7

Concepts and Processes

Contents

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Goal Strand: Science as Inquiry
RIT Score Range: Below 181

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• Interprets simple bar graphs • Interprets data in simple line graphs* • Draws conclusions from simple diagrams*	• Interprets simple bar graphs • Interprets trends in bar graphs • Interprets data represented as pictures or icons within a table or chart* • Interprets diagrams • Makes inferences about common events and phenomena
Identifying Variables and Their Relationships	**Identifying Variables and Their Relationships**
Formulating Models	**Formulating Models**
Designing Investigations, Understanding Inquiry	**Designing Investigations, Understanding Inquiry**
• Asks questions that define the problem to be investigated, and which will allow relevant data or information to be collected	• Recognizes that the purpose of scientific inquiry is to better understand the natural world • Asks questions that define the problem to be investigated, and which will allow relevant data or information to be collected • Describes observations clearly, objectively, and accurately
Constructing Hypotheses	**Constructing Hypotheses**
• Forms hypotheses that are based on real-life experience	
New Vocabulary: change, design, explain, gather, information, record	*New Vocabulary:* (data) log, accurate, average, color, conclude, data, expect, experiment, feet (measurement), identify, notes, observation, probable reason, reason, result, scientist, tool
New Signs and Symbols: none	*New Signs and Symbols:* C Celsius, ° degrees, E east, N north, S south, W west

* Both data from test items and review by NWEA curriculum specialists are used to place learning continuum statements into appropriate RIT ranges.
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Subject: Concepts and Processes
Goal Strand: Science as Inquiry
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
Acquiring, Processing, and Interpreting Data	**Acquiring, Processing, and Interpreting Data**	**Acquiring, Processing, and Interpreting Data**
• Interprets simple bar graphs • Interprets data in simple line graphs* • Draws conclusions from simple diagrams*	• Interprets simple bar graphs • Interprets trends in bar graphs • Interprets data represented as pictures or icons within a table or chart* • Interprets diagrams • Makes inferences about common events and phenomena	• 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* • Explains why data may not be consistent from trial to trial* • Explains that different people may interpret the same data or observations differently* • Draws conclusions from experimental observations • Extrapolates from data presented in tables • Extrapolates from data presented in graphs (linear relationships)*
Identifying Variables and Their Relationships	**Identifying Variables and Their Relationships**	**Identifying Variables and Their Relationships**
		• Determines which variables in a particular experiment must stay the same for results to be considered valid
Formulating Models	**Formulating Models**	**Formulating Models**
		• 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*
Designing Investigations, Understanding Inquiry	**Designing Investigations, Understanding Inquiry**	**Designing Investigations, Understanding Inquiry**
• Asks questions that define the problem to be investigated, and which will allow relevant data or information to be collected	• Recognizes that the purpose of scientific inquiry is to better understand the natural world • Asks questions that define the problem to be investigated, and which will allow relevant data or information to be collected • Describes observations clearly, objectively, and	• 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)*

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	accurately	• Differentiates among testable and non-testable questions (terms not used) • 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* • Describes observations clearly, objectively, and accurately • Evaluates written observations for accuracy and clarity* • Describes lab safety practices*
Constructing Hypotheses	**Constructing Hypotheses**	**Constructing Hypotheses**
• Forms hypotheses that are based on real-life experience		• Forms hypotheses that are based on observations and data
New Vocabulary: change, design, explain, gather, information, record	*New Vocabulary:* (data) log, accurate, average, color, conclude, data, expect, experiment, feet (measurement), identify, notes, observation, probable reason, reason, result, scientist, tool	*New Vocabulary:* affect, composition, condition, investigation, mechanism, prediction, reasonable result, scientific law, scientific method, scientific model, test, valid
New Signs and Symbols: none	*New Signs and Symbols:* C Celsius, ° degrees, E east, N north, S south, W west	*New Signs and Symbols:* a.m., cm^3 centimeter/centimetre, cubic centimeter/centimetre, p.m.

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Subject: Concepts and Processes
Goal Strand: Science as Inquiry
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
Acquiring, Processing, and Interpreting Data	**Acquiring, Processing, and Interpreting Data**	**Acquiring, Processing, and Interpreting Data**
• Interprets simple bar graphs • Interprets trends in bar graphs • Interprets data represented as pictures or icons within a table or chart* • Interprets diagrams • Makes inferences about common events and phenomena	• 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* • Explains why data may not be consistent from trial to trial* • Explains that different people may interpret the same data or observations differently* • Draws conclusions from experimental observations • Extrapolates from data presented in tables • Extrapolates from data presented in graphs (linear relationships)*	• 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 • Examines data to pinpoint possible errors in data collection* • Analyzes data shown in diagrams • 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"*
Identifying Variables and Their Relationships	**Identifying Variables and Their Relationships**	**Identifying Variables and Their Relationships**
	• Determines which variables in a particular experiment must stay the same for results to be considered valid	• Determines which variable (independent or manipulated) will be changed in the course of an investigation • Determines which variable should be controlled in an

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		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*
Formulating Models	**Formulating Models**	**Formulating Models**
	• 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*
Designing Investigations, Understanding Inquiry	**Designing Investigations, Understanding Inquiry**	**Designing Investigations, Understanding Inquiry**
• Recognizes that the purpose of scientific inquiry is to better understand the natural world • Asks questions that define the problem to be investigated, and which will allow relevant data or information to be collected • Describes observations clearly, objectively, and accurately	• 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) • 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* • Describes observations clearly, objectively, and accurately • Evaluates written observations for accuracy and clarity* • Describes lab safety practices*	• Asks questions that define the problem to be investigated, and which will allow relevant data or information to be collected • 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* • Selects graphs as the most appropriate way to present trends in data* • Represents observations using symbols and diagrams* • Communicates results clearly and accurately
Constructing Hypotheses	**Constructing Hypotheses**	**Constructing Hypotheses**
	• Forms hypotheses that are based on observations and data	• 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*
New Vocabulary: (data) log, accurate, average, color, conclude, data, expect, experiment, feet (measurement),	*New Vocabulary:* affect, composition, condition, investigation, mechanism, prediction, reasonable result,	*New Vocabulary:* chance, control, decrease, design experiment, evaluate, formulate model, geologist, hold

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identify, notes, observation, probable reason, reason, result, scientist, tool	scientific law, scientific method, scientific model, test, valid	constant, increase, independent variable, investigate, justify, level, pendulum, physical model, quality, quantity, random group, reliable, scale (measurement), significant, statistics
New Signs and Symbols: C Celsius, ° degrees, E east, N north, S south, W west	*New Signs and Symbols:* a.m., cm^3 centimeter/centimetre, cubic centimeter/centimetre, p.m	*New Signs and Symbols:* . decimal point, g gram, mL milliliter/millilitre, pH, sec second

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Subject: Concepts and Processes
Goal Strand: Science as Inquiry
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
Acquiring, Processing, and Interpreting Data	**Acquiring, Processing, and Interpreting Data**	**Acquiring, Processing, and Interpreting Data**
• 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* • Explains why data may not be consistent from trial to trial* • Explains that different people may interpret the same data or observations differently* • Draws conclusions from experimental observations • Extrapolates from data presented in tables • Extrapolates from data presented in graphs (linear relationships)*	• 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 • Examines data to pinpoint possible errors in data collection* • Analyzes data shown in diagrams • 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"*	• 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* • 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 the trend shown* • Interpolates from data presented in tables* • Interpolates from data presented in graphs*
Identifying Variables and Their Relationships	**Identifying Variables and Their Relationships**	**Identifying Variables and Their Relationships**
• Determines which variables in a particular experiment must stay the same for results to be considered valid	• Determines which variable (independent or manipulated) will be changed in the course of an investigation • Determines which variable should be controlled in an	• 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*

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	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*	• 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*
Formulating Models	**Formulating Models**	**Formulating Models**
• 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*
Designing Investigations, Understanding Inquiry	**Designing Investigations, Understanding Inquiry**	**Designing Investigations, Understanding Inquiry**
• 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) • 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* • Describes observations clearly, objectively, and accurately • Evaluates written observations for accuracy and clarity* • Describes lab safety practices*	• Asks questions that define the problem to be investigated, and which will allow relevant data or information to be collected • 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* • Selects graphs as the most appropriate way to present trends in data* • Represents observations using symbols and diagrams* • Communicates results clearly and accurately	• Explains that scientists investigate for many differing reasons, but the ultimate purpose is to understand the natural world* • Differentiates among testable and non-testable questions • Recognizes that testable questions are most useful in scientific investigations, as they can be answered by investigating* • 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* • Selects the appropriate graph to represent data shown in a table*
Constructing Hypotheses	**Constructing Hypotheses**	**Constructing Hypotheses**
• Forms hypotheses that are based on observations and data	• 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	• 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

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	hypotheses (outside of an experimental context)* • Distinguishes among examples of hypotheses and observations*	based on trends seen in data* • Makes predictions within the context of a scientific investigation • Classifies statements as hypotheses
New Vocabulary: affect, composition, condition, investigation, mechanism, prediction, reasonable result, scientific law, scientific method, scientific model, test, valid	*New Vocabulary:* chance, control, decrease, design experiment, evaluate, formulate model, geologist, hold constant, increase, independent variable, investigate, justify, level, pendulum, physical model, quality, quantity, random group, reliable, scale (measurement), significant, statistics	*New Vocabulary:* absolute knowledge, controlled experiment, dependent, disprove, inconclusive, orderly pattern, probable, scientific evidence, testable, theorize
New Signs and Symbols: a.m., cm^3 centimeter/centimetre, cubic centimeter/centimetre, p.m	*New Signs and Symbols:* . decimal point, g gram, mL milliliter/millilitre, pH, sec second	*New Signs and Symbols:* none

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Subject: Concepts and Processes
Goal Strand: Science as Inquiry
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
Acquiring, Processing, and Interpreting Data	**Acquiring, Processing, and Interpreting Data**	**Acquiring, Processing, and Interpreting Data**
• 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 • Examines data to pinpoint possible errors in data collection* • Analyzes data shown in diagrams • 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"*	• 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* • 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 the trend shown* • Interpolates from data presented in tables* • Interpolates from data presented in graphs*	• 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*
Identifying Variables and Their Relationships	**Identifying Variables and Their Relationships**	**Identifying Variables and Their Relationships**
• Determines which variable (independent or manipulated) will be changed in the course of an investigation • Determines which variable should be controlled in an	• 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 (independent or manipulated) is being tested in control setup, when this variable has been purposefully omitted from the setup*

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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*	• 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*	• 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
Formulating Models	**Formulating Models**	**Formulating Models**
• 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*
Designing Investigations, Understanding Inquiry	**Designing Investigations, Understanding Inquiry**	**Designing Investigations, Understanding Inquiry**
• Asks questions that define the problem to be investigated, and which will allow relevant data or information to be collected • 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* • Selects graphs as the most appropriate way to present trends in data* • Represents observations using symbols and diagrams* • Communicates results clearly and accurately	• Explains that scientists investigate for many differing reasons, but the ultimate purpose is to understand the natural world* • Differentiates among testable and non-testable questions • Recognizes that testable questions are most useful in scientific investigations, as they can be answered by investigating* • 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* • Selects the appropriate graph to represent data shown in a table*	• Recognizes that the purpose of scientific inquiry is not the discovery of absolute truth* • Understands that the more precise a procedure is, the more likely it is that it will be replicable*
Constructing Hypotheses	**Constructing Hypotheses**	**Constructing Hypotheses**
• 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	• Determines the hypothesis being tested, given a particular experimental setup or problem/question • Formulates testable hypotheses based on data presented in a table*	• Distinguishes between testable and nontestable hypotheses for a given experimental setup* • Describes results that would necessitate the revision of the hypothesis being tested*

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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*	• 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	
New Vocabulary: chance, control, decrease, design experiment, evaluate, formulate model, geologist, hold constant, increase, independent variable, investigate, justify, level, pendulum, physical model, quality, quantity, random group, reliable, scale (measurement), significant, statistics	*New Vocabulary:* absolute knowledge, controlled experiment, dependent, disprove, inconclusive, orderly pattern, probable, scientific evidence, testable, theorize	*New Vocabulary:* modification, principle, scientific
New Symbols: . decimal point, g gram, mL milliliter/millilitre, pH, sec second	*New Signs and Symbols:* none	*New Signs and Symbols:* % percent

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Subject: Concepts and Processes
Goal Strand: Science as Inquiry
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
Acquiring, Processing, and Interpreting Data	**Acquiring, Processing, and Interpreting Data**	**Acquiring, Processing, and Interpreting Data**
• 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* • 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 the trend shown* • Interpolates from data presented in tables* • Interpolates from data presented in graphs*	• 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*	• Extrapolates from data presented in graphs (exponential/logistic relationships)*
Identifying Variables and Their Relationships	**Identifying Variables and Their Relationships**	**Identifying Variables and Their Relationships**
• 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*	• 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	• Identifies the dependent variable in a given experimental setup*
Formulating Models	**Formulating Models**	**Formulating Models**
• Explains how models help scientists to understand the	• Differentiates among examples of models and	• Analyzes relationships using a simple mathematical

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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*	observations* • Selects appropriate scale models to represent data* • Assesses how well a model represents a real life event, process, or concept*	model*
Designing Investigations, Understanding Inquiry	**Designing Investigations, Understanding Inquiry**	**Designing Investigations, Understanding Inquiry**
• Explains that scientists investigate for many differing reasons, but the ultimate purpose is to understand the natural world* • Differentiates among testable and non-testable questions • Recognizes that testable questions are most useful in scientific investigations, as they can be answered by investigating* • 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* • Selects the appropriate graph to represent data shown in a table*	• Recognizes that the purpose of scientific inquiry is not the discovery of absolute truth* • Understands that the more precise a procedure is, the more likely it is that it will be replicable*	• Recognizes that the purpose of scientific inquiry is not the discovery of absolute truth* • Evaluates written results for accuracy and clarity*
Constructing Hypotheses	**Constructing Hypotheses**	**Constructing Hypotheses**
• 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	• Distinguishes between testable and nontestable hypotheses for a given experimental setup* • Describes results that would necessitate the revision of the hypothesis being tested*	• Formulates hypotheses within the context of a scientific investigation*
New Vocabulary: absolute knowledge, controlled experiment, dependent, disprove, inconclusive, orderly pattern, probable, scientific evidence, testable, theorize	*New Vocabulary:* modification, principle, scientific	*New Vocabulary:* none
New Signs and Symbols: none	*New Signs and Symbols:* % percent	*New Signs and Symbols:* none

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Blank cells indicate data are limited or unavailable for this range or document version.

Subject: Concepts and Processes
Goal Strand: Science as Inquiry
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
Acquiring, Processing, and Interpreting Data	**Acquiring, Processing, and Interpreting Data**	**Acquiring, Processing, and Interpreting Data**
• 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*	• Extrapolates from data presented in graphs (exponential/logistic relationships)*	• Extrapolates from data presented in tables using calculations*
Identifying Variables and Their Relationships	**Identifying Variables and Their Relationships**	**Identifying Variables and Their Relationships**
• 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	• Identifies the dependent variable in a given experimental setup*	
Formulating Models	**Formulating Models**	**Formulating Models**
• 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*	
Designing Investigations, Understanding Inquiry	**Designing Investigations, Understanding Inquiry**	**Designing Investigations, Understanding Inquiry**
• Recognizes that the purpose of scientific inquiry is not the discovery of absolute truth* • Understands that the more precise a procedure is, the more likely it is that it will be replicable*	• Recognizes that the purpose of scientific inquiry is not the discovery of absolute truth* • Evaluates written results for accuracy and clarity*	
Constructing Hypotheses	**Constructing Hypotheses**	**Constructing Hypotheses**
• Distinguishes between testable and nontestable hypotheses for a given experimental setup* • Describes results that would necessitate the revision of	• Formulates hypotheses within the context of a scientific investigation*	

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the hypothesis being tested*		
New Vocabulary: modification, principle, scientific	*New Vocabulary:* none	*New Vocabulary:* none
New Signs and Symbols: % percent	*New Signs and Symbols:* none	*New Signs and Symbols:* none

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Subject: Concepts and Processes
Goal Strand: Science as Inquiry
RIT Score Range: Above 240

Skills and Concepts to Enhance 231 - 240	Skills and Concepts to Develop Above 240
Acquiring, Processing, and Interpreting Data	**Acquiring, Processing, and Interpreting Data**
• Extrapolates from data presented in graphs (exponential/logistic relationships)*	• Extrapolates from data presented in tables using calculations*
Identifying Variables and Their Relationships	**Identifying Variables and Their Relationships**
• Identifies the dependent variable in a given experimental setup*	
Formulating Models	**Formulating Models**
• Analyzes relationships using a simple mathematical model*	
Designing Investigations, Understanding Inquiry	**Designing Investigations, Understanding Inquiry**
• Recognizes that the purpose of scientific inquiry is not the discovery of absolute truth* • Evaluates written results for accuracy and clarity*	
Constructing Hypotheses	**Constructing Hypotheses**
• Formulates hypotheses within the context of a scientific investigation*	
New Vocabulary: none	*New Vocabulary:* none
New Signs and Symbols: none	*New Signs and Symbols:* none

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

Skills and Concepts to Develop Below 171	Skills and Concepts to Introduce 171 - 180
Ability to do Scientific Inquiry, Process Skill	**Ability to do Scientific Inquiry, Process Skill**
• Recognizes examples of systems (term not used) and their parts*	• 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 • 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*
Science, Technology; Science in Personal Social	**Science, Technology; Science in Personal Social**
	• Explains how new tools and technologies affect the way we view the world*
Analyzing Investigations	**Analyzing Investigations**
New Vocabulary: none	*New Vocabulary:* after, before, cause, change, count, effect, find out, interaction, rank, scale (tool), science, technology, variable, weigh
New Signs and Symbols: none	*New Signs and Symbols:* ¢ cent sign

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Subject: Concepts and Processes
Goal Strand: 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
Ability to do Scientific Inquiry, Process Skill	**Ability to do Scientific Inquiry, Process Skill**	**Ability to do Scientific Inquiry, Process Skill**
• Recognizes examples of systems (term not used) and their parts*	• 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 • 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*	• 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)* • 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*
Science, Technology; Science in Personal Social	**Science, Technology; Science in Personal Social**	**Science, Technology; Science in Personal Social**
	• Explains how new tools and technologies affect the way we view the world*	
Analyzing Investigations	**Analyzing Investigations**	**Analyzing Investigations**
		• 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

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		replicable by anyone, anywhere* • Describes how theories are developed* • Recognizes that scientific theories depend on evidence*
New Vocabulary: none	*New Vocabulary:* after, before, cause, change, count, effect, find out, interaction, rank, scale (tool), science, technology, variable, weigh	*New Vocabulary:* accurate, color, data, experiment, magnifying glass, measurement, metric ruler, ruler, scientific theory, scientist, sense, sight, smell, taste, telescope, tool, touch
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: 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
Ability to do Scientific Inquiry, Process Skill	**Ability to do Scientific Inquiry, Process Skill**	**Ability to do Scientific Inquiry, Process Skill**
• 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 • 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*	• 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)* • 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*	• 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

* Both data from test items and review by NWEA curriculum specialists are used to place learning continuum statements into appropriate RIT ranges.
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		tables* • Orders steps of familiar procedures* • Understands that when components of systems interact, change occurs • Gives examples of interacting components* • 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*
Science, Technology; Science in Personal Social	**Science, Technology; Science in Personal Social**	**Science, Technology; Science in Personal Social**
• Explains how new tools and technologies affect the way we view the world*		• Uses technology in scientific investigations to gather accurate data*
Analyzing Investigations	**Analyzing Investigations**	**Analyzing Investigations**
	• 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* • 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*

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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*
New Vocabulary: after, before, cause, change, count, effect, find out, interaction, rank, scale (tool), science, technology, variable, weigh	*New Vocabulary:* accurate, color, data, experiment, magnifying glass, measurement, metric ruler, ruler, scientific theory, scientist, sense, sight, smell, taste, telescope, tool, touch	*New Vocabulary:* cause and effect relationship, computer, cyclic pattern, direct observation, enlarge, evidence, exert, experimental result, extend, field, gradient, hand lens, hypothesis, image, imbalance, instrument, interact, magnifying lens, perception, pH meter, position, prediction, quantification, quantify, regular pattern, senses, series, slope, speed, stethoscope, test, trial, vision, X-ray machine
New Signs and Symbols: ¢ cent sign	*New Signs and Symbols:* none	*New Signs and Symbols:* ℃ Celsius, . decimal point, ° degrees, min minute, mL milliliter/millilitre, pH

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Subject: Concepts and Processes
Goal Strand: 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
Ability to do Scientific Inquiry, Process Skill	**Ability to do Scientific Inquiry, Process Skill**	**Ability to do Scientific Inquiry, Process Skill**
• 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)* • 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*	• 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	• 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

* Both data from test items and review by NWEA curriculum specialists are used to place learning continuum statements into appropriate RIT ranges.
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	tables* • Orders steps of familiar procedures* • Understands that when components of systems interact, change occurs • Gives examples of interacting components* • 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*	• 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 • 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* • 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
Science, Technology; Science in Personal Social	**Science, Technology; Science in Personal Social**	**Science, Technology; Science in Personal Social**
	• 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*
Analyzing Investigations	**Analyzing Investigations**	**Analyzing Investigations**
• 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 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,	• 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*

* Both data from test items and review by NWEA curriculum specialists are used to place learning continuum statements into appropriate RIT ranges.
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• Describes how theories are developed* • Recognizes that scientific theories depend on evidence*	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*	• 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 • 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*
New Vocabulary: accurate, color, data, experiment, magnifying glass, measurement, metric ruler, ruler, scientific theory, scientist, sense, sight, smell, taste, telescope, tool, touch	*New Vocabulary:* cause and effect relationship, computer, cyclic pattern, direct observation, enlarge, evidence, exert, experimental result, extend, field, gradient, hand lens, hypothesis, image, imbalance, instrument, interact, magnifying lens, perception, pH meter, position, prediction, quantification, quantify, regular pattern, senses, series, slope, speed, stethoscope, test, trial, vision, X-ray machine	*New Vocabulary:* accelerate, apparent size, arrangement, balance (equilibrium), claim, contact, diameter, discard, disequilibrium, double-pan balance, evolution, evolutionary change, evolutionary trend, evolve, field of view, gradual change, graduated cylinder, interval, magnification power, material, meter stick, observable, orderly, per, percentage, precision, predictable, regular increase, reject, reversible, scale (size), scale model, scaled up
New Signs and Symbols: none	*New Signs and Symbols:* ℃ Celsius, . decimal point, ° degrees, min minute, mL milliliter/millilitre, pH	*New Signs and Symbols:* cm centimeter/centimetre, . , ft feet, = is equal to, km kilometer/kilometre, mm millimeter/millimetre, – negative, % percent

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Subject: Concepts and Processes
Goal Strand: 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
Ability to do Scientific Inquiry, Process Skill	**Ability to do Scientific Inquiry, Process Skill**	**Ability to do Scientific Inquiry, Process Skill**
• 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	• 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	• 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* • 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,

 NC 1.1.1

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tables* • Orders steps of familiar procedures* • Understands that when components of systems interact, change occurs • Gives examples of interacting components* • 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*	• 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 • 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* • 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	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*
Science, Technology; Science in Personal Social	**Science, Technology; Science in Personal Social**	**Science, Technology; Science in Personal Social**
• 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*
Analyzing Investigations	**Analyzing Investigations**	**Analyzing Investigations**
• 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,	• 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*	• 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

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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*	• 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 • 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*	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* • 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

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		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 Vocabulary: cause and effect relationship, computer, cyclic pattern, direct observation, enlarge, evidence, exert, experimental result, extend, field, gradient, hand lens, hypothesis, image, imbalance, instrument, interact, magnifying lens, perception, pH meter, position, prediction, quantification, quantify, regular pattern, senses, series, slope, speed, stethoscope, test, trial, vision, X-ray machine	*New Vocabulary:* accelerate, apparent size, arrangement, balance (equilibrium), claim, contact, diameter, discard, disequilibrium, double-pan balance, evolution, evolutionary change, evolutionary trend, evolve, field of view, gradual change, graduated cylinder, interval, magnification power, material, meter stick, observable, orderly, per, percentage, precision, predictable, regular increase, reject, reversible, scale (size), scale model, scaled up	*New Vocabulary:* balance, beaker, coincidence, cyclic, cyclic phenomenon, episodic, indicate, number pattern, phenomena, quantitative, regulated, repeat, replicate, replication, results, vary
New Signs and Symbols: ℃ Celsius, . decimal point, ° degrees, min minute, mL milliliter/millilitre, pH	*New Signs and Symbols:* cm centimeter/centimetre, . , ft feet, = is equal to, km kilometer/kilometre, mm millimeter/millimetre, − negative, % percent	*New Signs and Symbols:* cm^3 cubic centimeter/centimetre, ′ foot, ″ inch

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Subject: Concepts and Processes
Goal Strand: 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
Ability to do Scientific Inquiry, Process Skill	**Ability to do Scientific Inquiry, Process Skill**	**Ability to do Scientific Inquiry, Process Skill**
• 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	• 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* • 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,	• 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* • Describes qualities that make observations scientific* • Understands that some tools are used to extend the senses* • Classifies statements as quantitative observations*

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• 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 • 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* • 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	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*	
Science, Technology; Science in Personal Social	**Science, Technology; Science in Personal Social**	**Science, Technology; Science in Personal Social**
• 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*	
Analyzing Investigations	**Analyzing Investigations**	**Analyzing Investigations**
• 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*	• 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	• 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*

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• 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 • 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*	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* • 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	• 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 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*

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	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*	• 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 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*

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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)*
New Vocabulary: accelerate, apparent size, arrangement, balance (equilibrium), claim, contact, diameter, discard, disequilibrium, double-pan balance, evolution, evolutionary change, evolutionary trend, evolve, field of view, gradual change, graduated cylinder, interval, magnification power, material, meter stick, observable, orderly, per, percentage, precision, predictable, regular increase, reject, reversible, scale (size), scale model, scaled up	*New Vocabulary:* balance, beaker, coincidence, cyclic, cyclic phenomenon, episodic, indicate, number pattern, phenomena, quantitative, regulated, repeat, replicate, replication, results, vary	*New Vocabulary:* cancellation, finding (scientific), invalid (data), opposing forces, regular time interval, sense extender
New Signs and Symbols: cm centimeter/centimetre, . , ft feet, = is equal to, km kilometer/kilometre, mm millimeter/millimetre, – negative, % percent	*New Signs and Symbols: :* cm^3 cubic centimeter/centimetre, ′ foot, ″ inch	*New Signs and Symbols:* none

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Subject: Concepts and Processes
Goal Strand: 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
Ability to do Scientific Inquiry, Process Skill	**Ability to do Scientific Inquiry, Process Skill**	**Ability to do Scientific Inquiry, Process Skill**
• 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* • 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,	• 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* • Describes qualities that make observations scientific* • Understands that some tools are used to extend the senses* • Classifies statements as quantitative observations*	• 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)* • Classifies statements as qualitative observations*

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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*		
Science, Technology; Science in Personal Social	**Science, Technology; Science in Personal Social**	**Science, Technology; Science in Personal Social**
• Applies the steps of technological design • Compares and contrasts the procedures used in scientific inquiry and technological design*		
Analyzing Investigations	**Analyzing Investigations**	**Analyzing Investigations**
• 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	• 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*	• 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*

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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* • 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 communication of results)* • Explains that scientific theories depend on logically consistent arguments*	• 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 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	• 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* • 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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	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 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* • 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*	

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	• 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)*	
New Vocabulary: balance, beaker, coincidence, cyclic, cyclic phenomenon, episodic, indicate, number pattern, phenomena, quantitative, regulated, repeat, replicate, replication, results, vary	*New Vocabulary:* cancellation, finding (scientific), invalid (data), opposing forces, regular time interval, sense extender	*New Vocabulary:* factual, procedure, qualitative, replicable, researcher
New Signs and Symbols: : cm^3 cubic centimeter/centimetre, ′ foot, ″ inch	*New Signs and Symbols:* none	*New Signs and Symbols:* kg kilogram

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Subject: Concepts and Processes
Goal Strand: 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
Ability to do Scientific Inquiry, Process Skill	**Ability to do Scientific Inquiry, Process Skill**	**Ability to do Scientific Inquiry, Process Skill**
• 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* • Describes qualities that make observations scientific* • Understands that some tools are used to extend the senses* • Classifies statements as quantitative observations*	• 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)* • Classifies statements as qualitative observations*	• Gives examples of dynamic equilibrium in systems* • Infers that things that have come to rest are in equilibrium*
Science, Technology; Science in Personal Social	**Science, Technology; Science in Personal Social**	**Science, Technology; Science in Personal Social**
Analyzing Investigations	**Analyzing Investigations**	**Analyzing Investigations**
• 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 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*	

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• 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 occur* • Recognizes that as scientific theories are continually reevaluated, major shifts in scientific thinking may occur*	• 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* • 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	

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• 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 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* • Contrasts the terms theory and law*	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 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)*		
New Vocabulary: cancellation, finding (scientific), invalid (data), opposing forces, regular time interval, sense extender	*New Vocabulary:* factual, procedure, qualitative, replicable, researcher	*New Vocabulary:* none
New Signs and Symbols: none	*New Signs and Symbols:* kg kilogram	*New Signs and Symbols:* none

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

Skills and Concepts to Enhance 231 - 240	Skills and Concepts to Develop Above 240
Ability to do Scientific Inquiry, Process Skill	**Ability to do Scientific Inquiry, Process Skill**
• 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)* • Classifies statements as qualitative observations*	• Gives examples of dynamic equilibrium in systems* • Infers that things that have come to rest are in equilibrium*
Science, Technology; Science in Personal Social	**Science, Technology; Science in Personal Social**
Analyzing Investigations	**Analyzing Investigations**
• 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*	

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• 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* • 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	

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are based on superstition cannot be considered science* • Explains why explanations about the natural world that are based on authority cannot be considered science*	
New Vocabulary: factual, procedure, qualitative, replicable, researcher	*New Vocabulary:* none
New Signs and Symbols: kg kilogram	*New Signs and Symbols:* none

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