DesCartes
(Combined)

Subject: Concepts and Processes
Goal: Connections; Nature of Science

Subject: Concepts and Processes
Goal Strand: Connections; Nature of Science
RIT Score Range: Below 171

Skills and Concepts to Develop Below 171	Skills and Concepts to Introduce 171 - 180
System, Order, Organization, Interactions; Form	**System, Order, Organization, Interactions; Form**
• Recognizes examples of systems (term not used) and their parts*	• 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
Evidence, Models and Explanations	**Evidence, Models and Explanations**
Evolution, Equilibrium and Energy	**Evolution, Equilibrium and Energy**
	• 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
Nature of Science	**Nature of Science**
Science and Technology; Personal-Social Issues	**Science and Technology; Personal-Social Issues**
	• Explains how new tools and technologies affect the way we view the world*
New Vocabulary: none	*New Vocabulary:* cause, change, interaction, science, technology, variable
New Signs and Symbols: none	*New Signs and Symbols:* ¢ cent sign

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Subject: Concepts and Processes
Goal Strand: Connections; Nature of Science
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
System, Order, Organization, Interactions; Form	**System, Order, Organization, Interactions; Form**	**System, Order, Organization, Interactions; Form**
• Recognizes examples of systems (term not used) and their parts*	• 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	• 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)*
Evidence, Models and Explanations	**Evidence, Models and Explanations**	**Evidence, Models and Explanations**
Evolution, Equilibrium and Energy	**Evolution, Equilibrium and Energy**	**Evolution, Equilibrium and Energy**
	• 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 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
Nature of Science	**Nature of Science**	**Nature of Science**
		• 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* • Recognizes that the purpose of scientific inquiry is to better understand the natural world • Describes how theories are developed* • Recognizes that scientific theories depend on evidence*
Science and Technology; Personal-Social Issues	**Science and Technology; Personal-Social Issues**	**Science and Technology; Personal-Social Issues**
	• Explains how new tools and technologies affect the way we view the world*	

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New Vocabulary: none	*New Vocabulary:* cause, change, interaction, science, technology, variable	*New Vocabulary:* accurate, data, experiment, measurement, reason, scientific theory, scientist
New Signs and Symbols: none	*New Signs and Symbols:* ¢ cent sign	*New Signs and Symbols:* none

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Subject: Concepts and Processes
Goal Strand: Connections; Nature of Science
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
System, Order, Organization, Interactions; Form	**System, Order, Organization, Interactions; Form**	**System, Order, Organization, Interactions; Form**
• 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	• 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)*	• 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*
Evidence, Models and Explanations	**Evidence, Models and Explanations**	**Evidence, Models and Explanations**
		• 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*
Evolution, Equilibrium and Energy	**Evolution, Equilibrium and Energy**	**Evolution, Equilibrium and Energy**
• 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 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	• 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

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		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)*
Nature of Science	**Nature of Science**	**Nature of Science**
	• 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* • Recognizes that the purpose of scientific inquiry is to better understand the natural world • Describes how theories are developed* • Recognizes that scientific theories depend on evidence*	• 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* • Explains why a scientific investigation will work the same way in different places* • Recognizes that science is limited to understanding the physical causes of the physical world* • 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* • Understands that a key part of the scientific process is accurate communication of procedures and results to others* • Recognizes that scientific explanations must be based on observations and scientific knowledge*

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Science and Technology; Personal-Social Issues	Science and Technology; Personal-Social Issues	Science and Technology; Personal-Social Issues
• Explains how new tools and technologies affect the way we view the world*		• Uses technology in scientific investigations to gather accurate data*
New Vocabulary: cause, change, interaction, science, technology, variable	*New Vocabulary:* accurate, data, experiment, measurement, reason, scientific theory, scientist	*New Vocabulary:* cause and effect relationship, composition, condition, cyclic pattern, evidence, exert, experimental result, field, gradient, hypothesis, imbalance, interact, mechanism, prediction, quantification, regular pattern, scientific law, scientific model, series, slope, speed, test, trial
New Signs and Symbols: ¢ cent sign	*New Signs and Symbols:* none	*New Signs and Symbols:* ℃ Celsius, ° degrees

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Subject: Concepts and Processes
Goal Strand: Connections; Nature of Science
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
System, Order, Organization, Interactions; Form	**System, Order, Organization, Interactions; Form**	**System, Order, Organization, Interactions; Form**
• 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)*	• 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*	• 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*
Evidence, Models and Explanations	**Evidence, Models and Explanations**	**Evidence, Models and Explanations**
	• 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*	• 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*
Evolution, Equilibrium and Energy	**Evolution, Equilibrium and Energy**	**Evolution, Equilibrium and Energy**
• 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	• 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*	• 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

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	• 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)*	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
Nature of Science	**Nature of Science**	**Nature of Science**
• 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* • Recognizes that the purpose of scientific inquiry is to better understand the natural world • Describes how theories are developed* • Recognizes that scientific theories depend on evidence*	• 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* • Explains why a scientific investigation will work the same way in different places* • Recognizes that science is limited to understanding the physical causes of the physical world* • Recognizes that direct observations allow a	• 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* • Explains why a scientific investigation will work the same way in different places* • Recognizes that scientific ideas are tentative and therefore subject to change* • Explains that as scientific knowledge increases, scientific ideas are subject to change • Understands that scientific knowledge is incomplete, and room exists for advancement in our understanding • Describes how scientific knowledge is modified as new information challenges previously held theories

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	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* • Understands that a key part of the scientific process is accurate communication of procedures and results to others* • Recognizes that scientific explanations must be based on observations and scientific knowledge*	• Recognizes that scientific understanding is produced through use of empirical standards (i.e., the use of direct observation and measurement)* • 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* • Describes factors that produce biased data* • Recognizes bias in scientific information* • Explains that scientific theories depend on logically consistent arguments* • Recognizes that scientific explanations must be based on observations and scientific knowledge*
Science and Technology; Personal-Social Issues	**Science and Technology; Personal-Social Issues**	**Science and Technology; Personal-Social Issues**
	• Uses technology in scientific investigations to gather accurate data*	• Explains how scientific knowledge and economics drive the development of technology* • Explains that scientific advances often depend on development of new technologies*
New Vocabulary: accurate, data, experiment, measurement, reason, scientific theory, scientist	*New Vocabulary:* cause and effect relationship, composition, condition, cyclic pattern, evidence, exert, experimental result, field, gradient, hypothesis, imbalance, interact, mechanism, prediction, quantification, regular pattern, scientific law, scientific model, series, slope, speed, test, trial	*New Vocabulary:* accelerate, apparent size, arrangement, balance (equilibrium), claim, contact, discard, disequilibrium, double-pan balance, evaluate, evolution, evolutionary change, evolutionary trend, evolve, field of view, geologist, magnification power, material, observable, orderly, percentage, physical model, predictable, regular increase, reject, reversible, scale model, scaled up
New Signs and Symbols: none	*New Signs and Symbols:* ℃ Celsius, ° degrees	*New Signs and Symbols:* ., . decimal point, ft feet, km kilometer/kilometre, %

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Subject: Concepts and Processes
Goal Strand: Connections; Nature of Science
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
System, Order, Organization, Interactions; Form	**System, Order, Organization, Interactions; Form**	**System, Order, Organization, Interactions; Form**
• 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*	• 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*	• 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*
Evidence, Models and Explanations	**Evidence, Models and Explanations**	**Evidence, Models and Explanations**
• 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*	• 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*	• 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*
Evolution, Equilibrium and Energy	**Evolution, Equilibrium and Energy**	**Evolution, Equilibrium and Energy**
• 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	• 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	• 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*

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• 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)*	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	• 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*
Nature of Science	**Nature of Science**	**Nature of Science**
• 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* • Explains why a scientific investigation will work the same way in different places*	• 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* • Explains why a scientific investigation will work the same way in different places* • Recognizes that scientific ideas are tentative and therefore subject to change* • Explains that as scientific knowledge increases, scientific ideas are subject to change • Understands that scientific knowledge is incomplete,	• 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

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• Recognizes that science is limited to understanding the physical causes of the physical world* • 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* • Understands that a key part of the scientific process is accurate communication of procedures and results to others* • Recognizes that scientific explanations must be based on observations and scientific knowledge*	and room exists for advancement in our understanding • Describes how scientific knowledge is modified as new information challenges previously held theories • Recognizes that scientific understanding is produced through use of empirical standards (i.e., the use of direct observation and measurement)* • 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* • Describes factors that produce biased data* • Recognizes bias in scientific information* • Explains that scientific theories depend on logically consistent arguments* • Recognizes that scientific explanations must be based on observations and scientific knowledge*	reproducible results* • Compares controlled and uncontrolled experiments in terms of the consistency of data produced* • Recognizes that science changes as new theories and evidence arise* • Explains that scientific knowledge is tentative and therefore subject to change as new evidence is uncovered* • Gives examples of changes in scientific knowledge that have resulted from the appearance of new evidence* • Recognizes that when data is incomplete, great opportunity for advancement exists* • Recognizes that when little understanding of an area exists, scientists may interpret data and theory differently* • Explains that scientists investigate for many differing reasons, but the ultimate purpose is to understand the natural world* • Describes characteristics of scientific thinking* • Recognizes that reasoning can be distorted by strong emotions* • 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* • Describes factors that produce biased data* • Explains that science limits itself to natural phenomena* • Explains that scientific explanations limit themselves to natural causes for natural phenomena* • Recognizes that a key assumption of science is that the universe is a vast, single system that operates according to a single, consistent set of rules* • Recognizes that a key assumption of science is that the rules which govern the universe can be discovered and understood by careful, systematic study* • 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

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		communication of results)* • Explains that scientific theories depend on logically consistent arguments*
Science and Technology; Personal-Social Issues	**Science and Technology; Personal-Social Issues**	**Science and Technology; Personal-Social Issues**
• Uses technology in scientific investigations to gather accurate data*	• Explains how scientific knowledge and economics drive the development of technology* • Explains that scientific advances often depend on development of new technologies*	• Applies the steps of technological design • Compares and contrasts the procedures used in scientific inquiry and technological design*
New Vocabulary: cause and effect relationship, composition, condition, cyclic pattern, evidence, exert, experimental result, field, gradient, hypothesis, imbalance, interact, mechanism, prediction, quantification, regular pattern, scientific law, scientific model, series, slope, speed, test, trial	*New Vocabulary:* accelerate, apparent size, arrangement, balance (equilibrium), claim, contact, discard, disequilibrium, double-pan balance, evaluate, evolution, evolutionary change, evolutionary trend, evolve, field of view, geologist, magnification power, material, observable, orderly, percentage, physical model, predictable, regular increase, reject, reversible, scale model, scaled up	*New Vocabulary:* absolute knowledge, balance, coincidence, cyclic, cyclic phenomenon, episodic, inconclusive, indicate, number pattern, phenomena, regulated, repeat, replication, results, testable, vary
New Signs and Symbols: ℃ Celsius, ° degrees	*New Signs and Symbols:* ., , decimal point, ft feet, km kilometer/kilometre, %	*New Signs and Symbols:* cubic centimeter/centimetre

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Subject: Concepts and Processes
Goal Strand: Connections; Nature of Science
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
System, Order, Organization, Interactions; Form	**System, Order, Organization, Interactions; Form**	**System, Order, Organization, Interactions; Form**
• 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*	• 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*	• Gives examples of inputs and outputs of systems*
Evidence, Models and Explanations	**Evidence, Models and Explanations**	**Evidence, Models and Explanations**
• 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*	• 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*	• 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*
Evolution, Equilibrium and Energy	**Evolution, Equilibrium and Energy**	**Evolution, Equilibrium and Energy**
• 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	• 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*	• 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*

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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	• 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*	
Nature of Science	**Nature of Science**	**Nature of Science**
• 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* • Explains why a scientific investigation will work the same way in different places* • Recognizes that scientific ideas are tentative and therefore subject to change* • Explains that as scientific knowledge increases, scientific ideas are subject to change • Understands that scientific knowledge is incomplete,	• 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	• 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

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and room exists for advancement in our understanding • Describes how scientific knowledge is modified as new information challenges previously held theories • Recognizes that scientific understanding is produced through use of empirical standards (i.e., the use of direct observation and measurement)* • 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* • Describes factors that produce biased data* • Recognizes bias in scientific information* • Explains that scientific theories depend on logically consistent arguments* • Recognizes that scientific explanations must be based on observations and scientific knowledge*	reproducible results* • Compares controlled and uncontrolled experiments in terms of the consistency of data produced* • Recognizes that science changes as new theories and evidence arise* • Explains that scientific knowledge is tentative and therefore subject to change as new evidence is uncovered* • Gives examples of changes in scientific knowledge that have resulted from the appearance of new evidence* • Recognizes that when data is incomplete, great opportunity for advancement exists* • Recognizes that when little understanding of an area exists, scientists may interpret data and theory differently* • Explains that scientists investigate for many differing reasons, but the ultimate purpose is to understand the natural world* • Describes characteristics of scientific thinking* • Recognizes that reasoning can be distorted by strong emotions* • 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* • Describes factors that produce biased data* • Explains that science limits itself to natural phenomena* • Explains that scientific explanations limit themselves to natural causes for natural phenomena* • Recognizes that a key assumption of science is that the universe is a vast, single system that operates according to a single, consistent set of rules* • Recognizes that a key assumption of science is that the rules which govern the universe can be discovered and understood by careful, systematic study* • 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	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)* • Explains why scientific ideas may change over time* • Recognizes that despite the tentative nature of science, most core ideas of science have been confirmed through much observation and experimentation* • Recognizes that when an observation does not agree with accepted scientific theory, it may be because the observation is mistaken or fraudulent, or it may be because the theory is wrong* • Recognizes that any conclusion can be challenged by new evidence* • Recognizes that all scientific knowledge, regardless of age, can be reviewed, criticized, and if necessary, discarded* • Explains that because theories are models, they may be revised as more data becomes available* • Explains that as new theories develop, previous data is not discarded but is reevaluated* • Explains how experimental results may cause modification of a theory or hypothesis* • Recognizes that scientific knowledge accumulates most rapidly after the acceptance of a major new theory* • Recognizes that as scientific theories are continually reevaluated, minor shifts in scientific thinking may occur* • Recognizes that as scientific theories are continually reevaluated, major shifts in scientific thinking may occur* • Recognizes that scientific ideas that are supported by

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	communication of results)* • Explains that scientific theories depend on logically consistent arguments*	large amounts of data and observation are unlikely to change in the future* • Gives examples of changes in scientific knowledge that have resulted from the appearance of new evidence* • Recognizes that when there is insufficient data to answer the question, multiple scientific explanations may exist simultaneously* • Explains that when data is incomplete, new data can resolve competing theories* • Recognizes that when data is incomplete, great opportunity for advancement exists* • Recognizes that when little understanding of an area exists, scientists may interpret data and theory differently* • Recognizes that in areas of limited understanding, it may not be possible to determine which explanation is correct* • Recognizes that conclusions that are supported by insufficient data are weak* • Explains why areas of science with incomplete data are areas of opportunity* • Recognizes that the purpose of scientific inquiry is not the discovery of absolute truth* • Recognizes practices of science that distinguish it from other ways of knowing* • Explains how the use of logical arguments distinguishes science from other disciplines* • Recognizes that reasoning can be distorted by faulty data* • Recognizes that scientific understanding is produced through the use of logical arguments* • Recognizes that scientific understanding is produced through the use of skepticism* • 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* • 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*

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		• Contrasts the terms theory and law* • Explains how certain factors may bias data* • Explains why explanations about the natural world that are based on personal beliefs cannot be considered science* • Explains why explanations about the natural world that are based on religious values cannot be considered science* • Explains why explanations about the natural world that are based on superstition cannot be considered science* • Explains why explanations about the natural world that are based on authority cannot be considered science* • 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)*
Science and Technology; Personal-Social Issues	**Science and Technology; Personal-Social Issues**	**Science and Technology; Personal-Social Issues**
• Explains how scientific knowledge and economics drive the development of technology* • Explains that scientific advances often depend on development of new technologies*	• Applies the steps of technological design • Compares and contrasts the procedures used in scientific inquiry and technological design*	
New Vocabulary: accelerate, apparent size, arrangement, balance (equilibrium), claim, contact, discard, disequilibrium, double-pan balance, evaluate, evolution, evolutionary change, evolutionary trend, evolve, field of view, geologist, magnification power, material, observable, orderly, percentage, physical model, predictable, regular increase, reject, reversible, scale model, scaled up	*New Vocabulary:* absolute knowledge, balance, coincidence, cyclic, cyclic phenomenon, episodic, inconclusive, indicate, number pattern, phenomena, regulated, repeat, replication, results, testable, vary	*New Vocabulary:* cancellation, finding (scientific), invalid (data), opposing forces, principle, regular time interval
New Signs and Symbols: ., , . decimal point, ft feet, km kilometer/kilometre, %	*New Signs and Symbols:* cubic centimeter/centimetre	*New Signs and Symbols:* none

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Subject: Concepts and Processes
Goal Strand: Connections; Nature of Science
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
System, Order, Organization, Interactions; Form	**System, Order, Organization, Interactions; Form**	**System, Order, Organization, Interactions; Form**
• 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*	• Gives examples of inputs and outputs of systems*	• Understands that ordering sets of objects requires characteristics that have multiple forms (e.g., height, but not right/left-handedness)*
Evidence, Models and Explanations	**Evidence, Models and Explanations**	**Evidence, Models and Explanations**
• 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*	• 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*	• Analyzes relationships using a simple mathematical model*
Evolution, Equilibrium and Energy	**Evolution, Equilibrium and Energy**	**Evolution, Equilibrium and Energy**
• 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*	• 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*	• 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*

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• Analyzes changes in scale • Understands that correlations seen in data are most useful in making predictions when a cause-effect relationship is established*		
Nature of Science	**Nature of Science**	**Nature of Science**
• 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* • Recognizes that science changes as new theories and evidence arise* • Explains that scientific knowledge is tentative and therefore subject to change as new evidence is uncovered* • Gives examples of changes in scientific knowledge that have resulted from the appearance of new evidence* • Recognizes that when data is incomplete, great opportunity for advancement exists* • Recognizes that when little understanding of an area exists, scientists may interpret data and theory differently* • Explains that scientists investigate for many differing reasons, but the ultimate purpose is to understand the natural world* • Describes characteristics of scientific thinking* • Recognizes that reasoning can be distorted by strong emotions* • 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*	• 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)* • Explains why scientific ideas may change over time* • Recognizes that despite the tentative nature of science, most core ideas of science have been confirmed through much observation and experimentation* • Recognizes that when an observation does not agree with accepted scientific theory, it may be because the observation is mistaken or fraudulent, or it may be because the theory is wrong* • Recognizes that any conclusion can be challenged by	• 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* • Recognizes that when an observation does not agree with accepted scientific theory, it may be because the observation is mistaken or fraudulent, or it may be because the theory is wrong* • Recognizes that any conclusion can be challenged by new evidence* • Recognizes that all scientific knowledge, regardless of age, can be reviewed, criticized, and if necessary, discarded* • Explains that because theories are models, they may be revised as more data becomes available* • Recognizes that scientific knowledge accumulates most rapidly after the acceptance of a major new theory* • Recognizes that as scientific theories are continually reevaluated, minor shifts in scientific thinking may occur* • Recognizes that as scientific theories are continually reevaluated, major shifts in scientific thinking may occur* • Recognizes that scientific ideas that are supported by large amounts of data and observation are unlikely to change in the future* • Recognizes that when there is insufficient data to answer the question, multiple scientific explanations may exist simultaneously* • Explains that when data is incomplete, new data can resolve competing theories* • Recognizes that in areas of limited understanding, it may not be possible to determine which explanation is correct*

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• Distinguishes examples of observations from facts, theories, and hypotheses* • Classifies a particular statement as an hypothesis* • Describes factors that produce biased data* • Explains that science limits itself to natural phenomena* • Explains that scientific explanations limit themselves to natural causes for natural phenomena* • Recognizes that a key assumption of science is that the universe is a vast, single system that operates according to a single, consistent set of rules* • Recognizes that a key assumption of science is that the rules which govern the universe can be discovered and understood by careful, systematic study* • 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*	new evidence* • Recognizes that all scientific knowledge, regardless of age, can be reviewed, criticized, and if necessary, discarded* • Explains that because theories are models, they may be revised as more data becomes available* • Explains that as new theories develop, previous data is not discarded but is reevaluated* • Explains how experimental results may cause modification of a theory or hypothesis* • Recognizes that scientific knowledge accumulates most rapidly after the acceptance of a major new theory* • Recognizes that as scientific theories are continually reevaluated, minor shifts in scientific thinking may occur* • Recognizes that as scientific theories are continually reevaluated, major shifts in scientific thinking may occur* • Recognizes that scientific ideas that are supported by large amounts of data and observation are unlikely to change in the future* • Gives examples of changes in scientific knowledge that have resulted from the appearance of new evidence* • Recognizes that when there is insufficient data to answer the question, multiple scientific explanations may exist simultaneously* • Explains that when data is incomplete, new data can resolve competing theories* • Recognizes that when data is incomplete, great opportunity for advancement exists* • Recognizes that when little understanding of an area exists, scientists may interpret data and theory differently* • Recognizes that in areas of limited understanding, it may not be possible to determine which explanation is correct* • Recognizes that conclusions that are supported by insufficient data are weak* • Explains why areas of science with incomplete data are areas of opportunity* • Recognizes that the purpose of scientific inquiry is not the discovery of absolute truth* • Recognizes practices of science that distinguish it from other ways of knowing*	• Explains why areas of science with incomplete data are areas of opportunity* • Recognizes that the purpose of scientific inquiry is not the discovery of absolute truth* • Explains how the use of logical arguments distinguishes science from other disciplines* • Explains how the use of skepticism distinguishes science from other disciplines* • Evaluates pseudoscientific claims in the media* • 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* • Explains why explanations about the natural world that are based on personal beliefs cannot be considered science* • Explains why explanations about the natural world that are based on religious values cannot be considered science* • Explains why explanations about the natural world that are based on superstition cannot be considered science* • Explains why explanations about the natural world that are based on authority cannot be considered science*

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	• Explains how the use of logical arguments distinguishes science from other disciplines* • Recognizes that reasoning can be distorted by faulty data* • Recognizes that scientific understanding is produced through the use of logical arguments* • Recognizes that scientific understanding is produced through the use of skepticism* • 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* • 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* • Explains how certain factors may bias data* • Explains why explanations about the natural world that are based on personal beliefs cannot be considered science* • Explains why explanations about the natural world that are based on religious values cannot be considered science* • Explains why explanations about the natural world that are based on superstition cannot be considered science* • Explains why explanations about the natural world that are based on authority cannot be considered science* • 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)*	
Science and Technology; Personal-Social Issues	**Science and Technology; Personal-Social Issues**	**Science and Technology; Personal-Social Issues**
• Applies the steps of technological design • Compares and contrasts the procedures used in scientific inquiry and technological design*		
New Vocabulary: absolute knowledge, balance, coincidence, cyclic, cyclic phenomenon, episodic,	*New Vocabulary:* cancellation, finding (scientific), invalid (data), opposing forces, principle, regular time interval	*New Vocabulary:* factual, procedure, replicable, researcher

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inconclusive, indicate, number pattern, phenomena, regulated, repeat, replication, results, testable, vary		
New Signs and Symbols: cubic centimeter/centimetre	*New Signs and Symbols:* none	*New Signs and Symbols:* none

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Subject: Concepts and Processes
Goal Strand: Connections; Nature of Science
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
System, Order, Organization, Interactions; Form	**System, Order, Organization, Interactions; Form**	**System, Order, Organization, Interactions; Form**
• Gives examples of inputs and outputs of systems*	• Understands that ordering sets of objects requires characteristics that have multiple forms (e.g., height, but not right/left-handedness)*	
Evidence, Models and Explanations	**Evidence, Models and Explanations**	**Evidence, Models and Explanations**
• 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*	• Analyzes relationships using a simple mathematical model*	
Evolution, Equilibrium and Energy	**Evolution, Equilibrium and Energy**	**Evolution, Equilibrium and Energy**
• 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*	• 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*	• Gives examples of dynamic equilibrium in systems* • Infers that things that have come to rest are in equilibrium*
Nature of Science	**Nature of Science**	**Nature of Science**
• 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	• 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*	

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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)* • Explains why scientific ideas may change over time* • Recognizes that despite the tentative nature of science, most core ideas of science have been confirmed through much observation and experimentation* • Recognizes that when an observation does not agree with accepted scientific theory, it may be because the observation is mistaken or fraudulent, or it may be because the theory is wrong* • Recognizes that any conclusion can be challenged by new evidence* • Recognizes that all scientific knowledge, regardless of age, can be reviewed, criticized, and if necessary, discarded* • Explains that because theories are models, they may be revised as more data becomes available* • Explains that as new theories develop, previous data is not discarded but is reevaluated* • Explains how experimental results may cause modification of a theory or hypothesis* • Recognizes that scientific knowledge accumulates most rapidly after the acceptance of a major new theory* • Recognizes that as scientific theories are continually reevaluated, minor shifts in scientific thinking may	• Recognizes that when an observation does not agree with accepted scientific theory, it may be because the observation is mistaken or fraudulent, or it may be because the theory is wrong* • Recognizes that any conclusion can be challenged by new evidence* • Recognizes that all scientific knowledge, regardless of age, can be reviewed, criticized, and if necessary, discarded* • Explains that because theories are models, they may be revised as more data becomes available* • Recognizes that scientific knowledge accumulates most rapidly after the acceptance of a major new theory* • Recognizes that as scientific theories are continually reevaluated, minor shifts in scientific thinking may occur* • Recognizes that as scientific theories are continually reevaluated, major shifts in scientific thinking may occur* • Recognizes that scientific ideas that are supported by large amounts of data and observation are unlikely to change in the future* • Recognizes that when there is insufficient data to answer the question, multiple scientific explanations may exist simultaneously* • Explains that when data is incomplete, new data can resolve competing theories* • Recognizes that in areas of limited understanding, it may not be possible to determine which explanation is correct* • Explains why areas of science with incomplete data are areas of opportunity* • Recognizes that the purpose of scientific inquiry is not the discovery of absolute truth* • Explains how the use of logical arguments distinguishes science from other disciplines* • Explains how the use of skepticism distinguishes science from other disciplines* • Evaluates pseudoscientific claims in the media* • 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* • Explains why explanations about the natural world that	

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occur* • Recognizes that as scientific theories are continually reevaluated, major shifts in scientific thinking may occur* • Recognizes that scientific ideas that are supported by large amounts of data and observation are unlikely to change in the future* • Gives examples of changes in scientific knowledge that have resulted from the appearance of new evidence* • Recognizes that when there is insufficient data to answer the question, multiple scientific explanations may exist simultaneously* • Explains that when data is incomplete, new data can resolve competing theories* • Recognizes that when data is incomplete, great opportunity for advancement exists* • Recognizes that when little understanding of an area exists, scientists may interpret data and theory differently* • Recognizes that in areas of limited understanding, it may not be possible to determine which explanation is correct* • Recognizes that conclusions that are supported by insufficient data are weak* • Explains why areas of science with incomplete data are areas of opportunity* • Recognizes that the purpose of scientific inquiry is not the discovery of absolute truth* • Recognizes practices of science that distinguish it from other ways of knowing* • Explains how the use of logical arguments distinguishes science from other disciplines* • Recognizes that reasoning can be distorted by faulty data* • Recognizes that scientific understanding is produced through the use of logical arguments* • Recognizes that scientific understanding is produced through the use of skepticism* • 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*	are based on personal beliefs cannot be considered science* • Explains why explanations about the natural world that are based on religious values cannot be considered science* • Explains why explanations about the natural world that are based on superstition cannot be considered science* • Explains why explanations about the natural world that are based on authority cannot be considered science*	

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• 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* • Explains how certain factors may bias data* • Explains why explanations about the natural world that are based on personal beliefs cannot be considered science* • Explains why explanations about the natural world that are based on religious values cannot be considered science* • Explains why explanations about the natural world that are based on superstition cannot be considered science* • Explains why explanations about the natural world that are based on authority cannot be considered science* • 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)*		
Science and Technology; Personal-Social Issues	**Science and Technology; Personal-Social Issues**	**Science and Technology; Personal-Social Issues**
New Vocabulary: cancellation, finding (scientific), invalid (data), opposing forces, principle, regular time interval	*New Vocabulary:* factual, procedure, replicable, researcher	*New Vocabulary:* none
New Signs and Symbols: none	*New Signs and Symbols:* none	*New Signs and Symbols:* none

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Subject: Concepts and Processes
Goal Strand: Connections; Nature of Science
RIT Score Range: Above 240

Skills and Concepts to Enhance 231 - 240	Skills and Concepts to Develop Above 240
System, Order, Organization, Interactions; Form	**System, Order, Organization, Interactions; Form**
• Understands that ordering sets of objects requires characteristics that have multiple forms (e.g., height, but not right/left-handedness)*	
Evidence, Models and Explanations	**Evidence, Models and Explanations**
• Analyzes relationships using a simple mathematical model*	
Evolution, Equilibrium and Energy	**Evolution, Equilibrium and Energy**
• 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*	• Gives examples of dynamic equilibrium in systems* • Infers that things that have come to rest are in equilibrium*
Nature of Science	**Nature of Science**
• 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* • Recognizes that when an observation does not agree with accepted scientific theory, it may be because the observation is mistaken or fraudulent, or it may be	

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because the theory is wrong* • Recognizes that any conclusion can be challenged by new evidence* • Recognizes that all scientific knowledge, regardless of age, can be reviewed, criticized, and if necessary, discarded* • Explains that because theories are models, they may be revised as more data becomes available* • Recognizes that scientific knowledge accumulates most rapidly after the acceptance of a major new theory* • Recognizes that as scientific theories are continually reevaluated, minor shifts in scientific thinking may occur* • Recognizes that as scientific theories are continually reevaluated, major shifts in scientific thinking may occur* • Recognizes that scientific ideas that are supported by large amounts of data and observation are unlikely to change in the future* • Recognizes that when there is insufficient data to answer the question, multiple scientific explanations may exist simultaneously* • Explains that when data is incomplete, new data can resolve competing theories* • Recognizes that in areas of limited understanding, it may not be possible to determine which explanation is correct* • Explains why areas of science with incomplete data are areas of opportunity* • Recognizes that the purpose of scientific inquiry is not the discovery of absolute truth* • Explains how the use of logical arguments distinguishes science from other disciplines* • Explains how the use of skepticism distinguishes science from other disciplines* • Evaluates pseudoscientific claims in the media* • 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* • Explains why explanations about the natural world that are based on personal beliefs cannot be considered science* • Explains why explanations about the natural world that	

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are based on religious values cannot be considered science* • Explains why explanations about the natural world that are based on superstition cannot be considered science* • Explains why explanations about the natural world that are based on authority cannot be considered science*	
Science and Technology; Personal-Social Issues	**Science and Technology; Personal-Social Issues**
New Vocabulary: factual, procedure, replicable, researcher	*New Vocabulary:* none
New Signs and Symbols: none	*New Signs and Symbols:* none

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