SAMPLE ITEMS

9–12 MAP Growth Science for use with Next Generation Science Standards

Test purpose

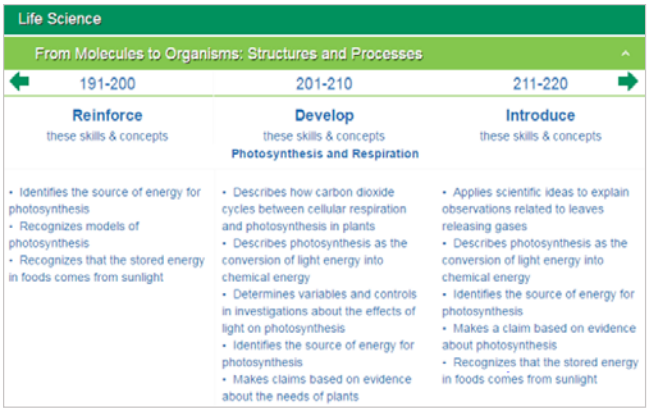
The MAP® Growth™ Science for use with Next Generation Science Standards* (NGSS) measures growth as students build understanding of the multidimensional NGSS Performance Expectations (PEs). The tests do not provide a summative or diagnostic measure of a student's proficiency in the NGSS PEs or their dimensions. The results can be used as a growth measure of overall student understanding of the NGSS with an overall score—as well as scores in the disciplinary instructional areas of the test. Taking this interim, adaptive test allows students to gauge their growth throughout the school year and from year to year.

Multidimensional items, alignment, learning statements, and the learning continuum report

The tests include multidimensional items that align to the NGSS dimensions: **Disciplinary Core Ideas (DCIs)**, **Science and Engineering Practices (SEPs)**, and **Crosscutting Concepts (CCCs)**. Some items assess all dimensions of appropriate PEs for a high school interim test, and others assess different combinations of the dimensions. All provide measures of growth toward students' understanding of the **DCIs**, **SEPs**, and **CCCs** of NGSS. Over time, more and more of the item pool will include items aligned to all three dimensions of the NGSS PEs. The information about sample items in this document is color-coded for these dimensions.

All existing items were rated for their alignment to the **DCIs**, **SEPs**, and **CCCs** as cited from *A Framework for K–12 Science Education* (2012 NRC). This process included writing multidimensional learning statements before hand-aligning items to the NGSS PEs.

The NWEA® learning statements are used in the learning continuum reports. These statements give teachers information about how students are performing in the dimensions of the NGSS. The sample items include the learning statements that teachers will see in the reports. For example, below is a portion of the Life Sciences instructional area, From Molecules to Organisms sub-area, Photosynthesis and Respiration topic in three RIT bands:



Test blueprint

The blueprint for the 9–12 MAP Growth Science for use with NGSS has three instructional areas: Life Sciences, Physical Sciences, and Earth and Space Sciences—all with embedded Engineering Design. The sub-areas are derived from the **DCIs**.

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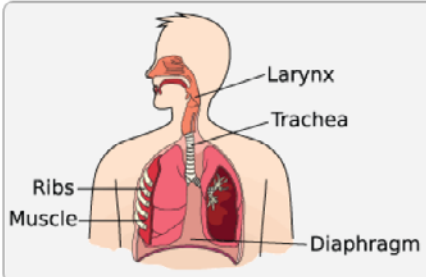
Instructional area 1: Life Sciences

Sub-area 1a: From Molecules to Organisms: Structures and Processes

	DCI+	SEP**	CCC**
Aligned PE: HS-LS1-2 Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.**	Structure and Function	Developing and Using Models	Systems and System Models
NWEA learning statement: Describes how systems work together for the body to function, using models **Item RIT:** 217 **Item DOK:** 2	Structure and Function	Developing and Using Models	Systems and System Models

The diagram shows several components of body systems involved in breathing.



How do the muscular and respiratory systems contribute to breathing?

A. The muscles squeeze all sides of the lungs to release air.

B. The dome-shaped diaphragm lets air fill the lungs from the bottom up.

C. The muscles around the larynx and trachea push air along the tube and in and out of the lungs.

D. The diaphragm and rib muscles expand and contract the chest cavity, drawing air in and out of the lungs.

Narrative: The item provides evidence of students' growth in their understanding of **using models** to describe **how the muscular and respiratory systems work together for humans to breathe**. This item provides understanding of the three dimensions of this high school PE. NWEA is a WebbAlign® Depth of Knowledge Partner. This item is rated DOK 2 because students **used a given model** instead of constructing their own **model**.

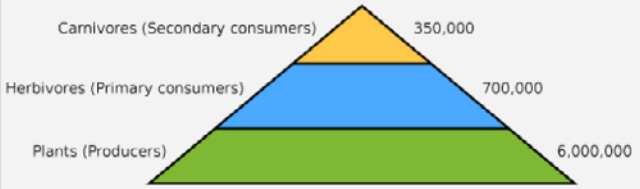
** NGSS Lead States. 2013. *Next Generation Science Standards: For States, By States*. Washington, DC: The National Academies Press.
+ Washington State 2013 K–12 Science Learning Standards adopting the Next Generation Science Standards (2013).

Instructional area 1: Life Sciences

Sub-area 1b: Ecosystems: Interactions, Energy, and Dynamics

	DCI+	SEP**	CCC**
Aligned PE: HS-LS2-4 Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.**	Cycles of Matter and Energy Transfer in Ecosystems	Using Mathematics Computational Thinking	Energy and Matter
NWEA learning statement: Describes available energy at different trophic levels in ecosystems, using models **Item RIT:** 225 **Item DOK:** 2	Cycles of Matter and Energy Transfer in Ecosystems	Developing and Using Models	Systems and System Models

The diagram shows the approximate number of organisms scientists counted in one acre of a grassland ecosystem.



Why are there more producers than consumers in the grassland?

A. Producers have more offspring than consumers.

B. Producer populations stay high because new plants grow when old plants are eaten.

C. Producers have more available energy and use less energy to stay alive than consumers.

D. Producer populations are larger because plants have more sources of food than consumers.

Narrative: This item provides evidence of students' ability to **interpret a food pyramid model to explain the different numbers of producers and consumers in this system**. Though students are demonstrating understanding of a **SEP** and a **CCC** that are different from the PE, the item does provide evidence of growth toward understanding the PE. This item is rated DOK 2 because students are demonstrating their understanding of the **roles of organisms in ecosystems** and how to interpret a **model**.

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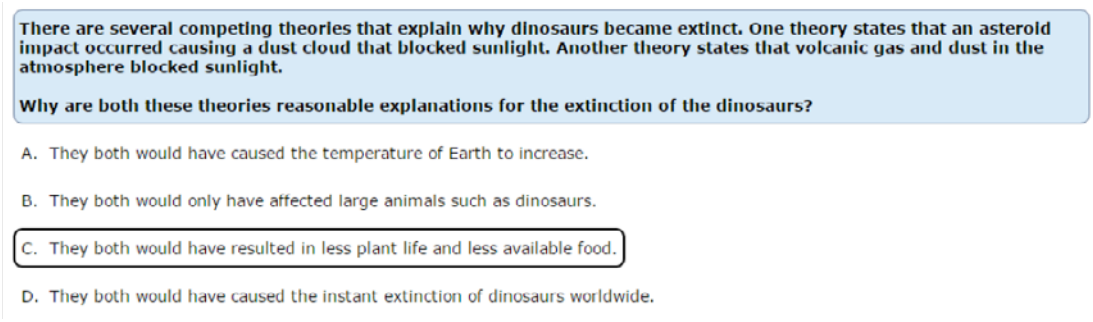
Instructional area 1: Life Sciences

Sub-area 1c: Heredity: Inheritance and Variations; Biological Evolution: Unity and Diversity

	DCI+	SEP**	CCC**
Aligned PE: HS-LS4-5 Evaluate the evidence supporting claims that changes in environmental conditions may result in: **1. Increases in the number of individuals of some species** **2. The emergence of new species over time** **3. The extinction of other species.****	**Adaptation**	**Engaging in Argument from Evidence**	**Cause and Effect**
NWEA learning statement: Relates extinction to environmental change **Item RIT:** 212 **Item DOK:** 2	**Adaptation**	None	**Cause and Effect**



There are several competing theories that explain why dinosaurs became extinct. One theory states that an asteroid impact occurred causing a dust cloud that blocked sunlight. Another theory states that volcanic gas and dust in the atmosphere blocked sunlight.

Why are both these theories reasonable explanations for the extinction of the dinosaurs?

A. They both would have caused the temperature of Earth to increase.

B. They both would only have affected large animals such as dinosaurs.

C. They both would have resulted in less plant life and less available food.

D. They both would have caused the instant extinction of dinosaurs worldwide.

Narrative: The item demonstrates students' understanding of the **relationship between environmental changes** and the **extinction of dinosaurs**. Notice this item does not provide evidence of students' abilities to engage in any **SEP**. This two-dimensional item is rated DOK 2 because students are demonstrating how **environmental changes affect organisms**.

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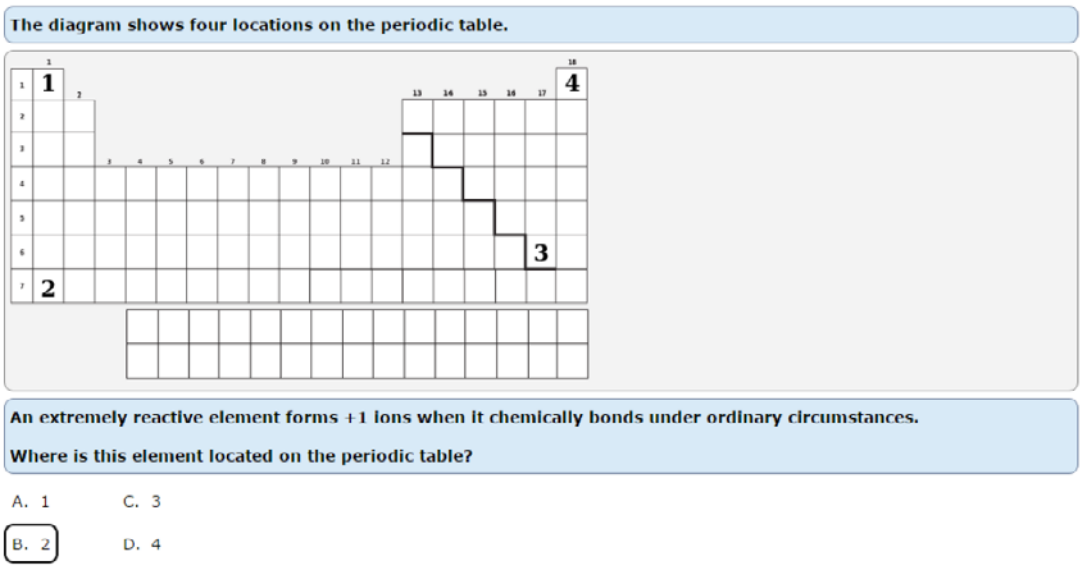
Instructional area 2: Physical Sciences

Sub-area 2a: Matter and Its Interactions

	DCI+	SEP**	CCC**
Aligned PE: HS-PS1-1 Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.**	Structure and Properties of Matter	Developing and Using Models	Patterns
NWEA learning statement: Uses the periodic table to predict patterns of properties of elements **Item RIT:** 237 **Item DOK:** 2	Structure and Properties of Matter	Developing and Using Models	Patterns



Narrative: The item provides evidence of students' ability to use **the properties of an element** to **locate its position in a model** according to **the patterns** used to construct the **periodic table**. This item provides understanding of the three dimensions of this high school PE. This item is rated DOK 2 because students use a **given model** instead of **constructing their own model**.

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Instructional area 2: Physical Sciences

Sub-area 2b: Motion and Stability: Forces and Interactions

	DCI+	SEP**	CCC**
Aligned PE: HS-PS2-4 Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.**	Types of Interactions	Using Mathematics Computational Thinking	Patterns
NWEA learning statement: Describes gravitational force on objects with models **Item RIT:** 232 **Item DOK:** 2	Types of Interactions	Developing and Using Models	None

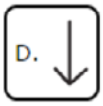
A student throws a ball as shown in the picture.

Which arrow represents the force exerted by gravity on the ball?

A. 

B. 

C. 

D. 

Narrative: This item provides evidence of students' growth in their understanding of how to **use force arrows** to describe the **force of gravity** on a ball. This item provides evidence of students' ability to **use a model**, and though a different **SEP** than the PE, it does gather useful growth information. The item is rated DOK 2 because students are **using a given model**, not constructing one.

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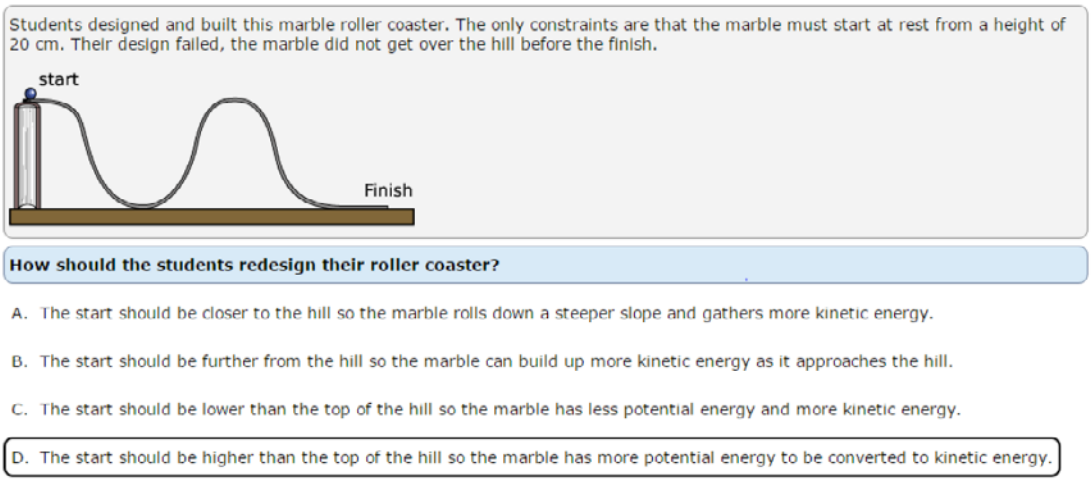
Instructional area 2: Physical Sciences

Sub-area 2c: Energy; Waves and their Applications in Technologies for Information Transfer

	DCI+	SEP**	CCC**
Aligned PEs: HS-PS3-3 Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.**	Definitions of Energy Energy in Chemical Process	Constructing Explanations and Designing Solutions	Energy and Matter
NWEA learning statement: Evaluates solutions to problems involving motion and energy **Item RIT:** 204 **Item DOK:** 2	Definitions of Energy Optimizing the Design Solution	Constructing Explanations and Designing Solutions	Energy and Matter



Narrative: This item provides evidence of students' growth in their understanding of optimizing a **solution to a problem** involving **energy and motion** using a **model**. Notice that this item aligns to both an Energy PE and an Engineering Design PE. This learning statement would appear in both the **energy forms** and **engineering solution optimizations** topics of the learning continuum reports, demonstrating how all engineering items are embedded in the disciplinary context of the items. This item is rated DOK 2 because students are applying a **disciplinary idea** to a common problem.

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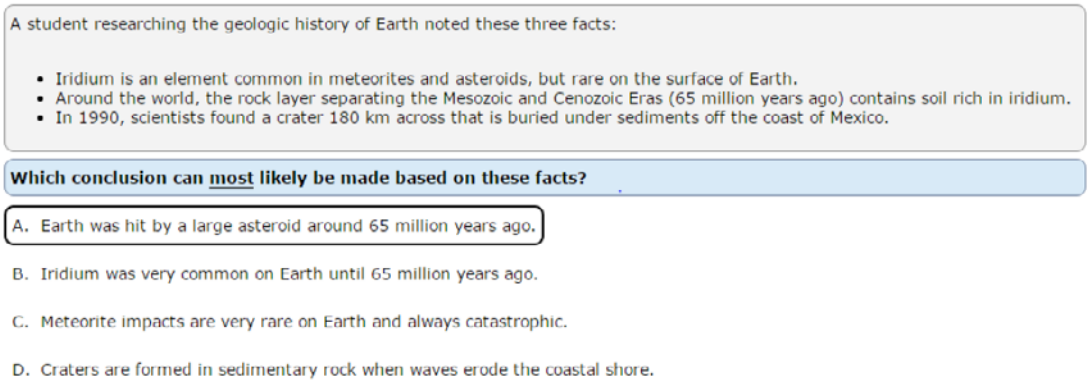
Instructional area 3: Earth and Space Sciences

Sub-area 3a: Earth's Place in the Universe

	DCI+	SEP**	CCC**
Aligned PE: HS-ESS1-6 Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.**	The History of Planet Earth	Constructing Explanations and Designing Solutions	Stability and Change
NWEA learning statement: Uses evidence to support claims about past collisions of space materials with Earth **Item RIT:** 217 **Item DOK:** 2	The History of Planet Earth	Constructing Explanations and Designing Solutions	Scale, Proportion, and Quantity



A student researching the geologic history of Earth noted these three facts:

- Iridium is an element common in meteorites and asteroids, but rare on the surface of Earth.
- Around the world, the rock layer separating the Mesozoic and Cenozoic Eras (65 million years ago) contains soil rich in iridium.
- In 1990, scientists found a crater 180 km across that is buried under sediments off the coast of Mexico.

Which conclusion can most likely be made based on these facts?

A. Earth was hit by a large asteroid around 65 million years ago.

B. Iridium was very common on Earth until 65 million years ago.

C. Meteorite impacts are very rare on Earth and always catastrophic.

D. Craters are formed in sedimentary rock when waves erode the coastal shore.

Narrative: This item provides evidence of students' growth in their understanding of how to **conclude from facts how Earth has changed from collisions with meteorites**. The item shows how common phrases like **"conclude from facts"** are consistent with the **SEP: Constructing Explanations**. This item is rated DOK 2 because students are not explaining their **reasoning or citing evidence from the facts presented**.

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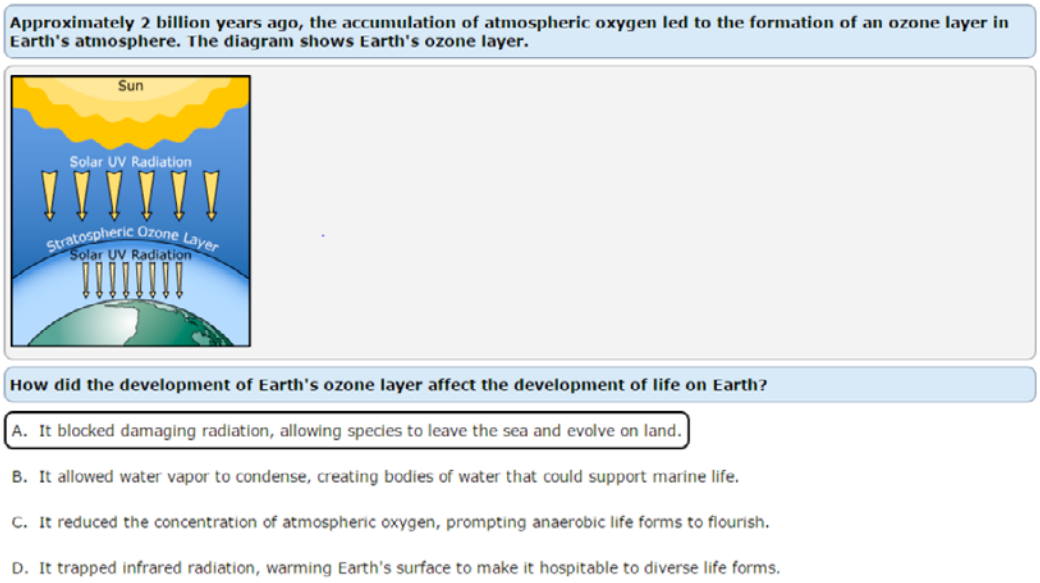
Instructional area 3: Earth and Space Sciences

Sub-area 3b: Earth's Systems

	DCI+	SEP**	CCC**
Aligned PE: HS-ESS2-7 Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.**	Weather and Climate Biogeology	Engaging in Argument from Evidence	Stability and Change
NWEA learning statement: Describes examples of **the coevolution of life and Earth's atmosphere** **Item RIT:** 217 **Item DOK:** 2	Weather and Climate Biogeology	None	Stability and Change



Narrative: This item provides evidence of students' growth in their ability to describe how the **formation of Earth's ozone layer allowed organisms to live on land**. This **coevolution** is an example of the **CCC: Stability and Change**. This two-dimensional item does not ask students to **engage in argumentation** or any other **SEP**. The 217 RIT indicates this is a difficult item for high school students.

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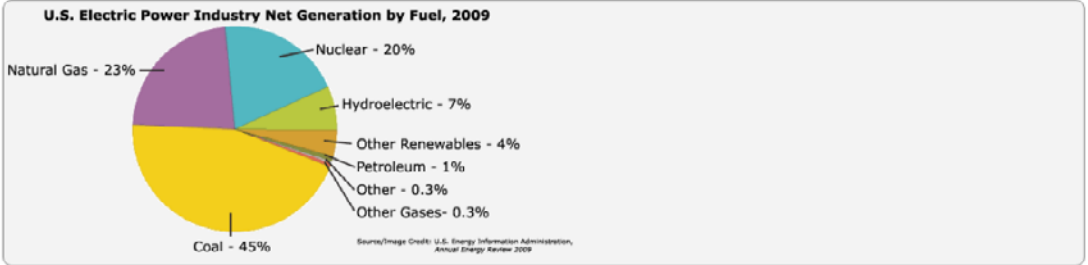
Instructional area 3: Earth and Space Sciences

Sub-area 3c: Earth and Human Activity

	DCI+	SEP**	CCC**
Aligned PE: HS-ESS3-4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.**	Human Impacts on Earth Systems	Constructing Explanations and Designing Solutions	Stability and Change
NWEA learning statement: Analyzes and interprets data to infer effects of human activity on ecosystems **Item RIT:** 238 **Item DOK:** 2	Human Impacts on Earth Systems Ecosystem Dynamics, Functioning, and Resilience	Analyzing and Interpreting Data	Cause and Effect

The chart shows how electricity was generated in 2009.



The battery in an electric car is running low. The owner of the car plugs it into a socket at an electric charging station. After the battery is charged, the owner drives home.

What is most likely the effect on the environment of driving an electric car?

A. It increases noise pollution.

B. It indirectly produces greenhouse gases.

C. It depletes renewable resources of energy.

D. It indirectly adds water vapor to Earth's systems.

Narrative: The item provides evidence of students' growth in their ability to **analyze data in a pie chart** **of the energy resources** used in the USA and **predict** the **environmental effect** of electric cars. Notice that this three-dimensional item aligns to a different **SEP** and **CCC** than the PE while providing evidence of growth in understanding the PE. The item is rated DOK 2 because students are not asked **to explain how the data supports** their **predicted environmental effects**.

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