4th Grade – Thematic Model - Bundle 2
Transfer of Energy and Information

This is the second bundle of the 4th Grade Thematic Model. Each bundle has connections to the other bundles in the course, as shown in the Course Flowchart.

Bundle 2 Question: This bundle is assembled to address the question "what evidence of patterns and systems do we see in organism structure and how those structures function in information transfer?"

Summary

The bundle organizes performance expectations with a focus on helping students build understanding of systems related to the transfer of energy and information. Instruction developed from this bundle should always maintain the three-dimensional nature of the standards, but recognize that instruction is not limited to the practices and concepts directly linked with any of the bundle performance expectations.

Connections between bundle DCIs

The idea that an object can be seen when light reflected from its surface enters the eyes (PS4.B as in 4-PS4-2) connects to the idea that different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain (LS1.D as in 4-LS1-2). Processing information also connects to the idea that information can be transferred: digitized information can be transmitted over long distances without significant degradation (PS4.C as in 4-PS4-3). The idea that light can be seen and processed connects to the concepts that light transfers energy from place to place, and that energy is present whenever there are moving objects, sound, light, or heat (PS3.A and PS3.B as in 4-PS3-2).

The engineering design idea that, at whatever stage of the design process, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs (ETS1.B as in 3-5-ETS1-2) could be applied to multiple science ideas, such as that energy can be moved from place to place by moving objects or through sound, light, or electric currents (PS3.A as in 4-PS3-2) and that different sense receptors are specialized for particular kinds of information (LS1.D as in 4-LS1-2). Connections could be made through engineering design tasks, such as by having students design a solution to a problem through the use of energy transfer, and by having students design a solution to a problem by mimicking the function of a sense receptor. In both cases, students should learn the importance of communicating about and collaborating on their design ideas throughout the process, as shared ideas can lead to improved designs.

Bundle Science and Engineering Practices

Instruction leading to this bundle of PEs will help students build toward proficiency in elements of the practices of planning and carrying out investigations (4-PS3-2), developing and using models (4-PS4-2 and 4-LS1-2), constructing explanations and designing solutions (4-PS4-3 and 3-5-ETS1-2), and engaging in argument from evidence (4-LS1-1). 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 (4-PS4-3), Cause and Effect (4-PS4-2), Systems and System Models (4-LS1-1 and 4-LS1-2), and Energy and Matter (4-PS3-2). Many other crosscutting concepts elements can be used in instruction.

All instruction should be three-dimensional.

Performance Expectations	4-PS3-2 **Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.** [*Assessment Boundary: Assessment does not include quantitative measurements of energy.*] 4-PS4-2 **Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.** [*Assessment Boundary: Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.*] 4-PS4-3 **Generate and compare multiple solutions that use patterns to transfer information**. [Clarification Statement: Examples of solutions could include drums sending coded information through sound waves, using a grid of 1's and 0's representing black and white to send information about a picture, and using Morse code to send text.] 4-LS1-1 **Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.** [Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.] [*Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.*] 4-LS1-2 **Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.** [Clarification Statement: Emphasis is on systems of information transfer.] [*Assessment Boundary: Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.*] 3-5 ETS1-2 **Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.**
Example Phenomena	We can talk on the phone to someone across the country. A flower has brightly colored petals.
Additional Practices Building to the PEs	**Asking Questions and Defining Problems** • Identify scientific (testable) and non-scientific (non-testable) questions. Students could [brainstorm questions about why] ***an object can be seen*** *and* [then] *identify* [which questions are] *scientific (testable) and* [which are] *non-scientific (non-testable) questions*. 4-LS1-1 **Developing and Using Models** • Develop a model using an analogy, example, or abstract representation to describe a scientific principle or design solution. Students could *develop a model using an analogy to describe* [that] ***high-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa***. 4-PS4-3 **Planning and Carrying Out Investigations** • Evaluate appropriate methods and/or tools for collecting data. Students could *evaluate appropriate methods and/or tools for collecting data* [on] ***plants' and animals' internal and external structures*** [and the] ***various functions*** [they] ***serve in growth, survival, behavior, and reproduction.*** 4-LS1-1 **Analyzing and Interpreting Data** • Analyze and interpret data to make sense of phenomena, using logical reasoning, mathematics, and/or computation. Students could *analyze and interpret data, using logical reasoning, to make sense of a phenomenon* [related to the idea that] ***energy moves from place to place by moving objects or through electric currents***. 4-PS3-2

Additional Practices Building to the PEs (Continued)	**Using Mathematical and Computational Thinking** • Decide if qualitative or quantitative data are best to determine whether a proposed object or tool meets criteria for success. Students could *decide if qualitative or quantitative data are best to determine whether a proposed object* [that is intended to mimic certain] ***external structures of plants*** *meets criteria for success*. 4-LS1-1 **Constructing Explanations and Designing Solutions** • Identify the evidence that supports particular points in an explanation. Students could *identify the evidence that supports particular points in an explanation* [that] ***light transfers energy from place to place***. 4-PS3-2 **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 proposed model* [that describes that] ***an object can be seen when light reflected from its surface enters the eyes*** *by citing relevant evidence and posing specific questions*. 4-PS4-2 **Obtaining, Evaluating, and Communicating Information** • Communicate scientific and/or technical information orally and/or in written formats, including various forms of media as well as tables, diagrams, and charts. Students could *communicate scientific information through various forms of media* [about] ***different sense receptors*** [that] ***are specialized for particular kinds of information***. 4-LS1-2
Additional Crosscutting Concepts Building to the PEs	**Cause and Effect** • Cause and effect relationships are routinely identified, tested, and used to explain change. Students could describe examples of *cause and effect relationships*—[like the relationship between] ***animals' perceptions and their actions***—[that are] *are routinely identified, tested, and used to explain change*. 4-LS1-2 **Systems and Systems Models** • A system can be described in terms of its components and their interactions. Students could describe the ***light reflected from*** [the] ***surface*** [of] ***an object that enters the eyes*** [as] *a system* [and] *describe the components interactions* [within that system]. 4-PS4-2 **Stability and Change** • Change is measured in terms of differences over time and may occur at different rates. Students could describe how *change is measured in terms of differences over time and may occur at different rates*, [using the collision of objects, which] ***transfer energy from one object to another thereby changing their motion***, as an example. 4-PS3-2

Additional Connections to Nature of Science	**Science Is a Way of Knowing** • Science is a way of knowing that is used by many people. Students could describe that *science is a way of knowing* [by describing how they used science to know that] ***an object can be seen when light reflected from its surface enters the eyes***. 4-PS4-2 **Influence of Science, Engineering, and Technology on Society and the Natural World** • Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands. Students could describe how engineers improve existing technologies or develop new ones [that can] ***transmit digitized information over long distances without significant degradation [and that] can receive and decode information—convert it from digitized form to voice—and vice versa*** to increase their benefits, to decrease known risks, and to meet societal demands. 4-PS4-3

4-PS3-2 Energy

Students who demonstrate understanding can:

4-PS3-2. **Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.** [*Assessment Boundary: Assessment does not include quantitative measurements 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

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 to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.

Disciplinary Core Ideas

PS3.A: Definitions of Energy

- Energy can be moved from place to place by moving objects or through sound, light, or electric currents.

PS3.B: Conservation of Energy and Energy Transfer

- Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced.
- Light also transfers energy from place to place.
- Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy.

Crosscutting Concepts

Energy and Matter

- Energy can be transferred in various ways and between objects.

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 following ideas:
		i. The transfer of energy, including:
		1. Collisions between objects.
		2. Light traveling from one place to another.
		3. Electric currents producing motion, sound, heat, or light.
		4. Sound traveling from one place to another.
		5. Heat passing from one object to another.
		6. Motion, sound, heat, and light causing a different type of energy to be observed after an interaction (e.g., in a collision between two objects, one object may slow down or stop, the other object may speed up, and the objects and surrounding air may be heated; a specific sound may cause the movement of an object; the energy associated with the motion of an object, via an electrical current, may be used to turn on a light).
	b	Students describe* the purpose of the investigation, which includes providing evidence for an explanation of the phenomenon, including the idea that energy can be transferred from place to place by:
		i. Moving objects.

		ii. Sound.
		iii. Light.
		iv. Heat.
		v. Electric currents.
2	Identifying the evidence to address the purpose of the investigation	
	a	From the given investigation plan, students describe* the data to be collected that will serve as the basis for evidence, including:
		i. The motion and collision of objects before and after an interaction (e.g., when a given object is moving fast, it can move another object farther than when the same object is moving more slowly).
		ii. The relative presence of sound, light, or heat (including in the surrounding air) before and after an interaction (e.g. shining a light on an object can increase the temperature of the object; a sound can move an object).
		iii. The presence of electric currents flowing through wires causally linking one form of energy output (e.g., a moving object) to another form of energy output (e.g., another moving object; turning on a light bulb).
	b	Students describe* how their observations will address the purpose of the investigation, including how the observations will provide evidence that energy, in the form of light, sound, heat, and motion, can be transferred from place to place by sound, light, heat, or electric currents (e.g., in a system in which the motion of an object generates an observable electrical current to turn on a light, energy (from the motion of an object) must be transferred to another place (energy in the form of the light bulb) via the electrical current, because the motion doesn't cause the light bulb to light up if the wire is not completing a circuit between them; when a light is directed at an object, energy (in the form of light) must be transferred from the source of the light to its destination and can be observed in the form of heat, because if the light is blocked, the object isn't warmed.
3	Planning the investigation	
	a	From the given investigation plan, students identify and describe* how the data will be observed and recorded, including the tools and methods for collecting data on:
		i. The motion and collision of objects, including any sound or heat producing the motion/collision, or produced by the motion/collision.
		ii. The presence of energy in the form of sound, light, or heat in one place as a result of sound, light, or heat in a different place.
		iii. The presence of electric currents in wires and the presence of energy (in the form of sound, light, heat, or motion resulting from the flow of electric currents through a device).
	b	Students describe* the number of trials, controlled variables, and experimental set up.
4	Collecting the data	
	a	Students make and record observations according to the given investigation plan to provide evidence that:
		i. Energy is present whenever there are moving objects, sound, light, or heat.
		ii. That energy has been transferred from place to place (e.g., a bulb in a circuit is not lit until a switch is closed and it lights, indicating that energy is transferred through electric current in a wire to light the bulb; a stationary ball is struck by a moving ball, causing the stationary ball to move and the moving ball to slow down, indicating that energy has been transferred from the moving ball to the stationary one).

4-PS4-2 Waves and Their Applications in Technologies for Information Transfer

Students who demonstrate understanding can:

4-PS4-2. **Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.** [*Assessment Boundary: Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.*]

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. • Develop a model to describe phenomena.	**PS4.B: Electromagnetic Radiation** • An object can be seen when light reflected from its surface enters the eyes.	**Cause and Effect** • Cause and effect relationships are routinely identified.

Observable features of the student performance by the end of the grade:			
1	Components of the model		
	a	Students develop a model to make sense of a phenomenon involving the relationship between light reflection and visibility of objects. In the model, students identify the relevant components, including:	
		i.	Light (including the light source).
		ii.	Objects.
		iii.	The path that light follows.
		iv.	The eye.
2	Relationships		
	a	Students identify and describe* causal relationships between the components, including:	
		i.	Light enters the eye, allowing objects to be seen.
		ii.	Light reflects off of objects, and then can travel and enter the eye.
		iii.	Objects can be seen only if light follows a path between a light source, the object, and the eye.
3	Connections		
	a	Students use the model to describe* that in order to see objects that do not produce their own light, light must reflect off the object and into the eye.	
	b	Students use the model to describe* the effects of the following on seeing an object:	
		i.	Removing, blocking, or changing the light source (e.g., a dimmer light).
		ii.	Closing the eye.
		iii.	Changing the path of the light (e.g., using mirrors to direct the path of light to allow the visualization of a previously unseen object or to change the position in which the object can be seen, using an opaque or translucent barrier between 1) the light source and the object or 2) the object and the eye to change the path light follows and the visualization of the object).

4-PS4-3 Waves and Their Applications in Technologies for Information Transfer

Students who demonstrate understanding can:

4-PS4-3. **Generate and compare multiple solutions that use patterns to transfer information.*** [Clarification Statement: Examples of solutions could include drums sending coded information through sound waves, using a grid of 1's and 0's representing black and white to send information about a picture, and using Morse code to send text.]

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

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.

- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution.

Disciplinary Core Ideas

PS4.C: Information Technologies and Instrumentation

- Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa.

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. *(secondary)*

Crosscutting Concepts

Patterns

- Similarities and differences in patterns can be used to sort and classify designed products.

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Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology

- Knowledge of relevant scientific concepts and research findings is important in engineering.

Observable features of the student performance by the end of the grade:		
1	Using scientific knowledge to generate design solutions	
	a	Students generate at least two design solutions, for a given problem, that use patterns to transmit a given piece of information (e.g., picture, message). Students describe* how the design solution is based on:
		i. Knowledge of digitized information transfer (e.g., information can be converted from a sound wave into a digital signal such as patterns of 1s and 0s and vice versa; visual or verbal messages can be encoded in patterns of flashes of light to be decoded by someone else across the room).
		ii. Ways that high-tech devices convert and transmit information (e.g., cell phones convert sound waves into digital signals, so they can be transmitted long distances, and then converted back into sound waves; a picture or message can be encoded using light signals to transmit the information over a long distance).
2	Describing* criteria and constraints, including quantification when appropriate	
	a	Students describe* the given criteria for the design solutions, including the accuracy of the final transmitted information and that digitized information (patterns) transfer is used.
	b	Students describe* the given constraints of the design solutions, including:
		i. The distance over which information is transmitted.
		ii. Safety considerations.
		iii. Materials available.
3	Evaluating potential solutions	
	a	Students compare the proposed solutions based on how well each meets the criteria and constraints.
	b	Students identify similarities and differences in the types of patterns used in the solutions to determine whether some ways of transmitting information are more effective than others at addressing the problem.

4-LS1-1 From Molecules to Organisms: Structures and Processes

Students who demonstrate understanding can:

4-LS1-1. **Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.** [Clarification Statement: Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.] [*Assessment Boundary: Assessment is limited to macroscopic structures within plant and animal systems.*]

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 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).

- Construct an argument with evidence, data, and/or a model.

Disciplinary Core Ideas

LS1.A: Structure and Function

- Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.

Crosscutting Concepts

Systems and System Models

- A system can be described in terms of its components and their interactions.

Observable features of the student performance by the end of the grade:			
1	Supported claims		
	a	Students make a claim to be supported about a phenomenon. In the claim, students include the idea that plants and animals have internal and external structures that function together as part of a system to support survival, growth, behavior, and reproduction.	
2	Identifying scientific evidence		
	a	Students describe* the given evidence, including:	
		i.	The internal and external structures of selected plants and animals.
		ii.	The primary functions of those structures
3	Evaluating and critiquing evidence		
	a	Students determine the strengths and weaknesses of the evidence, including whether the evidence is relevant and sufficient to support a claim about the role of internal and external structures of plants and animals in supporting survival, growth, behavior, and/or reproduction.	
4	Reasoning and synthesis		
	a	Students use reasoning to connect the relevant and appropriate evidence and construct an argument that includes the idea that plants and animals have structures that, together, support survival, growth, behavior, and/or reproduction. Students describe* a chain of reasoning that includes:	
		i.	Internal and external structures serve specific functions within plants and animals (e.g., the heart pumps blood to the body, thorns discourage predators).
		ii.	The functions of internal and external structures can support survival, growth, behavior, and/or reproduction in plants and animals (e.g., the heart pumps blood throughout the body, which allows the entire body access to oxygen and nutrients; thorns prevent predation, which allows the plant to grow and reproduce).
		iii.	Different structures work together as part of a system to support survival, growth, behavior, and/or reproduction (e.g., the heart works with the lungs to carry oxygenated blood throughout the system; thorns protect the plant, allowing reproduction via stamens and pollen to occur).

4-LS1-2 From Molecules to Organisms: Structures and Processes

Students who demonstrate understanding can:

4-LS1-2. **Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.** [Clarification Statement: Emphasis is on systems of information transfer.] [*Assessment Boundary: Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.*]

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 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 a model to test interactions concerning the functioning of a natural system.

Disciplinary Core Ideas

LS1.D: Information Processing

- Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions.

Crosscutting Concepts

Systems and System Models

- A system can be described in terms of its components and their interactions.

Observable features of the student performance by the end of the grade:		
1	Components of the model	
	a	From a given model, students identify and describe* the relevant components for testing interactions concerning the functioning of a given natural system, including:
		i. Different types of information about the surroundings (e.g., sound, light, odor, temperature).
		ii. Sense receptors able to detect different types of information from the environment.
		iii. Brain.
		iv. Animals' actions.
2	Relationships	
	a	Students describe* the relationships between components in the model, including:
		i. Different types of sense receptors detect specific types of information within the environment.
		ii. Sense receptors send information about the surroundings to the brain.
		iii. Information that is transmitted to the brain by sense receptors can be processed immediately as perception of the environment and/or stored as memories.
		iv. Immediate perceptions or memories processed by the brain influence an animal's action or responses to features in the environment.
3	Connections	
	a	Students use the model to describe* that:
		i. Information in the environment interacts with animal behavioral output via interactions mediated by the brain.
		ii. Different types of sensory information are relayed to the brain via different sensory receptors, allowing experiences to be perceived, stored as memories, and influence behavior (e.g., an animal sees a brown, rotten fruit and smells a bad odor — this sensory information allows the animal to use information about other fruits that appear to be rotting to make decisions about what to eat; an animal sees a red fruit and a green fruit — after eating them both, the animal learns that the red fruit is sweet and the green fruit is bitter and then uses this sensory information, perceived and stored as memories, to guide fruit selection next time).
		iii. Sensory input, the brain, and behavioral output are all parts of a system that allow animals to engage in appropriate behaviors.
	b	Students use the model to test interactions involving sensory perception and its influence on animal behavior within a natural system, including interactions between:
		i. Information in the environment.

		ii.	Different types of sense receptors.
		iii.	Perception and memory of sensory information.
		iv.	Animal behavior.

3-5-ETS1-2 Engineering Design

Students who demonstrate understanding can:

3-5-ETS1-2. **Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.**

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

Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.

- Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem.

Disciplinary Core Ideas

ETS1.B: Developing Possible Solutions

- Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions.
- At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.

Crosscutting Concepts

Influence of Science, Engineering, and Technology on Society and the Natural World

- Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.

Observable features of the student performance by the end of the grade:		
1	Using scientific knowledge to generate design solutions	
	a	Students use grade-appropriate information from research about a given problem, including the causes and effects of the problem and relevant scientific information.
	b	Students generate at least two possible solutions to the problem based on scientific information and understanding of the problem.
	c	Students specify how each design solution solves the problem.
	d	Students share ideas and findings with others about design solutions to generate a variety of possible solutions.
	e	Students describe* the necessary steps for designing a solution to a problem, including conducting research and communicating with others throughout the design process to improve the design [note: emphasis is on what is necessary for designing solutions, not on a step-wise process].
2	Describing* criteria and constraints, including quantification when appropriate	
	a	Students describe*:
		i. The given criteria (required features) and constraints (limits) for the solutions, including increasing benefits, decreasing risks/costs, and meeting societal demands as appropriate.
		ii. How the criteria and constraints will be used to generate and test the design solutions.
3	Evaluating potential solutions	
	a	Students test each solution under a range of likely conditions and gather data to determine how well the solutions meet the criteria and constraints of the problem.
	b	Students use the collected data to compare solutions based on how well each solution meets the criteria and constraints of the problem.