

Concepts and Processes

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Subject: Concepts and Processes

Goal Strand: Tech Design, Sci Inq: Ques, Hypothesizing, Design

RIT Score Range: Below 171

Skills and Concepts to Develop Below 171	Skills and Concepts to Introduce 171 - 180
Hypothesizing and Predicting	Hypothesizing and Predicting
	<ul style="list-style-type: none"> Forms hypotheses that are based on real-life experience
Asking Questions	Asking Questions
	<ul style="list-style-type: none"> Asks questions that define the problem to be investigated, and which will allow relevant data or information to be collected
Classifying	Classifying
	<ul style="list-style-type: none"> Sorts objects by a given characteristic* Sorts living and non-living things using different characteristics*
Tools and Technological Design	Tools and Technological Design
Models and Systems	Models and Systems
<ul style="list-style-type: none"> Recognizes examples of systems (term not used) and their parts* 	<ul style="list-style-type: none"> Describes ways in which things can change Describes variables that cause change* Identifies qualitative change in systems, given the conditions that occur before, during, and after an event* Predicts what comes next in sequences of objects or events Describes the sequence of elements within a pattern* Determines causes for a given effect Predicts effects of a particular action Describes the part that is missing from a diagram of a real-life system* Selects the part that will turn a specific collection of components into a system* Describes the component(s) of a given system that perform(s) a given role* Orders objects and events
<i>New Vocabulary: none</i>	<i>New Vocabulary: after, before, cause, change, design, effect, explain, gather, information, interaction</i>
<i>New Signs and Symbols: none</i>	<i>New Signs and Symbols: ¢ cent sign</i>

Subject: Concepts and Processes

Goal Strand: Tech Design, Sci Inq: Ques, Hypothesizing, Design

RIT Score Range: 171 - 180

Skills and Concepts to Enhance Below 171	Skills and Concepts to Develop 171 - 180	Skills and Concepts to Introduce 181 - 190
Hypothesizing and Predicting	Hypothesizing and Predicting	Hypothesizing and Predicting
	<ul style="list-style-type: none"> • Forms hypotheses that are based on real-life experience 	
Asking Questions	Asking Questions	Asking Questions
	<ul style="list-style-type: none"> • Asks questions that define the problem to be investigated, and which will allow relevant data or information to be collected 	<ul style="list-style-type: none"> • Asks questions that define the problem to be investigated, and which will allow relevant data or information to be collected
Classifying	Classifying	Classifying
	<ul style="list-style-type: none"> • Sorts objects by a given characteristic* • Sorts living and non-living things using different characteristics* 	<ul style="list-style-type: none"> • Sorts objects according to common characteristics • Sorts objects by a given characteristic*
Tools and Technological Design	Tools and Technological Design	Tools and Technological Design
		<ul style="list-style-type: none"> • Recognizes that the purpose of scientific inquiry is to better understand the natural world
Models and Systems	Models and Systems	Models and Systems
<ul style="list-style-type: none"> • Recognizes examples of systems (term not used) and their parts* 	<ul style="list-style-type: none"> • Describes ways in which things can change • Describes variables that cause change* • Identifies qualitative change in systems, given the conditions that occur before, during, and after an event* • Predicts what comes next in sequences of objects or events • Describes the sequence of elements within a pattern* • Determines causes for a given effect • Predicts effects of a particular action • Describes the part that is missing from a diagram of a real-life system* • Selects the part that will turn a specific collection of components into a system* • Describes the component(s) of a given system that perform(s) a given role* • Orders objects and events 	<ul style="list-style-type: none"> • Describes changes that have occurred in a system* • Explains what caused a particular change in a common system to occur* • Predicts the next step for a given cycle (term not used)* • Determines causes for a given effect • Predicts effects of a particular action • Understands that each part of a system (term not used) has a different function* • Infers the part of a given system that has been removed* • Orders steps of familiar procedures* • Orders objects to show levels of organization (simple to complex)*
<i>New Vocabulary:</i> none	<i>New Vocabulary:</i> after, before, cause, change, design, effect, explain, gather, information, interaction	<i>New Vocabulary:</i> belong, group, have in common, population, reason, scientist
<i>New Signs and Symbols:</i> none	<i>New Signs and Symbols:</i> ¢ cent sign	<i>New Signs and Symbols:</i> none

Subject: Concepts and Processes

Goal Strand: Tech Design, Sci Inq: Ques, Hypothesizing, Design

RIT Score Range: 181 - 190

Skills and Concepts to Enhance 171 - 180	Skills and Concepts to Develop 181 - 190	Skills and Concepts to Introduce 191 - 200
Hypothesizing and Predicting	Hypothesizing and Predicting	Hypothesizing and Predicting
<ul style="list-style-type: none"> Forms hypotheses that are based on real-life experience 		<ul style="list-style-type: none"> Forms hypotheses that are based on observations and data
Asking Questions	Asking Questions	Asking Questions
<ul style="list-style-type: none"> Asks questions that define the problem to be investigated, and which will allow relevant data or information to be collected 	<ul style="list-style-type: none"> Asks questions that define the problem to be investigated, and which will allow relevant data or information to be collected 	<ul style="list-style-type: none"> Asks questions that define the problem to be investigated, and which will allow relevant data or information to be collected Selects the appropriate research source to answer a specific question (e.g., personal interview, reference book, direct observation, experimental observation)* Differentiates among testable and non-testable questions (terms not used)
Classifying	Classifying	Classifying
<ul style="list-style-type: none"> Sorts objects by a given characteristic* Sorts living and non-living things using different characteristics* 	<ul style="list-style-type: none"> Sorts objects according to common characteristics Sorts objects by a given characteristic* 	<ul style="list-style-type: none"> Sorts objects according to common characteristics Describes characteristics that have been used to sort objects or living things Places objects into simple classification systems Understands that classification is the process used to sort objects or living things by attributes held in common*
Tools and Technological Design	Tools and Technological Design	Tools and Technological Design
	<ul style="list-style-type: none"> Recognizes that the purpose of scientific inquiry is to better understand the natural world 	
Models and Systems	Models and Systems	Models and Systems
<ul style="list-style-type: none"> Describes ways in which things can change Describes variables that cause change* Identifies qualitative change in systems, given the conditions that occur before, during, and after an event* Predicts what comes next in sequences of objects or events Describes the sequence of elements within a pattern* Determines causes for a given effect Predicts effects of a particular action Describes the part that is missing from a diagram of a real-life system* 	<ul style="list-style-type: none"> Describes changes that have occurred in a system* Explains what caused a particular change in a common system to occur* Predicts the next step for a given cycle (term not used)* Determines causes for a given effect Predicts effects of a particular action Understands that each part of a system (term not used) has a different function* Infers the part of a given system that has been removed* Orders steps of familiar procedures* Orders objects to show levels of organization (simple 	<ul style="list-style-type: none"> Recognizes that models are useful to illustrate processes that are too large to manipulate* Selects models to represent the parts of an object or process* Explains that models are useful to examine things or processes which cannot be directly observed or tested Compares physical models to what they represent* Gives examples of events that are likely to cause disequilibrium in a system (terms not used)* Describes a constant rate of change for a familiar system* Describes changes that have occurred in a system*

<ul style="list-style-type: none"> • Selects the part that will turn a specific collection of components into a system* • Describes the component(s) of a given system that perform(s) a given role* • Orders objects and events 	<p>to complex)*</p>	<ul style="list-style-type: none"> • Classifies events as change* • Explains what caused a particular change in a common system to occur* • Describes the importance of direct observation in determining the cause of change to systems* • Gives real life examples of things that remain constant • Infers what is missing in sequences of patterns or events* • Extends patterns found in nature* • Predicts what comes next in a sequence of numbers showing a complex pattern (e.g., addition then subtraction, geometric progression) • Gives examples of cycles • Understands that patterns that recur regularly are called cycles • Infers what step is missing from a cycle showing repetitive change* • Understands that a cycle may have no beginning or end, but events within the cycle will proceed in a predictable fashion* • Understands that recognizing an event is cyclic can help us prepare for the future* • Gives examples of a cause and effect relationship • Explains how determining cause and effect relationships can be useful* • Classifies a given scenario as an example of cause and effect • Infers the possible causes for a given scenario (presented as a diagram)* • Describes characteristics used to order data shown in tables* • Orders steps of familiar procedures* • Understands that when components of systems interact, change occurs • Gives examples of interacting components*
<p><i>New Vocabulary:</i> after, before, cause, change, design, effect, explain, gather, information, interaction</p>	<p><i>New Vocabulary:</i> belong, group, have in common, population, reason, scientist</p>	<p><i>New Vocabulary:</i> cause and effect relationship, composition, condition, control variables, cyclic pattern, evidence, exert, field, gradient, hypothesis, imbalance, interact, mechanism, position, prediction, quantification, regular pattern, scientific law, scientific method, scientific model, series, slope, speed</p>
<p><i>New Signs and Symbols:</i> ¢ cent sign</p>	<p><i>New Signs and Symbols:</i> none</p>	<p><i>New Signs and Symbols:</i> C Celsius, ° degrees, min minute, mL milliliter/millilitre</p>

Subject: Concepts and Processes

Goal Strand: Tech Design, Sci Inq: Ques, Hypothesizing, Design

RIT Score Range: 191 - 200

Skills and Concepts to Enhance 181 - 190	Skills and Concepts to Develop 191 - 200	Skills and Concepts to Introduce 201 - 210
Hypothesizing and Predicting	Hypothesizing and Predicting <ul style="list-style-type: none"> Forms hypotheses that are based on observations and data 	Hypothesizing and Predicting <ul style="list-style-type: none"> Describes characteristics of a good hypothesis* Determines the hypothesis being tested, given a particular experimental setup or problem/question Formulates hypotheses for a given experimental set-up* Classifies statements as predictions* Distinguishes between testable and non-testable hypotheses (outside of an experimental context)* Distinguishes among examples of hypotheses and observations*
Asking Questions <ul style="list-style-type: none"> Asks questions that define the problem to be investigated, and which will allow relevant data or information to be collected 	Asking Questions <ul style="list-style-type: none"> Asks questions that define the problem to be investigated, and which will allow relevant data or information to be collected Selects the appropriate research source to answer a specific question (e.g., personal interview, reference book, direct observation, experimental observation)* Differentiates among testable and non-testable questions (terms not used) 	Asking Questions <ul style="list-style-type: none"> Asks questions that define the problem to be investigated, and which will allow relevant data or information to be collected
Classifying <ul style="list-style-type: none"> Sorts objects according to common characteristics Sorts objects by a given characteristic* 	Classifying <ul style="list-style-type: none"> Sorts objects according to common characteristics Describes characteristics that have been used to sort objects or living things Places objects into simple classification systems Understands that classification is the process used to sort objects or living things by attributes held in common* 	Classifying <ul style="list-style-type: none"> Groups living things by similarities in the structure and function of external characteristics* Explains how objects and living things are classified Compares and contrasts characteristics in a given set of objects*
Tools and Technological Design <ul style="list-style-type: none"> Recognizes that the purpose of scientific inquiry is to better understand the natural world 	Tools and Technological Design	Tools and Technological Design <ul style="list-style-type: none"> Explains how scientific knowledge and economics drive the development of technology* Explains that scientific advances often depend on development of new technologies*
Models and Systems <ul style="list-style-type: none"> Describes changes that have occurred in a system* Explains what caused a particular change in a common 	Models and Systems <ul style="list-style-type: none"> Recognizes that models are useful to illustrate processes that are too large to manipulate* 	Models and Systems <ul style="list-style-type: none"> Recognizes that models are not identical to the object, process, or event they portray*

<p>system to occur*</p> <ul style="list-style-type: none"> • Predicts the next step for a given cycle (term not used)* • Determines causes for a given effect • Predicts effects of a particular action • Understands that each part of a system (term not used) has a different function* • Infers the part of a given system that has been removed* • Orders steps of familiar procedures* • Orders objects to show levels of organization (simple to complex)* 	<ul style="list-style-type: none"> • Selects models to represent the parts of an object or process* • Explains that models are useful to examine things or processes which cannot be directly observed or tested • Compares physical models to what they represent* • Gives examples of events that are likely to cause disequilibrium in a system (terms not used)* • Describes a constant rate of change for a familiar system* • Describes changes that have occurred in a system* • Classifies events as change* • Explains what caused a particular change in a common system to occur* • Describes the importance of direct observation in determining the cause of change to systems* • Gives real life examples of things that remain constant • Infers what is missing in sequences of patterns or events* • Extends patterns found in nature* • Predicts what comes next in a sequence of numbers showing a complex pattern (e.g., addition then subtraction, geometric progression) • Gives examples of cycles • Understands that patterns that recur regularly are called cycles • Infers what step is missing from a cycle showing repetitive change* • Understands that a cycle may have no beginning or end, but events within the cycle will proceed in a predictable fashion* • Understands that recognizing an event is cyclic can help us prepare for the future* • Gives examples of a cause and effect relationship • Explains how determining cause and effect relationships can be useful* • Classifies a given scenario as an example of cause and effect • Infers the possible causes for a given scenario (presented as a diagram)* • Describes characteristics used to order data shown in tables* • Orders steps of familiar procedures* • Understands that when components of systems interact, change occurs 	<ul style="list-style-type: none"> • Determines which model would be most useful in describing a particular process, event, or concept* • Orders the stages that are involved in creating a scientific model* • Gives examples of equilibrium in systems • Classifies a given event as an example of equilibrium • Understands that counterbalancing changes may be needed for systems to be maintained as conditions change • Explains how systems remain in equilibrium • Predicts how a particular change will affect the equilibrium of a system* • Gives examples of events that are likely to cause disequilibrium in a system (terms not used)* • Explains that very fast and very slow changes can be difficult to see or measure* • Represents change quantitatively* • Explains that change in nature is common and widespread* • Classifies events as change* • Describes properties of matter that remain constant after changes to systems • Determines the rate or gradient of change in systems, when given length of time and a total measurement of change* • Determines the location or time that a particular change is likely to occur when given the rate of change to a system* • Predicts what comes next in a sequence of numbers showing a complex pattern (e.g., addition then subtraction, geometric progression) • Gives evidence that supports the conclusion that a system (man-made or natural) has changed or evolved over time • Understands that evolution refers to changes to an entire species, not changes to an individual* • Describes characteristics of evolution • Makes inferences about the evolution of a system, given data about that system • Interprets data (diagrams) related to the evolution of a system* • Understands that rates describe the time it takes for a unit of a given event to occur* • Analyzes changes in scale
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	<ul style="list-style-type: none"> • Gives examples of interacting components* 	<ul style="list-style-type: none"> • Explains why an object or collection of objects is a system • Classifies an example of parts that work together as a system* • Describes characteristics used to order sets of objects or events • Compares characteristics used to order sets of objects or events* • Understands that when components of systems interact, change occurs • Understands that interaction may occur across a distance, without components physically touching*
<i>New Vocabulary:</i> belong, group, have in common, population, reason, scientist	<i>New Vocabulary:</i> cause and effect relationship, composition, condition, control variables, cyclic pattern, evidence, exert, field, gradient, hypothesis, imbalance, interact, mechanism, position, prediction, quantification, regular pattern, scientific law, scientific method, scientific model, series, slope, speed	<i>New Vocabulary:</i> accelerate, apparent size, arrangement, balance (equilibrium), common, contact, disequilibrium, double-pan balance, evaluate, evolution, evolutionary change, evolutionary trend, evolve, field of view, geologist, gradual change, magnification power, material, observable, orderly, per, percentage, physical model, predictable, regular increase, reversible, scale (size), scale model, scaled up, texture
<i>New Signs and Symbols:</i> none	<i>New Signs and Symbols:</i> C Celsius, ° degrees, min minute, mL milliliter/millilitre	<i>New Signs and Symbols:</i> cm centimeter/centimetre, . decimal point, ft feet, = is equal to, km kilometer/kilometre, mm millimeter/millimetre, % percent

Subject: Concepts and Processes

Goal Strand: Tech Design, Sci Inq: Ques, Hypothesizing, Design

RIT Score Range: 201 - 210

Skills and Concepts to Enhance 191 - 200	Skills and Concepts to Develop 201 - 210	Skills and Concepts to Introduce 211 - 220
<p>Hypothesizing and Predicting</p> <ul style="list-style-type: none"> Forms hypotheses that are based on observations and data 	<p>Hypothesizing and Predicting</p> <ul style="list-style-type: none"> Describes characteristics of a good hypothesis* Determines the hypothesis being tested, given a particular experimental setup or problem/question Formulates hypotheses for a given experimental set-up* Classifies statements as predictions* Distinguishes between testable and non-testable hypotheses (outside of an experimental context)* Distinguishes among examples of hypotheses and observations* 	<p>Hypothesizing and Predicting</p> <ul style="list-style-type: none"> Determines the hypothesis being tested, given a particular experimental setup or problem/question Formulates testable hypotheses based on data presented in a table* Evaluates whether or not hypotheses are supported by data* Understands that predictions are more accurate when based on trends seen in data* Makes predictions within the context of a scientific investigation Classifies statements as hypotheses
<p>Asking Questions</p> <ul style="list-style-type: none"> Asks questions that define the problem to be investigated, and which will allow relevant data or information to be collected Selects the appropriate research source to answer a specific question (e.g., personal interview, reference book, direct observation, experimental observation)* Differentiates among testable and non-testable questions (terms not used) 	<p>Asking Questions</p> <ul style="list-style-type: none"> Asks questions that define the problem to be investigated, and which will allow relevant data or information to be collected 	<p>Asking Questions</p> <ul style="list-style-type: none"> Differentiates among testable and non-testable questions Recognizes that testable questions are most useful in scientific investigations, as they can be answered by investigating*
<p>Classifying</p> <ul style="list-style-type: none"> Sorts objects according to common characteristics Describes characteristics that have been used to sort objects or living things Places objects into simple classification systems Understands that classification is the process used to sort objects or living things by attributes held in common* 	<p>Classifying</p> <ul style="list-style-type: none"> Groups living things by similarities in the structure and function of external characteristics* Explains how objects and living things are classified Compares and contrasts characteristics in a given set of objects* 	<p>Classifying</p>
<p>Tools and Technological Design</p>	<p>Tools and Technological Design</p> <ul style="list-style-type: none"> Explains how scientific knowledge and economics drive the development of technology* Explains that scientific advances often depend on development of new technologies* 	<p>Tools and Technological Design</p> <ul style="list-style-type: none"> Explains that scientists investigate for many differing reasons, but the ultimate purpose is to understand the natural world* Applies the steps of technological design Compares and contrasts the procedures used in scientific inquiry and technological design*

Models and Systems	Models and Systems	Models and Systems
<ul style="list-style-type: none"> • Recognizes that models are useful to illustrate processes that are too large to manipulate* • Selects models to represent the parts of an object or process* • Explains that models are useful to examine things or processes which cannot be directly observed or tested • Compares physical models to what they represent* • Gives examples of events that are likely to cause disequilibrium in a system (terms not used)* • Describes a constant rate of change for a familiar system* • Describes changes that have occurred in a system* • Classifies events as change* • Explains what caused a particular change in a common system to occur* • Describes the importance of direct observation in determining the cause of change to systems* • Gives real life examples of things that remain constant • Infers what is missing in sequences of patterns or events* • Extends patterns found in nature* • Predicts what comes next in a sequence of numbers showing a complex pattern (e.g., addition then subtraction, geometric progression) • Gives examples of cycles • Understands that patterns that recur regularly are called cycles • Infers what step is missing from a cycle showing repetitive change* • Understands that a cycle may have no beginning or end, but events within the cycle will proceed in a predictable fashion* • Understands that recognizing an event is cyclic can help us prepare for the future* • Gives examples of a cause and effect relationship • Explains how determining cause and effect relationships can be useful* • Classifies a given scenario as an example of cause and effect • Infers the possible causes for a given scenario (presented as a diagram)* • Describes characteristics used to order data shown in tables* 	<ul style="list-style-type: none"> • Recognizes that models are not identical to the object, process, or event they portray* • Determines which model would be most useful in describing a particular process, event, or concept* • Orders the stages that are involved in creating a scientific model* • Gives examples of equilibrium in systems • Classifies a given event as an example of equilibrium • Understands that counterbalancing changes may be needed for systems to be maintained as conditions change • Explains how systems remain in equilibrium • Predicts how a particular change will affect the equilibrium of a system* • Gives examples of events that are likely to cause disequilibrium in a system (terms not used)* • Explains that very fast and very slow changes can be difficult to see or measure* • Represents change quantitatively* • Explains that change in nature is common and widespread* • Classifies events as change* • Describes properties of matter that remain constant after changes to systems • Determines the rate or gradient of change in systems, when given length of time and a total measurement of change* • Determines the location or time that a particular change is likely to occur when given the rate of change to a system* • Predicts what comes next in a sequence of numbers showing a complex pattern (e.g., addition then subtraction, geometric progression) • Gives evidence that supports the conclusion that a system (man-made or natural) has changed or evolved over time • Understands that evolution refers to changes to an entire species, not changes to an individual* • Describes characteristics of evolution • Makes inferences about the evolution of a system, given data about that system • Interprets data (diagrams) related to the evolution of a system* 	<ul style="list-style-type: none"> • Explains how models help scientists to understand the physical world* • Compares physical, mathematical, and conceptual models* • Gives examples of conceptual (e.g., scientific) models • Evaluates the usefulness of a model* • Describes circumstances that might lead to the revision of a scientific model • Orders the stages that are involved in creating a scientific model* • Gives examples of equilibrium in systems • Predicts how a particular change will affect the equilibrium of a system* • Gives examples of systems which show balance* • Analyzes changes occurring within systems* • Gives examples of things in nature which do not change* • Determines the rate or gradient of change in systems, when given length of time and a total measurement of change* • Predicts patterns of change to systems* • Extrapolates using rate of change to a system* • Distinguishes cycles from non-cyclic events • Understands that events that occur regularly are called cyclic* • Understands that rates describe the time it takes for a unit of a given event to occur* • Analyzes changes in scale • Understands that correlations seen in data are most useful in making predictions when a cause-effect relationship is established* • Classifies an example of parts that work together as a system* • Understands that adding or removing components of systems will cause changes to those systems* • Understands that interacting components of systems affect each other*

<ul style="list-style-type: none"> • Orders steps of familiar procedures* • Understands that when components of systems interact, change occurs • Gives examples of interacting components* 	<ul style="list-style-type: none"> • Understands that rates describe the time it takes for a unit of a given event to occur* • Analyzes changes in scale • Explains why an object or collection of objects is a system • Classifies an example of parts that work together as a system* • Describes characteristics used to order sets of objects or events • Compares characteristics used to order sets of objects or events* • Understands that when components of systems interact, change occurs • Understands that interaction may occur across a distance, without components physically touching* 	
<p><i>New Vocabulary:</i> cause and effect relationship, composition, condition, control variables, cyclic pattern, evidence, exert, field, gradient, hypothesis, imbalance, interact, mechanism, position, prediction, quantification, regular pattern, scientific law, scientific method, scientific model, series, slope, speed</p>	<p><i>New Vocabulary:</i> accelerate, apparent size, arrangement, balance (equilibrium), common, contact, disequilibrium, double-pan balance, evaluate, evolution, evolutionary change, evolutionary trend, evolve, field of view, geologist, gradual change, magnification power, material, observable, orderly, per, percentage, physical model, predictable, regular increase, reversible, scale (size), scale model, scaled up, texture</p>	<p><i>New Vocabulary:</i> absolute knowledge, balance, coincidence, cyclic, cyclic phenomenon, episodic, inconclusive, indicate, number pattern, regulated, repeat, testable, vary</p>
<p><i>New Signs and Symbols:</i> ° Celsius, ° degrees, min minute, mL milliliter/millilitre</p>	<p><i>New Signs and Symbols:</i> cm centimeter/centimetre, . decimal point, ft feet, = is equal to, km kilometer/kilometre, mm millimeter/millimetre, % percent</p>	<p><i>New Signs and Symbols:</i> a.m., cm³ cubic centimeter/centimetre, p.m.</p>

Subject: Concepts and Processes

Goal Strand: Tech Design, Sci Inq: Ques, Hypothesizing, Design

RIT Score Range: 211 - 220

Skills and Concepts to Enhance 201 - 210	Skills and Concepts to Develop 211 - 220	Skills and Concepts to Introduce 221 - 230
<p>Hypothesizing and Predicting</p> <ul style="list-style-type: none"> • Describes characteristics of a good hypothesis* • Determines the hypothesis being tested, given a particular experimental setup or problem/question • Formulates hypotheses for a given experimental set-up* • Classifies statements as predictions* • Distinguishes between testable and non-testable hypotheses (outside of an experimental context)* • Distinguishes among examples of hypotheses and observations* 	<p>Hypothesizing and Predicting</p> <ul style="list-style-type: none"> • Determines the hypothesis being tested, given a particular experimental setup or problem/question • Formulates testable hypotheses based on data presented in a table* • Evaluates whether or not hypotheses are supported by data* • Understands that predictions are more accurate when based on trends seen in data* • Makes predictions within the context of a scientific investigation • Classifies statements as hypotheses 	<p>Hypothesizing and Predicting</p> <ul style="list-style-type: none"> • Distinguishes between testable and nontestable hypotheses for a given experimental setup* • Describes results that would necessitate the revision of the hypothesis being tested*
<p>Asking Questions</p> <ul style="list-style-type: none"> • Asks questions that define the problem to be investigated, and which will allow relevant data or information to be collected 	<p>Asking Questions</p> <ul style="list-style-type: none"> • Differentiates among testable and non-testable questions • Recognizes that testable questions are most useful in scientific investigations, as they can be answered by investigating* 	<p>Asking Questions</p>
<p>Classifying</p> <ul style="list-style-type: none"> • Groups living things by similarities in the structure and function of external characteristics* • Explains how objects and living things are classified • Compares and contrasts characteristics in a given set of objects* 	<p>Classifying</p>	<p>Classifying</p>
<p>Tools and Technological Design</p> <ul style="list-style-type: none"> • Explains how scientific knowledge and economics drive the development of technology* • Explains that scientific advances often depend on development of new technologies* 	<p>Tools and Technological Design</p> <ul style="list-style-type: none"> • Explains that scientists investigate for many differing reasons, but the ultimate purpose is to understand the natural world* • Applies the steps of technological design • Compares and contrasts the procedures used in scientific inquiry and technological design* 	<p>Tools and Technological Design</p> <ul style="list-style-type: none"> • Recognizes that the purpose of scientific inquiry is not the discovery of absolute truth*
<p>Models and Systems</p> <ul style="list-style-type: none"> • Recognizes that models are not identical to the object, process, or event they portray* • Determines which model would be most useful in describing a particular process, event, or concept* 	<p>Models and Systems</p> <ul style="list-style-type: none"> • Explains how models help scientists to understand the physical world* • Compares physical, mathematical, and conceptual models* 	<p>Models and Systems</p> <ul style="list-style-type: none"> • Differentiates among examples of models and observations* • Selects appropriate scale models to represent data* • Assesses how well a model represents a real life event,

<ul style="list-style-type: none"> • Orders the stages that are involved in creating a scientific model* • Gives examples of equilibrium in systems • Classifies a given event as an example of equilibrium • Understands that counterbalancing changes may be needed for systems to be maintained as conditions change • Explains how systems remain in equilibrium • Predicts how a particular change will affect the equilibrium of a system* • Gives examples of events that are likely to cause disequilibrium in a system (terms not used)* • Explains that very fast and very slow changes can be difficult to see or measure* • Represents change quantitatively* • Explains that change in nature is common and widespread* • Classifies events as change* • Describes properties of matter that remain constant after changes to systems • Determines the rate or gradient of change in systems, when given length of time and a total measurement of change* • Determines the location or time that a particular change is likely to occur when given the rate of change to a system* • Predicts what comes next in a sequence of numbers showing a complex pattern (e.g., addition then subtraction, geometric progression) • Gives evidence that supports the conclusion that a system (man-made or natural) has changed or evolved over time • Understands that evolution refers to changes to an entire species, not changes to an individual* • Describes characteristics of evolution • Makes inferences about the evolution of a system, given data about that system • Interprets data (diagrams) related to the evolution of a system* • Understands that rates describe the time it takes for a unit of a given event to occur* • Analyzes changes in scale • Explains why an object or collection of objects is a system 	<ul style="list-style-type: none"> • Gives examples of conceptual (e.g., scientific) models • Evaluates the usefulness of a model* • Describes circumstances that might lead to the revision of a scientific model • Orders the stages that are involved in creating a scientific model* • Gives examples of equilibrium in systems • Predicts how a particular change will affect the equilibrium of a system* • Gives examples of systems which show balance* • Analyzes changes occurring within systems* • Gives examples of things in nature which do not change* • Determines the rate or gradient of change in systems, when given length of time and a total measurement of change* • Predicts patterns of change to systems* • Extrapolates using rate of change to a system* • Distinguishes cycles from non-cyclic events • Understands that events that occur regularly are called cyclic* • Understands that rates describe the time it takes for a unit of a given event to occur* • Analyzes changes in scale • Understands that correlations seen in data are most useful in making predictions when a cause-effect relationship is established* • Classifies an example of parts that work together as a system* • Understands that adding or removing components of systems will cause changes to those systems* • Understands that interacting components of systems affect each other* 	<ul style="list-style-type: none"> process, or concept* • Explains that equilibrium can be produced when changes occur in opposition to each other and at the same time* • Gives examples of maintenance of equilibrium (homeostasis) in the human body* • Describes characteristics of a gradient* • Gives examples of cyclic events* • Determines evolutionary trends in Earth/space, physical, and biological systems* • Gives examples of inputs and outputs of systems*
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<ul style="list-style-type: none"> • Classifies an example of parts that work together as a system* • Describes characteristics used to order sets of objects or events • Compares characteristics used to order sets of objects or events* • Understands that when components of systems interact, change occurs • Understands that interaction may occur across a distance, without components physically touching* 		
<p><i>New Vocabulary:</i> accelerate, apparent size, arrangement, balance (equilibrium), common, contact, disequilibrium, double-pan balance, evaluate, evolution, evolutionary change, evolutionary trend, evolve, field of view, geologist, gradual change, magnification power, material, observable, orderly, per, percentage, physical model, predictable, regular increase, reversible, scale (size), scale model, scaled up, texture</p>	<p><i>New Vocabulary:</i> absolute knowledge, balance, coincidence, cyclic, cyclic phenomenon, episodic, inconclusive, indicate, number pattern, regulated, repeat, testable, vary</p>	<p><i>New Vocabulary:</i> cancellation, modification, opposing forces, principle, regular time interval</p>
<p><i>New Signs and Symbols:</i> cm centimeter/centimetre, . decimal point, ft feet, = is equal to, km kilometer/kilometre, mm millimeter/millimetre, % percent</p>	<p><i>New Signs and Symbols:</i> a.m., cm³ cubic centimeter/centimetre, p.m.</p>	<p><i>New Signs and Symbols:</i> none</p>

Subject: Concepts and Processes

Goal Strand: Tech Design, Sci Inq: Ques, Hypothesizing, Design

RIT Score Range: 221 - 230

Skills and Concepts to Enhance 211 - 220	Skills and Concepts to Develop 221 - 230	Skills and Concepts to Introduce 231 - 240
<p>Hypothesizing and Predicting</p> <ul style="list-style-type: none"> • Determines the hypothesis being tested, given a particular experimental setup or problem/question • Formulates testable hypotheses based on data presented in a table* • Evaluates whether or not hypotheses are supported by data* • Understands that predictions are more accurate when based on trends seen in data* • Makes predictions within the context of a scientific investigation • Classifies statements as hypotheses 	<p>Hypothesizing and Predicting</p> <ul style="list-style-type: none"> • Distinguishes between testable and nontestable hypotheses for a given experimental setup* • Describes results that would necessitate the revision of the hypothesis being tested* 	<p>Hypothesizing and Predicting</p> <ul style="list-style-type: none"> • Formulates hypotheses within the context of a scientific investigation*
<p>Asking Questions</p> <ul style="list-style-type: none"> • Differentiates among testable and non-testable questions • Recognizes that testable questions are most useful in scientific investigations, as they can be answered by investigating* 	<p>Asking Questions</p>	<p>Asking Questions</p>
<p>Classifying</p>	<p>Classifying</p>	<p>Classifying</p>
<p>Tools and Technological Design</p> <ul style="list-style-type: none"> • Explains that scientists investigate for many differing reasons, but the ultimate purpose is to understand the natural world* • Applies the steps of technological design • Compares and contrasts the procedures used in scientific inquiry and technological design* 	<p>Tools and Technological Design</p> <ul style="list-style-type: none"> • Recognizes that the purpose of scientific inquiry is not the discovery of absolute truth* 	<p>Tools and Technological Design</p> <ul style="list-style-type: none"> • Recognizes that the purpose of scientific inquiry is not the discovery of absolute truth*
<p>Models and Systems</p> <ul style="list-style-type: none"> • Explains how models help scientists to understand the physical world* • Compares physical, mathematical, and conceptual models* • Gives examples of conceptual (e.g., scientific) models • Evaluates the usefulness of a model* • Describes circumstances that might lead to the revision of a scientific model 	<p>Models and Systems</p> <ul style="list-style-type: none"> • Differentiates among examples of models and observations* • Selects appropriate scale models to represent data* • Assesses how well a model represents a real life event, process, or concept* • Explains that equilibrium can be produced when changes occur in opposition to each other and at the same time* 	<p>Models and Systems</p> <ul style="list-style-type: none"> • Analyzes relationships using a simple mathematical model* • Explains that equilibrium can be produced when changes occur in opposition to each other and at the same time* • Infers that a system is in balance due to forces equally opposing each other* • Recognizes examples of dynamic equilibrium in

<ul style="list-style-type: none"> • Orders the stages that are involved in creating a scientific model* • Gives examples of equilibrium in systems • Predicts how a particular change will affect the equilibrium of a system* • Gives examples of systems which show balance* • Analyzes changes occurring within systems* • Gives examples of things in nature which do not change* • Determines the rate or gradient of change in systems, when given length of time and a total measurement of change* • Predicts patterns of change to systems* • Extrapolates using rate of change to a system* • Distinguishes cycles from non-cyclic events • Understands that events that occur regularly are called cyclic* • Understands that rates describe the time it takes for a unit of a given event to occur* • Analyzes changes in scale • Understands that correlations seen in data are most useful in making predictions when a cause-effect relationship is established* • Classifies an example of parts that work together as a system* • Understands that adding or removing components of systems will cause changes to those systems* • Understands that interacting components of systems affect each other* 	<ul style="list-style-type: none"> • Gives examples of maintenance of equilibrium (homeostasis) in the human body* • Describes characteristics of a gradient* • Gives examples of cyclic events* • Determines evolutionary trends in Earth/space, physical, and biological systems* • Gives examples of inputs and outputs of systems* 	<p>systems*</p> <ul style="list-style-type: none"> • Infers that things that have come to rest are in equilibrium* • Classifies disparate events as examples of equilibrium* • Determines gradients of change to systems when given a table of relevant data* • Gives examples of gradient change* • Gives examples of evolutionary change* • Uses symbolic equations to represent change* • Understands that ordering sets of objects requires characteristics that have multiple forms (e.g., height, but not right/left-handedness)*
<p><i>New Vocabulary:</i> absolute knowledge, balance, coincidence, cyclic, cyclic phenomenon, episodic, inconclusive, indicate, number pattern, regulated, repeat, testable, vary</p>	<p><i>New Vocabulary:</i> cancellation, modification, opposing forces, principle, regular time interval</p>	<p><i>New Vocabulary:</i> none</p>
<p><i>New Signs and Symbols:</i> a.m., cm³ cubic centimeter/centimetre, p.m.</p>	<p><i>New Signs and Symbols:</i> none</p>	<p><i>New Signs and Symbols:</i> none</p>

Subject: Concepts and Processes

Goal Strand: Tech Design, Sci Inq: Ques, Hypothesizing, Design

RIT Score Range: 231 - 240

Skills and Concepts to Enhance 221 - 230	Skills and Concepts to Develop 231 - 240	Skills and Concepts to Introduce Above 240
Hypothesizing and Predicting <ul style="list-style-type: none"> Distinguishes between testable and nontestable hypotheses for a given experimental setup* Describes results that would necessitate the revision of the hypothesis being tested* 	Hypothesizing and Predicting <ul style="list-style-type: none"> Formulates hypotheses within the context of a scientific investigation* 	Hypothesizing and Predicting
Asking Questions	Asking Questions	Asking Questions
Classifying	Classifying	Classifying
Tools and Technological Design <ul style="list-style-type: none"> Recognizes that the purpose of scientific inquiry is not the discovery of absolute truth* 	Tools and Technological Design <ul style="list-style-type: none"> Recognizes that the purpose of scientific inquiry is not the discovery of absolute truth* 	Tools and Technological Design
Models and Systems <ul style="list-style-type: none"> Differentiates among examples of models and observations* Selects appropriate scale models to represent data* Assesses how well a model represents a real life event, process, or concept* Explains that equilibrium can be produced when changes occur in opposition to each other and at the same time* Gives examples of maintenance of equilibrium (homeostasis) in the human body* Describes characteristics of a gradient* Gives examples of cyclic events* Determines evolutionary trends in Earth/space, physical, and biological systems* Gives examples of inputs and outputs of systems* 	Models and Systems <ul style="list-style-type: none"> Analyzes relationships using a simple mathematical model* Explains that equilibrium can be produced when changes occur in opposition to each other and at the same time* Infers that a system is in balance due to forces equally opposing each other* Recognizes examples of dynamic equilibrium in systems* Infers that things that have come to rest are in equilibrium* Classifies disparate events as examples of equilibrium* Determines gradients of change to systems when given a table of relevant data* Gives examples of gradient change* Gives examples of evolutionary change* Uses symbolic equations to represent change* Understands that ordering sets of objects requires characteristics that have multiple forms (e.g., height, but not right/left-handedness)* 	Models and Systems <ul style="list-style-type: none"> Gives examples of dynamic equilibrium in systems* Infers that things that have come to rest are in equilibrium*
<i>New Vocabulary:</i> cancellation, modification, opposing forces, principle, regular time interval	<i>New Vocabulary:</i> none	<i>New Vocabulary:</i> none
<i>New Signs and Symbols:</i> none	<i>New Signs and Symbols:</i> none	<i>New Signs and Symbols:</i> none

Subject: Concepts and Processes

Goal Strand: Tech Design, Sci Inq: Ques, Hypothesizing, Design

RIT Score Range: Above 240

Skills and Concepts to Enhance 231 - 240	Skills and Concepts to Develop Above 240
Hypothesizing and Predicting	Hypothesizing and Predicting
<ul style="list-style-type: none"> Formulates hypotheses within the context of a scientific investigation* 	
Asking Questions	Asking Questions
Classifying	Classifying
Tools and Technological Design	Tools and Technological Design
<ul style="list-style-type: none"> Recognizes that the purpose of scientific inquiry is not the discovery of absolute truth* 	
Models and Systems	Models and Systems
<ul style="list-style-type: none"> Analyzes relationships using a simple mathematical model* Explains that equilibrium can be produced when changes occur in opposition to each other and at the same time* Infers that a system is in balance due to forces equally opposing each other* Recognizes examples of dynamic equilibrium in systems* Infers that things that have come to rest are in equilibrium* Classifies disparate events as examples of equilibrium* Determines gradients of change to systems when given a table of relevant data* Gives examples of gradient change* Gives examples of evolutionary change* Uses symbolic equations to represent change* Understands that ordering sets of objects requires characteristics that have multiple forms (e.g., height, but not right/left-handedness)* 	<ul style="list-style-type: none"> Gives examples of dynamic equilibrium in systems* Infers that things that have come to rest are in equilibrium*
<i>New Vocabulary: none</i>	<i>New Vocabulary: none</i>
<i>New Signs and Symbols: none</i>	<i>New Signs and Symbols: none</i>

Subject: Concepts and Processes

Goal Strand: Tech Design and Sci Inq: Design Sci Investigations

RIT Score Range: Below 181

Skills and Concepts to Develop Below 181	Skills and Concepts to Introduce 181 - 190
Designing Experiments	Designing Experiments
	<ul style="list-style-type: none"> • Explains why it is important for scientific observations to be accurate* • Recognizes that results differ slightly when an experiment is repeated in a different place, at a different time, or by a different person, but the general evidence gathered in an experiment should be replicable by anyone, anywhere* • Describes how theories are developed*
Controlling Variables	Controlling Variables
Collecting and Interpreting Data	Collecting and Interpreting Data
<ul style="list-style-type: none"> • Interprets simple bar graphs • Interprets data in simple line graphs* 	<ul style="list-style-type: none"> • Interprets simple bar graphs • Interprets trends in bar graphs • Interprets data represented as pictures or icons within a table or chart* • Interprets diagrams
Making Inferences and Drawing Conclusions	Making Inferences and Drawing Conclusions
<ul style="list-style-type: none"> • Draws conclusions from simple diagrams* 	<ul style="list-style-type: none"> • Recognizes that scientific theories depend on evidence* • Makes inferences about common events and phenomena
Observation and Measurement	Observation and Measurement
<ul style="list-style-type: none"> • Understands that tools (such as scales) can measure only physical properties of an object* • Describes the purpose of a ruler* • Understands the importance of counting (e.g., quantifying) in determining the properties of an item* 	<ul style="list-style-type: none"> • Describes characteristics of objects* • Understands that observations are useful in studying changes in an object over time* • Measures using non-standard units* • Understands that magnifying glasses, telescopes and microscopes are used to extend the sense of sight • Chooses the appropriate tools to measure length, height, or distance* • Chooses the appropriate tool to measure how hot an object is* • Understands that measuring tools can be used to improve the accuracy of an estimate*
Communicating Results	Communicating Results
	<ul style="list-style-type: none"> • Describes observations clearly, objectively, and

	accurately
<i>New Vocabulary:</i> count, find out, rank, record, scale (tool), weigh	<i>New Vocabulary:</i> (data) log, accurate, average, color, conclude, data, expect, experiment, feet (measurement), identify, magnifying glass, measurement, metric ruler, notes, observation, probable reason, result, scientific theory, scientist, sense, sight, smell, taste, telescope, tool, touch
<i>New Signs and Symbols:</i> ¢ cent sign	<i>New Signs and Symbols:</i> C Celsius, ° degrees, E east, N north, S south, W west

Subject: Concepts and Processes

Goal Strand: Tech Design and Sci Inq: Design Sci Investigations

RIT Score Range: 181 - 190

Skills and Concepts to Enhance Below 181	Skills and Concepts to Develop 181 - 190	Skills and Concepts to Introduce 191 - 200
<p>Designing Experiments</p>	<p>Designing Experiments</p> <ul style="list-style-type: none"> • Explains why it is important for scientific observations to be accurate* • Recognizes that results differ slightly when an experiment is repeated in a different place, at a different time, or by a different person, but the general evidence gathered in an experiment should be replicable by anyone, anywhere* • Describes how theories are developed* 	<p>Designing Experiments</p> <ul style="list-style-type: none"> • Recognizes that repeating an experiment many times may increase the reliability of the data collected* • Understands that scientists make the results of investigations public so that others can replicate their work* • Recognizes that the accuracy of observations is improved by repeating the observations several times, and by having others replicate results* • Recognizes that repeating an observation many times produces data of high quality and accuracy* • Explains why an observation must yield consistent, repeated results to be considered accurate* • Recognizes that direct observations allow a phenomenon to be confirmed whereas inference and relying on others' opinions do not allow a phenomenon to be confirmed* • Describes the criteria used to establish scientific laws and theories* • Determines which procedure will answer a specific question* • Understands that the type of investigation a scientist does depends on the question he or she is answering* • Orders the stages that are likely to occur in a scientific study* • Describes lab safety practices*
<p>Controlling Variables</p>	<p>Controlling Variables</p>	<p>Controlling Variables</p> <ul style="list-style-type: none"> • Determines which variables in a particular experiment must stay the same for results to be considered valid
<p>Collecting and Interpreting Data</p> <ul style="list-style-type: none"> • Interprets simple bar graphs • Interprets data in simple line graphs* 	<p>Collecting and Interpreting Data</p> <ul style="list-style-type: none"> • Interprets simple bar graphs • Interprets trends in bar graphs • Interprets data represented as pictures or icons within a table or chart* • Interprets diagrams 	<p>Collecting and Interpreting Data</p> <ul style="list-style-type: none"> • Understands that data collected in experiments must not be "fudged" or misrepresented* • Identifies the data being collected in a given scenario* • Interprets data presented in simple tables (e.g., T-charts)* • Interprets data presented in tables and charts that show

		<ul style="list-style-type: none"> data in more than two columns or categories Describes trends in data shown in tables that show change in one (responding/dependent) variable*
Making Inferences and Drawing Conclusions	Making Inferences and Drawing Conclusions	Making Inferences and Drawing Conclusions
<ul style="list-style-type: none"> Draws conclusions from simple diagrams* 	<ul style="list-style-type: none"> Recognizes that scientific theories depend on evidence* Makes inferences about common events and phenomena 	<ul style="list-style-type: none"> Recognizes that scientific explanations must be based on observations and scientific knowledge* Draws conclusions from experimental observations Extrapolates from data presented in tables Extrapolates from data presented in graphs (linear relationships)*
Observation and Measurement	Observation and Measurement	Observation and Measurement
<ul style="list-style-type: none"> Understands that tools (such as scales) can measure only physical properties of an object* Describes the purpose of a ruler* Understands the importance of counting (e.g., quantifying) in determining the properties of an item* 	<ul style="list-style-type: none"> Describes characteristics of objects* Understands that observations are useful in studying changes in an object over time* Measures using non-standard units* Understands that magnifying glasses, telescopes and microscopes are used to extend the sense of sight Chooses the appropriate tools to measure length, height, or distance* Chooses the appropriate tool to measure how hot an object is* Understands that measuring tools can be used to improve the accuracy of an estimate* 	<ul style="list-style-type: none"> Describes characteristics of objects* Distinguishes between visual observations and observations of mass, temperature, texture, etc.* Determines which observations are relevant to an investigation* Understands that observations describe physical characteristics of an object Understands that personal bias can affect perception of things and events* Understands that some things (e.g., color) are difficult to measure* Measures using non-standard units* Measures the temperature shown on a thermometer (positive numbers) Gives examples of tools that extend the senses* Measures length using a ruler* Chooses the appropriate tools to observe objects Reads the weight shown on a spring scale* Chooses the appropriate unit to measure length* Gives examples of things that can be quantified*
Communicating Results	Communicating Results	Communicating Results
	<ul style="list-style-type: none"> Describes observations clearly, objectively, and accurately 	<ul style="list-style-type: none"> Describes observations clearly, objectively, and accurately Evaluates written observations for accuracy and clarity*
<i>New Vocabulary:</i> count, find out, rank, record, scale (tool), weigh	<i>New Vocabulary:</i> (data) log, accurate, average, color, conclude, data, expect, experiment, feet (measurement), identify, magnifying glass, measurement, metric ruler, notes, observation, probable reason, result, scientific theory, scientist, sense, sight, smell, taste, telescope, tool, touch	<i>New Vocabulary:</i> affect, computer, direct observation, enlarge, experimental result, extend, hand lens, hypothesis, image, instrument, investigation, magnifying lens, perception, pH meter, prediction, quantify, reasonable result, senses, stethoscope, study, test, trial, valid, vision, X-ray machine
<i>New Signs and Symbols:</i> ¢ cent sign	<i>New Signs and Symbols:</i> C Celsius, ° degrees, E east, N north, S south, W west	<i>New Signs and Symbols:</i> a.m., cm centimeter/centimetre, cm ³ cubic centimeter/centimetre, . decimal point, p.m.,

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Subject: Concepts and Processes

Goal Strand: Tech Design and Sci Inq: Design Sci Investigations

RIT Score Range: 191 - 200

Skills and Concepts to Enhance 181 - 190	Skills and Concepts to Develop 191 - 200	Skills and Concepts to Introduce 201 - 210
<p>Designing Experiments</p> <ul style="list-style-type: none"> • Explains why it is important for scientific observations to be accurate* • Recognizes that results differ slightly when an experiment is repeated in a different place, at a different time, or by a different person, but the general evidence gathered in an experiment should be replicable by anyone, anywhere* • Describes how theories are developed* 	<p>Designing Experiments</p> <ul style="list-style-type: none"> • Recognizes that repeating an experiment many times may increase the reliability of the data collected* • Understands that scientists make the results of investigations public so that others can replicate their work* • Recognizes that the accuracy of observations is improved by repeating the observations several times, and by having others replicate results* • Recognizes that repeating an observation many times produces data of high quality and accuracy* • Explains why an observation must yield consistent, repeated results to be considered accurate* • Recognizes that direct observations allow a phenomenon to be confirmed whereas inference and relying on others' opinions do not allow a phenomenon to be confirmed* • Describes the criteria used to establish scientific laws and theories* • Determines which procedure will answer a specific question* • Understands that the type of investigation a scientist does depends on the question he or she is answering* • Orders the stages that are likely to occur in a scientific study* • Describes lab safety practices* 	<p>Designing Experiments</p> <ul style="list-style-type: none"> • Understands that when a scientific test is repeated using the same conditions, similar results usually occur* • Recognizes that repeating an experiment many times may increase the reliability of the data collected* • Explains why an observation must yield consistent, repeated results to be considered accurate* • Recognizes that direct observations allow a phenomenon to be confirmed whereas inference and relying on others' opinions do not allow a phenomenon to be confirmed* • Understands that theories are based on multiple observations, concepts, principles, and historical perspective* • Distinguishes examples of theories from facts, observations, hypotheses* • Describes characteristics of theories • Classifies a particular statement as an observation • Distinguishes examples of observations from facts, theories, and hypotheses* • Evaluates to determine which procedure will best answer a specific question or solve a specific problem • Infers the problem being investigated in an experiment, given the setup and/or results of the experiment • Evaluates and improves the quality of an experimental design* • Orders the stages that are likely to occur in a scientific study* • Describes alternative data-gathering strategies that may be used in place of the traditional scientific method* • Classifies example representing specific stages of a specific scientific investigation
<p>Controlling Variables</p>	<p>Controlling Variables</p> <ul style="list-style-type: none"> • Determines which variables in a particular experiment must stay the same for results to be considered valid 	<p>Controlling Variables</p> <ul style="list-style-type: none"> • Determines which variable (independent or manipulated) will be changed in the course of an

		<p>investigation</p> <ul style="list-style-type: none"> • Determines which variable should be controlled in an experimental design, when given the problem or question being studied* • Determines which variables in a particular experiment must stay the same for results to be considered valid • Determines whether experiments are fair or valid, based on their design*
Collecting and Interpreting Data	Collecting and Interpreting Data	Collecting and Interpreting Data
<ul style="list-style-type: none"> • Interprets simple bar graphs • Interprets trends in bar graphs • Interprets data represented as pictures or icons within a table or chart* • Interprets diagrams 	<ul style="list-style-type: none"> • Understands that data collected in experiments must not be "fudged" or misrepresented* • Identifies the data being collected in a given scenario* • Interprets data presented in simple tables (e.g., T-charts)* • Interprets data presented in tables and charts that show data in more than two columns or categories • Describes trends in data shown in tables that show change in one (responding/dependent) variable* 	<ul style="list-style-type: none"> • Interprets graphs (e.g., reads data) in which units are not given, or only partial data is given • Determines the type of data which will appear in a graph, based on its axes* • Analyzes data in line graphs* • Interprets data in complex graphs (exponential, logistic, multiple lines)* • Interprets data presented in tables and charts that show data in more than two columns or categories • Analyzes data presented in tables and charts • Analyzes data shown in diagrams
Making Inferences and Drawing Conclusions	Making Inferences and Drawing Conclusions	Making Inferences and Drawing Conclusions
<ul style="list-style-type: none"> • Recognizes that scientific theories depend on evidence* • Makes inferences about common events and phenomena 	<ul style="list-style-type: none"> • Recognizes that scientific explanations must be based on observations and scientific knowledge* • Draws conclusions from experimental observations • Extrapolates from data presented in tables • Extrapolates from data presented in graphs (linear relationships)* 	<ul style="list-style-type: none"> • Explains that scientific theories depend on logically consistent arguments* • Recognizes that scientific explanations must be based on observations and scientific knowledge* • Draws conclusions from data presented in tables containing two manipulated (independent) variables* • Draws conclusions from experimental observations • Makes inferences that limit themselves to the data which has been presented and avoids speculation • Understands that to be scientific, explanations must be supported with evidence • Draws conclusions from complex tables, charts or graphs* • Draws conclusions from complex diagrams • Extrapolates from data presented in diagrams • Interpolates from data presented in graphs* • Interpolates from data presented in diagrams* • Explains that results are significant if they most likely did not occur by chance • Draws conclusions from data described as "significant"*

Observation and Measurement	Observation and Measurement	Observation and Measurement
<ul style="list-style-type: none"> Describes characteristics of objects* Understands that observations are useful in studying changes in an object over time* Measures using non-standard units* Understands that magnifying glasses, telescopes and microscopes are used to extend the sense of sight Chooses the appropriate tools to measure length, height, or distance* Chooses the appropriate tool to measure how hot an object is* Understands that measuring tools can be used to improve the accuracy of an estimate* 	<ul style="list-style-type: none"> Describes characteristics of objects* Distinguishes between visual observations and observations of mass, temperature, texture, etc.* Determines which observations are relevant to an investigation* Understands that observations describe physical characteristics of an object Understands that personal bias can affect perception of things and events* Understands that some things (e.g., color) are difficult to measure* Measures using non-standard units* Measures the temperature shown on a thermometer (positive numbers) Gives examples of tools that extend the senses* Measures length using a ruler* Chooses the appropriate tools to observe objects Reads the weight shown on a spring scale* Chooses the appropriate unit to measure length* Gives examples of things that can be quantified* 	<ul style="list-style-type: none"> Determines which observations are relevant to an investigation* Predicts how objects will appear when viewed from different angles* Distinguishes among examples of direct observations and predictions* Understands that things that change over time can be measured* Measures the temperature shown on a thermometer, using interpolation Chooses the appropriate tools to measure the speed of an object* Understands that quantitative observations are often more precise than qualitative observations
Communicating Results	Communicating Results	Communicating Results
<ul style="list-style-type: none"> Describes observations clearly, objectively, and accurately 	<ul style="list-style-type: none"> Describes observations clearly, objectively, and accurately Evaluates written observations for accuracy and clarity* 	<ul style="list-style-type: none"> Selects graphs as the most appropriate way to present trends in data* Represents observations using symbols and diagrams* Communicates results clearly and accurately
<i>New Vocabulary:</i> (data) log, accurate, average, color, conclude, data, expect, experiment, feet (measurement), identify, magnifying glass, measurement, metric ruler, notes, observation, probable reason, result, scientific theory, scientist, sense, sight, smell, taste, telescope, tool, touch	<i>New Vocabulary:</i> affect, computer, direct observation, enlarge, experimental result, extend, hand lens, hypothesis, image, instrument, investigation, magnifying lens, perception, pH meter, prediction, quantify, reasonable result, senses, stethoscope, study, test, trial, valid, vision, X-ray machine	<i>New Vocabulary:</i> chance, claim, control, decrease, design experiment, formulate model, graduated cylinder, hold constant, increase, independent variable, interpret data, interval, investigate, justify, level, material, meter stick, pendulum, precision, quality, quantity, random group, reliable, scale (measurement), significant, statistics, trial-and-error procedure
<i>New Signs and Symbols:</i> C Celsius, ° degrees, E east, N north, S south, W west	<i>New Signs and Symbols:</i> a.m., cm centimeter/centimetre, cm ³ cubic centimeter/centimetre, . decimal point, p.m., pH	<i>New Signs and Symbols:</i> g gram, mL milliliter/millilitre, – negative, sec second

Subject: Concepts and Processes

Goal Strand: Tech Design and Sci Inq: Design Sci Investigations

RIT Score Range: 201 - 210

Skills and Concepts to Enhance 191 - 200	Skills and Concepts to Develop 201 - 210	Skills and Concepts to Introduce 211 - 220
<p>Designing Experiments</p> <ul style="list-style-type: none"> • Recognizes that repeating an experiment many times may increase the reliability of the data collected* • Understands that scientists make the results of investigations public so that others can replicate their work* • Recognizes that the accuracy of observations is improved by repeating the observations several times, and by having others replicate results* • Recognizes that repeating an observation many times produces data of high quality and accuracy* • Explains why an observation must yield consistent, repeated results to be considered accurate* • Recognizes that direct observations allow a phenomenon to be confirmed whereas inference and relying on others' opinions do not allow a phenomenon to be confirmed* • Describes the criteria used to establish scientific laws and theories* • Determines which procedure will answer a specific question* • Understands that the type of investigation a scientist does depends on the question he or she is answering* • Orders the stages that are likely to occur in a scientific study* • Describes lab safety practices* 	<p>Designing Experiments</p> <ul style="list-style-type: none"> • Understands that when a scientific test is repeated using the same conditions, similar results usually occur* • Recognizes that repeating an experiment many times may increase the reliability of the data collected* • Explains why an observation must yield consistent, repeated results to be considered accurate* • Recognizes that direct observations allow a phenomenon to be confirmed whereas inference and relying on others' opinions do not allow a phenomenon to be confirmed* • Understands that theories are based on multiple observations, concepts, principles, and historical perspective* • Distinguishes examples of theories from facts, observations, hypotheses* • Describes characteristics of theories • Classifies a particular statement as an observation • Distinguishes examples of observations from facts, theories, and hypotheses* • Evaluates to determine which procedure will best answer a specific question or solve a specific problem • Infers the problem being investigated in an experiment, given the setup and/or results of the experiment • Evaluates and improves the quality of an experimental design* • Orders the stages that are likely to occur in a scientific study* • Describes alternative data-gathering strategies that may be used in place of the traditional scientific method* • Classifies example representing specific stages of a specific scientific investigation 	<p>Designing Experiments</p> <ul style="list-style-type: none"> • Understands that a key part of science is for scientists to confirm each other's findings* • Understands that to replicate an experiment, the conditions of the experiment should be as similar to the original as possible • Understands that patterns and trends are easier to see when an experiment is repeated several times, multiple sets of data are collected, or data is averaged • Compares the results produced when an experiment is repeated several times* • Recognizes that it can be difficult to determine the sources of error in an experiment* • Lists possible reasons for inconsistent results* • Recognizes that a controlled experiment will produce reproducible results* • Compares controlled and uncontrolled experiments in terms of the consistency of data produced* • Defines scientific theory* • Contrasts the terms hypothesis, theory, principle, law, model, and paradigm as used by scientists* • Classifies a particular scientific explanation as a theory* • Distinguishes examples of observations from facts, theories, and hypotheses* • Classifies a particular statement as an hypothesis* • Determines which information should be collected in an experiment to answer a specific question • Evaluates to determine which procedure will best answer a specific question or solve a specific problem • Evaluates which procedure will best test a given hypothesis* • Evaluates and improves the quality of an experimental design* • Classifies example representing specific stages of a specific scientific investigation

Controlling Variables	Controlling Variables	Controlling Variables
<ul style="list-style-type: none"> Determines which variables in a particular experiment must stay the same for results to be considered valid 	<ul style="list-style-type: none"> Determines which variable (independent or manipulated) will be changed in the course of an investigation Determines which variable should be controlled in an experimental design, when given the problem or question being studied* Determines which variables in a particular experiment must stay the same for results to be considered valid Determines whether experiments are fair or valid, based on their design* 	<ul style="list-style-type: none"> Classifies the objects or persons undergoing a specific portion of an experiment as the control group* Explains the importance of controlling variables in an experiment* Determines which variable should be controlled in an experimental design, when given the problem or question being studied* Determines which variables are being controlled in a given experimental set-up*
Collecting and Interpreting Data	Collecting and Interpreting Data	Collecting and Interpreting Data
<ul style="list-style-type: none"> Understands that data collected in experiments must not be "fudged" or misrepresented* Identifies the data being collected in a given scenario* Interprets data presented in simple tables (e.g., T-charts)* Interprets data presented in tables and charts that show data in more than two columns or categories Describes trends in data shown in tables that show change in one (responding/dependent) variable* 	<ul style="list-style-type: none"> Interprets graphs (e.g., reads data) in which units are not given, or only partial data is given Determines the type of data which will appear in a graph, based on its axes* Analyzes data in line graphs* Interprets data in complex graphs (exponential, logistic, multiple lines)* Interprets data presented in tables and charts that show data in more than two columns or categories Analyzes data presented in tables and charts Analyzes data shown in diagrams 	<ul style="list-style-type: none"> Describes trends in line graphs where units are not given Determines the type of data which will appear in a graph, based on its axes*
Making Inferences and Drawing Conclusions	Making Inferences and Drawing Conclusions	Making Inferences and Drawing Conclusions
<ul style="list-style-type: none"> Recognizes that scientific explanations must be based on observations and scientific knowledge* Draws conclusions from experimental observations Extrapolates from data presented in tables Extrapolates from data presented in graphs (linear relationships)* 	<ul style="list-style-type: none"> Explains that scientific theories depend on logically consistent arguments* Recognizes that scientific explanations must be based on observations and scientific knowledge* Draws conclusions from data presented in tables containing two manipulated (independent) variables* Draws conclusions from experimental observations Makes inferences that limit themselves to the data which has been presented and avoids speculation Understands that to be scientific, explanations must be supported with evidence Draws conclusions from complex tables, charts or graphs* Draws conclusions from complex diagrams Extrapolates from data presented in diagrams Interpolates from data presented in graphs* Interpolates from data presented in diagrams* Explains that results are significant if they most likely did not occur by chance 	<ul style="list-style-type: none"> Recognizes that scientific explanations are considered valid when they meet multiple criteria (e.g., consistency with the evidence seen in nature, respect for the rules of evidence, openness to criticism, communication of methods used, public communication of results)* Explains that scientific theories depend on logically consistent arguments* Draws conclusions from data presented in tables containing two manipulated (independent) variables* Makes inferences that limit themselves to the data which has been presented and avoids speculation Makes inferences using deductive reasoning Determines which evidence will best support a particular inference Draws conclusions from data presented in simple (T) tables or charts Classifies statements as inferences* Extrapolates from data presented in diagrams Extrapolates from data given in a table, by estimating

	<ul style="list-style-type: none"> • Draws conclusions from data described as "significant"* 	<p>the trend shown*</p> <ul style="list-style-type: none"> • Interpolates from data presented in tables* • Interpolates from data presented in graphs*
<p>Observation and Measurement</p> <ul style="list-style-type: none"> • Describes characteristics of objects* • Distinguishes between visual observations and observations of mass, temperature, texture, etc.* • Determines which observations are relevant to an investigation* • Understands that observations describe physical characteristics of an object • Understands that personal bias can affect perception of things and events* • Understands that some things (e.g., color) are difficult to measure* • Measures using non-standard units* • Measures the temperature shown on a thermometer (positive numbers) • Gives examples of tools that extend the senses* • Measures length using a ruler* • Chooses the appropriate tools to observe objects • Reads the weight shown on a spring scale* • Chooses the appropriate unit to measure length* • Gives examples of things that can be quantified* 	<p>Observation and Measurement</p> <ul style="list-style-type: none"> • Determines which observations are relevant to an investigation* • Predicts how objects will appear when viewed from different angles* • Distinguishes among examples of direct observations and predictions* • Understands that things that change over time can be measured* • Measures the temperature shown on a thermometer, using interpolation • Chooses the appropriate tools to measure the speed of an object* • Understands that quantitative observations are often more precise than qualitative observations 	<p>Observation and Measurement</p> <ul style="list-style-type: none"> • Limits observations to the descriptions of properties and processes that those that are observed using the senses and or tools that extend the senses, not what may have happened previously, or what might happen next* • Distinguishes among examples of observations and inferences* • Measures the temperature shown on a thermometer, using interpolation • Estimates length when given a ruler smaller than the object being measured* • Chooses the appropriate tools to measure mass* • Understands that measurement of weight on a scale is not dependent on the arrangement of that object on the scale, as long as the entire object is touching only the scale* • Chooses the appropriate tools to measure volume* • Measures the temperature shown on a thermometer (negative numbers)* • Classifies statements as quantitative observations* • Understands that quantitative observations are often more precise than qualitative observations • Understands that precise measurements are an accurate, specific description of quantity, not estimations of quantity • Explains that the more accurate a tool is, the smaller the changes it is able to measure*
<p>Communicating Results</p> <ul style="list-style-type: none"> • Describes observations clearly, objectively, and accurately • Evaluates written observations for accuracy and clarity* 	<p>Communicating Results</p> <ul style="list-style-type: none"> • Selects graphs as the most appropriate way to present trends in data* • Represents observations using symbols and diagrams* • Communicates results clearly and accurately 	<p>Communicating Results</p> <ul style="list-style-type: none"> • Selects the appropriate graph to represent data shown in a table*
<p><i>New Vocabulary:</i> affect, computer, direct observation, enlarge, experimental result, extend, hand lens, hypothesis, image, instrument, investigation, magnifying lens, perception, pH meter, prediction, quantify, reasonable result, senses, stethoscope, study, test, trial, valid, vision, X-ray machine</p>	<p><i>New Vocabulary:</i> chance, claim, control, decrease, design experiment, formulate model, graduated cylinder, hold constant, increase, independent variable, interpret data, interval, investigate, justify, level, material, meter stick, pendulum, precision, quality, quantity, random group, reliable, scale (measurement), significant, statistics, trial-and-error procedure</p>	<p><i>New Vocabulary:</i> beaker, controlled experiment, dependent, disprove, orderly pattern, phenomena, probable, quantitative, replicate, replication, scientific evidence, theorize</p>
<p><i>New Signs and Symbols:</i> a.m., cm centimeter/centimetre,</p>	<p><i>New Signs and Symbols:</i> g gram, mL milliliter/millilitre, –</p>	<p><i>New Signs and Symbols:</i> ' foot, " inch</p>

cm ³ cubic centimeter/centimetre, . decimal point, p.m., pH	negative, sec second	
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Subject: Concepts and Processes

Goal Strand: Tech Design and Sci Inq: Design Sci Investigations

RIT Score Range: 211 - 220

Skills and Concepts to Enhance 201 - 210	Skills and Concepts to Develop 211 - 220	Skills and Concepts to Introduce 221 - 230
<p>Designing Experiments</p> <ul style="list-style-type: none"> • Understands that when a scientific test is repeated using the same conditions, similar results usually occur* • Recognizes that repeating an experiment many times may increase the reliability of the data collected* • Explains why an observation must yield consistent, repeated results to be considered accurate* • Recognizes that direct observations allow a phenomenon to be confirmed whereas inference and relying on others' opinions do not allow a phenomenon to be confirmed* • Understands that theories are based on multiple observations, concepts, principles, and historical perspective* • Distinguishes examples of theories from facts, observations, hypotheses* • Describes characteristics of theories • Classifies a particular statement as an observation • Distinguishes examples of observations from facts, theories, and hypotheses* • Evaluates to determine which procedure will best answer a specific question or solve a specific problem • Infers the problem being investigated in an experiment, given the setup and/or results of the experiment • Evaluates and improves the quality of an experimental design* • Orders the stages that are likely to occur in a scientific study* • Describes alternative data-gathering strategies that may be used in place of the traditional scientific method* • Classifies example representing specific stages of a specific scientific investigation 	<p>Designing Experiments</p> <ul style="list-style-type: none"> • Understands that a key part of science is for scientists to confirm each other's findings* • Understands that to replicate an experiment, the conditions of the experiment should be as similar to the original as possible • Understands that patterns and trends are easier to see when an experiment is repeated several times, multiple sets of data are collected, or data is averaged • Compares the results produced when an experiment is repeated several times* • Recognizes that it can be difficult to determine the sources of error in an experiment* • Lists possible reasons for inconsistent results* • Recognizes that a controlled experiment will produce reproducible results* • Compares controlled and uncontrolled experiments in terms of the consistency of data produced* • Defines scientific theory* • Contrasts the terms hypothesis, theory, principle, law, model, and paradigm as used by scientists* • Classifies a particular scientific explanation as a theory* • Distinguishes examples of observations from facts, theories, and hypotheses* • Classifies a particular statement as an hypothesis* • Determines which information should be collected in an experiment to answer a specific question • Evaluates to determine which procedure will best answer a specific question or solve a specific problem • Evaluates which procedure will best test a given hypothesis* • Evaluates and improves the quality of an experimental design* • Classifies example representing specific stages of a specific scientific investigation 	<p>Designing Experiments</p> <ul style="list-style-type: none"> • Recognizes why it is important for scientific observations to be repeated before drawing conclusions* • Recognizes why other scientists must be able to replicate results of an experiment* • Recognizes that an idea must be tested multiple times before being accepted or rejected* • Recognizes that uncertainty in measurement can produce results that differ slightly from experiment to experiment* • Recognizes that slight changes in an experimental method can produce changes in the result of an investigation* • Recognizes that slight differences in the things being investigated can produce differences in the result* • Recognizes that when results differ, it is necessary to judge whether the differences are trivial or significant, and further study may be needed to determine this* • Explains variations in the data recorded during an investigation* • Explains limitations in the data recording during an experiment* • Explains why a controlled experiment will produce reproducible results* • Explains why repeating an investigation multiple times may increase the reliability of the data collected* • Explains that before experimental results are generalized to a wider set of conditions, it is important to repeat the experiment using these conditions (e.g., drug tests, use of model organisms)* • Distinguishes hypotheses from conclusions and observations • Explains why there may be discrepancies between a scientific law and actual observations* • Relates scientific theory, generation of hypotheses, and experimentation*

		<ul style="list-style-type: none"> • Distinguishes between the ideas of hypothesis, fact, observation, opinion, model, and theory • Classifies a particular statement as an hypothesis* • Compares the terms hypothesis, theory, principle, law, model, paradigm as used by scientists* • Contrasts the terms theory and law* • Understands that the more precise a procedure is, the more likely it is that it will be replicable*
Controlling Variables	Controlling Variables	Controlling Variables
<ul style="list-style-type: none"> • Determines which variable (independent or manipulated) will be changed in the course of an investigation • Determines which variable should be controlled in an experimental design, when given the problem or question being studied* • Determines which variables in a particular experiment must stay the same for results to be considered valid • Determines whether experiments are fair or valid, based on their design* 	<ul style="list-style-type: none"> • Classifies the objects or persons undergoing a specific portion of an experiment as the control group* • Explains the importance of controlling variables in an experiment* • Determines which variable should be controlled in an experimental design, when given the problem or question being studied* • Determines which variables are being controlled in a given experimental set-up* 	<ul style="list-style-type: none"> • Determines which variable (independent or manipulated) is being tested in control setup, when this variable has been purposefully omitted from the setup* • Determines which variable (independent or manipulated) is being tested in a given experimental setup • Determines the independent variable by examining data presented as a line graph* • Determines the control group in a given experimental set-up* • Controls variables so that only the variable being tested changes over time
Collecting and Interpreting Data	Collecting and Interpreting Data	Collecting and Interpreting Data
<ul style="list-style-type: none"> • Interprets graphs (e.g., reads data) in which units are not given, or only partial data is given • Determines the type of data which will appear in a graph, based on its axes* • Analyzes data in line graphs* • Interprets data in complex graphs (exponential, logistic, multiple lines)* • Interprets data presented in tables and charts that show data in more than two columns or categories • Analyzes data presented in tables and charts • Analyzes data shown in diagrams 	<ul style="list-style-type: none"> • Describes trends in line graphs where units are not given • Determines the type of data which will appear in a graph, based on its axes* 	
Making Inferences and Drawing Conclusions	Making Inferences and Drawing Conclusions	Making Inferences and Drawing Conclusions
<ul style="list-style-type: none"> • Explains that scientific theories depend on logically consistent arguments* • Recognizes that scientific explanations must be based on observations and scientific knowledge* • Draws conclusions from data presented in tables containing two manipulated (independent) variables* • Draws conclusions from experimental observations • Makes inferences that limit themselves to the data 	<ul style="list-style-type: none"> • Recognizes that scientific explanations are considered valid when they meet multiple criteria (e.g., consistency with the evidence seen in nature, respect for the rules of evidence, openness to criticism, communication of methods used, public communication of results)* • Explains that scientific theories depend on logically consistent arguments* • Draws conclusions from data presented in tables 	<ul style="list-style-type: none"> • Recognizes that scientific explanations are considered valid when they meet multiple criteria (e.g., consistency with the evidence seen in nature, respect for the rules of evidence, openness to criticism, communication of methods used, public communication of results)* • Evaluates inferences within the context of a scientific investigation* • Classifies statements as inferences*

<ul style="list-style-type: none"> • which has been presented and avoids speculation • Understands that to be scientific, explanations must be supported with evidence • Draws conclusions from complex tables, charts or graphs* • Draws conclusions from complex diagrams • Extrapolates from data presented in diagrams • Interpolates from data presented in graphs* • Interpolates from data presented in diagrams* • Explains that results are significant if they most likely did not occur by chance • Draws conclusions from data described as "significant"* 	<ul style="list-style-type: none"> • containing two manipulated (independent) variables* • Makes inferences that limit themselves to the data which has been presented and avoids speculation • Makes inferences using deductive reasoning • Determines which evidence will best support a particular inference • Draws conclusions from data presented in simple (T) tables or charts • Classifies statements as inferences* • Extrapolates from data presented in diagrams • Extrapolates from data given in a table, by estimating the trend shown* • Interpolates from data presented in tables* • Interpolates from data presented in graphs* 	<ul style="list-style-type: none"> • Extrapolates from data presented in graphs where units are not shown on one or more axes* • Evaluates the significance of results*
<p>Observation and Measurement</p>	<p>Observation and Measurement</p>	<p>Observation and Measurement</p>
<ul style="list-style-type: none"> • Determines which observations are relevant to an investigation* • Predicts how objects will appear when viewed from different angles* • Distinguishes among examples of direct observations and predictions* • Understands that things that change over time can be measured* • Measures the temperature shown on a thermometer, using interpolation • Chooses the appropriate tools to measure the speed of an object* • Understands that quantitative observations are often more precise than qualitative observations 	<ul style="list-style-type: none"> • Limits observations to the descriptions of properties and processes that those that are observed using the senses and or tools that extend the senses, not what may have happened previously, or what might happen next* • Distinguishes among examples of observations and inferences* • Measures the temperature shown on a thermometer, using interpolation • Estimates length when given a ruler smaller than the object being measured* • Chooses the appropriate tools to measure mass* • Understands that measurement of weight on a scale is not dependent on the arrangement of that object on the scale, as long as the entire object is touching only the scale* • Chooses the appropriate tools to measure volume* • Measures the temperature shown on a thermometer (negative numbers)* • Classifies statements as quantitative observations* • Understands that quantitative observations are often more precise than qualitative observations • Understands that precise measurements are an accurate, specific description of quantity, not estimations of quantity • Explains that the more accurate a tool is, the smaller the changes it is able to measure* 	<ul style="list-style-type: none"> • Describes qualities that make observations scientific* • Understands that some tools are used to extend the senses* • Classifies statements as quantitative observations*
<p>Communicating Results</p>	<p>Communicating Results</p>	<p>Communicating Results</p>
<ul style="list-style-type: none"> • Selects graphs as the most appropriate way to present 	<ul style="list-style-type: none"> • Selects the appropriate graph to represent data shown 	

trends in data* • Represents observations using symbols and diagrams* • Communicates results clearly and accurately	in a table*	
<i>New Vocabulary:</i> chance, claim, control, decrease, design experiment, formulate model, graduated cylinder, hold constant, increase, independent variable, interpret data, interval, investigate, justify, level, material, meter stick, pendulum, precision, quality, quantity, random group, reliable, scale (measurement), significant, statistics, trial-and-error procedure	<i>New Vocabulary:</i> beaker, controlled experiment, dependent, disprove, orderly pattern, phenomena, probable, quantitative, replicate, replication, scientific evidence, theorize	<i>New Vocabulary:</i> scientific, sense extender
<i>New Signs and Symbols:</i> g gram, mL milliliter/millilitre, – negative, sec second	<i>New Signs and Symbols:</i> ' foot, " inch	<i>New Signs and Symbols:</i> % percent

Subject: Concepts and Processes

Goal Strand: Tech Design and Sci Inq: Design Sci Investigations

RIT Score Range: 221 - 230

Skills and Concepts to Enhance 211 - 220	Skills and Concepts to Develop 221 - 230	Skills and Concepts to Introduce 231 - 240
<p>Designing Experiments</p> <ul style="list-style-type: none"> • Understands that a key part of science is for scientists to confirm each other's findings* • Understands that to replicate an experiment, the conditions of the experiment should be as similar to the original as possible • Understands that patterns and trends are easier to see when an experiment is repeated several times, multiple sets of data are collected, or data is averaged • Compares the results produced when an experiment is repeated several times* • Recognizes that it can be difficult to determine the sources of error in an experiment* • Lists possible reasons for inconsistent results* • Recognizes that a controlled experiment will produce reproducible results* • Compares controlled and uncontrolled experiments in terms of the consistency of data produced* • Defines scientific theory* • Contrasts the terms hypothesis, theory, principle, law, model, and paradigm as used by scientists* • Classifies a particular scientific explanation as a theory* • Distinguishes examples of observations from facts, theories, and hypotheses* • Classifies a particular statement as an hypothesis* • Determines which information should be collected in an experiment to answer a specific question • Evaluates to determine which procedure will best answer a specific question or solve a specific problem • Evaluates which procedure will best test a given hypothesis* • Evaluates and improves the quality of an experimental design* • Classifies example representing specific stages of a specific scientific investigation 	<p>Designing Experiments</p> <ul style="list-style-type: none"> • Recognizes why it is important for scientific observations to be repeated before drawing conclusions* • Recognizes why other scientists must be able to replicate results of an experiment* • Recognizes that an idea must be tested multiple times before being accepted or rejected* • Recognizes that uncertainty in measurement can produce results that differ slightly from experiment to experiment* • Recognizes that slight changes in an experimental method can produce changes in the result of an investigation* • Recognizes that slight differences in the things being investigated can produce differences in the result* • Recognizes that when results differ, it is necessary to judge whether the differences are trivial or significant, and further study may be needed to determine this* • Explains variations in the data recorded during an investigation* • Explains limitations in the data recording during an experiment* • Explains why a controlled experiment will produce reproducible results* • Explains why repeating an investigation multiple times may increase the reliability of the data collected* • Explains that before experimental results are generalized to a wider set of conditions, it is important to repeat the experiment using these conditions (e.g., drug tests, use of model organisms)* • Distinguishes hypotheses from conclusions and observations • Explains why there may be discrepancies between a scientific law and actual observations* • Relates scientific theory, generation of hypotheses, and experimentation* 	<p>Designing Experiments</p> <ul style="list-style-type: none"> • Recognizes why it is important for scientific observations to be repeated before drawing conclusions* • Classifies a given experiment as an example of replication when given the conditions and purpose of the experiment* • Recognizes that when results differ, it is necessary to judge whether the differences are trivial or significant, and further study may be needed to determine this* • Defines scientific paradigm* • Explains how theories are used to answer questions* • Explains how laws are used to answer questions* • Explains how facts are used to answer questions*

	<ul style="list-style-type: none"> • Distinguishes between the ideas of hypothesis, fact, observation, opinion, model, and theory • Classifies a particular statement as an hypothesis* • Compares the terms hypothesis, theory, principle, law, model, paradigm as used by scientists* • Contrasts the terms theory and law* • Understands that the more precise a procedure is, the more likely it is that it will be replicable* 	
Controlling Variables	Controlling Variables	Controlling Variables
<ul style="list-style-type: none"> • Classifies the objects or persons undergoing a specific portion of an experiment as the control group* • Explains the importance of controlling variables in an experiment* • Determines which variable should be controlled in an experimental design, when given the problem or question being studied* • Determines which variables are being controlled in a given experimental set-up* 	<ul style="list-style-type: none"> • Determines which variable (independent or manipulated) is being tested in control setup, when this variable has been purposefully omitted from the setup* • Determines which variable (independent or manipulated) is being tested in a given experimental setup • Determines the independent variable by examining data presented as a line graph* • Determines the control group in a given experimental set-up* • Controls variables so that only the variable being tested changes over time 	<ul style="list-style-type: none"> • Identifies the dependent variable in a given experimental setup*
Collecting and Interpreting Data	Collecting and Interpreting Data	Collecting and Interpreting Data
<ul style="list-style-type: none"> • Describes trends in line graphs where units are not given • Determines the type of data which will appear in a graph, based on its axes* 		
Making Inferences and Drawing Conclusions	Making Inferences and Drawing Conclusions	Making Inferences and Drawing Conclusions
<ul style="list-style-type: none"> • Recognizes that scientific explanations are considered valid when they meet multiple criteria (e.g., consistency with the evidence seen in nature, respect for the rules of evidence, openness to criticism, communication of methods used, public communication of results)* • Explains that scientific theories depend on logically consistent arguments* • Draws conclusions from data presented in tables containing two manipulated (independent) variables* • Makes inferences that limit themselves to the data which has been presented and avoids speculation • Makes inferences using deductive reasoning • Determines which evidence will best support a particular inference • Draws conclusions from data presented in simple (T) 	<ul style="list-style-type: none"> • Recognizes that scientific explanations are considered valid when they meet multiple criteria (e.g., consistency with the evidence seen in nature, respect for the rules of evidence, openness to criticism, communication of methods used, public communication of results)* • Evaluates inferences within the context of a scientific investigation* • Classifies statements as inferences* • Extrapolates from data presented in graphs where units are not shown on one or more axes* • Evaluates the significance of results* 	<ul style="list-style-type: none"> • Extrapolates from data presented in graphs (exponential/logistic relationships)*

<p>tables or charts</p> <ul style="list-style-type: none"> • Classifies statements as inferences* • Extrapolates from data presented in diagrams • Extrapolates from data given in a table, by estimating the trend shown* • Interpolates from data presented in tables* • Interpolates from data presented in graphs* 		
Observation and Measurement	Observation and Measurement	Observation and Measurement
<ul style="list-style-type: none"> • Limits observations to the descriptions of properties and processes that those that are observed using the senses and or tools that extend the senses, not what may have happened previously, or what might happen next* • Distinguishes among examples of observations and inferences* • Measures the temperature shown on a thermometer, using interpolation • Estimates length when given a ruler smaller than the object being measured* • Chooses the appropriate tools to measure mass* • Understands that measurement of weight on a scale is not dependent on the arrangement of that object on the scale, as long as the entire object is touching only the scale* • Chooses the appropriate tools to measure volume* • Measures the temperature shown on a thermometer (negative numbers)* • Classifies statements as quantitative observations* • Understands that quantitative observations are often more precise than qualitative observations • Understands that precise measurements are an accurate, specific description of quantity, not estimations of quantity • Explains that the more accurate a tool is, the smaller the changes it is able to measure* 	<ul style="list-style-type: none"> • Describes qualities that make observations scientific* • Understands that some tools are used to extend the senses* • Classifies statements as quantitative observations* 	<ul style="list-style-type: none"> • Classifies statements as qualitative observations*
Communicating Results	Communicating Results	Communicating Results
<ul style="list-style-type: none"> • Selects the appropriate graph to represent data shown in a table* 		<ul style="list-style-type: none"> • Evaluates written results for accuracy and clarity*
<i>New Vocabulary:</i> beaker, controlled experiment, dependent, disprove, orderly pattern, phenomena, probable, quantitative, replicate, replication, scientific evidence, theorize	<i>New Vocabulary:</i> scientific, sense extender	<i>New Vocabulary:</i> factual, procedure, qualitative, replicable, researcher
<i>New Signs and Symbols:</i> ' foot, " inch	<i>New Signs and Symbols:</i> % percent	<i>New Signs and Symbols:</i> kg kilogram

Subject: Concepts and Processes

Goal Strand: Tech Design and Sci Inq: Design Sci Investigations

RIT Score Range: 231 - 240

Skills and Concepts to Enhance 221 - 230	Skills and Concepts to Develop 231 - 240	Skills and Concepts to Introduce Above 240
<p>Designing Experiments</p> <ul style="list-style-type: none"> • Recognizes why it is important for scientific observations to be repeated before drawing conclusions* • Recognizes why other scientists must be able to replicate results of an experiment* • Recognizes that an idea must be tested multiple times before being accepted or rejected* • Recognizes that uncertainty in measurement can produce results that differ slightly from experiment to experiment* • Recognizes that slight changes in an experimental method can produce changes in the result of an investigation* • Recognizes that slight differences in the things being investigated can produce differences in the result* • Recognizes that when results differ, it is necessary to judge whether the differences are trivial or significant, and further study may be needed to determine this* • Explains variations in the data recorded during an investigation* • Explains limitations in the data recording during an experiment* • Explains why a controlled experiment will produce reproducible results* • Explains why repeating an investigation multiple times may increase the reliability of the data collected* • Explains that before experimental results are generalized to a wider set of conditions, it is important to repeat the experiment using these conditions (e.g., drug tests, use of model organisms)* • Distinguishes hypotheses from conclusions and observations • Explains why there may be discrepancies between a scientific law and actual observations* • Relates scientific theory, generation of hypotheses, and experimentation* 	<p>Designing Experiments</p> <ul style="list-style-type: none"> • Recognizes why it is important for scientific observations to be repeated before drawing conclusions* • Classifies a given experiment as an example of replication when given the conditions and purpose of the experiment* • Recognizes that when results differ, it is necessary to judge whether the differences are trivial or significant, and further study may be needed to determine this* • Defines scientific paradigm* • Explains how theories are used to answer questions* • Explains how laws are used to answer questions* • Explains how facts are used to answer questions* 	<p>Designing Experiments</p>

<ul style="list-style-type: none"> • Distinguishes between the ideas of hypothesis, fact, observation, opinion, model, and theory • Classifies a particular statement as an hypothesis* • Compares the terms hypothesis, theory, principle, law, model, paradigm as used by scientists* • Contrasts the terms theory and law* • Understands that the more precise a procedure is, the more likely it is that it will be replicable* 		
Controlling Variables	Controlling Variables	Controlling Variables
<ul style="list-style-type: none"> • Determines which variable (independent or manipulated) is being tested in control setup, when this variable has been purposefully omitted from the setup* • Determines which variable (independent or manipulated) is being tested in a given experimental setup • Determines the independent variable by examining data presented as a line graph* • Determines the control group in a given experimental set-up* • Controls variables so that only the variable being tested changes over time 	<ul style="list-style-type: none"> • Identifies the dependent variable in a given experimental setup* 	
Collecting and Interpreting Data	Collecting and Interpreting Data	Collecting and Interpreting Data
Making Inferences and Drawing Conclusions	Making Inferences and Drawing Conclusions	Making Inferences and Drawing Conclusions
<ul style="list-style-type: none"> • Recognizes that scientific explanations are considered valid when they meet multiple criteria (e.g., consistency with the evidence seen in nature, respect for the rules of evidence, openness to criticism, communication of methods used, public communication of results)* • Evaluates inferences within the context of a scientific investigation* • Classifies statements as inferences* • Extrapolates from data presented in graphs where units are not shown on one or more axes* • Evaluates the significance of results* 	<ul style="list-style-type: none"> • Extrapolates from data presented in graphs (exponential/logistic relationships)* 	<ul style="list-style-type: none"> • Extrapolates from data presented in tables using calculations*
Observation and Measurement	Observation and Measurement	Observation and Measurement
<ul style="list-style-type: none"> • Describes qualities that make observations scientific* • Understands that some tools are used to extend the senses* • Classifies statements as quantitative observations* 	<ul style="list-style-type: none"> • Classifies statements as qualitative observations* 	

Communicating Results	Communicating Results	Communicating Results
	<ul style="list-style-type: none"> Evaluates written results for accuracy and clarity* 	
<i>New Vocabulary:</i> scientific, sense extender	<i>New Vocabulary:</i> factual, procedure, qualitative, replicable, researcher	<i>New Vocabulary:</i> none
<i>New Signs and Symbols:</i> % percent	<i>New Signs and Symbols:</i> kg kilogram	<i>New Signs and Symbols:</i> none

Subject: Concepts and Processes

Goal Strand: Tech Design and Sci Inq: Design Sci Investigations

RIT Score Range: Above 240

Skills and Concepts to Enhance 231 - 240	Skills and Concepts to Develop Above 240
Designing Experiments	Designing Experiments
<ul style="list-style-type: none"> • Recognizes why it is important for scientific observations to be repeated before drawing conclusions* • Classifies a given experiment as an example of replication when given the conditions and purpose of the experiment* • Recognizes that when results differ, it is necessary to judge whether the differences are trivial or significant, and further study may be needed to determine this* • Defines scientific paradigm* • Explains how theories are used to answer questions* • Explains how laws are used to answer questions* • Explains how facts are used to answer questions* 	
Controlling Variables	Controlling Variables
<ul style="list-style-type: none"> • Identifies the dependent variable in a given experimental setup* 	
Collecting and Interpreting Data	Collecting and Interpreting Data
Making Inferences and Drawing Conclusions	Making Inferences and Drawing Conclusions
<ul style="list-style-type: none"> • Extrapolates from data presented in graphs (exponential/logistic relationships)* 	<ul style="list-style-type: none"> • Extrapolates from data presented in tables using calculations*
Observation and Measurement	Observation and Measurement
<ul style="list-style-type: none"> • Classifies statements as qualitative observations* 	
Communicating Results	Communicating Results
<ul style="list-style-type: none"> • Evaluates written results for accuracy and clarity* 	
<i>New Vocabulary: factual, procedure, qualitative, replicable, researcher</i>	<i>New Vocabulary: none</i>
<i>New Signs and Symbols: kg kilogram</i>	<i>New Signs and Symbols: none</i>