen to release energy from food and produce carbon dioxide. The exercise/recovery pattern is consistent with increased gas-transfer needs and the connected pathways explain interdependence. Correlation alone does not prove the interaction.

Rubric: 2 points: Uses the exercise/recovery pattern and explains why lung gas exchange and blood transport together meet muscle needs. 1 point: Gives correct rate evidence or a partially correct interaction pathway, without both. 0 points: Gives no correct evidence-based interaction explanation.

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Test Bank question

MS-LS1-4 Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectivelyExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 · Recall****Why DOK 1:** Students connect a described display behavior to a higher chance of being chosen as a mate, a direct link stated almost fully in the passage.

In an Australian forest, a male satin bowerbird builds a structure of sticks called a bower. He decorates the ground in front of it with blue objects, such as feathers and berries. Females visit several bowers before they choose a mate. How does this bower-building behavior most likely affect the male's reproduction?

- ☒ It attracts females, which raises his chance of being chosen as a mate. ✓
- ☐ He builds it because he wants more bowerbirds to live in the forest.
- ☐ It gives his eggs a warm place to hatch after the female lays them.
- ☐ It lets him store extra food so he can survive the dry season.

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Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students sort each observation by whether it supports a claim about a plant structure aiding reproduction, which requires classifying evidence against the claim.

A student makes this claim: 'Hooked spines on seed-bearing burr fruits help the plant reproduce. The hooks let seeds stick to animals and travel to new places, where the seeds have less competition from the parent plant.' Look at each observation. Does it support the claim, or not? For each row, choose an answer for "Supports or does not support the claim".

	Does not support	Supports
Observation: Hooks on a burr seed grab onto a dog's fur while the dog walks through a field	☐	☒
Observation: The dog walks two miles before the burr falls off into a new field	☐	☒
Observation: The burr seed is brown, which helps it blend in with dirt	☒	☐
Observation: Young plants growing far from the parent plant get more sunlight and more nutrients from the soil	☐	☒

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must interpret a controlled experiment, compare two groups' results, and argue how flashing raises mating success, building an evidence-based argument.

A scientist randomly assigns 60 matched male fireflies to equal groups. She covers light organs with dark paint in one group and the same amount of clear paint in the other; handling and movement remain comparable. In one night, 12 of 30 clear-painted males displaying their species pattern mate, compared with 1 of 30 dark-painted males. What argument do these controlled results support about flashing and reproductive success?

Model response: The results support flashing improving mating opportunities: 12 of 30 visible-flashing males mated, compared with 1 of 30 males whose light was blocked. The species pattern provides a signal females can find and recognize. Equal handling and a clear-paint control strengthen the argument that visible light contributes to the difference, without establishing that it is the only influence on reproduction.

Rubric: 2 points: Uses the 12 of 30 versus 1 of 30 comparison and explains visible flashes as a mate-finding or recognition signal. 1 point: Gives either the correct comparison or the correct signal explanation. 0 points: Gives neither a correct comparison nor a correct signal explanation.

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Test Bank question

MS-LS1-5 Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms

Examples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students pick the one report sentence that shows growth changing with an environmental condition, simply recognizing evidence rather than analyzing it.

A team of divers grows kelp from one batch of spores on ropes at two depths in the same bay. Here are four sentences from their report. Which statement gives evidence that an environmental factor affected kelp growth?

☐ All of the kelp on the ropes grew from one batch of spores.

☐ The ropes hung from the same buoys in one part of the bay.

☒ Kelp at 2 m grew 20 cm a week, but kelp at 12 m grew 5 cm. ✓

☐ Kelp is a large seaweed that makes its own food from light.

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Test Bank question

Why DOK 2: Students must make two comparisons, same breed on different pastures and different breeds on the same pasture, to see both genes and environment matter.

A goat farm raises three groups of young goats, called kids, for 6 months. Group 1 is Boer goats, a large meat breed, on rich pasture. Group 2 is Boer goats on poor, dry pasture. Group 3 is Nigerian Dwarf goats, a small breed, on the same rich pasture as Group 1. At 6 months, the kids in Groups 1, 2, and 3 average 30 kg, 20 kg, and 12 kg. Which conclusion is best supported by these results?

☐ Only genes affected the kids' growth, since breed made the biggest difference.

☒ Both breed and pasture affected growth, since each change made a difference. ✓

☐ Only pasture affected the kids' growth, since food is what builds a body.

☐ Neither breed nor pasture mattered, since all the kids were young goats.

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MS-LS1-5



DOK 2



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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students test a general claim against six varied cases and decide which ones contradict it, reasoning about how environment can override parent size.

Mrs. Lin tells her class, "A bigger parent always has bigger offspring." The class collects observations to test her claim. Which observations are evidence against her claim? Select all that apply.

- ☒ Seeds from a 40 cm bonsai juniper grew into trees 5 m tall in open ground. ✓
- ☐ A large Great Dane had puppies that grew much larger than beagle puppies.
- ☐ Seeds from a tall pea variety grew into tall plants in the same garden as their parent.
- ☒ Seeds from a 900 kg prize pumpkin grew only 60 kg pumpkins in a shady, dry garden. ✓
- ☐ Seeds from a big sunflower grew into big sunflowers in the same sunny field.
- ☒ A small cow raised on poor pasture had a calf that grew large on rich pasture. ✓

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Test Bank question

MS-LS1-6 Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms

Examples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall whether each photosynthesis input or output is matter or energy and whether it enters, leaves or is made in the plant.

Duckweed is a tiny floating plant that can cover a whole pond in a few weeks. Amara lists some things that are involved when duckweed carries out photosynthesis. For each item, choose whether it is matter or energy and what happens to it. Choose the missing values from the drop-down menus.

Item	Matter or energy?	What happens to it?
Sunlight	Blank 1	Blank 2
Carbon dioxide	Blank 3	Enters the plant
Oxygen	Blank 4	Blank 5
Sugar	Matter	Blank 6

Blank 1 (Row 1 (Item: Sunlight) — Matter or energy?): Energy ▾

Blank 2 (Row 1 (Item: Sunlight) — What happens to it?): Enters the plant ▾

Blank 3 (Row 2 (Item: Carbon dioxide) — Matter or energy?): Matter ▾

Blank 4 (Row 3 (Item: Oxygen) — Matter or energy?): Matter ▾

Blank 5 (Row 3 (Item: Oxygen) — What happens to it?): Leaves the plant ▾

Blank 6 (Row 4 (Item: Sugar) — What happens to it?): Made inside the plant ▾

Drop-down 1 choices: Matter **Energy ✓**

Drop-down 2 choices: Made inside the plant Leaves the plant **Enters the plant ✓**

Drop-down 3 choices: **Matter ✓** Energy

Drop-down 4 choices: **Matter** ✓ Energy

Drop-down 5 choices: Made inside the plant **Leaves the plant** ✓ Enters the plant

Drop-down 6 choices: **Made inside the plant** ✓ Leaves the plant Enters the plant

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DOK 1

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Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a two-group data table to conclude that carbon dioxide builds plant mass, then choose the comparison that supports it.

Anika grows two groups of oat seedlings under the same bright lights with the same water. One group grows in normal air. The other grows in a chamber where a filter removes the carbon dioxide from the air. She dries representative matched samples at the start and after two weeks to estimate each group's average dry mass.

Dry Mass of Oat Seedlings With and Without Carbon Dioxide

Group	Dry mass at start (g)	Dry mass after 2 weeks (g)
Normal air	1.0	2.4
Air with no carbon dioxide	1.0	0.8

Part A: Which conclusion is best supported by the results?

Choose one answer.

- ☒ Oat seedlings need carbon dioxide to build new dry mass. ✓
- ☐ Oat seedlings grow the same with or without carbon dioxide.
- ☐ Oat seedlings need extra light when carbon dioxide is removed.
- ☐ Oat seedlings get most of their dry mass from the water they use.

Part B: Which evidence from the data best supports your answer to Part A?

Choose one answer.

- ☒ Only the group in normal air gained dry mass; the other lost some. ✓

- ☐ Both groups started with a dry mass of exactly 1.0 gram.
- ☐ Both groups had the same bright lights and the same water.
- ☐ The group in normal air ended with a dry mass of 2.4 grams.

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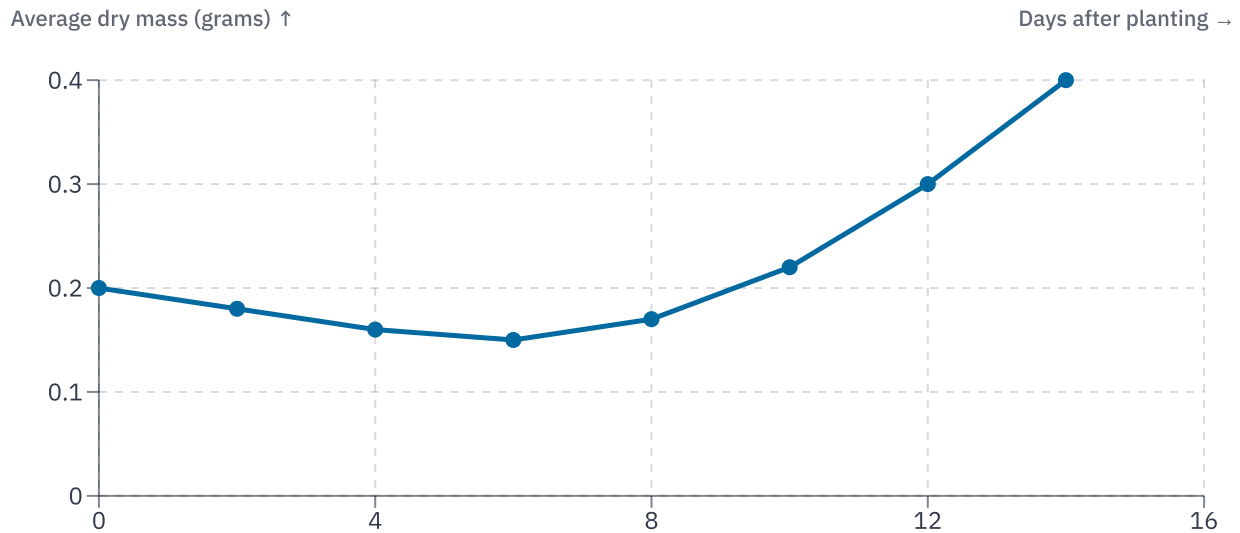
Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students explain why seedling mass first drops and then rises, combining stored food use and photosynthesis to account for a non-obvious pattern.

Elif plants squash seeds in pots of soil in a sunny window. Every two days, she dries and weighs a few seedlings to find their average dry mass. Which explanation best accounts for the pattern in the data?

Average Dry Mass of Squash Seedlings After Planting



- ☐ Dry mass fell as seedlings dried out, then rose as they took up more water.
- ☒ Dry mass fell while seedlings used seed food, then rose once leaves made sugar. ✓
- ☐ Dry mass fell at first because seedlings do not respire until leaves open.
- ☐ Dry mass fell while roots lost soil, then rose once they took in more soil.

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Test Bank question

MS-LS1-7 Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism

Examples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students fill in the gas taken in, the gas given off and what muscles get from fat, recalling the basic parts of cellular respiration.

Bar-tailed godwits fly nonstop from Alaska to New Zealand, about 11,000 kilometers. They do not eat or drink for 8 or 9 days. A bird starts the trip with lots of stored fat and arrives much lighter. Choose the missing values from the drop-down menus.

Part of the model	What it is
Food molecules the bird uses in flight	Stored fat
Gas the bird takes in to break down fat	Blank 1
Gas the bird breathes out as waste	Blank 2
What the flight muscles get from the fat	Blank 3

Blank 1 (Row 2 (Part of the model: Gas the bird takes in to break down fat) — What it is):

Oxygen ▼

Blank 2 (Row 3 (Part of the model: Gas the bird breathes out as waste) — What it is):

Carbon dioxide ▼

Blank 3 (Row 4 (Part of the model: What the flight muscles get from the fat) — What it is):

Released energy ▼

Drop-down 1 choices: **Oxygen ✓** Carbon dioxide Nitrogen

Drop-down 2 choices: Oxygen **Carbon dioxide ✓** Nitrogen

Drop-down 3 choices: **Released energy ✓** Created energy Fat atoms turned into energy

FIND MORE LIKE THIS

DOK 2 · Skills & concepts

Why DOK 2: Students classify each item as entering, leaving or being rebuilt into the bird's body, applying the matter-flow model to a new organism.

Arctic terns fly from Greenland to Antarctica each year. On the way, they stop to catch fish, then fly on. Match each item to the column that shows where it fits in a model of matter moving through a tern.

	Enters the tern's body	Leaves the tern's body	Rebuilt into the tern's body
Water vapor breathed out	☐	☒	☐
Fish molecules rebuilt into stored fat	☐	☐	☒
Carbon dioxide breathed out	☐	☒	☐
Fish molecules rebuilt into flight muscle	☐	☐	☒
Oxygen breathed in	☒	☐	☐
Fish swallowed at a stop	☒	☐	☐

FIND MORE LIKE THIS

DOK 3 · Strategic thinking

Why DOK 3: Students must reason out why body mass gain is far less than food eaten and describe two separate matter pathways, an open explanation with no single route.

A blue whale eats krill and builds blubber, but gains much less body mass than the fresh food mass it eats. Describe two food-matter pathways that a model could show to explain this difference.

Model response: Some digested krill atoms are rearranged into fat molecules in new blubber. Other food molecules undergo respiration, releasing stored energy and forming carbon dioxide and water that can leave the body; undigested matter also leaves as waste. Fresh intake and body gain alone do not measure each pathway's exact share.

Rubric: 2 points: describes krill matter being rearranged into blubber AND a pathway by which food matter leaves as respiratory products or waste. 1 point: describes one of these pathways. 0 points: describes neither pathway correctly, or claims food atoms disappear into energy.

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Test Bank question

MS-LS1-8 Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memoriesExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 · Recall****Why DOK 1:** Students identify the basic pathway from eye receptors to brain to muscles, recalling how a stimulus leads to a response.

A volleyball player sees an approaching ball and quickly raises her arms to block. Which explanation correctly connects the visual stimulus with her response?

- ☒ Eye receptors send brain messages, and brain signals guide arm movement. ✓
- ☐ A quick block proves that the brain cannot use any previous experience.
- ☐ The eyes store the blocking skill and directly command the arm muscles.
- ☐ The arms detect the ball's light and decide to block without brain input.

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Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students sort pieces of information by whether they actually link smell to memory, deciding relevance rather than just recalling facts about smell.

Hugo wants to support the claim that smells can bring back memories. Match each piece of information to the column that shows whether it supports his claim.

	Supports the claim	Does not support the claim
The nose has millions of smell receptors	☐	☒
An article says smell messages reach memory areas of the brain	☒	☐
A baker says fresh bread reminds her of her first job	☒	☐
22 of 30 classmates said a smell brought back a strong memory	☒	☐
Smells travel through the air as tiny particles	☐	☒
Dogs can smell much better than people	☐	☒

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate four possible tests and choose the one that isolates voice recognition from other cues, which requires planning a fair investigation.

Bao claims that his cat, Miso, recognizes Bao's voice. Miso often comes running when Bao calls her. Which test would give the best evidence for Bao's claim?

- ☒ Play recordings of Bao and of strangers calling Miso from a hidden speaker, and compare her responses. ✓
- ☐ Ask Bao's friends whether they think Miso knows Bao's voice better than their voices.
- ☐ Have Bao call Miso while standing in plain view, and time how fast she runs to him.
- ☐ Have Bao call Miso at dinnertime every day for a week, and count how often she comes.

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Test Bank question

MS-LS2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystemExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 · Recall****Why DOK 1:** Students read that the population fell and name the resource that was scarce, recalling a fact directly from the short scenario.

Use the drop-down menus to complete the statement.

A scientist studied a rabbit population in a forest over 10 years. During a drought, grass became scarce, and the rabbit count fell from 300 to 110. When the grass was scarce, the rabbit population decreased ▾. This pattern supports reduced food availability ▾ as a possible contributor to the population change.

Drop-down 1 choices: stayed the same **decreased ✓** increased steadily**Drop-down 2 choices:** predation competition with other species **food availability ✓**

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Test Bank question

Why DOK 2: Students interpret a trend across three winters and connect snow depth to food access to explain calf survival, a cause and effect from data.

Elk calf survival in a mountain valley was 90% in a winter with 30 cm of snow, 70% with 80 cm, and 55% with 120 cm. Elk dig through snow to reach grass. Select the claim best supported by these data.

- ☒ Deeper snow made food harder to reach, so fewer calves survived. ✓
- ☐ Fewer calves survived because the adult elk ate all the snow.
- ☐ Deeper snow made the calves warmer, so more of them survived.
- ☐ Snow depth had no effect on how many calves survived.

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students analyze a multi-year table, rule out fish supply, and argue that nesting space limited the colony, drawing a conclusion from competing evidence.

Western gulls nest on the ground on a small island and feed on fish at sea. The island was covered in a thick plant called ice plant, and gulls nested only in the open patches. In 2021, volunteers cleared ice plant from half the island. Make a claim about what limited the gull colony. Support it with evidence from the data and explain your reasoning.

Open Ground, Gull Nests, and Fish Near an Island

Year	Open Nesting Ground (square meters)	Gull Nests	Fish Near Island (catch per net)
2019	2,000	180	50
2020	2,100	185	30
2022	6,000	510	45
2023	6,100	530	28

Model response: Open nesting ground is a supported limitation: roughly 2,000 square meters and 180 nests became roughly 6,000 square meters and 510 to 530 nests after clearing. Nests follow space more closely than the changing fish catches, supporting nesting space as a contributor without proving food never matters.

Rubric: 2 points: gives a nesting-space claim with the before-and-after area/nest comparison and explains why it is supported relative to fish catches. 1 point: gives a correct claim with partial evidence or reasoning. 0 points: gives no supported claim.

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Test Bank question

MS-LS2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems

 Examples at: DOK 1 DOK 2 DOK 3 DOK 4

DOK 1 · Recall

Why DOK 1: Students label each pair as predation, competition or mutualism, which is recall of the definitions of these interaction types.

A scientist studied three ocean places. She watched how animals act with each other. Classify each row. Pick the type of relationship for each pair: predation, competition, or mutualism.

	predation	mutualism	competition
Coral reef: clownfish gain shelter and anemones gain nutrients	☐	☒	☐
Kelp forest: otters hunt and eat urchins	☒	☐	☐
Place: Rocky Shore — Animals: Barnacles and mussels fighting for space on rocks	☐	☐	☒

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Test Bank question

Use the drop-down menus to complete the statement.

As the Arctic warms, red foxes are moving north onto the tundra. They take over dens and hunt the same prey as arctic foxes. In Pacific forests, barred owls have spread west into the home of spotted owls, and they hunt the same prey. As red foxes spread, arctic foxes most likely . As barred owls spread, spotted owls most likely .

Both cases show the pattern of .

Drop-down 1 choices:

Drop-down 2 choices:

Drop-down 3 choices:

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students map each organism in the marsh example onto a rocky shore and reason through a chain of effects to predict a new outcome.

In a salt marsh, blue crabs eat snails, and the snails graze on marsh grass. Where people caught most of the crabs, the snails increased and the grass died back. On a rocky shore, oystercatcher birds eat limpets, and limpets scrape algae off rocks. Select the prediction for the rocky shore that follows the same pattern.

- ☒ If oystercatchers are scared away, limpets increase and less algae is left. ✓
- ☐ If oystercatchers are scared away, limpets decrease and algae spread over the rocks.
- ☐ If oystercatchers are scared away, limpets and algae both increase together.
- ☐ If oystercatchers are scared away, nothing changes, since birds do not eat algae.

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Test Bank question

MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystemExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 · Recall****Why DOK 1:** Students recall that eating moves both matter and stored energy from food into the consumer, a single basic fact.

A giraffe eats acacia leaves on the savanna. Which statement correctly describes what the giraffe takes in when it eats?

☒ It takes in matter and the energy stored in the leaves. ✓☐ It takes in only sunlight that is stored in the leaves.☐ It takes in only water, since leaves are mostly water.☐ It takes in heat that the acacia tree made from soil.

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Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students judge several statements about a food chain model, distinguishing how matter cycles from how energy flows, which requires comparing two ideas.

A model of a grassland ecosystem shows grass being eaten by grasshoppers, grasshoppers eaten by mice, and mice eaten by hawks. When the mice and hawks die, decomposers such as fungi and bacteria break down their bodies. A student is developing this model to show how matter cycles and energy flows through the ecosystem. Which statements about this model are scientifically accurate? Select all that apply.

- ☒ Decomposers break down dead organisms and waste, returning matter to the soil so producers like grass can reuse it. ✓
- ☒ At each step from grass to grasshopper to mouse to hawk, less energy is available than at the step before it. ✓
- ☒ Energy flows through the ecosystem and is eventually lost as heat, so it does not cycle back to the grass the way matter does. ✓
- ☐ The arrows in the food web represent only which organism eats which, not the movement of matter and energy.
- ☒ Without decomposers, the matter in dead mice and hawks would stay locked up and unavailable to producers. ✓
- ☐ Energy is recycled through the ecosystem in the same way matter is, moving repeatedly from hawks back to grass.

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students write an explanation that traces matter reuse through decomposers and argues why sunlight is still required, combining two model ideas in their own words.

A sealed-jar model contains a plant, bacteria and fungi that decompose dead material, pill bugs that eat dead material, and soil. Sunlight enters and heat leaves. Explain how matter is reused and why continued food production requires sunlight.

Model response: Bacteria and fungi release nutrients and gases from dead material into soil and air, and the plant reuses that matter. Pill bugs eat dead material. The plant stores sunlight energy in food, and energy eventually leaves as heat, so continued food production requires incoming light.

Rubric: 2 points: explains matter release by decomposers and plant reuse, and explains sunlight entering for food production with heat leaving. 1 point: correctly explains either pathway. 0 points: explains neither.

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Test Bank question

MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populationsExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 · Recall****Why DOK 1:** Students identify the cold snap as a nonliving change and state that the population dropped, recalling a category and an obvious effect.

A cold snap froze a Florida lagoon for several days. Many snook, a fish that cannot survive cold water, died. Describe what kind of change affected the snook, living or nonliving, and explain how it affected the snook population.

Model response: The cold snap was a nonliving change, because it changed the water temperature. The snook population decreased because many snook died in the cold water.

Rubric: 2 points: identifies the cold snap as a nonliving (physical) change, AND explains that the snook population decreased because many died in the cold water. 1 point: gives only one of these. 0 points: neither.

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Test Bank question

Winters in a western forest have become warmer. Mountain pine beetle larvae used to die in cold winters, but now most survive. Over ten years, the beetles killed millions of pine trees. Which statement best explains how the warmer winters affected the pine trees?

- ☐ Warmer winters killed the beetles, so the pines had fewer beetles to fight.
- ☐ Warmer winters gave the pines more food, so the beetles had to eat more.
- ☐ Warmer winters killed the pines directly, and the beetles moved in afterward.
- ☒ Warmer winters let more beetles survive, and more beetles killed more pines. ✓

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students combine nest data with ideas about edges and parasitism to evaluate claims about forest fragmentation, reasoning from several pieces of information.

Cowbirds lay eggs in other birds' nests and search mostly near forest edges. Their chicks compete with host chicks for food. Scientists compared similar-shaped forest patches of different sizes: 70 percent of wood thrush nests in small patches had cowbird eggs, compared with 10 percent in large patches. Select True or False for each statement.

	True	False
Cutting a large forest into small patches likely helps cowbirds find more nests.	☒	☐
Wood thrushes in small patches likely raise fewer of their own young.	☒	☐
The data show forest patch size has no link to cowbird eggs in nests.	☐	☒
Small patches have more edge compared with their size than large patches.	☒	☐

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Test Bank question

MS-LS2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem servicesExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 · Recall**

Why DOK 1: Students choose between two simple plans using the basic fact that predators control prey without poisoning other animals, a straightforward recall-based choice.

A farm has too many mice eating stored grain. Plan A puts out rat poison around the barns. Plan B puts up nest boxes for barn owls, which hunt mice at night. Which plan better protects the farm's biodiversity while controlling mice?

- ☐ Plan A, because poison affects only the mice that eat it.
- ☒ Plan B, because owls eat mice without poisoning other animals. ✓
- ☐ Plan A, because owls would scare away every other bird.
- ☐ Plan B, because owls eat grain instead of mice.

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Test Bank question

Engineers compared two ways to let a stream flow under a road. A small round pipe makes water rush through fast and drop off the end. A wide, open-bottom arch keeps the natural streambed and slow water. Trout and crayfish must move upstream to feed and breed. Select True or False for each statement.

	True	False
Fast water and a drop at the pipe's end can block fish from moving upstream.	☒	☐
The arch keeps the streambed that crayfish and insects live on.	☒	☐
The small pipe connects the stream for animals better than the arch.	☐	☒
Choosing the arch could help trout reach places to lay eggs.	☒	☐
The design under the road has no effect on stream animals.	☐	☒

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students check two designs against three criteria and write a justified choice using the data, evaluating competing solutions with evidence.

A county compares a concrete seawall costing 12 million dollars, reducing wave energy by 70 percent and supporting 3 kinds of fish and crabs, with an oyster reef and marsh costing 8 million dollars, reducing waves by 60 percent and supporting 25 kinds. Its criteria are at least 50 percent wave reduction and at least 20 kinds of fish and crabs within a 10-million-dollar budget. Use the data to justify your choice. Which design meets all criteria?

Model response: The oyster reef and marsh meets all criteria: 8 million is within the 10-million budget, 60 percent exceeds 50 percent, and 25 kinds exceed 20. The wall costs 12 million and supports only 3 kinds.

Rubric: 2 points: Chooses the reef and marsh and accurately uses cost, wave reduction and species evidence to show it meets all criteria. 1 point: Chooses the reef with incomplete evidence, or correctly compares one criterion. 0 points: Gives no relevant choice or comparison.

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Test Bank question

MS-LS3-1 Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism

Examples at:

DOK 1

DOK 2

DOK 3

DOK 4

DOK 1 · Recall

Why DOK 1: Students fill in that a mutation changes a gene, which changes a protein, recalling the basic gene to protein to trait chain.

Use the drop-down menus to complete the statement.

A branch on a green apple tree grew red apples because of a mutation in one of its cells.

Growers cut that branch and grafted it onto other trees to grow more red apples. The

mutation changed a in the branch, which changed a that made the apples red.

Drop-down 1 choices:

Drop-down 2 choices:

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Test Bank question

Scientists placed butterflies with small and large eyespots in a field with birds. Large eyespots come from a mutation in a wing-pattern gene. Of butterflies attacked by birds, 70 percent of those with large eyespots escaped with only torn wing edges, compared with 30 percent of those with small eyespots.

Part A: How is the large-eyespot mutation best classified in this field?

Choose one answer.

- ☒ Beneficial, since it helps more butterflies escape attacks ✓
- ☐ Harmful, since it makes birds attack the butterflies more
- ☐ Beneficial, since the butterflies chose to grow bigger spots
- ☐ Neutral, since eyespot size does not affect escaping

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ☒ 70 percent with large spots escaped, compared with 30 percent. ✓
- ☐ Birds hunt butterflies in open fields during the day.
- ☐ The large eyespots come from a mutation in a wing gene.
- ☐ Butterflies have eyespots on the edges of their wings.

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Grade 8 Life



MS Life Science



LS3



MS-LS3-1



DOK 2



Generate

Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students critique four claims and must recognize that a mutation's effect cannot be judged without knowing the environment, reasoning about what the model can support.

A student models a fictional Zebrook chromosome gene. Gene version A → protein A → orange pigment; a mutation produces version B → protein B → blue pigment. The model includes no survival data. Which claim correctly interprets the gene-to-trait change and its possible effects?

- ☐ Claim 1: The mutation changed the instructions in the gene, which changed the protein produced, which resulted in blue pigment in fur cells instead of orange pigment. This is a beneficial mutation because blue fur is brighter.
- ☒ Claim 2: The mutation changed the instructions in the gene, which changed the protein produced, which resulted in blue pigment in fur cells instead of orange pigment. Whether this mutation is beneficial, harmful, or neutral depends on the organism's environment. ✓
- ☐ Claim 3: The mutation is harmful because all mutations cause damage to an organism's genes and make it weaker over time.
- ☐ Claim 4: The organism chose to mutate its gene in order to produce a new protein that would give it blue fur to survive better in its habitat.

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Test Bank question

MS-LS3-2 Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation

Examples at:

DOK 1

DOK 2

DOK 3

DOK 4

DOK 1 · Recall

Why DOK 1: Students recall the number of parents and whether offspring are identical for three familiar ways plants reproduce.

Plants can make new plants in different ways. For each way, fill in the number of parents and whether the offspring are identical to a parent. Choose the missing values from the drop-down menus.

Way of Reproducing	Number of Parents	Offspring Genetic Information
Strawberry runner	Blank 1	Blank 2
Pollen from one plant fertilizes another plant's flower	Blank 3	Blank 4
Potato grown from a piece of tuber	Blank 5	Blank 6

Blank 1 (Row 1 (Way of Reproducing: Strawberry runner) — Number of Parents):

1 ▼

Blank 2 (Row 1 (Way of Reproducing: Strawberry runner) — Offspring Genetic Information):

Identical to parent ▼

Blank 3 (Row 2 (Way of Reproducing: Pollen from one plant fertilizes another plant's flower)

— Number of Parents):

2 ▼

Blank 4 (Row 2 (Way of Reproducing: Pollen from one plant fertilizes another plant's flower)

— Offspring Genetic Information):

Varies from parents ▼

Blank 5 (Row 3 (Way of Reproducing: Potato grown from a piece of tuber) — Number of

Parents): 1 ▾

Blank 6 (Row 3 (Way of Reproducing: Potato grown from a piece of tuber) — Offspring

Genetic Information): Identical to parent ▾

Drop-down 1 choices: 0 1 ✓ 2

Drop-down 2 choices: Identical to parent ✓ Varies from parents

Drop-down 3 choices: 1 2 ✓ 3

Drop-down 4 choices: Identical to parent Varies from parents ✓

Drop-down 5 choices: 0 1 ✓ 2

Drop-down 6 choices: Identical to parent ✓ Varies from parents

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Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students classify new examples by whether offspring copy one parent or combine information from two, applying the concept to unfamiliar organisms.

A model predicts copied information from one-source tissue growth and new combinations from fertilization. Match each described pathway to its genetic outcome. Assume no mutations.

	Copies one source	Combines parental information
Example: A pineapple top planted in soil grows into a plant	☒	☐
Example: Two seahorses mate, and babies are born	☐	☒
Example: A sea anemone splits into two anemones	☒	☐
Example: Bees carry pollen between two blackberry bushes, and berries with seeds form	☐	☒

FIND MORE LIKE THIS

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Test Bank question

Scientists grew yeast in rich food and in poor food. In rich food, 95 percent of cells budded and 2 percent formed sexual spores. In poor food, 20 percent budded and 70 percent formed sexual spores. Budding makes copies, and sexual spores carry new gene combinations.

Part A: Which claim is best supported?

Choose one answer.

- ☐ Yeast reproduce the same way whether food is rich or poor.
- ☐ Yeast make more copies of themselves when food runs low.
- ☐ Yeast form spores only when food is plentiful.
- ☒ Yeast shift toward making varied offspring when food runs low. ✓

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ☐ Budding makes copies of the parent yeast cell.
- ☐ Yeast are tiny one-celled living things.
- ☒ Spore forming rose from 2 to 70 percent in poor food. ✓
- ☐ Scientists grew the yeast in two kinds of food.

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Grade 8 Life



MS Life Science



LS3



MS-LS3-2



DOK 3



Generate

Test Bank question

MS-LS4-1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past

Examples at:

DOK 1

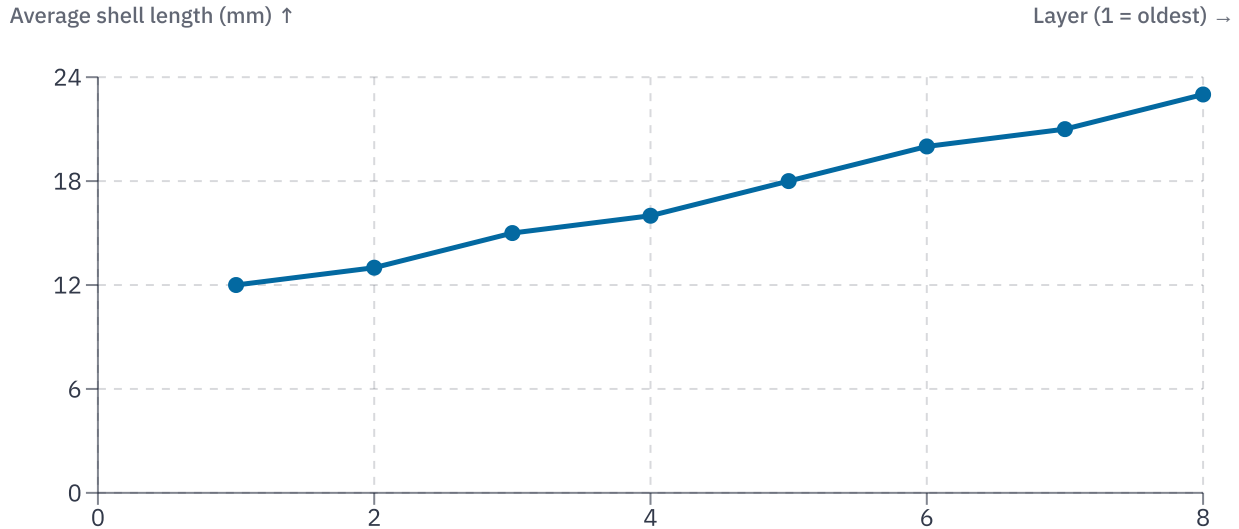
DOK 2

DOK 3

DOK 4

DOK 1 · Recall**Why DOK 1:** Students read the trend straight off the graph, knowing only that layer 1 is the oldest.

Scientists measured fossil snail shells in eight undisturbed layers of an old lake bed. Layer 1 is the oldest. What pattern does the graph show?

Average Length of Fossil Snail Shells by Layer☐ Shell length stayed the same in every layer.☐ Shells got shorter in younger layers.☒ Shells got longer in younger layers. ✓☐ The longest shells are in the oldest layer.**FIND MORE LIKE THIS**[Create questions](#)[Grade 8 Life](#)[MS Life Science](#)[LS4](#)[MS-LS4-1](#)[DOK 1](#)[Generate](#)

DOK 2 · Skills & concepts

Why DOK 2: Students interpret the order of fossils in three layers to judge statements about when features appeared and how body forms changed.

In rock layers in China, the lower layers hold small two-legged dinosaurs covered in feathers. The middle layers hold feathered animals with wings and claws on their wings. The upper layers hold birds with beaks and no teeth. Select True or False for each statement.

	True	False
Feathers appear in these layers before toothless beaks do.	☒	☐
The middle-layer animals share features with animals above and below them.	☒	☐
Birds with toothless beaks lived before the feathered dinosaurs.	☐	☒
The animals changed because they wanted to fly.	☐	☒
The pattern shows body forms changing over long periods of time.	☒	☐

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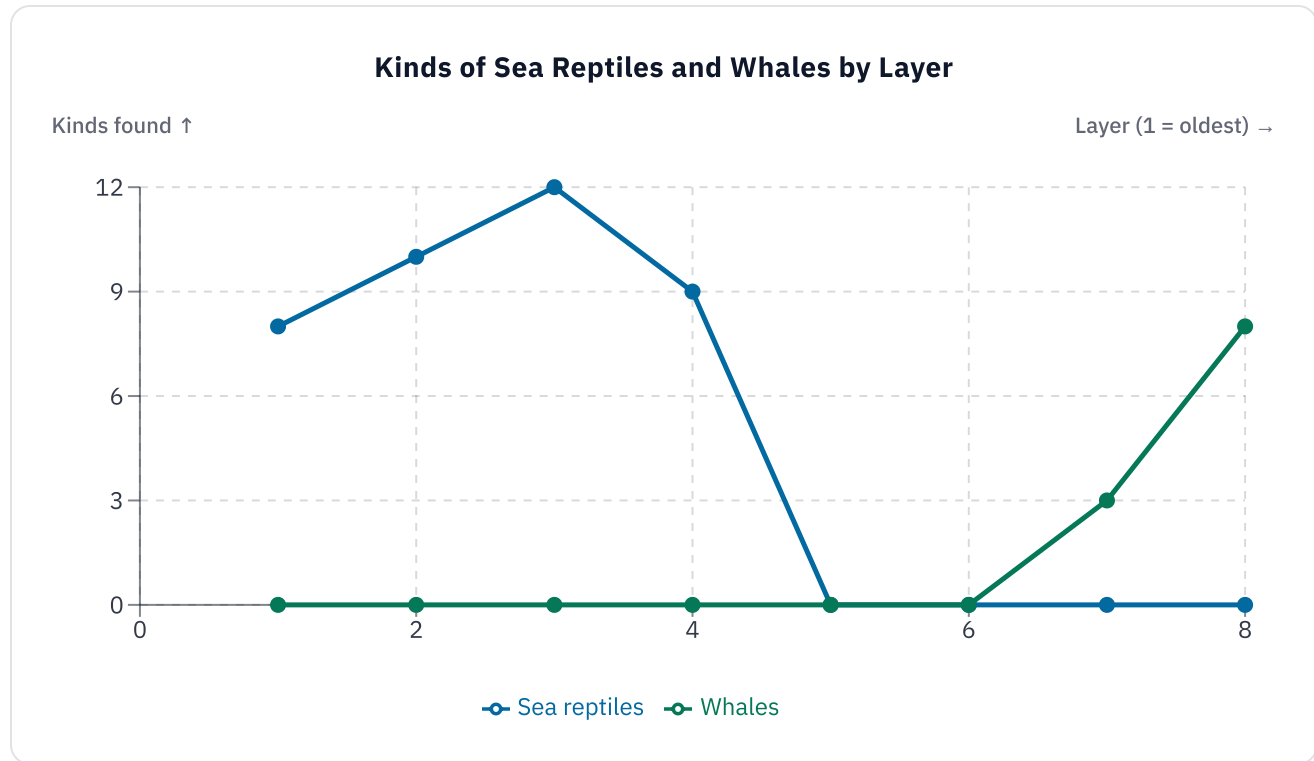
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DOK 3 · Strategic thinking

Why DOK 3: Students evaluate a friend's claim against a two-line fossil graph, spotting the gap between groups to decide whether the claim holds.

Kofi counted the kinds of sea reptiles and the kinds of whales in eight layers of a coastal region. Layer 1 is the oldest. His friend claims that whales replaced the sea reptiles right away. Which statement best evaluates this claim using the graph?



☐ The claim is supported, because whales appear in the same layers as the sea reptiles.

☒ The claim is not supported, because no whales appear until two layers after the reptiles vanish. ✓

☐ The claim is supported, because the sea reptiles turned into whales at Layer 5.

☐ The claim is not supported, because whales lived before the sea reptiles did.

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Test Bank question

MS-LS4-2 Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships

Examples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall that shared body structures, not diet or habitat, are anatomical evidence of common ancestry.

Which observations would be good anatomical evidence that two animals share a fairly recent common ancestor? Select all that apply.

- ☒ Their teeth come in the same kinds and the same order. ✓
- ☐ They are both brown with small white spots on the back.
- ☒ They have the same bones arranged the same way in their legs. ✓
- ☐ They both eat the same kinds of small fish.
- ☐ They both live in the same lake and hunt at night.
- ☒ They share the same unusual skull feature near the ear. ✓

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Test Bank question

Scientists compared a new fossil with living cats. Match each observation to the column that shows how strongly it suggests the fossil is a close relative of cats.

	Strong evidence		Weak evidence	
Its skull has the same ear region as a cat's		☒		☐
It was found in a forest		☐		☒
Its claws fit into sheaths, like a cat's		☒		☐
Its teeth have the same slicing shape as a cat's		☒		☐
It hunted small animals		☐		☒
It was about the size of a house cat		☐		☒

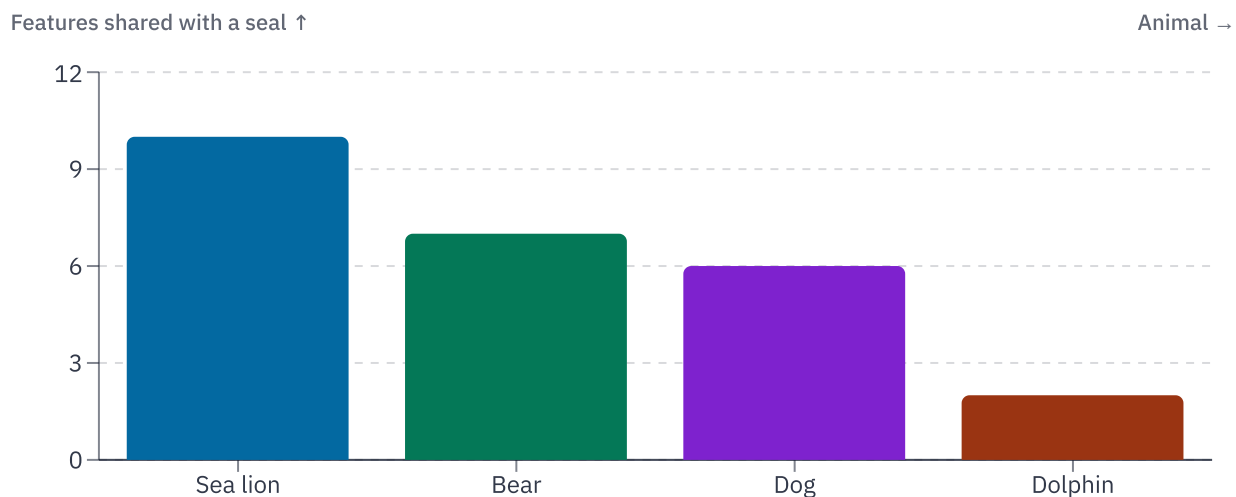
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Test Bank question

Seals swim in the ocean, as dolphins do. Scientists counted how many of 12 skeleton features each animal shares with a seal. Leo claims that seals are most closely related to dolphins, since both swim. Which statement best evaluates his claim?

Skeleton Features Shared With a Seal (out of 12)



- ☐ It is strong, because dolphins share more features with seals than dogs do.
- ☐ It is strong, because seals and dolphins both have flippers and swim in the sea.
- ☐ It is weak, because seals do not really swim the way dolphins do.
- ☒ It is weak, because bears and dogs share more features with seals than dolphins do. ✓

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Test Bank question

MS-LS4-3 Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy

Examples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall that similar early embryos point to a common ancestor and pick the fact that states that similarity.

A class looks at early embryo pictures of a fish, a chicken, and a human, all at a similar early stage. Each embryo has a short tail and a row of gill-like folds near where the neck will form. As the animals grow, the fish keeps its tail and gills, but the chicken and human lose the gill folds and grow very different bodies.

Part A: What do the shared tail and gill-like folds most likely show?

Choose one answer.

- ☐ The three animals are really one species
- ☐ Embryos of different animals never look alike
- ☒ The three animals share a common ancestor ✓
- ☐ Human embryos breathe underwater with gills

Part B: Which fact best supports your answer to Part A?

Choose one answer.

- ☐ The class looked at pictures of three embryos.
- ☒ The embryos share early parts, though adults differ. ✓
- ☐ The chicken grows wings, and the human grows arms.
- ☐ The fish is the only adult with a tail and gills.

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DOK 2 · Skills & concepts

Why DOK 2: Students apply the embryo idea to a new case, shared larvae in different adults, and judge which statements the evidence supports.

Brine shrimp, krill, and copepods are small sea animals that look quite different as adults. All three hatch as the same kind of larva: a tiny body with one eye and three pairs of legs. Select True or False for each statement.

	True	False
The three animals share a larva with the same basic body plan.	☒	☐
The shared larva suggests the three animals share an ancestor.	☒	☐
The adults keep one eye and three pairs of legs.	☐	☒
The larvae show a link that is harder to see in the adults.	☒	☐
Similar larvae prove the three are the same species.	☐	☒

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DOK 3 · Strategic thinking

Why DOK 3: Students must weigh embryo evidence against misleading adult body shape and explain both the relationship and why the shapes look alike.

Use the drop-down menus to complete the statement.

Adult dolphins look like sharks, but dolphin embryos grow hair follicles and hind limb buds like pig embryos. This suggests dolphins are more closely related to pigs ▼, and that their shark-like shape came from living in water ▼.

Drop-down 1 choices: fish pigs ✓ sharks

Drop-down 2 choices: a shared fish ancestor being the same species living in water ✓

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Test Bank question

MS-LS4-4 Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environmentExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 · Recall****Why DOK 1:** Students identify which cactus variety is more likely to survive, recalling that a protective trait improves survival.

Barrel cactus plants vary in how many spines they have. In a desert, animals like to eat the soft inside of the cactus for water. Which statement correctly describes which plants are more likely to survive?

- ☐ Spine number has nothing to do with which plants are eaten.
- ☐ Animals teach cactus plants to grow extra spines.
- ☐ Cactus plants with fewer spines grow more spines when bitten.
- ☒ Cactus plants with more spines are less likely to be eaten. ✓

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Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students judge statements about beetle color, deciding how existing variation and environment together explain which color becomes common in each habitat.

A population of beetles lives on forest floors with both dark soil and light sand patches. Dark beetles are easier to spot by birds on light sand, while light beetles are easier to spot on dark soil. Over many generations, scientists observe that dark beetles become more common in areas with dark soil, and light beetles become more common in areas with light sand. For each statement, decide if it is True or False based on how genetic variation and survival relate to this environment.

	True	False
The dark beetle color variation gives individuals a survival advantage specifically in the dark soil environment because they are harder for birds to see there.	☒	☐
Individual beetles changed their color from light to dark because they needed to survive better on dark soil.	☐	☒
The light beetle color variation causes beetles to have a better chance of surviving and reproducing in light sand areas due to camouflage from predators.	☒	☐
Both dark and light color variations are equally likely to survive and reproduce in any environment, so the environment does not matter.	☐	☒
The genetic variation in beetle color exists in the population before birds start hunting, and the environment determines which variation gives a survival advantage.	☒	☐

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students predict a change in a new situation and explain it with variation, mate choice and missing predators, building a multi-part explanation.

Male guppies in a stream full of predator fish are mostly dull. A scientist plans to move some of these guppies, including a few bright males, to a stream with no predators. Female guppies prefer bright males. Predict how male color will change in the new stream over many generations, and explain why, using the ideas of variation and reproduction.

Model response: I predict bright males will become more common in the new stream. The moved guppies vary, since a few males are bright. With no predators, bright males are not eaten more, and females choose them as mates, so bright males will have more young. Their young inherit bright color, so over many generations, bright color will spread.

Rubric: 2 points: The response includes all required elements: predicts bright males will become more common, uses variation (a few bright males are present), AND explains that bright males will have more young because females prefer them and predators are absent.

1 point: The response includes one or two of the three required elements above, but not all three.

0 points: none. No correct required element; the response is incorrect, too vague to earn credit, irrelevant, blank, or only copies the prompt without answering.

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Test Bank question

MS-LS4-5 Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms

Examples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recognize the description of artificial selection, recalling that choosing parents over generations makes a trait more common.

Turkeys raised on farms today are much larger than wild turkeys. For decades, farmers chose the biggest birds to be parents. Which statement correctly describes how this changed turkeys?

- ☐ Large size appeared in all turkeys in one generation of breeding.
- ☐ Scientists put a growth gene from another animal into turkeys.
- ☒ Choosing big parents made large size more common in each generation. ✓
- ☐ Eating more food made farm turkeys pass large size to their chicks.

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Test Bank question

Source A describes dog breeding: people select parents with desired traits over generations. Source B describes a laboratory method that edits DNA directly before an animal develops. Compare the methods using the source information.

Source A describes , driven by . Source B differs because it .

Drop-down 1 choices:

Drop-down 2 choices:

Drop-down 3 choices:

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Test Bank question

A student found two sources about merino sheep. A wool company ad says wrinkly merinos are "perfect in every way." A farm research report says wrinkly skin gives more wool but leads to more fly problems in skin folds.

Part A: Which source gives the more complete picture?

Choose one answer.

- ☐ Both sources equally
- ☐ The wool company ad
- ☐ Neither source
- ☒ The farm research report

Part B: Which reason best supports your answer to Part A?

Choose one answer.

- ☐ It says the sheep are perfect, which sounds certain.
- ☒ It reports both a benefit and a cost of the bred trait.
- ☐ It is shorter and easier to read than the ad.
- ☐ It was written by a company that sells wool products.

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Test Bank question

MS-LS4-6 Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time

Examples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students do a routine percent calculation for each year, a one-step procedure repeated across rows.

A city put out the same rat poison for five years. Each year, workers caught 200 rats and tested whether each one could survive the poison. Find the percent of rats that could survive the poison each year. Choose the missing values from the drop-down menus.

Year	Rats Tested	Rats That Survived the Poison	Percent That Survived
Year 1	200	10	Blank 1
Year 3	200	50	Blank 2
Year 5	200	120	Blank 3

Blank 1 (Row 1 (Year: Year 1) — Percent That Survived):

Blank 2 (Row 2 (Year: Year 3) — Percent That Survived):

Blank 3 (Row 3 (Year: Year 5) — Percent That Survived):

Drop-down 1 choices:

Drop-down 2 choices:

Drop-down 3 choices:

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Test Bank question

In a classroom model, rabbit fur color is inherited. Foxes catch light gray rabbits more often on brown soil. Light gray rabbits fall from 65% in generation 1 to 20% in generation 5. Classify each statement.

	Supported by the model	Not supported by the model
Light gray share fell by 45 percentage points.	☒	☐
Dark brown share rose from 35% to 80%.	☒	☐
Light gray share fell by 65 percentage points.	☐	☒
Individual light rabbits changed their inherited color after seeing foxes.	☐	☒
Dark rabbits left more offspring that inherited their color.	☒	☐
Dark brown share fell from 80% to 35%.	☐	☒

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LS4



MS-LS4-6



DOK 2



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Test Bank question

Wild sheep on a Scottish island have dark or light coats. Scientists found that light-coated lambs survive winters slightly better. The share of sheep with dark coats was 70% in 1990, 60% in 2005, and 50% in 2020. Which conclusions are supported? Select all that apply.

- ☒ The trait fell gradually rather than all at once. ✓
- ☒ If the trend goes on, about 40% may be dark by 2035. ✓
- ☐ Each sheep's coat got lighter as the sheep grew older.
- ☒ Dark coats fell by 20 percentage points in 30 years. ✓
- ☐ Light coats will make up 100% of the sheep by 2035.
- ☐ Light-coated sheep became less common over the 30 years.

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Test Bank question

NGSS DOMAIN

Physical Science

19 performance expectations, grouped by disciplinary core idea. In the Test Bank, choose the Grade 8 Physical course, then MS Physical Science.

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MS-PS1-1 Develop models to describe the atomic composition of simple molecules and extended structuresExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 · Recall****Why DOK 1:** Students read a formula and a ball-and-stick model directly to recall what a simple molecule is and what the subscript counts, a one-step recognition task.

A student uses a ball-and-stick model to represent a molecule of ammonia (NH_3). The model shows one nitrogen atom bonded to three hydrogen atoms. Which statements correctly describe what this model shows? Select all that apply.

- ☐ The 3 in NH_3 means an ammonia molecule is three times as large as a hydrogen atom.
- ☐ Ammonia is a simple molecule, a small separate unit rather than a pattern that repeats through a whole solid. ✓
- ☐ Every ammonia molecule in a pure sample has the same atoms: one nitrogen and three hydrogens. ✓
- ☐ The formula NH_3 means one ammonia molecule has one nitrogen atom and three hydrogen atoms. ✓
- ☐ Each nitrogen atom in the model has the strong smell that ammonia gas has.
- ☐ Ammonia must be a liquid because the atoms in the model are touching each other.

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Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students must combine two steps, multiplying atoms per molecule by the number of molecules, then classify each group, rather than recall a single fact.

A student builds models of these groups of molecules and sorts them by total atoms.

	Fewer than 7 atoms in all			7 or more atoms in all		
2 molecules of H ₂ O		☒			☐	
1 molecule of CH ₄		☒			☐	
2 molecules of C ₂ H ₆ O		☐			☒	
1 molecule of O ₂		☒			☐	
3 molecules of CO ₂		☐			☒	
4 molecules of N ₂		☐			☒	

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students infer what each particle model must look like and then choose the property evidence that justifies the difference, linking structure to behavior with reasoning.

A student looks at two white solids. Solid A is table salt. Solid B is dry ice (solid carbon dioxide). She makes a particle model of each one.

Part A: Which statement describes a key difference between the two models?

Choose one answer.

- ☐ Both are separate molecules, because every solid is made of molecules.
- ☐ A is separate molecules; B is one repeating pattern of atoms.
- ☐ A has larger molecules than B, so A is harder.
- ☒ B is separate CO₂ molecules; A is one repeating pattern of atoms. ✓

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ☒ B turns to gas at -78 °C, but A stays solid until 801 °C. ✓
- ☐ B has 3 atoms in its formula, but A has only 2.
- ☐ A forms cube-shaped crystals, but B forms white chunks.
- ☐ A is white, but B is white with a mist around it.

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Test Bank question

MS-PS1-2 Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred

Examples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall basic rules, such as melting and dissolving do not make new substances, and apply them to familiar kitchen examples without analyzing data.

A class compares a silver spoon with its tarnish coating, butter before and after melting, bread before and after toasting, and sugar before and after dissolving in water. Tests compare properties under the same conditions. Select True or False for each statement.

	True	False
The coating on the spoon is a new substance because its measured material density differs from silver under the same conditions.	☒	☐
The melted butter is a new substance, because it changed from solid to liquid.	☐	☒
The toast contains new substances because it has a different odor from the bread.	☒	☐
The sugar is gone for good, because it dissolved in the tea.	☐	☒

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Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a property table, comparing density and melting behavior before and after heating, to decide whether a new substance formed.

A student heats a copper wire in air. A black coating forms. She scrapes off the coating and tests it. Did a chemical reaction occur?

Properties of Copper and of the Black Coating

Property	Copper wire	Black coating
Color	Shiny reddish	Black
Density (g/cm ³)	8.96	6.3
Melting behavior	Original copper behavior	Different measured behavior

- ☐ No; the coating is still copper, just darker.
- ☒ Yes; the isolated coating has different material density and melting behavior. ✓
- ☐ No; the coating formed on the wire, so it must be copper.
- ☐ Yes; the wire got hot when it was heated.

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students weigh several properties to draw a conclusion and must also critique weak evidence (color, mass), so they reason from multiple pieces of information.

A student mixes two clear, colorless solutions. Solution A is silver nitrate dissolved in water. Solution B is table salt (sodium chloride) dissolved in water. A white solid forms right away and settles to the bottom. The student filters out the solid, dries it and tests it. Her data: Silver nitrate (before mixing): white solid, dissolves in water, melts at 212 °C. Sodium chloride (before mixing): white solid, dissolves in water, melts at 801 °C. New white solid (after mixing): does not dissolve in water, melts at 455 °C, turns gray-purple in sunlight. Her partner says no reaction happened, because all three solids are white and the total mass of the beaker did not change.

Part A: Which conclusion is best supported by the data?

Choose one answer.

- ☒ A chemical reaction occurred, because the new solid has properties that neither starting substance has. ✓
- ☐ No chemical reaction occurred, because all three solids are white.
- ☐ No chemical reaction occurred, because the total mass did not change.
- ☐ A chemical reaction occurred, because two liquids were poured together.

Part B: Which statement best explains why the partner's evidence does not show that no reaction occurred?

Choose one answer.

- ☒ Color alone cannot identify a substance, and total mass stays the same in both physical and chemical changes. ✓
- ☐ White solids can never take part in chemical reactions.
- ☐ Total mass always increases during a chemical reaction.
- ☐ The partner did not measure how long the mixing took.

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Written for this guide

MS-PS1-3 Gather and make sense of information to describe that synthetic materials come from natural resources and impact society

Examples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~

DOK 1 • Recall

Why DOK 1: Students recall basic facts stated in the note: synthetic fabric comes from petroleum, a natural resource, and chemical processing makes a new material.

A company note traces tent fabric to chemicals from petroleum changed by chemical reactions into new fibers. Tests report lightweight, flexible fabric suitable for packing and carrying. Select True or False for each statement using the note.

	True	False
Synthetic tent fabric is made from petroleum, a natural resource. Chemical processing turns it into a new material with different properties than the original petroleum.	☒	☐
The synthetic fabric was made waterproof and strong in a lab, without using anything from nature.	☐	☒
The synthetic fabric is lightweight and flexible. This matches its job: being packed and carried, then set up as a tent.	☒	☐
Making synthetic tent fabric only changes the shape and size of the petroleum. It does not change what the petroleum is made of.	☐	☒

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Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret a short report and connect a synthetic material to a societal effect, going beyond recall to explain a relationship.

Long ago, farmers fed crops with manure. Now factories make a fertilizer called ammonia. They join nitrogen from the air with hydrogen from natural gas. A farming report says large factory supplies made more crop nitrogen available and increased food production. Which societal effect does this information support?

☒ Farms could grow much more food to feed more people. ✓

☐ Crops no longer needed nitrogen.

☐ Fertilizer became a natural material.

☐ Farms stopped needing any natural resources.

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students make a claim and justify it by weighing a benefit against a cost of a synthetic material, and more than one choice can be defended.

A city is deciding whether to use plastic lumber, made from recycled bottles, or wood for new park benches. Use at least one benefit and one cost of the plastic lumber to argue which the city should choose.

Model response: The city should choose plastic lumber. A benefit is that it does not rot or need painting, so it lasts longer, and it reuses plastic bottles. A cost is that it is made from plastic that came from crude oil, and it will not break down if it is thrown away. Because the benches will last a long time and reuse waste, the benefits outweigh the costs.

Rubric: 2 points: The response includes all required elements: a clear choice; one benefit of plastic lumber; one cost of plastic lumber, used in the argument.

1 point: The response includes one or two of the three required elements above, but not all three.

0 points: No correct required element; the response is incorrect, too vague to earn credit, irrelevant, blank, or only copies the prompt without answering.

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Test Bank question

MS-PS1-4 Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed

Examples at: DOK 1 DOK 2 DOK 3 DOK 4

DOK 1 · Recall

Why DOK 1: Students reproduce the standard particle description of melting (vibrating in place, then sliding past each other), which is recall of a learned model.

A metal worker heats a solid piece of tin until it melts. Use a particle model to describe how the tin particles change from solid to liquid.

Model response: In the solid tin, the particles vibrate in fixed positions. As thermal energy is added, the particles vibrate faster. At the melting point, they have enough energy to break out of their fixed positions and slide past each other, so the tin becomes a liquid.

Rubric: 2 points: describes solid tin particles vibrating in fixed positions AND liquid particles sliding past each other after gaining energy. 1 point: one of these. 0 points: neither.

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Test Bank question

A student places a sealed balloon of air in a freezer at -18°C . After 30 minutes it has shrunk. She puts it in a room at 25°C , and after 15 minutes it returns to its original size.

Part A: What happens to the air particles when thermal energy is removed?

Choose one answer.

- ☐ They become smaller and contract.
- ☐ They stop moving completely because the air is cold.
- ☒ They move more slowly and stay closer together on average. ✓
- ☐ They are replaced by smaller particles.

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ☒ Warming the balloon made it grow back to its original size. ✓
- ☐ The rubber of the balloon shrank in the cold.
- ☐ The freezer removed all the air from the balloon.
- ☐ Cold air is heavier, so it pressed the balloon in.

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must build a particle model to explain a surprising result, ice expanding while losing energy, which requires reasoning beyond the routine model.

A student places a sealed plastic water bottle, completely full with liquid water and no air gaps, into a freezer overnight. In the morning, the bottle is bulging outward and looks like it might crack, and the water inside is now solid ice. Develop a particle model to explain what is happening to the water particles as thermal energy is removed, and use that model to explain why the bottle bulges outward even though the substance is losing energy and getting colder. Explain your reasoning.

Model response: As the bottle sits in the freezer, thermal energy flows out of the water into the colder freezer air. This causes the water particles to slow down (lose average kinetic energy), which is measured as a drop in temperature. As the particles slow down, the attractive forces between them are able to pull them into a fixed, orderly arrangement, forming a solid (ice). While the particles vibrate in place rather than sliding past each other as they did in the liquid, water is an unusual substance in that its solid form actually takes up slightly more space than its liquid form because the rigid arrangement of particles in ice holds them slightly farther apart on average than in liquid water. Since the particles themselves do not change size, this increase in volume is due to the change in spacing/arrangement of the particles as they freeze, and since the bottle is sealed and full, the expanding ice pushes outward on the rigid walls, causing the bulge.

Rubric: 2 points: The response explains cooling/freezing with lower average kinetic energy and molecules around fixed positions, and explains the bulge as the same molecules occupying greater volume in ice's arrangement rather than enlarging.

1 point: The response correctly explains either cooling/freezing behavior or the arrangement-based volume increase, but not both.

0 points: The response includes neither required explanation, is irrelevant, or is blank.

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Test Bank question

MS-PS1-5 Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conservedExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 · Recall****Why DOK 1:** Students do a routine count of oxygen atoms on each side of a given equation, a one-procedure task with a single right answer.

Air pollution from coal plants can form sulfur trioxide by the reaction $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$. How many oxygen atoms are on each side of the reaction?

☐ 3☐ 2☐ 4☒ 6 ✓

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Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students apply the atom model to a sealed-flask reaction and judge several statements about atoms and mass, connecting atom conservation to mass conservation.

A student burns sulfur in a sealed flask. Sulfur (S) joins oxygen (O_2) to form sulfur dioxide (SO_2). Which statements are correct? Select all that apply.

☐ The SO_2 has less mass than the sulfur and oxygen.

☒ The total mass in the flask stays the same. ✓

☐ New oxygen atoms are made in the flame.

☒ The sulfur atom is still present after the reaction. ✓

☒ The two oxygen atoms are now part of SO_2 . ✓

☐ The sulfur atom is destroyed by the flame.

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students combine a mass ratio, a starting amount and conservation of mass to reason about leftover reactant and total mass, a non-routine multi-step problem.

Charcoal briquettes are mostly carbon. A lab group burns 6 g of charcoal carbon in a sealed jar with 20 g of oxygen. Carbon and oxygen join in a 3 to 8 ratio by mass to make carbon dioxide. Select True or False for each statement.

	True	False
6 g of carbon joins with 16 g of oxygen.	☒	☐
22 g of carbon dioxide forms.	☒	☐
4 g of oxygen is left over.	☒	☐
The total mass in the jar changes to 22 g.	☐	☒

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Test Bank question

MS-PS1-6 Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processesExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 · Recall****Why DOK 1:** Students identify which single statement is temperature evidence of a released-energy reaction, a direct recognition task.

A student wrote four sentences about her hand warmer test. Which statement gives evidence the reaction releases thermal energy?

- ☐ The packet contains iron powder and salt.
- ☒ The packet warmed from 20 °C to 55 °C in 5 minutes. ✓
- ☐ The packet is small enough to fit in a glove.
- ☐ The packet costs less than one dollar.

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Test Bank question

A student recorded how long different hand warmers stayed above 40 °C. Which warmer lasts at least 2 hours while using the least iron powder?

Hand Warmer Test Results

Warmer	Iron powder (g)	Hours above 40 °C
1	15	1.5
2	20	2.2
3	25	2.8
4	30	3.5

☐ Warmer 4☒ Warmer 2 ✓☐ Warmer 3☐ Warmer 1**FIND MORE LIKE THIS**[Create questions](#)

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate design claims against test data and a safety criterion, recognizing that the biggest temperature drop is not automatically the best design.

A design team tested a cold pack for sports injuries. They mixed a chemical with water inside a sealed pouch and measured temperature over time. Trial 1 used 10 g of the chemical and the temperature dropped from 24°C to 14°C in 2 minutes. Trial 2 used 20 g of the chemical and the temperature dropped from 24°C to 4°C in 2 minutes, but the pack became too stiff and cold to safely hold against skin. Decide whether each statement is True or False based on this test data.

	True	False
The chemical reaction in the cold pack absorbs thermal energy from the surrounding water and pouch.	☒	☐
The cold pack works by transferring 'coldness' from the chemicals into the injured area.	☐	☒
Because Trial 2 dropped in temperature more, 20 g of chemical is automatically the better design choice for the cold pack.	☐	☒
Test data on amount of substance and resulting temperature can be used to decide whether the pack meets safe-use criteria, not just how large the temperature drop is.	☒	☐
Since there were no flames or light produced, no thermal energy was released or absorbed in this reaction.	☐	☒

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Test Bank question

MS-PS2-1 Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objectsExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 · Recall****Why DOK 1:** Students recall Newton's third law, that paired forces are equal and opposite, and recognize it in a simple catch.

A soccer goalie catches a fast ball. Which statement correctly describes the forces?

- ☐ The ball pushes on the hands, but the hands do not push back.
- ☐ The hands push harder because the goalie is bigger.
- ☒ The hands push on the ball as hard as the ball pushes on the hands. ✓
- ☐ The ball pushes harder because it is moving.

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Test Bank question

A skateboard ramp designer is testing two skateboarders of different masses colliding head-on at the bottom of a ramp. Skateboarder A has a mass of 50 kg and Skateboarder B has a mass of 80 kg. Both skateboarders are moving at the same speed when they collide. Using Newton's Third Law, explain what forces the two skateboarders exert on each other during the collision. Then explain why the skateboarders experience different changes in motion even though the forces between them are equal and opposite.

Model response: During the collision, Skateboarder A exerts a force on Skateboarder B, and Skateboarder B exerts an equal and opposite force on Skateboarder A (Newton's Third Law). Even though these two forces are equal in size and opposite in direction, the skateboarders experience different changes in motion because they have different masses. The lighter skateboarder (A, 50 kg) experiences a greater change in velocity (more acceleration or deceleration) from the same force compared to the heavier skateboarder (B, 80 kg). The effect of the equal force pair depends on the mass of each object in the system.

Rubric: 2 points: Identifies equal opposite forces and explains that the 50 kg skateboarder has the larger velocity change because of smaller mass. 1 point: Gives one correct idea or an incomplete connection between equal forces and mass-dependent motion. 0 points: Gives no correct explanation or leaves the response blank.

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students reason about a design solution, using the third law and stopping time together to explain why one phone case protects better.

Engineers drop two phones from the same height onto a hard floor. Design 1 has a thin, stiff plastic shell. Design 2 has thick foam inside that squashes on impact. Which statement best explains why Design 2 reduces damage?

- ☐ The foam is lighter, so gravity pulls on the phone less.
- ☒ The foam makes the stop take longer, so the force on the phone is smaller. ✓
- ☐ The foam stops the phone from pushing on the case at all.
- ☐ The foam pushes on the phone with less force than the phone pushes on it.

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Test Bank question

MS-PS2-2 Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the objectExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 · Recall****Why DOK 1:** Students recognize the basic rule that a bigger push gives a bigger change in motion and point to the matching fact in the stem.

A student launches the same paper airplane twice from a rubber band launcher. The first time, the band gives a 2 N push. The second time, it gives a 6 N push. With the 6 N push, the airplane speeds up much faster.

Part A: What does this show?

Choose one answer.

- ☒ A bigger force gives a bigger change in motion. ✓
- ☐ Mass does not affect motion.
- ☐ Force does not affect motion.
- ☐ A bigger force gives a smaller change in motion.

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ☒ The same airplane sped up faster with the 6 N push. ✓
- ☐ The airplane started from rest each time.
- ☐ The airplane is made of folded paper.
- ☐ Mass was the variable that was changed.

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Test Bank question

A student uses a spring scale to pull a cart across a track with negligible friction, applying a constant force of 5 N. She measures the time it takes the cart to travel 2 meters. First she pulls an empty cart (mass 2 kg) with the 5 N force and records the time. Then she loads the cart with bricks so its mass is 4 kg and pulls it again with the same 5 N force, recording the time. She repeats each trial three times and finds that the empty cart consistently reaches the 2-meter mark faster than the loaded cart. Every pull begins from rest. Identify the independent variable, the dependent variable, and one variable she controlled in this investigation. Then explain, using her results, how mass affects the change in motion produced by a given net force. Explain your reasoning.

Model response: The independent variable is the mass of the cart (2 kg vs. 4 kg). The dependent variable is the time it takes the cart to travel the 2-meter distance (which relates to its change in motion/acceleration). A controlled variable is the applied force (5 N) and the distance traveled (2 m), which were kept the same in both trials. Since the empty (less massive) cart took less time to travel the same distance under the same force, it had a greater acceleration than the more massive cart. This shows that when the same net force is applied, a larger mass results in a smaller change in motion (smaller acceleration), while a smaller mass results in a larger change in motion.

Rubric: 2 points: Identifies mass, measured travel time and a valid control, then uses shorter travel time of the lighter cart to explain greater acceleration at the same net force. 1 point: Correctly identifies variables or gives a correct but incomplete data-based mass explanation. 0 points: Gives no correct explanation or leaves the response blank.

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students critique an investigation plan, noticing that adding propellers also adds mass, so they must reason about hidden variables.

An engineering class tests whether adding more propellers to a model airboat makes it speed up faster across a pool. Each propeller has its own battery pack. Sort each part of their plan.

	Good for the test		Problem for the test	
Test some boats in the pool and some in a pond	☐		☒	
Use a different hull for each propeller number	☐		☒	
Test each propeller number three times	☒		☐	
Use the same hull every time	☒		☐	
Run each test only once	☐		☒	
Add clay to match the mass of missing propeller packs	☒		☐	

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Test Bank question

MS-PS2-3 Ask questions about data to determine the factors that affect the strength of electric and magnetic forcesExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 · Recall****Why DOK 1:** Students identify the one factor that changed (the balloon's charge) and point to the observation that shows it, a direct read of the description.

A student charges a balloon by rubbing it on her hair. After 5 rubs, it picks up 4 bits of paper. After 20 rubs, it picks up 15 bits. A charge sensor confirms greater charge after 20 rubs. The gap and paper-bit mass remain unchanged.

Part A: What factor changed the strength of the electric force?

Choose one answer.

☐ The color of the paper☒ The balloon's charge ✓☐ The size of the balloon☐ The time of day**Part B: Which evidence best supports your answer to Part A?**

Choose one answer.

☐ The balloon was rubbed on hair.☐ She used the same balloon.☐ Paper bits are very light.☒ More rubs led to more paper bits picked up. ✓**FIND MORE LIKE THIS**[Create questions](#) › [Grade 8 Physical](#) › [MS Physical Science](#) › [PS2](#) › [MS-PS2-3](#) › [DOK 1](#) › [Generate](#)

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students compare two magnets across two distances to interpret which is stronger and how distance affects force.

Use the drop-down menus to complete the statement.

A student compares two magnets. Magnet X lifts 30 paper clips when touching the pile.

Magnet Y lifts 10. At 3 cm away, X lifts 5 and Y lifts 0. This shows that X is **stronger ▾**,

and that both magnets get **weaker ▾** with distance.

Drop-down 1 choices: **stronger ✓** weaker the same

Drop-down 2 choices: stronger **weaker ✓** the same

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must judge which data comparisons are controlled, reject a flawed comparison and draw conclusions about two factors, which takes planning and reasoning.

A class tests an electromagnet made of wire coiled around a nail. They count how many paper clips it can lift. Trial 1: 10 coils, 0.5 A of current, 1 cm from the clips, 6 clips lifted. Trial 2: 20 coils, 0.5 A, 1 cm, 12 clips. Trial 3: 20 coils, 1.0 A, 1 cm, 24 clips. Trial 4: 20 coils, 1.0 A, 3 cm, 8 clips. A classmate says, "Trials 1 and 3 prove that more current makes the electromagnet stronger." (a) Explain why Trials 1 and 3 cannot prove this. (b) Name the two trials that do test the effect of current, and state what they show. (c) Name two trials that test the effect of distance, and state what they show.

Model response: (a) Between Trials 1 and 3, both the number of coils and the current changed, so the class cannot tell which change caused more clips to be lifted. (b) Trials 2 and 3 test current: only the current changed (0.5 A to 1.0 A), and the clips lifted went from 12 to 24, so more current made a stronger magnetic force. (c) Trials 3 and 4 test distance: only the distance changed (1 cm to 3 cm), and the clips dropped from 24 to 8, so the force is weaker farther away.

Rubric: 2 points: explains that Trials 1 and 3 change two factors, AND correctly identifies Trials 2 and 3 for current and Trials 3 and 4 for distance with correct conclusions. 1 point: gives one or two of these three parts correctly. 0 points: no correct part.

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MS-PS2-4 Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects

Examples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall two basic facts about gravity, that it always attracts and that it is stronger for objects with more mass.

Which statement about the gravitational force between two objects is correct?

- ☒ It always pulls the objects toward each other, and it is stronger when the objects have more mass. ✓
- ☐ It can push the objects apart or pull them together, depending on their masses.
- ☐ It acts only when the two objects are touching each other.
- ☐ It acts only on objects that are close to Earth's surface.

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DOK 2 · Skills & concepts

Why DOK 2: Students interpret a comparison with size held constant to explain that more planet mass gives a stronger pull, and separate mass from weight.

A model planet has Earth radius and four times Earth mass. At that radius a model records a 20 kg dog weight of 784 N, compared with 196 N near Earth. Explain how this evidence supports mass-dependent attraction and distinguish dog mass from weight.

Model response: The same dog mass and same center distance are used. The larger planet mass gives the larger inward force, 784 N instead of 196 N, supporting mass-dependent attraction. The dog mass stays 20 kg; weight is the changed gravitational force.

Rubric: 2 points: Uses the fixed dog mass and equal radius to connect the larger planet mass to greater measured attraction and distinguishes unchanged dog mass from changed weight. 1 point: Gives a correct relevant element but an incomplete comparison or explanation. 0 points: Gives no correct relevant response.

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must build an argument from several data points, using them both to refute a claim and to describe how gravitational attraction depends on mass.

Scientists hang pairs of metal spheres from thin wires so the spheres are 10 cm apart, center to center. A very sensitive instrument measures the gravitational pull between each pair, in billionths of a newton (nN). Pair A: 1 kg and 1 kg, 6.7 nN. Pair B: 2 kg and 1 kg, 13.3 nN. Pair C: 2 kg and 2 kg, 26.7 nN. Pair D: 4 kg and 2 kg, 53.4 nN. In every pair, the spheres slowly swing toward each other. A student claims, "Gravity only pulls things toward Earth. Small objects do not pull on each other." Use the data to argue whether the student's claim is correct. Then describe how the gravitational pull depends on the masses of the objects.

Model response: The claim is not correct. Every pair of small spheres pulled on each other with a measurable force, and the spheres swung toward each other, which shows gravity is an attractive force between any two objects with mass, not just with Earth. The pull depends on mass: when one mass doubled (Pair A to Pair B), the pull doubled from 6.7 to 13.3 nN, and when both masses doubled (Pair A to Pair C), it became four times as large. More mass gives a stronger pull.

Rubric: 2 points: refutes the claim using the measured nonzero, attractive forces between small spheres AND uses at least one data comparison to show the pull increases with mass. 1 point: does one of these two things. 0 points: neither.

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MS-PS2-5 Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contactExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 · Recall****Why DOK 1:** Students recognize the basic idea that a magnetic field reaches through the table and acts on the compass without contact, which is recall of the field concept.

A student places a bar magnet under a table and holds a compass above the table surface at different locations. The compass needle rotates to point in different directions depending on where the student holds it. Select all statements that correctly explain why the compass needle moves without the magnet and compass touching each other.

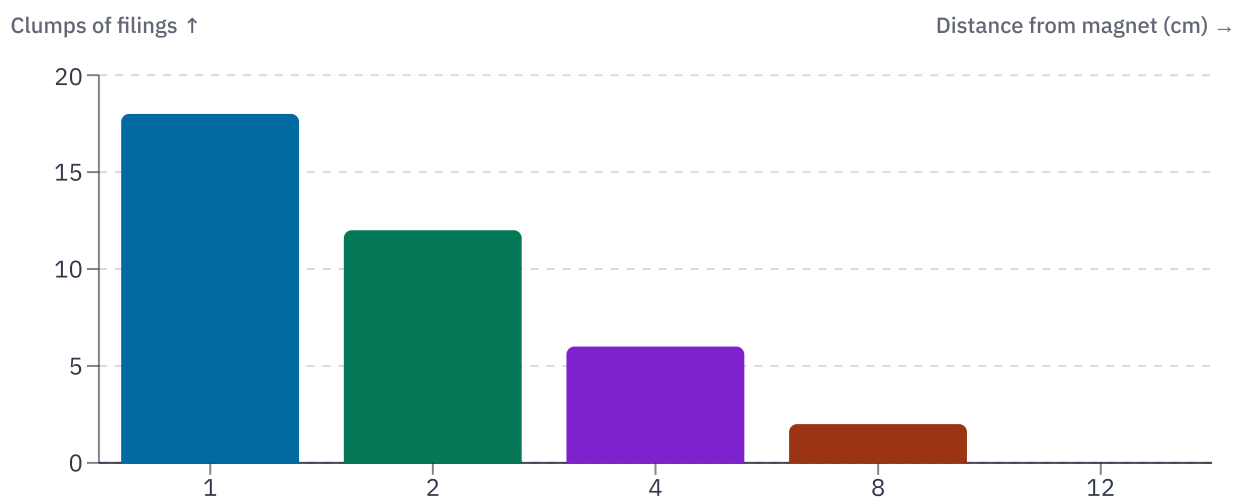
- ☐ The magnetic field causes the compass needle to align with the direction of the field at each location. ✓
- ☐ The compass needle only moves when it is placed directly on top of the magnet because magnetic fields cannot pass through materials.
- ☐ A magnetic field exists around the bar magnet and exerts a force on the compass needle even through the table. ✓
- ☐ The observation of the compass needle changing direction at different positions is evidence that a force is acting without contact between objects. ✓
- ☐ The table blocks the magnetic field, so the compass needle moves only because the student is moving it closer to the magnet.

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Test Bank question

A student holds a sheet of paper with iron filings at different distances above a bar magnet. The magnet never touches the paper. She counts the clumps of filings that form. What does the graph show about the magnet's force?

Iron Filing Clumps at Different Distances from a Magnet



- ☐ The paper blocks the field at 12 cm and beyond.
- ☐ No force acts, since nothing touched the filings.
- ☐ The magnet pulls the filings only at 1 cm.
- ☒ A field surrounds the magnet and weakens with distance. ✓

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students design a controlled test that rules out a classmate's alternate explanation and state what result would support the field idea.

A charged comb lifts paper bits from 2 cm away. A classmate proposes that air moved by the approaching comb causes the motion. Describe a controlled test and a result that would favor the electric-field explanation.

Model response: Move charged and uncharged combs along the same path to the same 2 cm gap, keeping the paper and surroundings unchanged. Repeat both conditions. If the paper bits move only with the charged comb before contact, the difference supports an electric field rather than the identical air movement.

Rubric: 2 points: describes a charged versus uncharged comparison with unchanged distance and movement, and explains that repeatable motion only with charge before contact supports the field explanation. 1 point: gives the controlled comparison or the supporting result, but not both. 0 points: gives neither a suitable comparison nor a supporting result.

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Test Bank question

MS-PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object

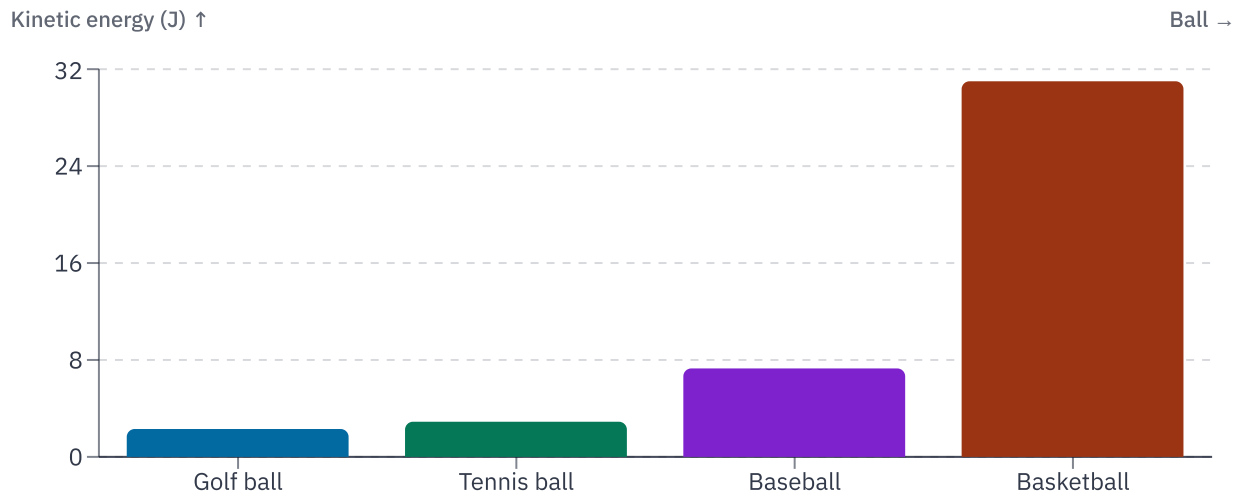
Examples at: **DOK 1** **DOK 2** **DOK 3** **DOK 4**

DOK 1 · Recall

Why DOK 1: Students read the tallest bar on the graph and use the fact that, at equal speed, more kinetic energy means more mass.

At a sports lab, a launcher fires a golf ball, a tennis ball, a baseball and a basketball, each at 10 m/s. Based on the graph, which ball has the most mass?

Kinetic Energy of Balls Thrown at 10 m/s



☐ Tennis ball

☒ Basketball ✓

☐ Baseball

☐ Golf ball

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DOK 1

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Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students calculate and compare kinetic energies for several balls, deciding how mass and speed changes combine, which takes more than one step.

A student rolls balls into a cup and compares each one with a reference ball: a 2 kg ball rolling at 3 m/s. Sort each ball by how its kinetic energy compares with the reference ball.

	More kinetic energy than the reference ball	Same kinetic energy as the reference ball	Less kinetic energy than the reference ball
A 4 kg ball rolling at 6 m/s	☒	☐	☐
A 1 kg ball rolling at 3 m/s	☐	☐	☒
A 2 kg ball rolling at 6 m/s	☒	☐	☐
An 8 kg ball rolling at 1.5 m/s	☐	☒	☐
A 4 kg ball rolling at 3 m/s	☒	☐	☐
A 2 kg ball rolling at 1.5 m/s	☐	☐	☒

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate competing relationships against the data, using more than one comparison to justify that kinetic energy depends on speed squared.

An ideal car model keeps mass and braking force constant, so stopping distance is proportional to initial kinetic energy. The table gives results at three speeds. Evaluate whether the energy data fit a direct-speed or squared-speed relationship.

Stopping Distance of the Same Car

Speed (mph)	Stopping distance (ft)
10	5
20	20
30	45

Model response: When the speed doubles from 10 mph to 20 mph, the stopping distance grows from 5 ft to 20 ft, so the kinetic energy becomes four times as large. If kinetic energy grew in step with speed, the distance would only double to 10 ft. When the speed triples to 30 mph, the distance is 45 ft, nine times as far. Four times for double and nine times for triple shows that kinetic energy grows with speed squared.

Rubric: 2 points: uses the fourfold change for doubled speed and a second comparison or direct-speed prediction to support the squared-speed relationship. 1 point: gives a correct energy ratio or identifies squared speed, but provides incomplete comparative evidence. 0 points: gives no correct relationship or relevant comparison.

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Test Bank question

MS-PS3-2 Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the systemExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 · Recall****Why DOK 1:** Students recall that objects held higher above Earth store more energy in the object-Earth system.

Use the drop-down menus to complete the statement.

A water tower holds water high above a town. The water-Earth system stores more ▾

energy than it would if the same water were at ground level, because the water is

farther from ▾ Earth's surface.**Drop-down 1 choices:** more ✓ less the same**Drop-down 2 choices:** farther from ✓ closer to touching

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Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students classify attracting and repelling pairs and apply the model to decide whether stored energy rises or falls when objects move closer.

In a toy store, a student tries out several toys that use pulls and pushes. Sort each pair by how the stored energy changes when the objects move closer together.

	Stored energy decreases			Stored energy increases		
A falling rock and Earth		☒			☐	
Two north poles of magnets		☐			☒	
An iron nail and a magnet		☒			☐	
A balloon and a wall it clings to		☒			☐	
Two positively charged beads		☐			☒	

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students use data to refute a claim, explain where the cart's energy came from and extend the pattern to a new case, which is reasoning with a model.

A student fixes one magnet to the end of a track. She tapes a second magnet to a low-friction cart so the two north poles face each other. She holds the cart at different gaps from the fixed magnet, lets go and measures the cart's top speed. Gap 2 cm: 0.60 m/s. Gap 4 cm: 0.35 m/s. Gap 6 cm: 0.20 m/s. Her friend claims, "The two magnets store the same amount of energy no matter how far apart they are, because they are the same magnets." Use the data to argue whether the claim is correct. Explain where the cart's kinetic energy came from, and predict how the cart's top speed would change if it were released from an 8 cm gap.

Model response: The claim is not correct. The same cart moved fastest when released from the smallest gap (0.60 m/s at 2 cm) and slowest from the largest gap (0.20 m/s at 6 cm). A faster cart has more kinetic energy, so more energy was stored in the magnet system when the repelling magnets were held closer together. The kinetic energy came from the potential energy stored in the system of the two magnets, which changed as the magnets pushed apart. At an 8 cm gap, less energy would be stored, so the cart's top speed would be less than 0.20 m/s.

Rubric: 2 points: refutes the claim using the speed data (smaller gap, more speed, more stored energy) AND explains the kinetic energy came from energy stored in the magnet system with a correct prediction for 8 cm. 1 point: one of these. 0 points: neither.

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MS-PS3-3 Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer

Examples at: **DOK 1** **DOK 2** **DOK 3** **DOK 4**

DOK 1 · Recall

Why DOK 1: Students recall basic facts about how glass, a closed door and stored water affect energy in a greenhouse, with no data to analyze.

A student designs a greenhouse to keep plants warm on cold nights. Select True or False for each statement.

	True	False
Glass walls let sunlight in during the day.	☒	☐
A closed door keeps warm air from escaping.	☒	☐
Barrels of water can store energy and release it at night.	☒	☐
Leaving the roof vents open at night keeps it warmest.	☐	☒

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Test Bank question

DOK 2 · Skills & concepts

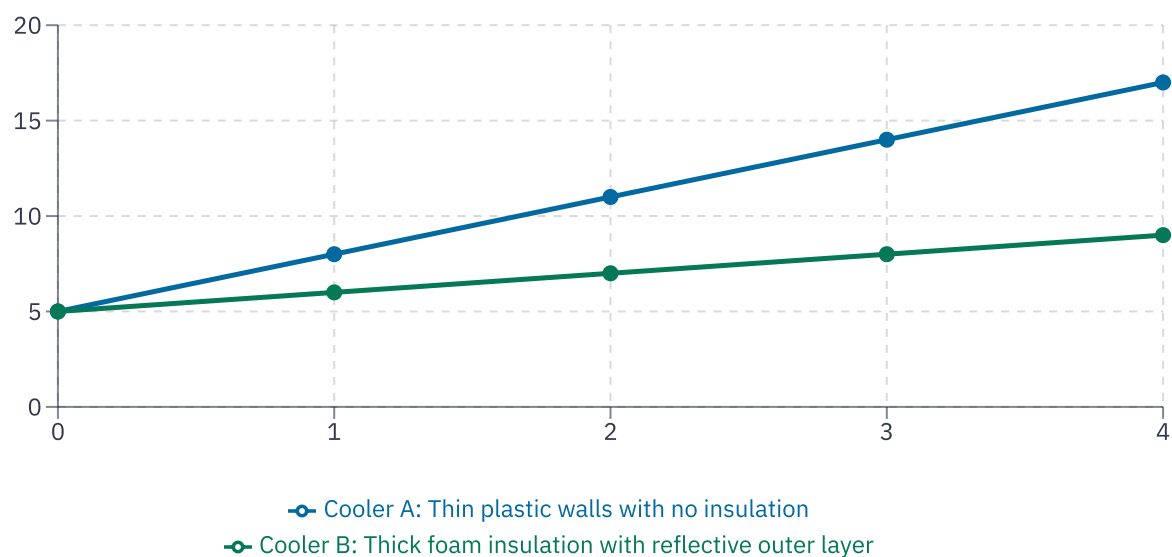
Why DOK 2: Students interpret a two-line graph and connect the slower temperature rise to the design feature that reduced energy transfer.

A student designed two coolers to keep sports drinks cold during a soccer tournament. Cooler A has thin plastic walls with no insulation. Cooler B has thick foam insulation and a reflective outer layer. Both coolers started at 5 degrees Celsius and were left in the sun for 4 hours. The graph shows how the temperature inside each cooler changed over time. Both contain equal amounts of the same drink. Based on the graph, which explanation best describes why Cooler B minimized thermal energy transfer more effectively than Cooler A?

Temperature Change in Two Coolers Over Time

Temperature (degrees Celsius) ↑

Time (hours) →



- ☒ Cooler B's foam insulation reduced the movement of thermal energy from the warm surroundings into the cold drinks inside. ✓
- ☐ Cooler B's reflective outer layer produced cold energy that prevented heat from entering the cooler.
- ☐ Cooler A's thin plastic walls conducted cold from inside the cooler to the outside environment.
- ☐ Cooler B kept the drinks cold because the foam insulation moved the heat energy away from the drinks more quickly.

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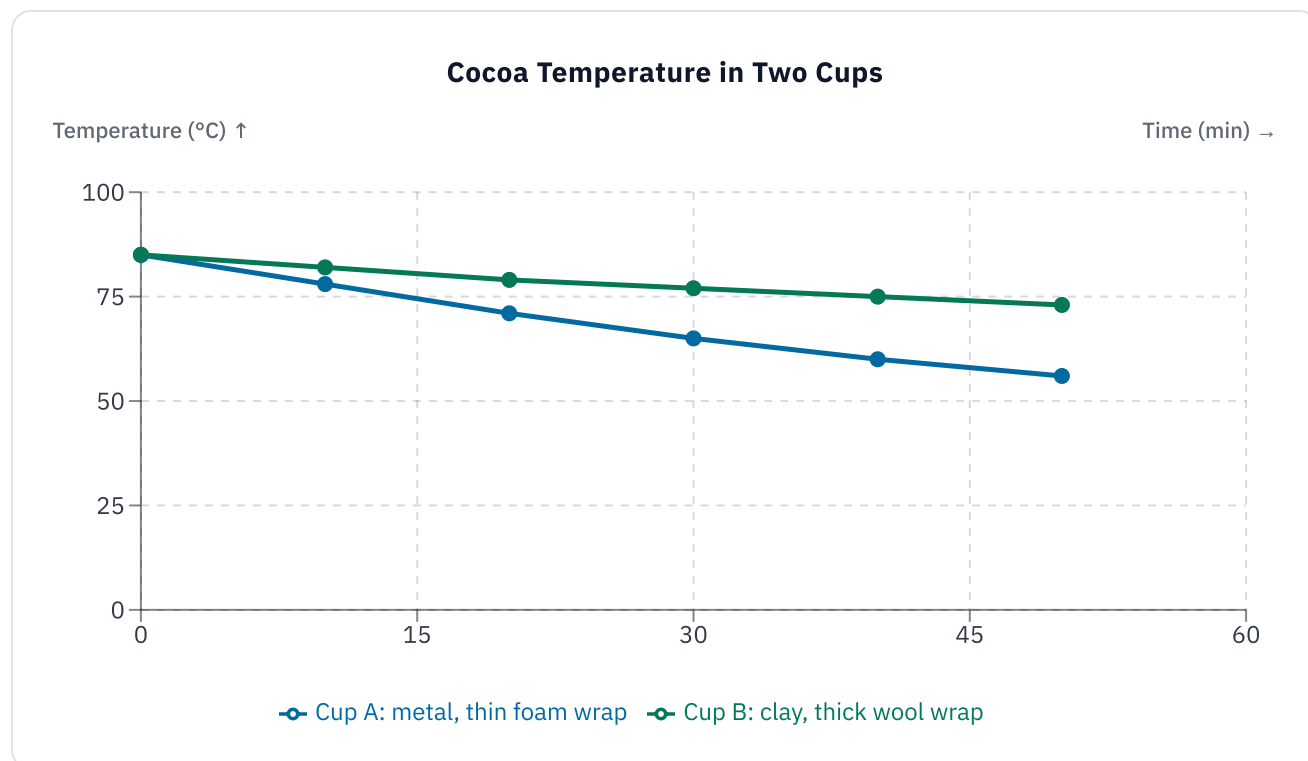
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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students judge what a test can and cannot conclude, noticing that two design features changed at once, which requires critical reasoning about evidence.

Two cup designs hold equal cocoa volumes initially at 85 °C under the same cooler conditions. A is metal with thin foam; B is clay with thick wool. Which statement is best supported by the graph?



- ☐ Cup A works better because metal always stays colder.
- ☐ The test proves the wool wrap alone caused the result.
- ☒ Cup B's design slows energy loss better, but two things changed. ✓
- ☐ Cup A stays warmer because metal makes its own heat.

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Test Bank question

MS-PS3-4 Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample

Examples at: DOK 1 DOK 2 DOK 3 DOK 4

DOK 1 • Recall

Why DOK 1: Students recall that a larger mass of the same material needs more energy to warm by one degree, applied to a nail and a pan.

A student compares a small iron nail and a large iron pan heated with the same energy. Select True or False for each statement.

	True	False
The nail warms more than the pan.	☒	☐
The pan needs more energy to warm by 1 °C.	☒	☐
Both warm the same because they are both iron.	☐	☒
The pan has more particles to share the energy.	☒	☐

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Test Bank question

A hotel model compares 20 L and 60 L water samples at equal initial temperatures. Each receives equal measured heater energy in 10 minutes, with negligible losses and no phase change. The 20 L sample rises 15 °C.

Part A: About how much does the 60 L tub warm?

Choose one answer.

☐ About 45 °C

☐ About 30 °C

☐ About 15 °C

☒ About 5 °C ✓

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

☐ The smaller tub's measured rise was 15 °C.

☐ Both tubs contain water of the same composition.

☐ Both tub trials last the same 10 minutes.

☒ Three times the water shares equal added energy. ✓

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate a plan and several interpretations, deciding what makes a fair test and which conclusions the data can and cannot support.

A metal slide and wood fence feel different in sunlight. A student compares their material temperature responses using calibrated heaters and thermometers. Which statements describe a fair test or valid interpretation? Select all that apply.

- ☐ If the metal reaches 45 degrees Celsius and the wood reaches only 30 degrees Celsius after getting the same amount of energy, this proves that metal particles always move faster than wood particles at every temperature.
- ☒ Use equal masses and initial temperatures with equal measured input energy, then measure each rise. ✓
- ☒ The results would show that the same amount of energy causes different temperature changes in different materials, because metal and wood respond differently to the same energy. ✓
- ☐ Temperature and thermal energy are the same thing, so if both materials end up at the same final temperature, they must have absorbed the same amount of energy.
- ☒ If the student used twice as much metal under the same lamp for the same time, that metal would need about twice as much energy to reach the same temperature change as the smaller amount did. ✓
- ☐ To do the test fairly, the student should use more metal than wood so the metal heats up faster and the difference is easier to see.

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Test Bank question

MS-PS3-5 Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object

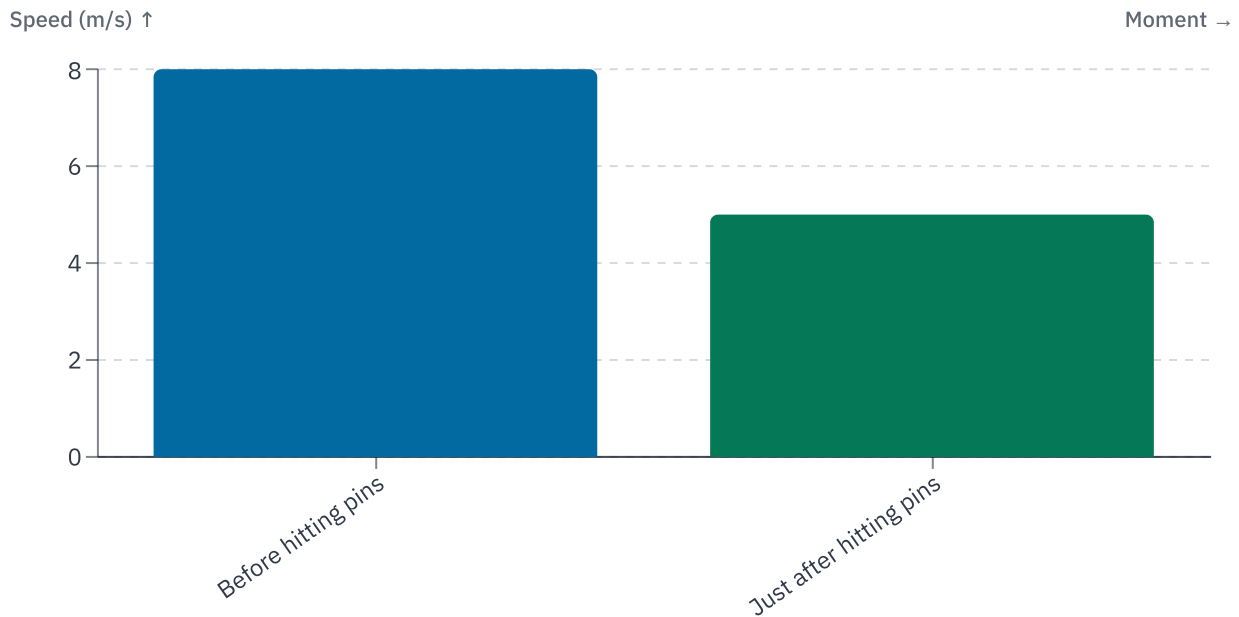
Examples at: **DOK 1** **DOK 2** **DOK 3** **DOK 4**

DOK 1 · Recall

Why DOK 1: Students read a two-bar graph showing the ball slowed and recognize that its energy went to the pins, a direct read and recall.

A student measured the speed of a bowling ball before and after it hit the pins. Which statement is best supported by the graph?

Speed of a Bowling Ball Near the Pins



- ☐ The ball's energy stayed the same.
- ☐ The ball gained energy from the hit.
- ☐ Energy moved from the pins to the ball.
- ☒ Energy moved from the ball to the pins. ✓

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DOK 2 · Skills & concepts

Why DOK 2: Students explain where kinetic energy goes when friction slows a skateboard, connecting the slowing to energy transfer.

A student rolls a skateboard across a rough concrete surface and watches it gradually come to a stop. It moves much faster at the start than at the end. Which statement best explains where its kinetic energy went?

- ☒ Friction moved it to the concrete and air as heat and sound. ✓
- ☐ It was used up when the board stopped and no longer exists.
- ☐ Friction is a force, so it destroyed the energy of the board.
- ☐ It stayed in the board even after the board stopped moving.

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students construct an argument from several observations to refute a claim and trace the direction of energy transfer, which requires reasoning with evidence.

A student hits a nail with a hammer. She records these observations: the hammer head moved at 6 m/s just before it hit the nail and stopped right after; the nail was driven 1 cm deeper into the wood; a thermometer probe showed the nail head warmed from 21 °C to 25 °C; a loud bang was heard across the room. Her friend says, "When the hammer stops, its kinetic energy is destroyed." Construct an argument that supports or refutes the friend's claim. Use at least two of the observations, and describe the direction of the energy transfer.

Model response: The claim is wrong. The hammer's kinetic energy was not destroyed; it was transferred out of the hammer to other objects. The nail moved 1 cm into the wood, so energy went into moving the nail. The nail head warmed from 21 °C to 25 °C, so some energy became thermal energy. The loud bang shows some energy was carried away as sound. Energy moved from the hammer to the nail, the wood and the air.

Rubric: 2 points: refutes the claim AND uses at least two observations to show where the energy went, with the transfer from the hammer to other objects. 1 point: refutes the claim with one supporting observation, or uses observations without a clear direction of transfer. 0 points: supports the claim or gives no relevant evidence.

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MS-PS4-1 Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a waveExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 · Recall****Why DOK 1:** Students recall the definition of frequency and match it to counting waves passing a post, a one-step identification.

A student stands on a dock and counts the waves that pass a wooden post. She counts 12 waves in 60 seconds. Which wave property is she measuring?

☐ Amplitude☐ Energy☒ Frequency ✓☐ Wavelength

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Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students translate a word description into wave properties and use more than one step, including speed from frequency and wavelength.

At a pier, crests are 4 m apart and rise 0.5 m above calm water. Two crests pass a post each second. Classify each statement as true or false.

	True	False
The wavelength is 4 m.	☒	☐
The amplitude is 0.5 m.	☒	☐
The frequency is 2 waves per second.	☒	☐
The amplitude is 4 m.	☐	☒
The waves move at 2 m per second.	☐	☒

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students use a mathematical pattern in data to critique a claim, describe the relationship and make a prediction, which goes beyond reading values.

A student makes waves on a long rope by shaking one end at the same rate each time. A sensor measures the energy each wave carries. Amplitude 1 cm: 3 energy units. Amplitude 2 cm: 12 energy units. Amplitude 3 cm: 27 energy units. Her partner says, "When the amplitude doubles, the energy doubles." Use the data to evaluate the partner's claim. Describe the mathematical relationship between amplitude and energy, and predict the energy carried by a wave with an amplitude of 4 cm.

Model response: The claim is not correct. When the amplitude doubles from 1 cm to 2 cm, the energy goes from 3 to 12 units, which is four times as much, not twice. When the amplitude triples to 3 cm, the energy is 27 units, nine times as much. The energy is proportional to the amplitude squared (energy = 3 x amplitude x amplitude). For a 4 cm amplitude, the energy would be $3 \times 4 \times 4 = 48$ units.

Rubric: 2 points: uses the data to show doubling amplitude gives four times the energy (claim incorrect), describes the squared relationship AND predicts 48 units. 1 point: gives one or two of these correctly. 0 points: none correct.

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MS-PS4-2 Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materialsExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 · Recall****Why DOK 1:** Students recall that snow reflects most light and looks white because it reflects all colors, which is recall of basic facts.

A field is covered with fresh snow on a sunny day. Which statements about light and snow are correct? Select all that apply.

☐ Snow absorbs most of the sunlight that hits it.☐ Snow looks white because it reflects all colors. ✓☐ Snow looks white because it makes white light.☐ Snow reflects most of the sunlight that hits it. ✓☐ Skiers wear sunglasses because reflected light is bright. ✓☐ Snow transmits all sunlight down to the ground.**FIND MORE LIKE THIS**[Create questions](#) › [Grade 8 Physical](#) › [MS Physical Science](#) › [PS4](#) › [MS-PS4-2](#) › [DOK 1](#) › [Generate](#)

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students apply the model in two steps, first what the filter transmits and then what each object can reflect, to predict colors.

A white-light flashlight shines through a red filter that transmits mostly red and absorbs most other colors. White paper reflects all colors; a blue marker mostly reflects blue. Classify each statement as true or false.

	True	False
The filter transmits mostly red light.	☒	☐
A white sheet of paper looks red in this light.	☒	☐
A blue marker looks bright blue in this light.	☐	☒
The filter absorbs most of the other colors.	☒	☐

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must decide what kind of evidence would disprove a claim, recognizing that reflection and warming show light not transmitted, which takes reasoning about evidence.

A student claims that clear window glass transmits all the light that hits it. Which evidence best shows that the claim is wrong?

- ☐ Sunlight lights up the room behind the glass.
- ☐ The glass looks clear from both sides.
- ☒ A faint reflection shows in the glass, and it warms in the sun. ✓
- ☐ People outside can be seen clearly through the glass.

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Test Bank question

MS-PS4-3 **Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals**

Examples at: DOK 1 DOK 2 DOK 3 DOK 4

DOK 1 · Recall **Why DOK 1:** Students read values straight from a table to see that digital text stayed correct while analog voice got worse with distance.

A note describes continuous analog voice information and discrete digital text values. The table reports correct words at four noisy-stadium distances. Which statement matches the evidence?

Words Received Correctly (out of 20)		
Distance (m)	Walkie-talkie (analog)	Text (digital)
50	19	20
100	16	20
200	11	20
300	6	20

- ☐ Neither method was affected by distance.
- ☐ Both methods lost words at the same rate.
- ☒ Text stayed correct; analog voice worsened with distance. ✓
- ☐ The walkie-talkie stayed correct, but the text got worse.

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Test Bank question

A school radio club plays the same song two ways. Method A sends it through the air as an analog signal. Method B sends it through the internet as a digital signal. Near electric machines, listeners hear crackling on Method A. Method B stays clear.

Part A: Why does the digital signal sound clearer?

Choose one answer.

- ☐ It travels through air, which blocks noise.
- ☐ It was invented more recently than analog.
- ☐ Machines can never affect a digital wave.
- ☒ Its on-off pattern can be rebuilt after noise. ✓

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ☒ Noise changes the shape of a smooth analog wave. ✓
- ☐ Digital signals were built to block all noise.
- ☐ Digital copies of songs are stored on computers.
- ☐ Analog signals match how sound moves in air.

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Test Bank question

A town radio club sends the same recorded message through 5 relay stations in a row, once as an analog signal and once as a digital signal. Source 1 (technical note): An analog signal is a smooth wave whose shape carries the message. Any noise that changes the shape becomes part of the signal and is passed on to the next station. A digital signal is a pattern of pulses that stand for only two values, 0 and 1. Each station decides whether each pulse is a 0 or a 1, even if noise has changed it a little, and sends out fresh, clean pulses. Source 2 (test data): After 5 stations, listeners understood 58% of the words in the analog message and 100% of the words in the digital message. Use information from BOTH sources to support the claim that digital signals are a more reliable way to send information. Then describe one situation in which the digital message could still fail.

Model response: The test data show the digital message arrived 100% understandable after 5 stations, while the analog message dropped to 58%. The technical note explains why: noise changes the shape of the analog wave, and each station passes that noise on, so it builds up. A digital station only has to decide 0 or 1, so small noise is removed and clean pulses are sent each time. A digital message could still fail if the noise is so strong that a station reads a 1 as a 0, or if the signal is lost completely.

Rubric: 2 points: supports the claim with the test data AND the explanation from the technical note, and describes a reasonable failure case. 1 point: uses only one source, or uses both sources without a failure case. 0 points: no relevant support.

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Written for this guide

NGSS DOMAIN

Earth & Space Science

15 performance expectations, grouped by disciplinary core idea. In the Test Bank, choose the Grade 8 Earth course, then MS Earth Science.

Create questions



Grade 8 Earth



MS Earth Science



Core idea (DCI)



PE



Options: DOK



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MS-ESS1-1 Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasonsExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 · Recall****Why DOK 1:** Students recall the percent of the Moon's visible face that is lit at each named phase, a single remembered fact per row.

A student models the Earth-Moon-Sun system to explain why the Moon's appearance changes. The Moon always has one half lit by sunlight; the phase we see depends on how much of that lit half faces Earth. Choose the missing values from the drop-down menus by giving the percent of the Moon's visible face that appears lit for each position.

Moon Position	Phase Name	Percent of Visible Face Lit
Moon between Earth and Sun	New Moon	Blank 1
Moon at 90 degrees from Sun-Earth line	First Quarter	Blank 2
Earth between Moon and Sun	Full Moon	Blank 3
Moon at opposite 90 degree point	Third Quarter	Blank 4

Blank 1 (Row 1 (Moon Position: Moon between Earth and Sun) — Percent of Visible Face Lit):

Blank 2 (Row 2 (Moon Position: Moon at 90 degrees from Sun-Earth line) — Percent of Visible Face Lit):

Blank 3 (Row 3 (Moon Position: Earth between Moon and Sun) — Percent of Visible Face Lit):

Blank 4 (Row 4 (Moon Position: Moon at opposite 90 degree point) — Percent of Visible Face Lit):

Drop-down 1 choices: ☒ 0.0 ✓ ☐ 50.0 ☐ 100.0

Drop-down 2 choices: 0.0 **50.0 ✓** 100.0

Drop-down 3 choices: 0.0 50.0 **100.0 ✓**

Drop-down 4 choices: 0.0 **50.0 ✓** 100.0

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Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students interpret an eclipse data table and connect each eclipse type to Moon phase and timing, comparing the data with a model rather than recalling one fact.

Mira's eclipse model has the Moon orbiting Earth in a plane tilted to Earth's path around the Sun. A solar eclipse needs the Moon near the Sun–Earth line between those bodies; a lunar eclipse needs Earth between the Sun and Moon. She compares this model with the 2024 data. Select True or False for each statement.

Eclipses in 2024

Date	Type of Eclipse	Moon Phase
March 25	Lunar (partial shadow)	Full moon
April 8	Total solar	New moon
September 18	Partial lunar	Full moon
October 2	Annular solar	New moon

	True	False
In the data, solar eclipses happen at new moon.	☒	☐
In the data, lunar eclipses happen at new moon.	☐	☒
The data show an eclipse every month.	☐	☒
In the data, each lunar eclipse comes about two weeks before a solar eclipse.	☒	☐

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate a physical model against real data, calculating size and distance ratios to judge what the model gets right, what it gets wrong, and what it can still show.

Sofia models Earth with a basketball 24 cm wide and the Moon with a tennis ball 6.7 cm wide. She places them 30 cm apart. In real life, Earth is about 12,700 km wide, the Moon is about 3,500 km wide, and the Moon is about 384,000 km from Earth. Which statements correctly evaluate Sofia's model? Select all that apply.

- ☐ The 30 cm separation correctly scales the Earth–Moon distance.
- ☐ The ball sizes must be increased to correct the distance scale.
- ☐ The tennis ball should be half the basketball's diameter.
- ☒ The Moon is placed much too close; it should be about 30 Earth-widths away. ✓
- ☒ The model can still show why phases change as the Moon orbits Earth. ✓
- ☒ The sizes of the two balls are about right compared with each other. ✓

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Test Bank question

MS-ESS1-2 Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system

Examples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall what each object orbits and that gravity is the force holding every orbit, filling in known facts.

An orbital model shows Earth moving around the Sun, the Moon moving around Earth, and the Sun moving about the Milky Way's center. The table records the centers and forces explaining those curved paths. Choose the missing values from the drop-down menus.

Object	What It Orbits	Force That Holds It in Orbit
Earth	The Sun	Blank 1
The Moon	Blank 2	Blank 3
The Sun	Blank 4	Gravity

Blank 1 (Row 1 (Object: Earth) — Force That Holds It in Orbit): Gravity ▾

Blank 2 (Row 2 (Object: The Moon) — What It Orbits): Earth ▾

Blank 3 (Row 2 (Object: The Moon) — Force That Holds It in Orbit): Gravity ▾

Blank 4 (Row 3 (Object: The Sun) — What It Orbits): The center of the Milky Way ▾

Drop-down 1 choices: Friction Magnetism **Gravity ✓**

Drop-down 2 choices: **Earth ✓** The Sun only The whole galaxy

Drop-down 3 choices: Magnetism Friction **Gravity ✓**

Drop-down 4 choices: The solar system centered on Earth No center because stars have no gravity

The center of the Milky Way ✓

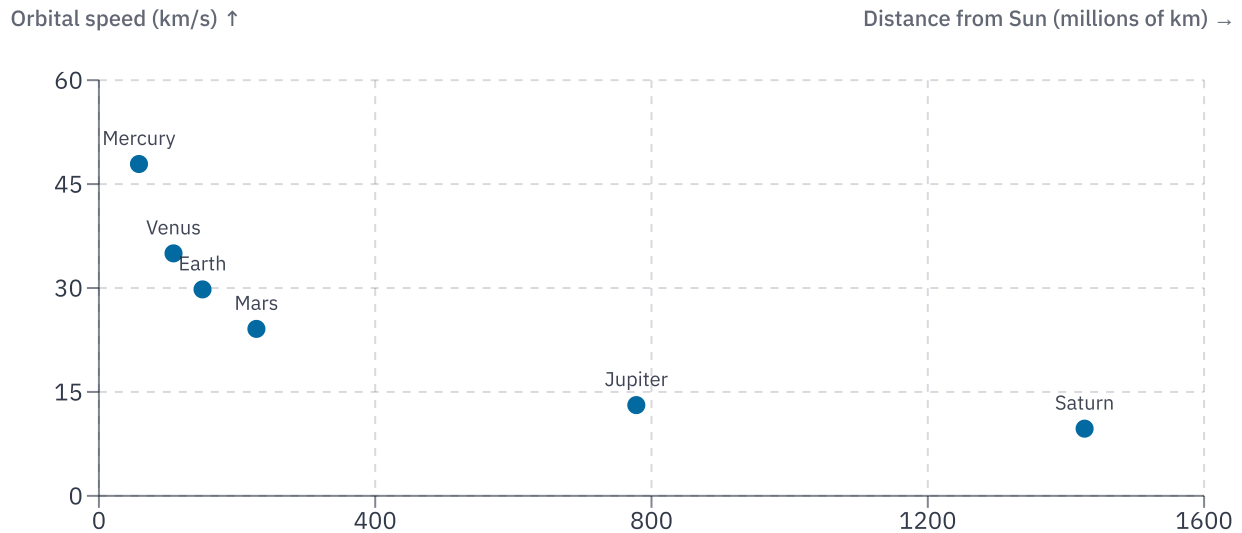
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Test Bank question

A model represents the graph's planets on nearly circular paths curved by the Sun's attraction. Which statement best connects gravity to the distance-speed pattern?

Orbital Speed and Distance From the Sun



- ☐ Distant planets feel zero solar pull, so straight motion alone maintains their circles.
- ☐ Distant planets feel stronger backward drag, which removes all their orbital motion.
- ☐ Distant planets feel stronger inward attraction, so the model requires faster circular speeds.
- ☒ Distant planets feel weaker inward attraction, matching slower circular speeds. ✓

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students reason from unfamiliar data comparing a comet and Earth to explain a surprising orbital speed, then choose the evidence that justifies their explanation.

In 2014, the Rosetta spacecraft orbited Comet 67P, which is only about 4 kilometers across. About 30 kilometers from the comet's center, Rosetta moved at only about 0.15 meters per second, slower than a person walking. A spacecraft orbiting close to Earth must move at about 7,800 meters per second. A classroom model represents each orbit as forward motion continually turned inward by the central object's gravity.

Part A: What best explains why Rosetta could orbit the comet so slowly?

Choose one answer.

- ☒ The comet pulled weakly, so only a slow speed was needed to stay in orbit. ✓
- ☐ The comet had no gravity, so Rosetta could move at any speed it wanted to.
- ☐ The comet pulled strongly, so Rosetta had to move slowly to avoid crashing.
- ☐ The Sun's gravity pushed Rosetta toward the comet, so it did not need speed.

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ☐ The comet's large distance from Earth makes its own gravity disappear.
- ☐ The spacecraft's solar panels reduce the comet's gravitational attraction.
- ☐ The comet's low temperature makes its gravity stronger than Earth's.
- ☒ The comet's much smaller mass gives it a weak inward gravitational pull. ✓

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Test Bank question

MS-ESS1-3 Analyze and interpret data to determine scale properties of objects in the solar systemExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 · Recall**

Why DOK 1: Students read diameters straight from a table and pick the values larger than the Moon's, a direct lookup and comparison.

Spacecraft have measured the diameters of many moons in the solar system. The table shows some of these moons, along with Earth's Moon and the planet Mercury. Which moons are wider than Earth's Moon? Select all that apply.

Diameters of Large Moons and Mercury

Object	Diameter (km)
Ganymede (moon of Jupiter)	5,268
Titan (moon of Saturn)	5,150
Mercury (planet)	4,879
Io (moon of Jupiter)	3,643
Earth's Moon	3,475
Europa (moon of Jupiter)	3,122
Triton (moon of Neptune)	2,707
Charon (moon of Pluto)	1,212

☒ Ganymede ✓☐ Europa☐ Triton☐ Charon☒ Io ✓



Titan



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Grade 8 Earth



MS Earth Science



ESS1



MS-ESS1-3



DOK 1



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Test Bank question

A class built a scale model of the solar system on a 100-yard football field, with the Sun at the goal line. Their scale is 1 yard = 10 million km. The table shows the real sizes and the model distances they used. Select True or False for each statement.

Real Diameters and Model Distances for the Football Field Model

Object	Real Diameter (km)	Model Distance from Sun (yards)
Sun	1,392,000	0
Mercury	4,879	5.8
Venus	12,104	10.8
Earth	12,742	15.0
Mars	6,779	22.8
Jupiter	139,820	77.8

	True	False
The listed planet gaps are unequal, even though one distance scale is used.	☒	☐
At the same size scale, the Sun model would be only slightly wider than Earth.	☐	☒
The Mars-to-Jupiter gap is much larger than the Venus-to-Earth gap.	☒	☐
Equal-sized planet circles accurately represent the listed real diameters.	☐	☒
The Sun model would be about 109 times Earth's model diameter.	☒	☐

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must decide to compare layers as fractions of each body's radius rather than raw sizes, then test several claims against those calculations.

Scientists use seismometers to study the insides of Earth and the Moon. The table compares the sizes of their layers. Which statement is supported by the data?

Sizes of the Layers of Earth and the Moon

Measurement	Earth (km)	Moon (km)
Radius	6,371	1,737
Average crust thickness	30	40
Core radius	3,480	350

- ☒ The core fills a much larger share of Earth's radius than of the Moon's radius. ✓
- ☐ The Moon's core is about half of the Moon's radius, just like Earth's core.
- ☐ The Moon's crust is thinner than Earth's crust because the Moon is smaller.
- ☐ Earth's crust makes up more than one-tenth of Earth's radius.

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Test Bank question

MS-ESS1-4 Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history

Examples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students apply the basic rule that upper layers in an undisturbed stack are younger, a single recalled principle.

Use the drop-down menus to complete the statement.

On the coast of Dorset, England, gray mudstone lies under yellow sandstone, and neither layer has been tipped over. The sandstone is **younger ▼** than the mudstone because new layers are deposited **on top of ▼** older ones.

Drop-down 1 choices: **younger ✓** the same age older

Drop-down 2 choices: underneath **on top of ✓** beside

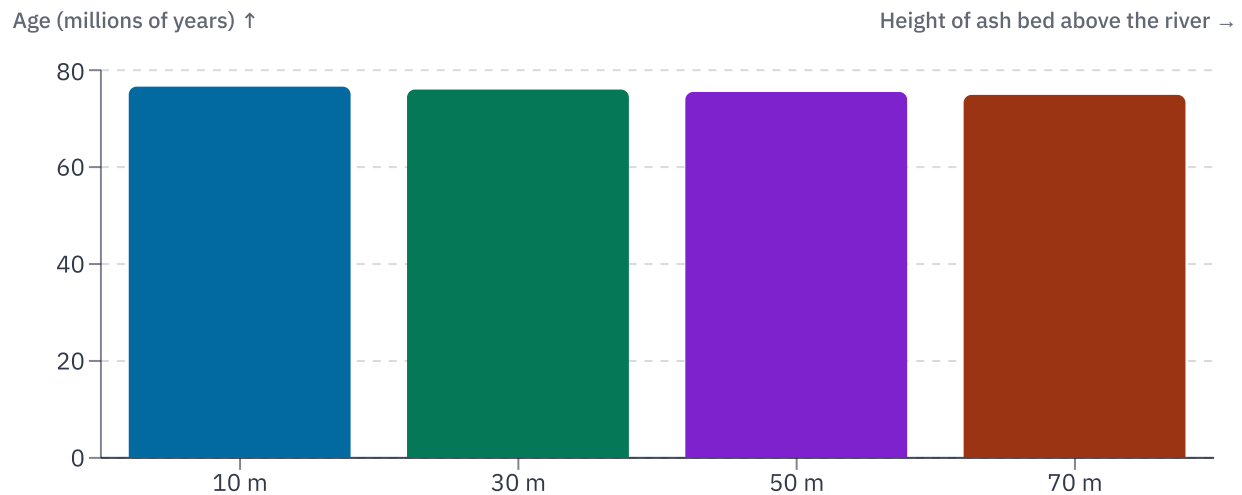
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Test Bank question

Geologists date ash beds in flat, undisturbed layers in Dinosaur Provincial Park. The graph gives each bed's age and height. Which explanation connects the pattern with how sedimentary sequences record time?

Age of Ash Beds by Height in Dinosaur Provincial Park



- ☒ Higher beds are younger because material was deposited over earlier layers. ✓
- ☐ Higher beds are older because their sediment had farther to fall.
- ☐ The beds must be the same age because they contain the same rock material.
- ☐ The beds alternate in age because erosion always reverses layer order.

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students combine three fossil age ranges and reason about their overlap to bracket a layer's age, drawing a conclusion from several pieces of information.

A Texas layer contains unreworked fossils of three species that all lived during deposition. A lived from 300 to 280 million years ago, B from 290 to 260, and C from 285 to 250. Use the overlap of their ranges to constrain the layer's age. Choose the missing values from the drop-down menus.

Age limit for the layer	Age (millions of years)
Oldest possible age	Blank 1
Youngest possible age	Blank 2
Length of the possible time window	Blank 3

Blank 1 (Row 1 (Age limit for the layer: Oldest possible age) — Age (millions of years)):

285 ▼

Blank 2 (Row 2 (Age limit for the layer: Youngest possible age) — Age (millions of years)):

280 ▼

Blank 3 (Row 3 (Age limit for the layer: Length of the possible time window) — Age (millions of years)):

5 ▼

Drop-down 1 choices: 285 ✓ 290 300

Drop-down 2 choices: 250 260 280 ✓

Drop-down 3 choices: 5 ✓ 50 565

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Test Bank question

MS-ESS2-1 Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process

Examples at: **DOK 1** **DOK 2** **DOK 3** **DOK 4**

DOK 1 • Recall

Why DOK 1: Students name the process for each arrow of the rock cycle, recalling standard vocabulary.

Kwesi drew a rock cycle diagram for his class in Ghana. Each arrow shows one rock type or material changing into another. For each arrow, choose the process it shows.

	weathering and erosion	compaction and cementation	metamorphism	melting
Arrow in the Diagram: Igneous rock → sediment	☒	☐	☐	☐
Arrow in the Diagram: Sediment → sedimentary rock	☐	☒	☐	☐
Arrow in the Diagram: Sedimentary rock → metamorphic rock	☐	☐	☒	☐
Arrow in the Diagram: Metamorphic rock → magma	☐	☐	☐	☒

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Test Bank question

A simplified model compares slower deep cooling with faster surface cooling of melt. Use the drop-down menus to connect cooling conditions, crystal sizes, and solidification.

Magma that cools slowly deep underground forms igneous rock with large ▼ crystals, like granite. Lava that cools quickly at the surface forms igneous rock with small ▼ crystals, like basalt. Both kinds of rock form because

melted rock loses heat and hardens ▼ .

Drop-down 1 choices: large ✓ no small

Drop-down 2 choices: large small ✓ layered

Drop-down 3 choices: solid rock is heated and squeezed sediment is pressed together

melted rock loses heat and hardens ✓

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate claims about energy across the whole rock cycle, deciding which energy source drives each part and rejecting statements that reverse heat flow.

A student is building a model of how energy flows through the rock cycle. Which statements correctly describe energy in the rock cycle? Select all that apply.

☐ Weathering creates new energy that is stored inside rocks.

☒ Gravity pulls sediment downhill and presses buried layers together. ✓

☐ The Sun's energy melts rock deep underground into magma.

☒ Heat from Earth's interior drives plate motions that lift rock up. ✓

☐ Magma takes in heat from its surroundings as it cools.

☒ Sunlight drives evaporation, which brings the rain that weathers rock. ✓

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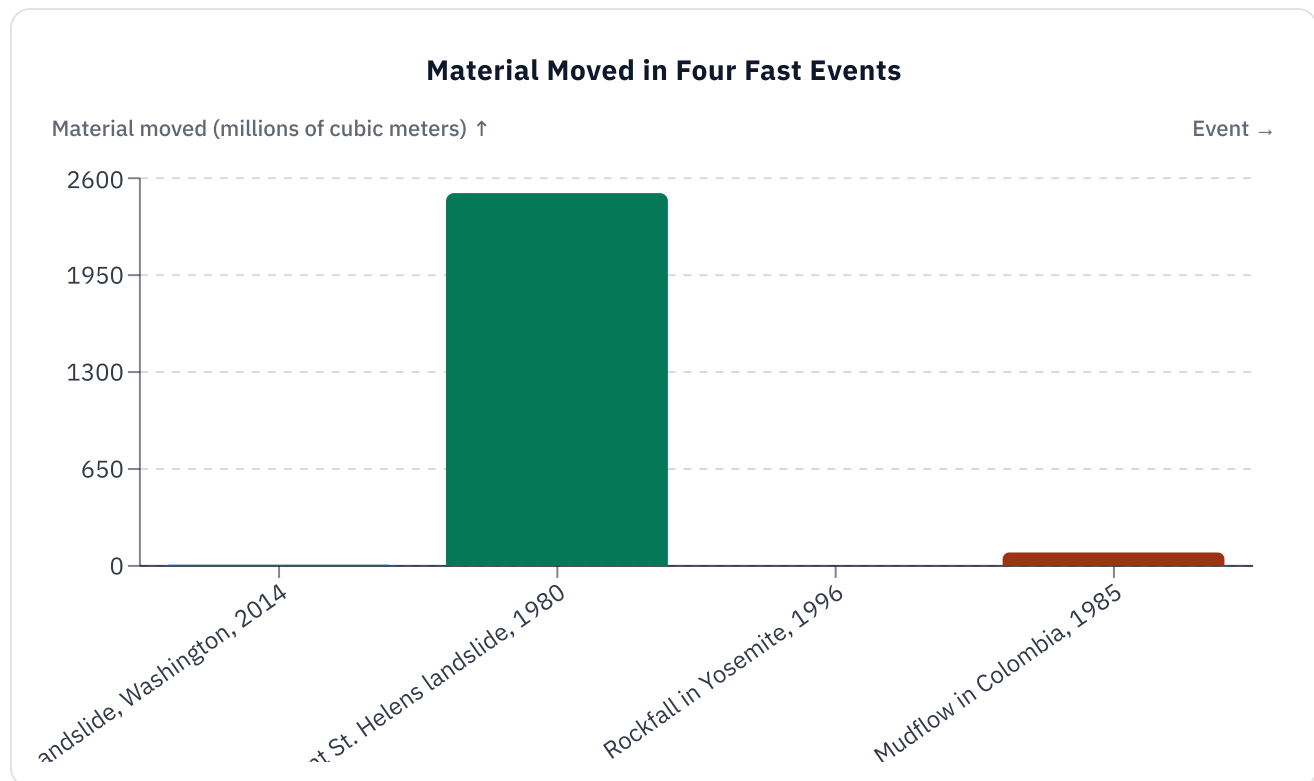
MS-ESS2-2 Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales

Examples at: **DOK 1** **DOK 2** **DOK 3** **DOK 4**

DOK 1 · Recall

Why DOK 1: Students read a bar graph to find which event moved the most material, a direct lookup.

A geologist compared how much rock and soil moved during four fast events. Which event moved the most material?



☐ The 2014 Oso landslide in Washington

☐ The 1985 mudflow in Colombia

☒ The 1980 Mount St. Helens landslide ✓

☐ The 1996 rockfall in Yosemite

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DOK 2 · Skills & concepts

Why DOK 2: Students classify surface changes as fast or slow by interpreting each description, sorting by time scale.

The table lists four changes to Earth's surface. Choose whether each is fast or slow.

	fast (minutes to days)	slow (thousands of years or more)
A sinkhole 100 meters wide appears within a day in Winter Park, Florida.	☒	☐
Repeated movement of ice scrapes and deepens the Great Lakes basins over many ice ages.	☐	☒
Many layers of river sediment gradually extend the Nile Delta into the sea.	☐	☒
The 2022 Hunga Tonga eruption removes part of an island within hours.	☒	☐

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students weigh an overall trend in island age and height against an exception, judging which conclusions the evidence supports and which go too far.

The Hawaiian Islands were built by volcanoes. After a volcano stops erupting, its island slowly wears down and sinks. The table shows the age and highest point of four islands. Select True or False for each statement.

Age and Height of Four Hawaiian Islands

Island	Age (million years)	Highest Point (meters)
Hawaii (Big Island)	0.4	4,205
Maui	1.3	3,055
Oahu	3.0	1,220
Kauai	5.1	1,598

	True	False
The youngest island in the table has the highest point.	☒	☐
Every older island is lower than every younger island.	☐	☒
Overall, the data fit the idea that islands wear down as they age.	☒	☐
Kauai is higher than Oahu, so Kauai must be the younger island.	☐	☒

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Test Bank question

MS-ESS2-3 Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions

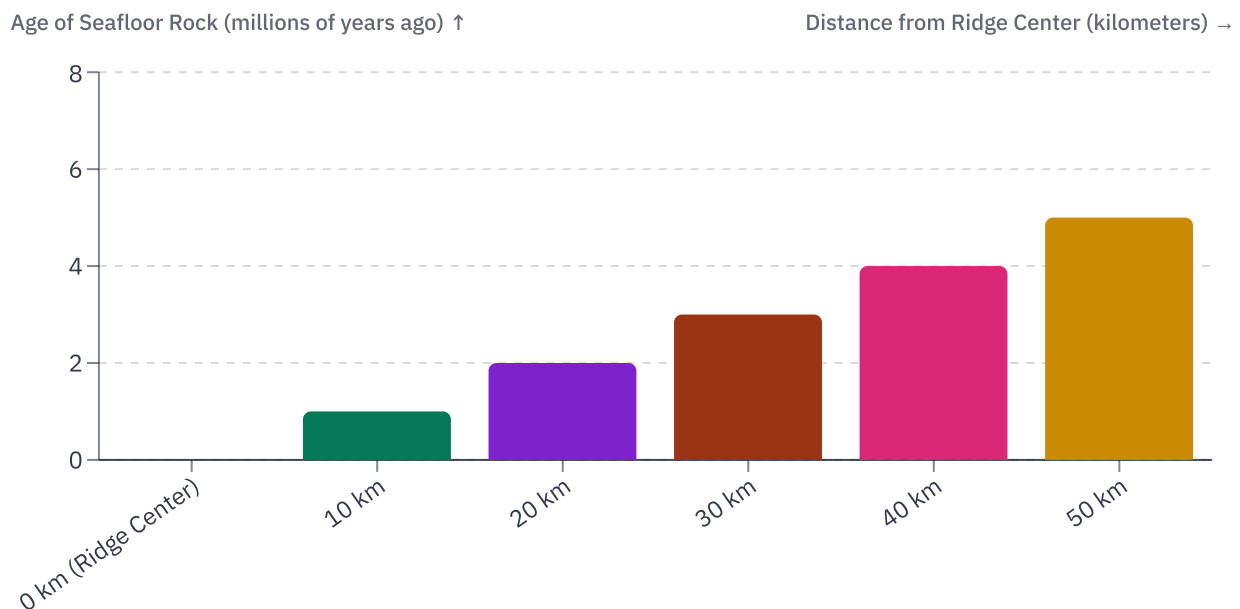
Examples at: **DOK 1** **DOK 2** **DOK 3** **DOK 4**

DOK 1 · Recall

Why DOK 1: Students identify the simple pattern in a graph, rocks getting older away from the ridge, and match it to seafloor spreading.

Scientists collected rock samples from the seafloor at different distances from the Mid-Atlantic Ridge center. The graph shows the age of each rock sample. What pattern in the data provides evidence that the seafloor is spreading apart at the Mid-Atlantic Ridge?

Age of Seafloor Rock Samples Collected Along the Mid-Atlantic Ridge



- ☐ The rock samples closest to the ridge center are the oldest, which shows that new seafloor is created at the ridge and moves outward.
- ☐ The rock samples get younger as you move away from the ridge center, which shows that plates move quickly enough to notice over a human lifetime.
- ☐ The rock samples all have the same age, which proves that continents have always been in their current positions.

- ☐ The rock samples get progressively older as you move away from the ridge center, which shows that new seafloor is created at the ridge and moves outward. ✓

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Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students classify landforms and measurements by the type of plate boundary that produces them, interpreting each piece of evidence.

Some features form where plates pull apart, and others form where plates push together. Sort each feature by where it forms.

	Plates pull apart	Plates push together
An East African valley has sides moving away and new cracks filled by lava	☒	☐
Japan has an offshore trench and earthquakes deepening inland	☐	☒
An ocean plate descends under the Andes volcanic arc	☐	☒
GPS stations on opposite sides of Iceland's rift move farther apart	☒	☐
India approaches Asia and former marine rock is raised in the Himalaya	☐	☒
A ridge has youngest crust at its center and older crust on both sides	☒	☐

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Test Bank question

GPS shows that Brazil and West Africa move apart at about 3 centimeters each year. In the South Atlantic, seafloor 750 kilometers from the ridge on each side is about 50 million years old.

Part A: Do the GPS data and the seafloor data agree about how fast the South Atlantic is widening?

Choose one answer.

- ☐ No, the seafloor shows the ocean widening ten times faster.
- ☐ No, the seafloor shows the ocean is not widening at all.
- ☐ Yes, but only because GPS and rock ages measure the same thing.
- ☒ Yes, both show about 3 centimeters of widening each year. ✓

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ☐ GPS using satellites proves that any geological age must equal the present measured rate.
- ☒ Each side moved 750 kilometers in 50 million years, or 1.5 centimeters yearly per side. ✓
- ☐ Young ridge rock alone proves a total widening rate of 30 centimeters per year.
- ☐ Continents on opposite sides prove equal spreading rates regardless of sample ages.

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Test Bank question

MS-ESS2-4 Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity

Examples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students name the water cycle process shown by an everyday example, recalling a term.

After Leo takes a hot shower, the bathroom mirror becomes covered with tiny water droplets. Warm, moist air from the shower touched the cool glass. Which water cycle process does the foggy mirror model?

☒ Condensation ✓

☐ Evaporation

☐ Precipitation

☐ Infiltration

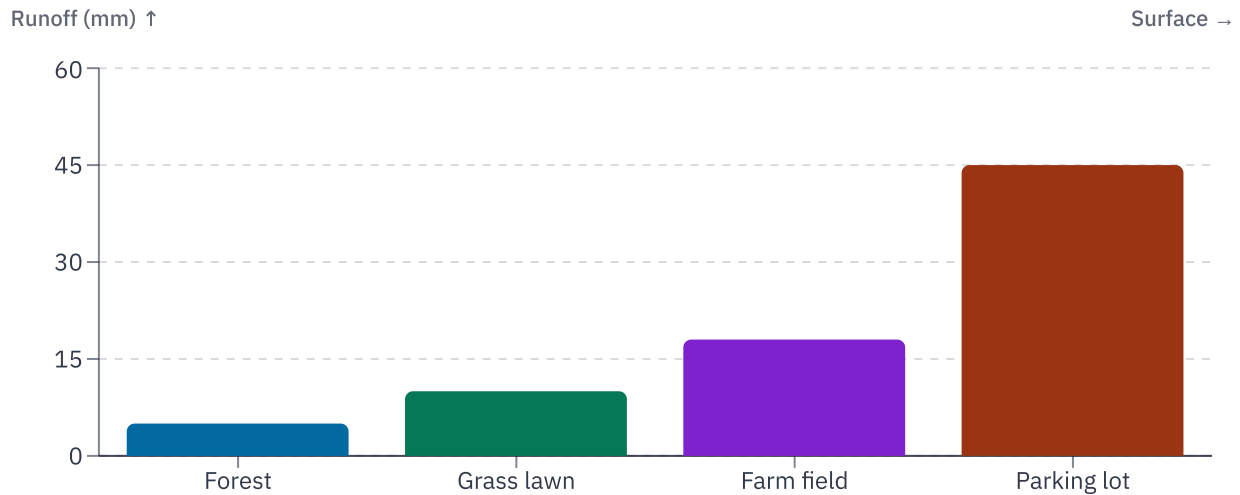
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Test Bank question

A model splits a 50-millimeter rainfall input between water remaining on or entering the surface and downhill runoff. The graph gives runoff from four surfaces. Which interpretation of the modeled paths fits the measurements?

Runoff From a 50 mm Rainstorm on Different Surfaces



- ☐ Parking lots let the most rain soak into the soil.
- ☒ Surfaces that let water soak in have less runoff. ✓
- ☐ Forests have the most runoff of all the surfaces.
- ☐ Every surface gets the same amount of runoff.

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students draw conclusions from a real dye-tracing study, deciding which claims the evidence supports about water paths and gravity and which go beyond the data.

In summer, scientists poured harmless dye into a moulin, a deep hole in the Greenland ice sheet where a meltwater stream disappears. Two days later, the dye came out in a river flowing from under the edge of the ice, about 20 kilometers downhill. Which conclusions are supported by this evidence? Select all that apply.

☐ The meltwater evaporated inside the ice and rained out later.

☒ Meltwater can travel through or under the ice sheet. ✓

☒ Gravity moved the meltwater downhill toward the ice edge. ✓

☐ The meltwater flowed uphill to reach the edge of the ice.

☐ The dye shows the Sun's heat reaches the bottom of the ice.

☒ Water melted on top of the ice can reach rivers and the sea. ✓

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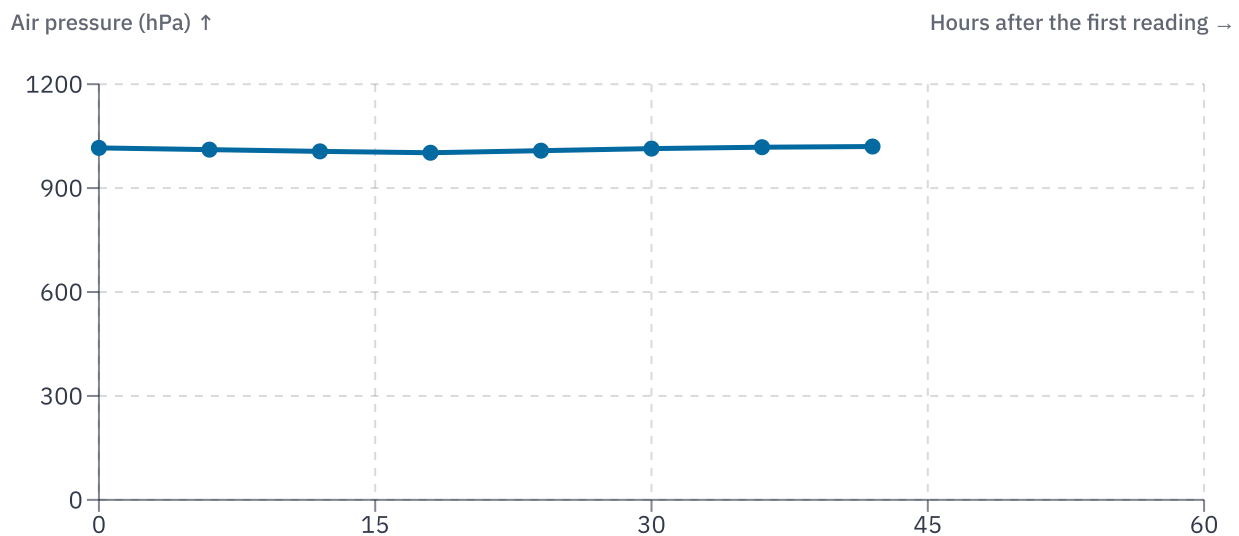
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Test Bank question

MS-ESS2-5 Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditionsExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 · Recall****Why DOK 1:** Given the rule for when a front passes, students find the lowest point on a pressure graph, a direct reading.

A student in Wellington, New Zealand, recorded the air pressure every 6 hours for two days while a cold front passed. The front passed when the pressure stopped falling and began to rise. When did the front most likely pass?

Air Pressure in Wellington Over Two Days☐ Around hour 6☐ Around hour 42☐ Around hour 30☒ Around hour 18 ✓**FIND MORE LIKE THIS**[Create questions](#)[Grade 8 Earth](#)[MS Earth Science](#)[ESS2](#)[MS-ESS2-5](#)[DOK 1](#)[Generate](#)

DOK 2 · Skills & concepts

Why DOK 2: Students interpret three days of pressure and temperature data to explain which air masses moved in, linking data to causes in a short explanation.

A weather station in the mountains recorded air pressure and temperature over three days as a weather system moved through the region. On Day 1, the pressure was 1010 mb and the temperature was 15 °C with clear skies. On Day 2, the pressure dropped to 995 mb and the temperature rose to 22 °C with increasing clouds. On Day 3, the pressure was 1005 mb, the temperature dropped to 8 °C, and heavy rain fell. Use the data to explain how the motion and interaction of air masses caused these weather changes.

Model response: From Day 1 to Day 2, the pressure dropped and the temperature rose, so a warm air mass moved in, and clouds began to form. On Day 3, the temperature dropped to 8 °C and the pressure rose, so a cold, dense air mass pushed in. The cold air forced the warm, moist air upward, where it cooled and its water vapor condensed into clouds and heavy rain.

Rubric: 2 points: uses the Day 1 to Day 2 data (pressure drop and temperature rise) to identify a warm air mass moving in, and uses the Day 3 data (temperature drop, pressure rise and heavy rain) to explain that a cold air mass pushed in and lifted the warm, moist air, causing the rain. 1 point: correctly explains only one of the two air masses using the data. 0 points: does not connect the data to moving air masses.

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DOK 3 · Strategic thinking

Why DOK 3: Students critique a data-collection plan, reasoning about sampling frequency, extra measurements, and fair setup to judge whether it can show that fronts cause temperature changes.

Jonah plans to test whether fronts cause temperature changes at his home. He will read an outdoor thermometer at 7 AM and 7 PM for two weeks and compare his data with news reports of when fronts passed. Select True or False for each statement about his plan.

	True	False
Adding air pressure readings would make his evidence stronger.	☒	☐
Two readings a day could miss when a front passes.	☒	☐
Comparing his data with the times fronts passed can show cause and effect.	☒	☐
Reading only at 7 AM would give him just as much evidence.	☐	☒
Hanging the thermometer next to the barbecue grill would be fine.	☐	☒

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Test Bank question

MS-ESS2-6 Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates

Examples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall that sinking air warms and dries, which explains why deserts lie near 30 degrees latitude.

Many of the world's large deserts, such as the Sahara in Africa, are found near 30° north or south of the equator. Air that rose near the equator sinks back down near these latitudes. Why does the sinking air help make deserts?

- ☐ Sinking air carries ocean water inland, which then dries.
- ☐ Sinking air pushes the Sun's light away from the ground.
- ☐ Sinking air cools and forms thick clouds that block rain.
- ☒ Sinking air warms and dries out, so few clouds form. ✓

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Test Bank question

Use the drop-down menus to complete the statement.

A model of ocean circulation shows the Gulf Stream carrying warm water from the tropics northeast toward Western Europe. This current is part of a circulation system driven by unequal heating, which makes tropical surface water **warmer and less dense ▼** than water near the poles. As this warm current flows past Western Europe, it **warms ▼** the air above it, so coastal regions of Western Europe have **milder ▼** winters than inland regions at the same latitude in Asia.

Drop-down 1 choices: **warmer and less dense ✓** colder and denser the same temperature

Drop-down 2 choices: has no effect on **warms ✓** cools

Drop-down 3 choices: **milder ✓** identical colder

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students build a claim, evidence, and reasoning explanation that transfers results from a sand-and-water model to India's monsoon.

A class models a monsoon with a pan of sand (land) and a pan of water (ocean) under a heat lamp. After 20 minutes, they hold a stick of smoking incense between the pans. How does this model explain India's summer monsoon rains? Make a claim, support it with evidence from the table, and explain your reasoning.

Monsoon Model Results After 20 Minutes Under a Lamp

Observation	Result
Sand temperature	45°C
Water temperature	28°C
Direction the smoke drifted	From the water toward the sand, then upward over the sand

Model response: In summer, the land heats up more than the ocean, so moist air flows from the ocean onto the land. In the model, the sand reached 45°C while the water reached only 28°C, and the smoke drifted from the water toward the sand and then rose. Over India, the moist ocean air rises over the hot land, cools, and forms rain clouds, which bring the monsoon rains.

Rubric: 2 points: The response includes all required elements: a correct claim (land heats more than the ocean, so moist ocean air flows inland), evidence from the table (sand 45°C vs water 28°C, smoke moving from water to sand and rising), and reasoning that the moist air rises over the land, cools, and forms rain clouds.

1 point: The response includes one or two of the three required elements above, but not all three. Reasoning counts only with the correct claim. Credit for "Reasoning: warm air rises over the land, moist ocean air flows in to replace it, and as it rises it cools and drops rain" requires "Claim: land heats more than the ocean, so moist ocean air flows onto the land in summer".

0 points: No correct required element; the response is incorrect, too vague to earn credit, irrelevant, blank, or only copies the prompt without answering.

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Test Bank question

MS-ESS3-1 Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes

Examples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~

DOK 1 • Recall

Why DOK 1: Students sort familiar resources by how they formed, recalling whether each came from evaporating water or buried living things.

Some resources formed when water evaporated and left minerals behind. Others formed from buried living things. Sort each resource by how it formed.

	Left when water evaporated	Formed from buried living things
Borax in Death Valley, California	☒	☐
Potash in Saskatchewan	☒	☐
Lignite coal in Germany	☐	☒
Natural gas in Groningen, Netherlands	☐	☒
Peat in Irish bogs	☐	☒
Gypsum at White Sands, New Mexico	☒	☐

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Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students explain in their own words how plate boundaries and volcanoes put usable heat near the surface in only some places, connecting a process to a resource pattern.

Many of the world's geothermal power plants are in Iceland, New Zealand, and Kenya. All three sit along plate boundaries with active volcanoes. Explain why geothermal energy is easy to use in these places but not in most other places.

Model response: These places are on plate boundaries with volcanoes, so magma and hot rock are close to the surface. The heat warms underground water into hot water and steam near the surface, which power plants can reach easily. In most other places the hot rock is too deep to reach.

Rubric: 2 points: explains that magma or hot rock is close to the surface near plate boundaries and volcanoes AND that this heat makes hot water or steam near the surface that can be used. 1 point: gives only one of these. 0 points: neither.

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students apply what they know about how oil forms and gets trapped to new site descriptions, reasoning about which conditions make oil likely.

An energy company wants to drill where oil is most likely to be found. Geologists describe several sites. Which sites are most likely to hold oil? Select all that apply.

☐ A thick glacier sitting on old, hard metamorphic rock

☐ A field of young lava flows from a volcano

☒ Sandstone layers arched into a dome under a tight cap rock ✓

☒ Layers of marine mud that were buried deep enough to be heated ✓

☐ A mountain made entirely of granite that cooled from magma

☒ A deep basin with thick layers of shale holding sea fossils ✓

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Test Bank question

MS-ESS3-2 Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects

Examples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recognize the basic use of earthquake location patterns: knowing where quakes are common helps people prepare.

A scientist looked at earthquake records from the last 50 years along the San Andreas Fault in California. Some sections of the fault had many earthquakes. Other sections had very few. How can this pattern help keep people safe?

- ☒ It shows which fault sections have more earthquakes, so builders and planners can focus safety efforts there. ✓
- ☐ It proves that new technology can stop earthquakes from happening along the fault.
- ☐ It shows earthquakes happen randomly, so no one can guess where the next one will happen.
- ☐ It lets scientists know the exact day and time the next earthquake will hit each section.

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Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students use a long-term data pattern to make a forecast and explain it, interpreting data rather than recalling a fact.

A California city keeps records of earthquakes over the past 100 years. The data show that most earthquakes in the region occur along a narrow zone that follows a known fault line, and almost no earthquakes occur in areas more than 20 miles away from that fault line. Based on this pattern, is a future earthquake more likely to occur near the fault line or far from it? Use the pattern in the data to explain your answer.

Model response: A future earthquake is more likely to occur near the fault line. The 100 years of data show a clear pattern: most earthquakes clustered along the zone that follows the fault, and almost none happened more than 20 miles away. A pattern that lasted that long is good evidence for where earthquakes are likely to happen next.

Rubric: 2 points: States that a future earthquake is more likely near the fault line and uses the pattern in the data (most earthquakes over 100 years clustered along the fault, almost none more than 20 miles away) to support the forecast. 1 point: States that the fault line is more likely but does not use the pattern in the data, or describes the pattern without making a clear forecast. 0 points: States that earthquakes are equally likely anywhere or more likely far from the fault, or gives no valid response.

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students analyze a disaster timeline to decide which improvement would most reduce future deaths, then justify that choice with evidence.

In March 2019, Cyclone Idai struck Mozambique. The table shows the timeline. Over 600 people died in Mozambique, many from flooding far inland.

Timeline of Cyclone Idai in Mozambique, 2019

Date	What Happened
March 11	Forecasters predicted landfall near the city of Beira
March 14	The cyclone struck Beira with strong winds and storm surge
March 15–20	Heavy rain upstream made rivers rise; huge areas inland flooded

Part A: Which improvement would most likely reduce deaths in a future cyclone like Idai?

Choose one answer.

- ☐ Building a wall around the city of Beira to stop the winds
- ☐ Forecasting the cyclone's landfall city more days in advance
- ☐ Stopping all weather forecasts once a cyclone reaches land
- ☒ Better river flood warnings and evacuations for inland areas ✓

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ☐ Cyclone Idai struck Mozambique in the month of March in 2019.
- ☐ Forecasters correctly predicted landfall near Beira three days early.
- ☒ Much of the deadly flooding came inland in the days after landfall. ✓
- ☐ The cyclone struck Beira with strong winds and a storm surge.

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ESS3



MS-ESS3-2



DOK 3



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Test Bank question

MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment

Examples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~

DOK 1 • Recall

Why DOK 1: Students match each human impact to a known fix, connecting a problem directly to its standard solution.

A class matches each human impact with a way to reduce it. Choose the best solution for each impact.

	Build a rain garden to soak up runoff	Add dot patterns that make glass visible	Use shielded, dim amber lights
Human Impact: Runoff from a parking lot carries oil into a creek	☒	☐	☐
Human Impact: Birds fly into a school's glass walkway	☐	☒	☐
Human Impact: Beach lights confuse sea turtle hatchlings	☐	☐	☒
Human Impact: Rain washes lawn fertilizer into a pond	☒	☐	☐
Human Impact: Bright streetlights draw moths away from a wetland	☐	☐	☒

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Test Bank question

Why DOK 2: Students compare monitoring results from two towns to conclude whether a salt-reduction plan worked, interpreting a comparison and choosing supporting evidence.

Two towns in Ohio sit along the same stream. Last winter, Town A sprayed brine on roads before storms and used 30% less rock salt than the winter before. Town B did not change. Salt levels in the stream fell below Town A but stayed about the same below Town B.

Part A: What is the best conclusion?

Choose one answer.

- ☒ Town A's brine plan likely reduced salt reaching the stream. ✓
- ☐ Town B's roads were safer because it used more salt.
- ☐ Brine adds more salt to streams than rock salt does.
- ☐ The winter was warmer than usual, so both towns used less salt overall.

Part B: Which evidence best supports your answer to Part A?

Choose one answer.

- ☒ Salt fell below Town A but not below Town B, which did not change. ✓
- ☐ Town A used rock salt on its roads during the winter before.
- ☐ Brine is salt dissolved in water and sprayed before storms.
- ☐ Both towns sit along the same stream in the state of Ohio.

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students evaluate monitoring data from a treated lake and a control lake, reasoning about what the control rules out and which conclusions go too far.

A town added a buffer of native plants around Lake A to reduce algae. Lake B, nearby and similar, got no buffer. Scientists measured algae in both lakes before and after. Which conclusions do the data support? Select all that apply.

Algae in Two Lakes Before and After a Buffer Was Added to Lake A

Lake	Algae Before (units)	Algae After (units)
Lake A (buffer added)	80	40
Lake B (no buffer)	78	75

- ☒ Lake B helps show the drop in Lake A was not just a change in weather. ✓
- ☐ Lake B's algae dropped more than Lake A's did.
- ☒ Algae dropped by half in the lake with the buffer. ✓
- ☐ The data show a buffer would not help Lake B.
- ☐ The buffer removed all the algae from Lake A.
- ☒ Algae barely changed in the lake without a buffer. ✓

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Test Bank question

MS-ESS3-4 Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systemsExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 • Recall****Why DOK 1:** Students apply the simple idea that total use equals people times use per person, so doubling the population doubles demand.

Use the drop-down menus to complete the statement.

A country's total freshwater use depends on both the number of people living there and how much water each person uses. If a country's population doubles while water use per person stays the same, the total freshwater use will **double** . This change will likely have a **negative** effect on Earth's systems, such as groundwater supplies and river ecosystems.

Drop-down 1 choices: stay the same **double ✓** go up by four times**Drop-down 2 choices:** positive **negative ✓** no**FIND MORE LIKE THIS**[Create questions](#) › [Grade 8 Earth](#) › [MS Earth Science](#) › [ESS3](#) › [MS-ESS3-4](#) › [DOK 1](#) › [Generate](#)

Test Bank question

DOK 2 · Skills & concepts

Why DOK 2: Students decide which findings actually support a cause-and-effect claim about beef demand and forest loss, separating relevant evidence from true but unrelated facts.

A student claims that growing demand for beef is causing forest loss in the Amazon. Match each finding to the correct column.

	Supports the claim	Does not support the claim
Beef exports from the region grew over the same years	☒	☐
Satellite images show pasture replacing forest in the same areas	☒	☐
The Amazon River is the largest river by volume	☐	☒
Many kinds of monkeys live in the Amazon rainforest	☐	☒
Cattle numbers in the region rose as forest area fell	☒	☐

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must calculate totals and separate the effect of population from the effect of use per person, then build an argument that critiques a proposed fix.

Riverside Town gets all of its water from wells that pump groundwater. The table shows town records for 2000 and 2020. A council member says, "Our groundwater is dropping mainly because more people moved here, so the best fix is to stop building new homes." Construct an argument that evaluates the council member's claim. Use calculations from the table as evidence, and explain which change has the larger effect on the groundwater.

Water Records for Riverside Town

Measurement	2000	2020
Population	20,000	25,000
Average water use per person (liters per day)	150	240
Depth to water in town wells (meters)	12	30

Model response: The claim is only partly correct. Total water use went from $20,000 \times 150 = 3,000,000$ liters a day to $25,000 \times 240 = 6,000,000$ liters a day, so it doubled, which explains why the wells now have to reach 30 m instead of 12 m. Population rose by only 25% (20,000 to 25,000), but use per person rose by 60% (150 to 240). If only population had grown, use would be $25,000 \times 150 = 3,750,000$ liters; if only use per person had grown, it would be $20,000 \times 240 = 4,800,000$ liters. So the rise in use per person had the larger effect. Stopping new homes would not fix most of the problem; the town also needs to cut how much water each person uses.

Rubric: 2 points: The response includes all required elements: a claim that the council member is only partly right (or wrong) because use per person is the larger cause, evidence from calculations (total use doubled from 3,000,000 to 6,000,000 liters a day; population up 25% vs. use per person up 60%, or equivalent separate calculations), and reasoning that more total pumping lowers the groundwater, so reducing use per person matters more than limiting population alone.

1 point: The response includes one or two of the three required elements above, but not all three.

0 points: No correct required element; the response agrees that population is the main cause without evidence, is too vague, or is blank.

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MS-ESS3-5 Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century

Examples at: **DOK 1** **DOK 2** **DOK 3** **DOK 4**

DOK 1 · Recall

Why DOK 1: Students pick the one question that asks about a cause of the CO₂ and temperature rise, recognizing a relevant science question.

A student looks at the data in the table. Since 1900, Earth's temperature has gone up by about 1.1°C, and carbon dioxide (CO₂) in the air has gone up from 295 to 414 parts per million. Both rise quickly after 1960. Which question would help the student learn what is causing these changes?

Carbon Dioxide and Global Temperature Change, 1900 to 2020

Year	CO ₂ in the Air (ppm)	Temperature Change Since 1900 (°C)
1900	295	0
1920	303	0.1
1940	310	0.2
1960	317	0.05
1980	339	0.3
2000	369	0.5
2020	414	1.1

☐ Does the hole in the ozone layer explain why CO₂ and temperature both rose?

☒ What human activities add CO₂ to the air, and how does CO₂ trap heat? ✓

☐ Did this past winter feel colder than winters ten years ago in my town?

☐ Do volcanoes alone explain all of the temperature rise shown in the data?

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DOK 2 · Skills & concepts

Why DOK 2: Students must connect melting ice, darker ocean, and absorbed sunlight to choose the question that could explain faster Arctic warming, linking a cause to an observation.

Over the past 40 years, the Arctic has warmed about three times faster than the world as a whole. Which question would best help explain why?

☐ Does the Sun shine for more hours each day in the Arctic in winter?

☐ Do more people live in the Arctic now than lived there in 1980?

☐ Are polar bears moving to new areas as the Arctic gets warmer?

☒ Does melting ice uncover dark ocean that absorbs more sunlight? ✓

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Write two questions that together could help find out whether people or natural factors caused most of the warming since 1900. For each question, name the data you would need. Then explain how comparing the answers would help.

Model response: Question 1: How much CO₂ has burning coal, oil, and gas added since 1900? I would need yearly records of fossil fuel burned and CO₂ in the air. Question 2: Did the Sun's energy or volcanic eruptions change in a way that matches the warming? I would need satellite data on the Sun's energy and records of eruptions. Comparing the answers would show which factor lines up with the warming, so I could tell whether people or nature caused most of it.

Rubric: 2 points: The response includes all required elements: gives a question and data about a human factor (such as fossil fuels or forest clearing), gives a question and data about a natural factor (such as the Sun or volcanoes), and explains that comparing them shows which factor matches the warming.

1 point: The response includes one or two of the three required elements above, but not all three.

0 points: none. No correct required element; the response is incorrect, too vague to earn credit, irrelevant, blank, or only copies the prompt without answering.

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MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutionsExamples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~**DOK 1 · Recall****Why DOK 1:** Students only need to recall the meaning of the term constraint; no analysis of the design problem is required.

A class is designing a model footbridge for a stream crossing. The bridge must hold at least 20 kg and span 1 m. It must cost no more than \$30.

In engineering design, what is the name for a limit, such as the \$30 budget, that every solution must stay within?

- ☒ A constraint ✓
- ☐ A prototype
- ☐ A hypothesis
- ☐ A variable

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DOK 2 · Skills & concepts

Why DOK 2: Students must compare each question with the stated criteria and constraints and classify which ones clarify the problem, which takes more than recall.

Sofia plans a small sunlight-powered charger with safe walking access. A charger must supply at least 5 Wh during a 2-hour matched sunlight test. Cost is at most \$25 and panel area at most 0.5 m². The device must not block a walking route or create unsafe exposed connections.

Which questions define or clarify measurable design needs and constraints? Select all that apply.

- ☐ What energy test under matched sunlight would check the 5 Wh requirement? ✓
- ☐ How should walkway access and exposed connections limit the placement plan? ✓
- ☐ Which charger looks brightest without measuring energy supplied during the 2-hour test?
- ☐ How can a charger supply 5 Wh in 2 hours within \$25 and 0.5 m² while keeping walkways and connections safe? ✓
- ☐ How can the largest panel be called successful even if it exceeds 0.5 m² and blocks the route?

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must plan a precise problem definition on their own, choose measurable criteria and limits, and justify one with science, with more than one valid answer.

Rain runs off a school parking lot, floods the walkway to the playground, and carries soil into a nearby creek. A student group wrote this problem statement: "Design something to stop the flooding."

Rewrite the problem statement so it could lead to a successful solution. Include at least two measurable criteria and at least two constraints, and make sure at least one requirement protects people or the creek. Then use a science idea to explain why one of your requirements is needed.

Model response: Sample answer: Design a system that stores at least 40 L of runoff from a matched test storm and lets no more than 20 L reach the walkway, while costing at most \$50, keeping the walkway usable, and keeping soil out of the creek. The soil requirement is needed because fast-moving water has more energy and can pick up and carry sediment, which would cloud the creek and harm living things there.

Rubric: One point for two measurable criteria, one point for two constraints including an effect on people or the environment, and one point for a science-based justification of a requirement.

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MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem

Examples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read one column of a table and compare each value with a single stated limit, a one-step task.

A team is designing an insulated lunch box. The box must keep food from warming more than 5 °C in 3 hours, and it must cost no more than \$20. The table shows test results for four designs.

Which design does NOT meet the cost constraint?

Test Results for Each Lunch Box Design

Design	Temperature rise in 3 hours (°C)	Cost (dollars)
Design A	7	15
Design B	4	18
Design C	3	24
Design D	6	12

- ☒ Design C ✓
- ☐ Design A
- ☐ Design B
- ☐ Design D

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Why DOK 2: Students must check every design against two requirements at once and eliminate the ones that fail either, a multi-step comparison of table data.

A class is designing a water filter. It must clean at least 253 mL per minute and cost no more than \$26. The table shows test results.

Which design meets both requirements?

Test Results for Each Design

Design	Water cleaned per minute (mL)	Cost (dollars)
Design A	246	22
Design B	304	10
Design C	168	20
Design D	176	22

☒ Design B



☐ Design C

☐ Design A

☐ Design D

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DOK 2



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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must build a written argument for one design, cite data for every criterion and constraint, and explain the systematic method that rules out the competitors.

Tyler evaluates turbine solutions. The team needs electrical output from a stable tower. Wind input and generator load are the same in all trials. Required electrical output is at least 5 W. Required tower tilt is at most 5 degrees. Cost is at most \$48. Use the lowest-cost design that meets every requirement.

Tested design solutions:

Argue for the preferred design. Compare evidence with every criterion and constraint, then explain the systematic method that makes this solution preferable to its competitors.

Electrical Output, Tower Tilt, and Cost by Design

Design	electrical output (W)	tower tilt (degrees)	Cost (USD)
S	8	3	38
T	10	4	43
P	2	3	33
Q	11	2	53
R	8	7	36

Model response: Design S meets all criteria and costs \$38, less than the other qualifying design at \$43. Design S has 8 W for electrical output and 3 degrees for tower tilt. Its cost is \$38. Check both performance criteria and the budget first, then choose the lowest cost among fully qualifying designs.

Rubric: One point each for the preferred qualifying design, its performance and cost evidence, and the systematic evaluation method.

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Test Bank question

MS-ETS1-3 Analyze data from tests 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

Examples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students read values straight from one column of the table and pick the largest, which is retrieving information rather than analyzing it.

A team building a model wind turbine tested blade sets and bases separately. Wind speed and load were the same in every test. The goals are more electrical power and less tower tilt. The table shows the component test results.

Which blade set produced the most electrical power?

Component Test Results

Source design	Blade set	Electrical power (W)	Base	Tower tilt (degrees)
P	Curved blade set	8	Small base	12
Q	Flat blade set	3	Wide base	4
R	Narrow blade set	5	Medium base	9

☒ Curved blade set



☐ Flat blade set

☐ Narrow blade set

☐ Wide base

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DOK 2 · Skills & concepts

Why DOK 2: Students must compare two separate sets of test results, pick the best feature for each goal, and combine them, which requires interpreting the data rather than reading one value.

Omar records blade power and base stability under wind. Blade sets and base designs were tested separately at matched wind and load. The goals are greater power and less tower tilt.

Curve trial settings: blade angle (degrees) = 10, 20, 30, 40 for Records 1 to 4. Only that setting changed in the curve tests. The second table supplies additional matched component comparisons.

Record data: electrical power (W).

Record	electrical power (W)
1	2
2	3
3	5
4	8

Component tests (each feature tested with other parts fixed):

Source design	First feature	electrical power (W)	Second feature	tower tilt (degrees)
P	Use curved blade set.	8	Use small base.	12
Q	Use flat blade set.	3	Use wide base.	4
R	Use narrow blade set.	5	Use medium base.	9

Which tested features should be combined in a new design and checked again?

Unknown visual type: line

- ☒ Combine the curved blade set from P with the wide base from Q, then test both goals in the hybrid. ✓

- ☐ Use both features from Q and ignore P even though its first feature performs better.
- ☐ Combine both best features and declare success without testing how they work together.
- ☐ Use both features from P and ignore Q even though its second feature performs better.

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must weigh several data sets and a mass limit, plan a new combined design, justify it with evidence, and reason about why it still needs testing.

A class tested three paper-glider designs. Each design used a different wing and tail. The goals are a flight distance of at least 8 m and no more than 5 uncontrolled turns over 10 launches. The total mass of the wing plus tail must be no more than 14 g. Launch method and flight space were the same for every test.

No design met every requirement. Use the data to propose a new design that combines the best features of the tested designs. Support your choice with evidence for each requirement, and explain why the new design still needs to be tested.

Glider Test Results

Design	Wing (mass)	Tail (mass)	Flight distance (m)	Uncontrolled turns
P	Broad wing (8 g)	Small tail (4 g)	9	12
Q	Short wing (5 g)	Stable tail (5 g)	4	2
R	Narrow wing (4 g)	Wide tail (5 g)	6	6

Model response: Combine the broad wing from Design P with the stable tail from Design Q. The broad wing gave the longest flight (9 m, above the 8 m goal), and the stable tail gave the fewest uncontrolled turns (2, below the 5-turn limit). Together they weigh $8\text{ g} + 5\text{ g} = 13\text{ g}$, which is within the 14 g limit. The new glider still needs repeated matched tests because the parts were tested in different gliders; the heavier tail could change the balance and shorten the flight, so the combination might not perform as well as each part did alone.

Rubric: One point for the correct combination of features, one point for evidence addressing every requirement including the mass calculation, and one point for explaining why the hybrid must be tested.

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MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved

Examples at: **DOK 1** **DOK 2** **DOK 3** ~~DOK 4~~

DOK 1 · Recall

Why DOK 1: Students recall the purpose of iterative testing of a model, a basic fact about the engineering design process.

Engineers often build a model of a proposed design and test it again and again, changing it a little after each test.

What is the main reason for testing a model many times?

☒ To collect data that show how to change the design until it best meets the criteria and constraints ✓

☐ To prove that the first version of the design never needs to be changed

☐ To replace measurements with opinions about how the design looks

☐ To change many variables at once so the tests finish faster

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DOK 2 · Skills & concepts

Why DOK 2: Students must judge each proposed change to the traffic model, deciding whether it keeps the test fair and respects the crossing constraint, which goes beyond recall.

Mateo develops a traffic-flow computer model. The model represents arrivals, signal time, pedestrian crossings, and vehicle queues. Three runs have mean waits of 70, 75, and 72 seconds, above a 60-second goal. Pedestrians need at least 20 seconds to cross. New runs must test a changed signal schedule.

Complete the model, then use it to predict what happens. Decide whether each proposed model relationship is supported. Select True or False for each statement.

	True	False
Reduce wait by deleting every pedestrian crossing requirement from the model.	☐	☒
Signal schedules change when vehicles can leave queues, while pedestrian time constrains which schedules are useful.	☒	☐
Model a changed signal schedule, repeat queue and crossing-time runs, and revise until wait and crossing requirements are met.	☒	☐
Use fewer arrivals in new runs and call the whole wait change a signal improvement.	☐	☒

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Test Bank question

DOK 3 · Strategic thinking

Why DOK 3: Students must use the trend in the data to plan and justify the next design iteration and a fair test, and more than one well-reasoned proposal can earn credit.

Tyler is developing an insulated cup. The goal is a water-temperature rise of no more than 5 °C in 3 hours when cold water sits in a warm room. The foam wall must have a mass of no more than 200 g. Tyler tested three versions of the model with the same water volume, starting temperature, and room conditions. The table shows the results.

No version met both requirements. Use the data to propose the next version Tyler should build and test. Predict how it will perform, explain your prediction using how energy moves through the cup wall, and describe how Tyler should test it.

Insulated Cup Model Tests

Version	Foam wall thickness (mm)	Temperature rise in 3 hours (°C)	Wall mass (g)
1	2	9	110
2	4	6	160
3	6	4	210

Model response: Sample answer: Tyler should try a 5 mm foam wall. The data show that each extra millimetre of foam lowered the temperature rise and added about 25 g, so a 5 mm wall should give a rise of about 5 °C and a mass of about 185 g, which could meet both limits. Thicker foam slows the transfer of thermal energy from the warm room into the cold water. Tyler should test the 5 mm cup several times with the same water volume, starting temperature, room conditions, and 3-hour time, then revise again if either limit is missed.

Rubric: One point for a data-supported proposal and prediction, one point for an energy-transfer explanation, and one point for a fair, repeated test plan that checks both requirements.

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Sources

- Performance expectations and disciplinary core ideas: NGSS Lead States (2013), Next Generation Science Standards: For States, By States. <https://www.nextgenscience.org>

- State science test (CAST) item specifications: these describe PEs and item clusters but do not assign DOK levels.
- DOK level definitions: Webb Depth of Knowledge, as used by Smarter Balanced, summarised on the "How to use" page.
- Example questions: the AchieveMetrics Test Bank, reviewed for this guide.

AchieveMetrics Test Bank · DOK Progression Guide · Grade 8 Science · October 2026 edition.

