Lawrence Hall of Science Assessment Project
Sample Assessment Items

Life Science

MS-LS2-3: Ecosystems, Interactions, and Dynamics

Students who demonstrate understanding can:

MS-LS2-3. **Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.** [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.] [*Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.*]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Developing and Using Models
Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.
- Develop a model to describe phenomena.

Disciplinary Core Ideas

LS2.B: Cycle of Matter and Energy Transfer in Ecosystems
- Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.

Crosscutting Concepts

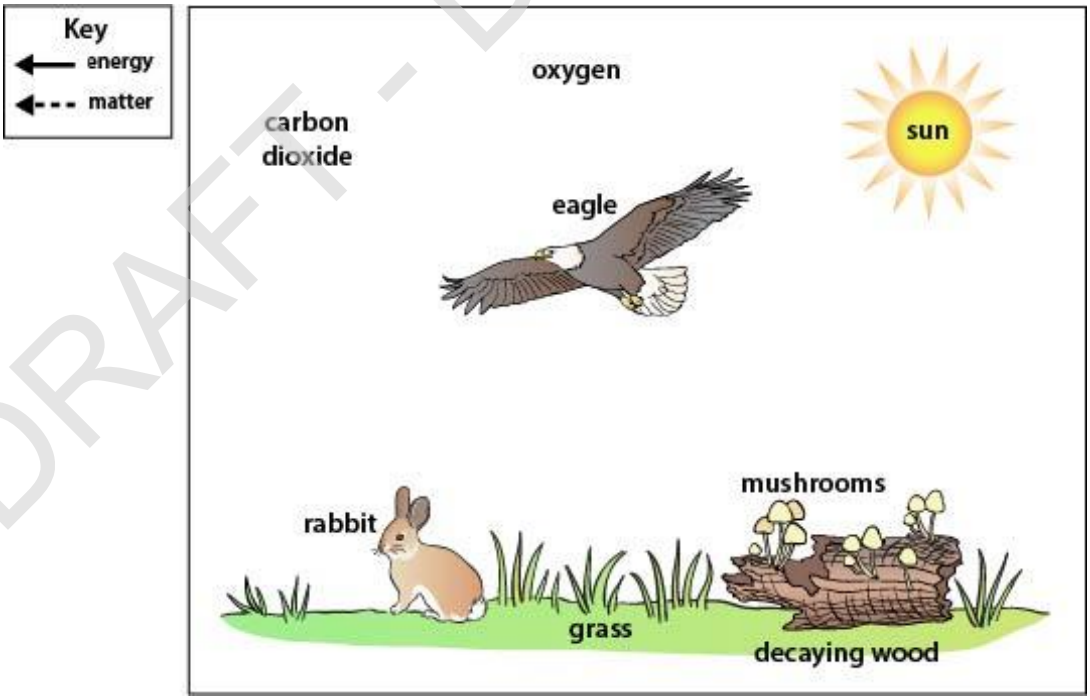
Energy and Matter
- The transfer of energy can be tracked as energy flows through a natural system.

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems
- Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation.

Learning Performance: Develop a model to show the flow of energy and the cycling of matter in an ecosystem.

Sample item: Add to the diagram below to develop a model of an ecosystem by doing each of the following:
a. Draw solid arrows (→) to show where energy flows in this ecosystem.
b. Draw dashed arrows (- - ->) to show where matter cycles in this ecosystem.



Physical Science
MS-PS3-5: Energy

Students who demonstrate understanding can:

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.** [Clarification Statement: Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object.] [*Assessment Boundary: Assessment does not include calculations of energy.*]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Engaging in Argument from Evidence
Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed worlds.

- Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon.

Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence

- Science knowledge is based upon logical and conceptual connections between evidence and explanations

Disciplinary Core Ideas

PS3.B: Conservation of Energy and Energy Transfer

- When the motion energy of an object changes, there is inevitably some other change in energy at the same time.

Crosscutting Concepts

Energy and Matter

- Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion).

Learning Performance: Students can present oral or written arguments to support or refute an explanation or model related to the energy transfers that must occur when the kinetic energy of an object changes.

Sample Item: Owen and Sophia were using the swings in the playground when they decided they wanted to see what affected how high a swing can rise. Sophia used a swing for three minutes before letting the swing stop on its own.

Owen used his cell phone to record Sophia on the swing. Later they analyzed the video and calculated the maximum speed and height of the swinging. Their results are shown in the table on the next page.

Sophia's results		
Time (min)	Maximum speed of swing (m/s)	Maximum height of swing (m)
0.5	3.1	0.5
1.0	4.0	0.8
1.5	4.8	1.1
2.0	5.0	1.2
2.5	5.2	1.3
3.0	5.2	1.4
3.5	4.0	0.8
4.0	2.0	0.2
4.5	0	0
5.0	0	0

After examining the data, Owen claimed that the kinetic energy of the swing affected how high the swing could rise. Construct an argument to support or refute Owen's claim. Make sure to include evidence of energy transformations and scientific reasoning in your response.

Earth Science
MS-ESS2-4: Earth's Systems

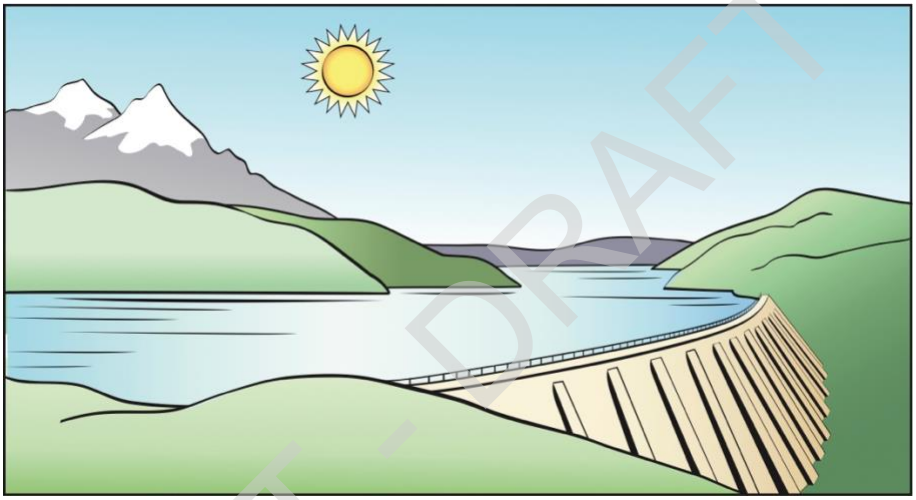
Students who demonstrate understanding can:

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.** [Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical.] [*Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.*]

The performance expectation above was developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop a model to describe unobservable mechanisms.	**ESS2.C: The Roles of Water in Earth's Surface Processes** • Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. • Global movements of water and its changes in form are propelled by sunlight and gravity.	**Energy and Matter** • Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.

Learning Performance: Students create a model that shows how water gets from the surface to the atmosphere, from the atmosphere to a mountain or area of high elevation, and then to an area of lower elevation.



Sample Item: The picture above shows a reservoir, a large body of water built by people, in the mountains.

a. Most of the water in the reservoir comes from the snow at the top of the mountains. How does the water get from being snow in the mountains to the reservoir? Add arrows and captions to the diagram to show your ideas.

b. The water of the snow in the mountains used to be in the oceans far away. How did the water in the ocean end up in these mountains? Create a model with arrows and captions to show your ideas.