Table of Contents for Standards		
Semester Assessed	Skill Development	Content Understanding
1st Semester	Investigations: Setup	Forces & Motion
	Investigations: Procedures	Energy
	Analyze & Interpret Data (being reworked)	Sound
Both Semesters	Cause & Effect	
2nd Semester	Asking Questions	Genetics: Using Mathematical Models
	Modeling	Genetics: Explaining Uniqueness
	Claim, Evidence, Reasoning	Forces at a Distance

Note that there is a link between skills and content understanding. It can be difficult to show skills without understanding the content and vice versa.

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Asking Questions

Scientific questions lead to explanations of how the natural world works and can be empirically tested using evidence

Beginning	Improving	Fine-Tuning	Proficient
Generates at least 1 question Relevance -Overly-broad or unclear questions may be off topic -The answers don't significantly help refine or clarify the student's model -Questions are too vague or off-topic to prioritize Depth -Questions are focused on irrelevant or overly simplistic concepts that do not encourage deeper exploration Testability -Questions are not testable as written	Generates at least 4 questions Relevance -Broad or vague questions address the topic -The answers may not help refine the student's model -Prioritizing questions is made difficult because they may not help refine the model Depth -Questions address surface-level ideas and may not be focused on relationships or processes Testability -Questions are too vague to be answered with testing or investigation. -Only 1 variable may be identified	Generates at least 6 questions Relevance -Clear and relevant questions address the topic -The answers help refine some part of a student's model -Correctly prioritizes the order in which some of their questions should be answered Depth -Questions show scientific thinking that explore relationships and processes Testability -Questions are close to being answerable with testing, investigation or gathering evidence -Independent and Dependent variables may need refining	Generates at least 8 questions Relevance -Well defined & highly relevant questions address critical aspects of a topic. -The answers help refine critical parts of a student's model -Correctly prioritizes the order in which their questions should be answered Depth -Questions show deep scientific thinking that encourage exploring complex relationships and processes Testability -Questions are written in a way that they can be answered via testing, investigation or gathering evidence -Independent and Dependent Variables are clearly defined So many questions are generated, it is okay if some don't meet the criteria above. (aka side mission questions)

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Modeling

A model is an abstract representation of a phenomena that is a tool used to predict or explain the world. Models can be represented as diagrams, 3-D objects, mathematical representations, analogies or computer simulations

Beginning	Improving	Fine-Tuning	Proficient
Clarity -Model doesn't feel like a story -Feels disorganized -Unclear to viewer why many parts were included or how they relate to each other -Visuals/words may be lacking or are confusing to the viewer. -Focus is on individual ideas rather than how ideas connect, large gaps are noticeable -Legibility & neatness may negatively impact the viewer's experience Accuracy -Reflects minimal understanding of the topic -Accurately includes a few Core ideas, if any -Finer details are largely missing or incorrect -When ideas are included accurately, they are typically not connected to other ideas	Clarity -Model generally doesn't feel like a story -There is a semblance of organization, but connections between many parts may be unclear -Unclear to the viewer how some parts relate to each other or why they were included -Visuals and words are included, but are rarely used to show the relationships between ideas, gaps are noticeable -Some parts are legible & neat Accuracy -Reflects a partial understanding of the topic -Accurately includes some Core ideas -Finer details are largely missing or incorrect -Some core ideas are woven together in a way that is accurate	Clarity -Parts of the model may feel like a story, but it is disjointed at times -There is a general flow of information from start to finish -The viewer may find that some transitions or information may not be clear, make logical sense, or connect to the rest of the explanation -Most visuals and words are used to show relationships between ideas, some gaps are noticeable -Mostly legible & neat Accuracy -Reflects a broad understanding of the topic -Accurately includes most Core ideas -Finer details may still be missing or incorrect -Core ideas are usually woven together in a way that is accurate	Clarity -Acts as a cohesive story, as it aims to explain a natural phenomena -There is a clear flow of information from start to finish -The viewer understands why each piece of information is included and why it is shown when/where it is shown -Visuals and words are used to clearly show relationships between ideas gaps aren't noticeable -Legible & neat Accuracy -Reflects a deep understanding of the topic -Accurately includes most Core ideas and finer details with almost no omissions -Core ideas and finer details are woven together in the explanation in a way that feels seamless, but puts the emphasis on core ideas

Note on Modeling: There is a strong link between being able to create a proficient model and having a proficient level of content understanding of the topic being modeled

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Investigations: Setup

An investigation is a systematic way to gather data about the natural world either in the field or in a laboratory setting

Beginning	Improving	Fine-Tuning	Proficient
Planning investigations: -May not have a hypothesis. If one is present it may not follow the if/then/because format. -Variables may not be included. If they are, one or more may be misidentified.	Planning Investigations: -Hypothesis included, follows correct format. -Variables included, one may be misidentified. Variables may not align with hypotheses and/or procedures.	Planning investigations: -Hypothesis included, in correct format -Dependent and Independent variables correctly identified and match both hypothesis and procedures. -Controlled variables list may leave important variables off list or be vague about the aspects that need be kept the same	Setting Up Investigations: -Question makes clear what is being tested in the investigation. -Independent variable can be accurately identified -Dependent variable be accurately identified -Controlled variables accurately identified. This list is exhaustive, detailed and focuses on the qualities of objects or procedures that need to be consistent across all trials. -Hypothesis makes a if-then prediction about the connection between the independent & dependent variables with a explanatory because statement that is logical and doesn't involve circular reasoning. Question, variables and hypothesis address the same things. Mistakes in the alignment of the variables between those three things can be identified.

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Investigations: Procedures

An investigation is a systematic way to gather data about the natural world either in the field or in a laboratory setting

Beginning	Improving	Fine-Tuning	Proficient
Planning investigations: Materials List: -May have omissions. Amounts/important identifiers may be missing. Procedure Steps: -Organization may be hard to follow or in large paragraphs without clear steps -Procedures are included, but have large gaps or are too vague to be carried out as intended by others -When or how to measure, record or calculate data may be missing -Produces data that may not answer the intended scientific question OR is too inconsistent to yield usable findings.	Planning Investigations: Materials List: -All items included. Amounts or important identifiers for materials may be left off. Procedure Steps: -Clear attempt at organization. Placement of images or wording/sequence of steps may be confusing. -Steps may be missing or too vague/confusing to be followed as intended -May omit when some data needs to be measured, recorded -May omit when to make calculations or how they are done. -Data produced answers the intended scientific question, but is too inconsistent to yield usable findings.	Planning investigations: Material List: -Accurately describes what each items is and how many are needed Procedures Steps: -Organized -Details on the exact set-up may be unclear. For example: the general placement of materials may be indicated, but not the precise measured location. -Lack of details may prevent some variables from being controlled -Makes it clear when to measure and record data -Makes it clear when and how to do any calculations -If followed as written will yield usable results, but those results may not be consistent across different people conducting the experiment.	Planning Investigations: Material List: -Accurately describes what each items is and how many are needed Procedure Steps: -Organized -Clear and thorough, leaving no room for confusion about what to do next -Written so that controlled variables remain the same across all trials -Makes it clear when to measure and record data -Makes it clear when and how to do any calculations with data -If followed as written will yield consistent results when many different people conduct the experiment

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Analyze & Interpret Data

Analyzing and interpreting data includes making sense of data produced during investigations. Because patterns are not always obvious, this includes a range of tools such as tables, graphs and other visualization techniques

Beginning	Improving	Fine-Tuning	Proficient
Attempts to creates representations of patterns and relationships in data: -Needs support creating graphs, tables, equations and/or ratios that are free of inaccuracies in order to more successfully identify patterns	Creates accurate representations of patterns and relationships in data: -Creates graphs, tables, and/or ratios that are at least mostly accurate. -May attempt to create a line of best fit. -Needs support in finding the patterns present in the data. -Needs support with identifying most or all of the limitations of the data.	Accurately determines larger patterns and relationships in data: -Accurately creates graphs, tables, and/or ratios -Attempts creating lines of best fit when graphing, but they may have minor inaccuracies. -Identifies general patterns based on graphs, tables, and rations. (ie. variable x increases causes variable y to decrease). -Needs support with identifying some or all of the limitations of the data source(s)	Accurately determines larger patterns and relationships in data as well as nuance: -Accurately creates graphs, tables and/or ratios -Accurately creates lines of best fit when graphing. -Accurately identifies specific patterns between variables. -Identified patterns can be described using mathematical equations when possible, or as linear/non-linear when not possible. -Can Identify the limitations of a data source (outliers, sample size considerations, errors in data collection, non-error uncertainties built into data set via experimental design)

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Claim, Evidence & Reasoning

A scientific explanation articulates how or why a natural phenomena occurs in a way that is supported by evidence and scientific ideas. These explanations need to be able to be shared out, compared, debated, and evaluated based on their underlying evidence and reasoning.

Beginning	Improving	Fine-Tuning	Proficient
Explanation for a natural phenomena is attempted. -A claim may not have been made or is made but incorrect -Evidence and/or reasoning may be missing -Evidence and reasoning, if used, are typically not tied together -Evidence and/or reasoning, if used, is often not relevant or misapplied. -Student need support identifying what is similar or different between competing claims.	Explanation for a natural phenomena: -A claim is made and correct -Evidence and reasoning are both used -Evidence and reasoning are sometimes not relevant, misapplied or repeated unnecessarily -Some evidence in data is not utilized -Evidence and reasoning are rarely connected to each other or connected incorrectly -Competing claims can be compared. Student needs support with the skills of accurately evaluating the evidence/reasoning in order to determine which is the stronger claim.	Explanation for natural phenomena is built on a claim, evidence and reasoning. -Multiple pieces of evidence and reasoning are used to support a claim. -Evidence and reasoning are sometimes correctly tied together -At times evidence may be confused with reasoning and vice versa -At times evidence may be used without accompanying reasoning or vice versa -Explanation may hop around topics and be disorganized in places -Competing claims can be compared evaluated with some accuracy.	Explanation for natural phenomena is built on a claim, evidence and reasoning. -Multiple pieces of qualitative and/or quantitative evidence are provided to support a claim -Reasoning is used to connect how each piece of evidence helps support the claim. -Distinction between what is evidence and reasoning is clear -Explanation is organized and has a clear flow -Multiple competing claims can be compared, evaluated, critiqued and refuted/accepted using evidence and reasoning.

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Cause & Effect

Beginning	Improving	Fine-Tuning	Proficient
When explaining a natural phenomena: -At least one cause-effect is linked together. -If more than one is included, large gaps and/or inaccuracies exist.	When explaining a natural phenomena: -Multiple cause-effects relationships are linked together in a chain. -Some core relationships or many minor relationships are missing and/or inaccurate in the chain of cause-effect relationships.	When explaining a natural phenomena: -Can set-up an accurate chain of cause-effect relationships. -Minor gaps and/or inaccuracies exist in the chain of cause-effect relationships. -All core cause-effect relationships are present.	When explaining a natural phenomena: -Can set-up an accurate chain of cause-effect relationships, where one cause triggers an effect, which triggers the next effect like in a line of falling dominos. -No gaps or inaccuracies exist in the chain of cause-effect relationships.
-How structure impacts function may not be attempted when discussing cause-effect relationships.	-Where applicable how the structure of an object or organism influences its function/reaction are infrequently included. -When included there may be inaccuracies in the impact of the structure's influence on function, or the structure/function's role in the chain of cause-effect relationships.	-Where applicable how the structure of an object or organism influences its function/reaction is sometimes included in the discussion of the cause-effect relationships. -When included it tends to be done accurately.	. -Whenever applicable how the structure of an object or organism influences its function/reaction is accurately included in the discussion of the cause-effect relationships

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Forces & Motion

Beginning	Improving	Fine-Tuning	Proficient
Within a system attempts to identify the sources of applied forces to all relevant objects at a given time. When using diagrams and words the following are attempted for each applied force: -its strength relative to other forces -its direction -its source Attempts to identify the changes in motion and/or shape of an object due to the forces applied to it.	Within a system can correctly identify at somet of the force(s) applied to all relevant objects at a given time. When using diagrams and words can accurately depict the the following for some of the forces: -its strength relative to other forces -its direction -its source Can accurately identify some of the changes in motion and/or shape of an object due to the forces applied to it. This may include intrinsic qualities of the object itself that may impact the applied forces.	Within a system can correctly identify most the force(s) applied to all relevant objects at a given time. When using diagrams and words unambiguously depicts the following for most forces -its strength relative to other forces -its direction -its source Can accurately identify most changes in motion and/or shape of an object due to all forces applied to it. This may include intrinsic qualities of the object itself that may impact the applied forces.	Within a system can correctly identify all the force(s) applied to all relevant objects at a given time. Using diagrams and words is able to unambiguously depict the following for all forces: -its strength relative to other forces -its direction -its source Can accurately identify any change in motion and/or shape of an object due to all forces applied to it. Can discuss the magnitude and direction of these changes. Their assessment includes intrinsic qualities of the object itself that may impact the applied forces.

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Energy			
Beginning	Improving	Fine-Tuning	Proficient
Attempts to identify and describe different types of energy. Within a system: -Attempts to diagram how energy is transferred into/out of systems. -Attempts to estimate the amount of each type of energy an object possess relative to to other objects in the system or the system at other times. -Attempts to identify the relationship between energy and force and its impact on energy transfer.	Can accurately identify and describe most different types of energy. . Within a system: -Can accurately describe and diagram how some energy is transferred into/out of systems or between different parts of a system -Some of the time accurately estimates the amount of each type of energy an object possesses relative to other objects in the system or the system at other times. -Can identify the relationship between energy and force and use this to help explain when and/or how energy is transferred between objects at least some of the time.	Can accurately identify and describe different types of energy. Within a system: -Can accurately describe and diagram how most energy is transferred into/out of systems or between different parts of a system -Most of the time accurately estimates the amount of each type of energy an object possesses relative to other objects in the system or the system at other times, but without a clear link to the mathematical relationships we have learned about in class. -Can identify the relationship between energy and force and use this to help explain when and/or how energy is transferred between objects in most relevant contexts	Can accurately identify and describe different types of energy. Including how they work macroscopically and microscopically. Within a system: -Can accurately describe and diagram how all energy is transferred into/out of systems or between different parts of a system -Using the mathematical relationships we have learned about, accurately estimates the amount of each type of energy an object possesses relative to other objects in the system or the system at other times. -Can identify the relationship between energy and force and use this to help explain when and/or how energy is transferred between objects in all relevant contexts

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Sound

Beginning	Improving	Fine-Tuning	Proficient
What sound needs: -Attempts to describe what is necessary for sound to be generated or travel. Attributes of Sound: -Attempts to identify the attributes that define sound. -Attempts to model how sound is created, travels or is received. Mathematical Representations of Sound: -Attempts to graph different attributes of sound. -Attempts to connect what is happening on the graphs to what is physically changing when the sound is created, traveling or being received.	What sound needs: -Describes some of what is necessary for a sound to be generated and travel Attributes of Sound: -Can identify the attributes that define any sound. May leave out or mix-up what alters each attribute of sound. -Models, with some errors or gaps, how those attributes appear and impact a sound's creation, travel and reception. Mathematical Representations of Sound: -When creating or interpreting graphs meant to represent different attributes of sound, may mix-up attributes or leave one out. -Can accurately connect what is happening at some points on the graphs to physical changes happening in at least one of the following: what created the sound, how the sound is traveling or how the sound is being received.	What sound needs: -Describes, with minor errors or gaps, what is necessary for a sound to be generated and travel Attributes of Sound: -Can identify the attributes that define any sound and what alters them. -Models, with minor errors or gaps, how those attributes appear and impact a sound's creation, travel and reception. Mathematical Representations of Sound: -Creates or interprets, with minor errors or gaps, graphs meant to represent sounds with different attributes. -Can accurately connect what is happening at most points on those graphs to the physical changes happening in some of the following: what created the sound, how the sound is traveling or how the sound is being received.	What sound needs: -Accurately describes what is necessary for a sound to be generated and travel Attributes of Sound: -Can identify the attributes that define any sound and what alters them. -Models, accurately, how those attributes appear and impact a sound's creation, travel and reception. Mathematical Representations of Sound: -Accurately creates or interprets graphs meant to represent sounds with different attributes. -Can accurately connect what is happening at any point on those graphs to the physical changes happening in what created the sound, how the sound is traveling or how the sound is being received.

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Genetics: Using Mathematical Models

Beginning	Improving	Fine-Tuning	Proficient
Attempts to develop, use, apply or analyze models to explain or predict genotype and phenotype outcomes for both parent and offspring. Pedigrees and punnett squares, if used, follow an incorrect format. They may be misused or misapplied to the situation. May not attempt to alter how the model works based on the type of dominance, or may attempt with mistakes. Relevant genetics vocab may not be used or is often misapplied.	Attempts to develop, use, apply or analyze mathematical models (such as pedigrees & punnett squares) to explain or predict genotype and phenotype outcomes for both parents and offspring. The formats of the model may be correct, but they are misapplied to the situation. May not attempt to alter how the models work based on the type of dominance or may attempt with mistakes. Attempts to apply genetics vocab related to genotypes, phenotypes and dominance but minor and possible major errors occur.	Accurately develops, uses, applies and analyzes mathematical models (such as pedigrees & punnett squares) to explain or predict genotype and phenotype outcomes for both parents and offspring. May only be able to model either sexual or asexual reproduction. Attempts to adapt models to account for types of dominance, but mistakes may be made. Attempts to apply genetics vocab related to genotypes, phenotypes and dominance but minor errors may occur.	Accurately develops, uses, applies and analyzes mathematical models (such as pedigrees & punnett squares) to explain or predict genotype and phenotype outcomes for both parents and offspring. This can be done for both sexual and asexual reproduction. Correctly adapts models to account for the type(s) of dominance at play for the trait(s) being considered. Can explain how altering the type of dominance would alter the model. Accurately applies genetics vocab related to genotypes, phenotypes and dominance.

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Genetics: Explaining Uniqueness			
Beginning	Improving	Fine-Tuning	Proficient
Attempts to explain in words and/or drawings how species that reproduce sexually are able to create unique offspring. The explanation may not have a clear sequence. Many major gaps exist in the explanation. Few, if any, root causes for uniqueness are identified. Large parts of the explanation are missing or inaccurate.	Attempts to explain in words and/or drawings how species that reproduce sexually are able to create unique offspring. The explanation may not have a clear sequence. There are both minor and a few major gaps in the explanation. Few root causes for uniqueness may be identified. Others may be omitted or inaccurate. Processes that act on that uniqueness to construct the body and traits may not be present or are incomplete/inaccurate. The explanation may only focus on genetic contributors to uniqueness.	Attempts to explain in words and/or drawings how species that reproduce sexually are able to create unique offspring. The explanation will have a clear sequence from how the offspring was able to be made through the time it is able to display unique traits, but their may be minor gaps or inaccuracies. Some of the root causes for uniqueness are identified, but others may be omitted or inaccurate. Some processes that act on that uniqueness to construct the body and traits may be omitted. The explanation may only focus on genetic contributors to uniqueness.	Can explain in words and/or drawings how species that reproduce sexually are able to create unique offspring. The explanation will accurately go from how the offspring was able to be made through the time it is able to display unique traits without any gaps. The explanation will accurately identify and highlight the root causes for uniqueness and explain processes that act on that uniqueness to construct the body and traits. The explanations will accurately include both genetic and non-genetic factors.

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Forces at a Distance

Beginning	Improving	Fine-Tuning	Proficient
Attempts to describe major steps in how an object can apply a force and transfer energy without making physical contact with another object.	Can accurately describe some major steps in how an object can apply a force and transfer energy without making physical contact with another object.	Can accurately describe major steps in how an object can apply a force and transfer energy without making physical contact with another object.	Can accurately describe in a detailed, step-by-step way how an object can apply a force and transfer energy without making physical contact with another object.
Attempts to describe and draw what is happening to the objects and they space around them. May misidentify which objects are involved in the interactions. Large errors or gaps exist in what each object is doing as well as how they influence each other.	This includes describing and drawing what is happening to objects and the space around each individual object. Correct objects are identified, but errors or gaps exist in what each object does on its own as well as how they influence each other.	This includes describing and drawing what is happening to objects and the space around each individual object, with inaccuracies about how they influence each other.	This includes describing and drawing what is happening to objects and the space around them that allows them to interact as well as how the objects and the space around them changes during the interaction.
May misidentify when forces will attract versus repel. If correctly identified large gaps or inaccuracies exist in the explanation for why.	Can identify when forces will be attractive versus repulsive, but doesn't explain why.	Explanations can elaborate on why the forces will be attractive at some times or repulsive at others based on internal qualities of the objects.	Explanations can elaborate on why the forces will be attractive at some times or repulsive at others as it relates to the space around the objects.
May attempt to explain energy changes in the objects. Large inaccuracies or gaps exist in the explanation.	Explanations attempt to explain how energy changes in the objects, but does so with inaccuracies beyond flippings or conflating attraction with repulsion	Explanations attempt to explain how energy changes in attractive and repulsive interactions, and are generally correct, but may have the two processes flipped or working exactly the same.	Explanations will be able to explain how changes in energy differ in attractive versus repulsive interactions.
May omit or describe inaccurately changes to the system that strengthen or weaken the forces	Can accurately identify at least one change to the system that will strengthen or weaken the forces.	Can quantify how some changes to the system will strengthen or weaken the applied forces and overall energy transfers.	Can quantify how changes to the system will strengthen or weaken the applied forces and overall energy transfers.
Free body diagrams may not be used or used with major mistakes to show applied forces	Forces applied from a distance are shown with minor and/or major mistakes using Free Body Diagrams.	Forces applied from a distance are shown with minor mistakes using Free Body Diagrams.	Forces applied from a distance are accurately shown with Free Body Diagrams