5th Grade - Thematic Model - Bundle 1
Scale, Proportion, and Quantity

This is the first bundle of the Fifth Grade Thematic Model. Each bundle has connections to the other bundles in the course, as shown in the Course Flowchart.

Bundle 1 Question: This bundle is assembled to address the question "How big is the sun, and what is it made of?"

Summary

The bundle organizes performance expectations with a focus on helping students build an understanding of the crosscutting concept of scale, proportion, and quantity along with related disciplinary concepts. Instruction developed from this bundle should always maintain the three-dimensional nature of the standards, and is not limited to the practices and concepts directly linked with any of the bundle performance expectations.

Connections between bundle DCIs

The disciplinary core ideas in this bundle are linked through the concept of scale, proportion, and quantity. The ideas that: 1) measurements of a variety of properties can be used to identify materials (PS1.A as in 5-PS1-3), 2) the amount (weight) of matter is conserved when it changes form (PS1.A as in 5-PS1-2), and 3) the patterns caused by orbits of Earth around the sun and of the moon around Earth and the rotation of Earth about an axis such as the daily changes in the length and direction of shadows (ESS1.B as in 5-ESS1-2) connect through the idea that physical quantities can be measured and described. These ideas also connect to the concept that when two or more different substances are mixed, a new substance with different properties may be formed (PS1.B as in 5-PS1-4) as new substances could be identified by measuring different properties.

And the concepts that matter of any type can be subdivided into particles that are too small to see (PS1.A as in 5-PS1-1) and that the sun is a star that appears larger and brighter than other stars because it is closer (ESS1.A as in 5-ESS1-1) connect to each other and the rest of the bundle through the concept of scale.

The engineering design idea that different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints (ETS1.C as in 3-5-ETS1-3) could connect to multiple science concepts, such as that when two or more different substances are mixed, a new substance with different properties may be formed (PS1.B as in 5-PS1-4), and that the sun is a star that appears larger and brighter than other stars because it is closer (ESS1.A as in 5-ESS1-1). The first connection could be made through a challenge in which students test multiple different substances to find one with particular properties. The second could be made by having students test how well design solutions work for communicating how close an object is, using apparent size and scale.

Bundle Science and Engineering Practices

Instruction leading to this bundle of PEs will help students build toward proficiency in elements of the practices of developing and using models (5-PS1-1); planning and carrying out investigations (5-PS1-3, 5-PS1-4, and 3-5-ETS1-3); using mathematics and computational thinking (5-PS1-2); analyzing and interpreting data (5-ESS1-2); and engaging in argument from evidence (5-ESS1-1). Many other practice elements can be used in instruction.

Bundle Crosscutting Concepts

Instruction leading to this bundle of PEs will help students build toward proficiency in elements of the crosscutting concepts of Patterns (5-ESS1-2); Cause and Effect (5-PS1-4); and Scale, Proportion, and Quantity (5-PS1-1, 5-PS1-2, 5-PS1-3, and 5-ESS1-1). Many other crosscutting concepts elements can be used in instruction.

All instruction should be three-dimensional.

Performance Expectations 5-PS1-1 and 5-ESS1-2 are partially assessable	5-PS1-1. **Develop a model to describe that matter is made of particles too small to be seen.** [Clarification Statement: Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.] [*Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.*] 5-PS1-2. **Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.** [Clarification Statement: Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances.] [*Assessment Boundary: Assessment does not include distinguishing mass and weight.*] 5-PS1-3. **Make observations and measurements to identify materials based on their properties.** [Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property.] [*Assessment Boundary: Assessment does not include density or distinguishing mass and weight.*] 5-PS1-4. **Conduct an investigation to determine whether the mixing of two or more substances results in new substances.** 5-ESS1-1. **Support an argument that the apparent brightness of the sun and stars is due to their relative distances from the Earth.** [*Assessment Boundary: Assessment is limited to relative distances, not sizes, of stars. Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, stage).*] 5-ESS1-2. **Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.** [Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.] [*Assessment Boundary: Assessment does not include causes of seasons.*] 3-5-ETS1-3. **Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.**
Example Phenomena	Two objects of the same size appear to be different sizes when they are different distances from the viewer. Wind can move leaves.
Additional Practices Building to the PEs	**Asking Questions and Defining Problems** • Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. Students could *ask questions* [about what happens] ***when two or more different substances are mixed*** *and predict reasonable outcomes based on cause and effect relationships.* 5-PS1-4 **Developing and Using Models** • Develop and/or use models to describe and/or predict phenomena. Students could *use models to describe* [that] ***the amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish***. 5-PS1-2 **Planning and Carrying Out Investigations** • Evaluate appropriate methods and/or tools for collecting data. Students could *evaluate appropriate methods and tools for collecting data* [on the] ***different positions of the sun, moon, and stars at different times of the day, month, and year***. 5-ESS1-2

Additional Practices Building to the PEs (Continued)	**Analyzing and Interpreting Data** • Represent data in tables and/or various graphical displays (bar graphs, pictographs, and/or pie charts) to reveal patterns that indicate relationships. Students could *represent* ***measurements of a variety of properties*** [that] ***can be used to identify materials*** *in tables and various graphical displays to reveal patterns*. 5-PS1-3 **Mathematical and Computational Thinking** • Organize simple data sets to reveal patterns that suggest relationships. Students could *organize simple data sets* [of the] ***brightness of stars*** [and] ***their distance from Earth*** *to reveal patterns that suggest relationships,* [including that] ***the sun is a star that appears larger and brighter than other stars because it is closer***. 5-ESS1-1 **Constructing Explanations and Designing Solutions** • Use evidence (e.g., measurements, patterns) to construct or support an explanation or design a solution to a problem. Students could *use evidence to support an explanation* [that] ***when two or more different substances are mixed, a new substance with different properties may be formed***. 5-PS1-4 **Engaging in Argument from Evidence** • Respectfully provide and receive critiques from peers about a proposed procedure, explanation or model by citing relevant evidence and posing specific questions. Students could *respectfully provide critiques to peers about a model* [that describes that] ***matter of any type can be subdivided into particles that are too small to see*** *by citing relevant evidence and posing specific questions*. 5-PS1-1 **Obtaining, Evaluating, and Communicating Information** • Communicate scientific and/or technical information orally and/or in written formats, including various forms of media and may include tables, diagrams, and charts. Students could *communicate scientific information* [about] ***stars*** [and] ***their distance from Earth*** *orally and in written formats* [to describe that] ***the sun is a star that appears larger and brighter than other stars because it is closer***. 5-ESS1-1
Additional Crosscutting Concepts Building to the PEs	**Patterns** • Patterns of change can be used to make predictions Students could identify *patterns* [when] ***matter changes form*** *to predict* [that] ***the weight of the substances*** [will] ***not change***. 5-PS1-2 **Energy and Matter** • Matter flows and cycles can be tracked in terms of the weight of the substances before and after a process occurs. Students could describe that *matter flows and cycles can be tracked in terms of the weight of the substances* ***when two or more different substances are mixed*** [and] ***a new substance with different properties may be formed***. 5-PS1-4

Additional Crosscutting Concepts Building to the PEs (Continued)	**Stability and Change** • Change is measured in terms of differences over time and may occur at different rates. Students could investigate what happens ***when two or more different substances are mixed*** [to describe that] *change is measured in terms of differences over time and may occur at different rates*. 5-PS1-4
Additional Connections to Nature of Science	**Science Knowledge Is Based on Empirical Evidence** • Science uses tools and technologies to make accurate measurements and observations. Students could describe how they used *tools and technologies to make accurate measurements and observations* ***of a variety of properties*** [that] ***can be used to identify materials***. 5-PS1-3 **Science Is a Human Endeavor** • Science affects everyday life. Students could describe how *everyday life is affected* [by the knowledge that] ***when two or more different substances are mixed, a new substance with different properties may be formed***. 5-PS1-4

5-PS1-1 Matter and Its Interactions

Students who demonstrate understanding can:

5-PS1-1. **Develop a model to describe that matter is made of particles too small to be seen.** [Clarification Statement: Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.] [*Assessment Boundary: Assessment does not include the atomic-scale mechanism of evaporation and condensation or defining the unseen particles.*]

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 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. • Use models to describe phenomena.	**PS1.A: Structure and Properties of Matter** • Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing that gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects.	**Scale, Proportion, and Quantity** • Natural objects exist from the very small to the immensely large.

Observable features of the student performance by the end of the grade:			
1	Components of the model		
	a	Students develop a model to describe* a phenomenon that includes the idea that matter is made of particles too small to be seen. In the model, students identify the relevant components for the phenomenon, including:	
		i.	Bulk matter (macroscopic observable matter; e.g., as sugar, air, water).
		ii.	Particles of matter that are too small to be seen.
2	Relationships		
	a	In the model, students identify and describe* relevant relationships between components, including the relationships between:	
		i.	Bulk matter and tiny particles that cannot be seen (e.g., tiny particles of matter that cannot be seen make up bulk matter).
		ii.	The behavior of a collection of many tiny particles of matter and observable phenomena involving bulk matter (e.g., an expanding balloon, evaporating liquids, substances that dissolve in a solvent, effects of wind).
3	Connections		
	a	Students use the model to describe* how matter composed of tiny particles too small to be seen can account for observable phenomena (e.g., air inflating a basketball, ice melting into water).	

5-PS1-2 Matter and Its Interactions

Students who demonstrate understanding can:

5-PS1-2. **Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substances, the total weight of matter is conserved.** [Clarification Statement: Examples of reactions or changes could include phase changes, dissolving, and mixing that form new substances.] [*Assessment Boundary: Assessment does not include distinguishing mass and weight.*]

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

Using Mathematics and Computational Thinking

Mathematical and computational thinking in 3–5 builds on K–2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.

- Measure and graph quantities such as weight to address scientific and engineering questions and problems.

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish.

PS1.B: Chemical Reactions

- No matter what reaction or change in properties occurs, the total weight of the substances does not change. (Boundary: Mass and weight are not distinguished at this grade level.)

Crosscutting Concepts

Scale, Proportion, and Quantity

- Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.

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Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems

- Science assumes consistent patterns in natural systems.

Observable features of the student performance by the end of the grade:		
1	Representation	
	a	Students measure and graph the given quantities using standard units, including:
		i. The weight of substances before they are heated, cooled, or mixed.
		ii. The weight of substances, including any new substances produced by a reaction, after they are heated, cooled, or mixed.
2	Mathematical/computational analysis	
	a	Students measure and/or calculate the difference between the total weight of the substances (using standard units) before and after they are heated, cooled, and/or mixed.
	b	Students describe* the changes in properties they observe during and/or after heating, cooling, or mixing substances.
	c	Students use their measurements and calculations to describe* that the total weights of the substances did not change, regardless of the reaction or changes in properties that were observed.
	d	Students use measurements and descriptions* of weight, as well as the assumption of consistent patterns in natural systems, to describe* evidence to address scientific questions about the conservation of the amount of matter, including the idea that the total weight of matter is conserved after heating, cooling, or mixing substances.

5-PS1-3 Matter and Its Interactions

Students who demonstrate understanding can:

5-PS1-3. **Make observations and measurements to identify materials based on their properties.** [Clarification Statement: Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids. Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility; density is not intended as an identifiable property.] [*Assessment Boundary: Assessment does not include density or distinguishing mass and weight.*]

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

Planning and Carrying Out Investigations
Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

- Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.

Disciplinary Core Ideas

PS1.A: Structure and Properties of Matter

- Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.)

Crosscutting Concepts

Scale, Proportion, and Quantity

- Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.

Observable features of the student performance by the end of the grade:			
1	Identifying the phenomenon under investigation		
	a	From the given investigation plan, students identify the phenomenon under investigation, which includes the observable and measurable properties of materials.	
	b	Students identify the purpose of the investigation, which includes collecting data to serve as the basis for evidence for an explanation about the idea that materials can be identified based on their observable and measurable properties.	
2	Identifying the evidence to address the purpose of the investigation		
	a	From the given investigation plan, students describe* the evidence from data (e.g., qualitative observations and measurements) that will be collected, including:	
		i.	Properties of materials that can be used to identify those materials (e.g., color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility).
	b	Students describe* how the observations and measurements will provide the data necessary to address the purpose of the investigation.	
3	Planning the investigation		
	a	From the given plan investigation plan, students describe* how the data will be collected. Examples could include:	
		i.	Quantitative measures of properties, in standard units (e.g., grams, liters).
		ii.	Observations of properties such as color, conductivity, and reflectivity.
		iii.	Determination of conductors vs. nonconductors and magnetic vs. nonmagnetic materials.
	b	Students describe* how the observations and measurements they make will allow them to identify materials based on their properties.	
4	Collecting the data		
	a	Students collect and record data, according to the given investigation plan.	

5-PS1-4 Matter and Its Interactions

Students who demonstrate understanding can:

5-PS1-4. **Conduct an investigation to determine whether the mixing of two or more substances results in new substances.**

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
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. • Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.	**PS1.B: Chemical Reactions** • When two or more different substances are mixed, a new substance with different properties may be formed.	**Cause and Effect** • Cause and effect relationships are routinely identified and used to explain change.

Observable features of the student performance by the end of the grade:			
1	Identifying the phenomenon under investigation		
	a	From the given investigation plan, students describe* the phenomenon under investigation, which includes the mixing of two or more substances.	
	b	Students identify the purpose of the investigation, which includes providing evidence for whether new substances are formed by mixing two or more substances, based on the properties of the resulting substance.	
2	Identifying the evidence to address the purpose of the investigation		
	a	From the given investigation plan, students describe* the evidence from data that will be collected, including:	
		i.	Quantitative (e.g., weight) and qualitative properties (e.g., state of matter, color, texture, odor) of the substances to be mixed.
		ii.	Quantitative and qualitative properties of the resulting substances.
	b	Students describe* how the collected data can serve as evidence for whether the mixing of the two or more tested substances results in one or more new substances.	
3	Planning the investigation		
	a	From the given investigation plan, students describe* how the data will be collected, including:	
		i.	How quantitative and qualitative properties of the two or more substances to be mixed will be determined and measured.
		ii.	How quantitative and qualitative properties of the substances that resulted from the mixture of the two or more substances will be determined and measured.
		iii.	Number of trials for the investigation.
		iv.	How variables will be controlled to ensure a fair test (e.g., the temperature at which the substances are mixed, the number of substances mixed together in each trial).
4	Collecting the data		
	a	According to the investigation plan, students collaboratively collect and record data, including data about the substances before and after mixing.	

5-ESS1-1 Earth's Place in the Universe

Students who demonstrate understanding can:

5-ESS1-1. **Support an argument that the apparent brightness of the sun and stars is due to their relative distances from the Earth.** [*Assessment Boundary: Assessment is limited to relative distances, not sizes, of stars. Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, stage).*]

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
Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). • Support an argument with evidence, data, or a model.	**ESS1.A: The Universe and its Stars** • The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth.	**Scale, Proportion, and Quantity** • Natural objects exist from the very small to the immensely large.

Observable features of the student performance by the end of the grade:			
1	Supported claims		
	a	Students identify a given claim to be supported about a given phenomenon. The claim includes the idea that the apparent brightness of the sun and stars is due to their relative distances from Earth.	
2	Identifying scientific evidence		
	a	Students describe* the evidence, data, and/or models that support the claim, including:	
		i.	The sun and other stars are natural bodies in the sky that give off their own light.
		ii.	The apparent brightness of a variety of stars, including the sun.
		iii.	A luminous object close to a person appears much brighter and larger than a similar object that is very far away from a person (e.g., nearby streetlights appear bigger and brighter than distant streetlights).
		iv.	The relative distance of the sun and stars from Earth (e.g., although the sun and other stars are all far from the Earth, the stars are very much farther away; the sun is much closer to Earth than other stars).
3	Evaluating and critiquing evidence		
	a	Students evaluate the evidence to determine whether it is relevant to supporting the claim, and sufficient to describe* the relationship between apparent size and apparent brightness of the sun and other stars and their relative distances from Earth.	
	b	Students determine whether additional evidence is needed to support the claim.	
4	Reasoning and synthesis		
	a	Students use reasoning to connect the relevant and appropriate evidence to the claim with argumentation. Students describe* a chain of reasoning that includes:	
		i.	Because stars are defined as natural bodies that give off their own light, the sun is a star.
		ii.	The sun is many times larger than Earth but appears small because it is very far away.
		iii.	Even though the sun is very far from Earth, it is much closer than other stars.
		iv.	Because the sun is closer to Earth than any other star, it appears much larger and brighter than any other star in the sky.
		v.	Because objects appear smaller and dimmer the farther they are from the viewer, other stars, although immensely large compared to the Earth, seem much smaller and dimmer because they are so far away.
		vi.	Although stars are immensely large compared to Earth, they appear small and dim because they are so far away.
		vii.	Similar stars vary in apparent brightness, indicating that they vary in distance from Earth.

5-ESS1-2 Earth's Place in the Universe

Students who demonstrate understanding can:

5-ESS1-2. **Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.** [Clarification Statement: Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.] [*Assessment Boundary: Assessment does not include causes of seasons.*]

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
Analyzing and Interpreting Data Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. • Represent data in graphical displays (bar graphs, pictographs and/or pie charts) to reveal patterns that indicate relationships.	**ESS1.B: Earth and the Solar System** • The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year.	**Patterns** • Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena.

Observable features of the student performance by the end of the grade:			
1	Organizing data		
	a	Using graphical displays (e.g., bar graphs, pictographs), students organize data pertaining to daily and seasonal changes caused by the Earth's rotation and orbit around the sun. Students organize data that include:	
		i.	The length and direction of shadows observed several times during one day.
		ii.	The duration of daylight throughout the year, as determined by sunrise and sunset times.
		iii.	Presence or absence of selected stars and/or groups of stars that are visible in the night sky at different times of the year.
2	Identifying relationships		
	a	Students use the organized data to find and describe* relationships within the datasets, including:	
		i.	The apparent motion of the sun from east to west results in patterns of changes in length and direction of shadows throughout a day as Earth rotates on its axis.
		ii.	The length of the day gradually changes throughout the year as Earth orbits the sun, with longer days in the summer and shorter days in the winter.
		iii.	Some stars and/or groups of stars (i.e., constellations) can be seen in the sky all year, while others appear only at certain times of the year.
	b	Students use the organized data to find and describe* relationships among the datasets, including:	
		i.	Similarities and differences in the timing of observable changes in shadows, daylight, and the appearance of stars show that events occur at different rates (e.g., Earth rotates on its axis once a day, while its orbit around the sun takes a full year).

3-5-ETS1-3 Engineering Design

Students who demonstrate understanding can:

3-5-ETS1-3. **Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.**

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
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions. • Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.	**ETS1.B: Developing Possible Solutions** • Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. **ETS1.C: Optimizing the Design Solution** • Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.	

Observable features of the student performance by the end of the grade:			
1	Identifying the purpose of the investigation		
	a	Students describe* the purpose of the investigation, which includes finding possible failure points or difficulties to identify aspects of a model or prototype that can be improved.	
2	Identifying the evidence to be address the purpose of the investigation		
	a	Students describe* the evidence to be collected, including:	
		i.	How well the model/prototype performs against the given criteria and constraints.
		ii.	Specific aspects of the prototype or model that do not meet one or more of the criteria or constraints (i.e., failure points or difficulties).
		iii.	Aspects of the model/prototype that can be improved to better meet the criteria and constraints.
	b	Students describe* how the evidence is relevant to the purpose of the investigation.	
3	Planning the investigation		
	a	Students create a plan for the investigation that describes* different tests for each aspect of the criteria and constraints. For each aspect, students describe*:	
		i.	The specific criterion or constraint to be used.
		ii.	What is to be changed in each trial (the independent variable).
		iii.	The outcome (dependent variable) that will be measured to determine success.
		iv.	What tools and methods are to be used for collecting data.
		v.	What is to be kept the same from trial to trial to ensure a fair test.
4	Collecting the data		
	a	Students carry out the investigation, collecting and recording data according to the developed plan.	