"I Can¨ Mascoma Science Grade 8 Curriculum

I Have Good SCIENTIFIC SKILLS

☐ I can observe and ask questions about scientific topics.

☐ I can build and revise a simple model to represent events and design solutions.

☐ I can develop a model to describe or represent scientific phenomena.

☐ I can plan and carry out a scientific investigation to answer a question or solve a problem.

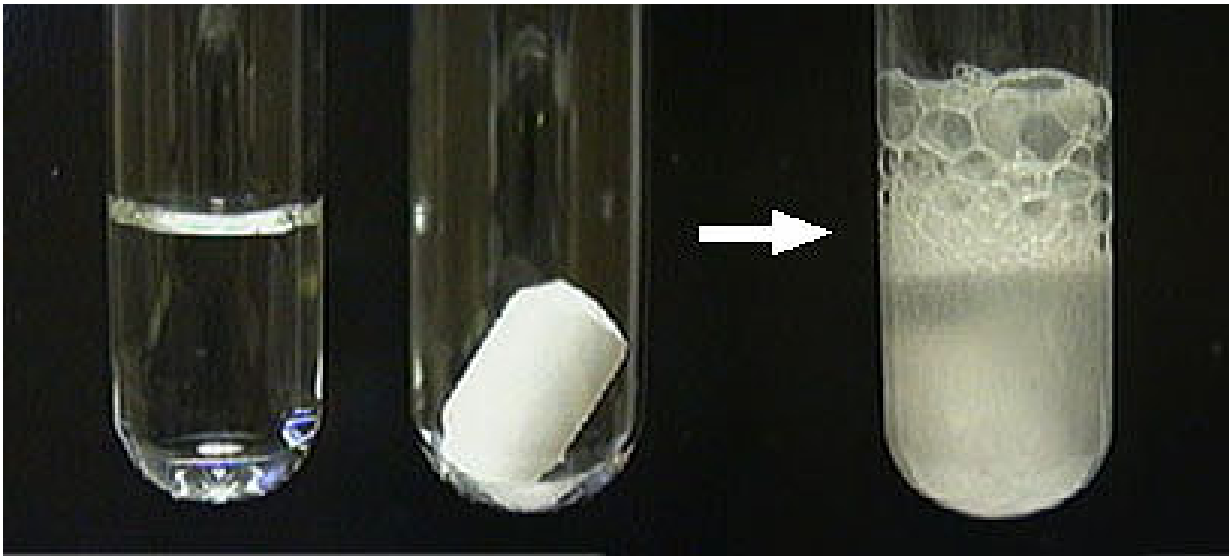
☐ I can produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials is considered.

☐ I can make observations and measurements to produce data to serve as the basis for evidence for the explanation of a phenomenon.

☐ I can measure and graph quantities such as weight and length to address scientific and engineering questions and problems.

☐ I can explain the results of a scientific investigation.

I know about Matter and Its Interactions



☐ I can develop models to describe the atomic composition of simple molecules and extended structures (Emphasis is on developing models of molecules that vary in complexity.

- Simple molecules: include ammonia and methanol
- Extended structures: include sodium chloride and diamond
- Molecular level models: include 3D ball and stick structures or computer representation showing different molecules with different types of atoms

Assessment does not include valence electrons, bonding energy, the ionic nature of subunits of complex structures, or a complete depiction of all individual atoms in a complex molecule or extended structure).

☐ I can analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. (Examples of reactions could include:

- Burning of sugar or steel wool
- Fat reacting with sodium hydroxide
- Mixing zinc with hydrogen chloride

Assessment is limited to the following properties: density, melting point, boiling point, solubility, flammability, and odor).

☐ I can gather and make sense of information to describe that synthetic materials come from natural resources and impact society (Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples include: new medicines, new foods, and alternative fuels).

☐ I can develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed. (Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases and decreases kinetic energy of the particles until a change of state occurs. Examples of particles could include molecules or inert atoms. Pure substances and include water, carbon dioxide, and helium).

☐ I can conduct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms (Examples of environmental conditions include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth and fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than in small ponds. Assessment Boundary: Assessment does not include genetic mechanisms, gene regulation, or biochemical processes).

☐ I can develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved (Emphasis is on the law of conservation of matter and on physical models or drawings, including digital forms, that represent atoms. Assessment does not include the use of atomic masses, balancing symbolic equations, or intermolecular forces).

☐ I can undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes (Emphasis is on the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. Designs could involve reactions such as dissolving chloride or calcium chloride. Assessment is limited to the criteria of amount, time, and temperature of substance in testing the device).

A little primer for my teacher:

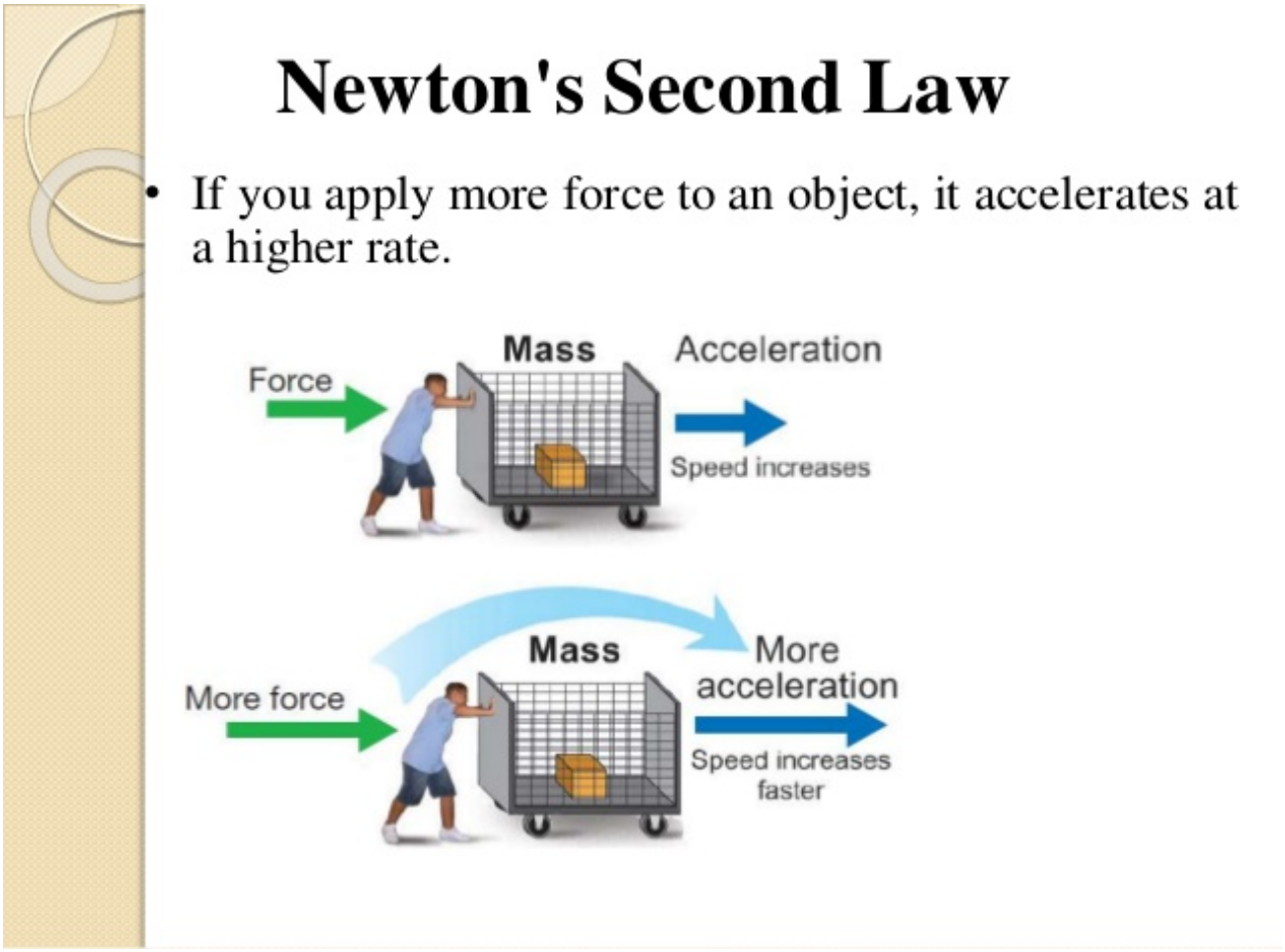
Common Core	RIST.8.1- Cite textural evidence to support analysis of what the test says explicitly as well as inferences drawn from the text.	RIST.8.3- Follow precisely a multistep procedure when carrying our experiments, taking measurements, or performing technical tasks.
	RIST.8.6- Integrate quantitative or technical information expressed in words in a test with a version of that information expressed visually (flowchart, diagram, model, graph, or table)	WHST.8.7- Conduct short research projects to answer a question, including a self-generated question, drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
	WHST.8.8- Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.	MP.8.2- Reason abstractly and quantitatively
	MP.8.4- Model with mathematics	RP.8.A.3- Use ratio and rate reasoning to solve real-world and mathematical problems
	NS.8.C.5- Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (temperature, above/below contexts, elevation above/ below sea level, credits/debits, positive/ negative electrical charge); use positive and negative numbers to represents quantities in real world contexts, explaining the meaning of zero in each situation).	EE.A-8.3- Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.

	SP.B-8.4- Display numerical data in plots on a number line, including dot plots, histograms, and box plots.	SP.B-8.5- Summarize numerical data sets in relation to their context.
Vocabulary	Atomic model, atomic composition, simple molecule, extended structure, properties of substances, interact, chemical reaction, synthetic materials, particle motion, state of a pure substance, thermal energy, mass, conservation of mass, chemical process, release/absorb	
Disciplinary Core Ideas	Structure and Properties of Matter • Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. • Each pure substance has characteristic physical and chemical properties that can be used to identify it. • Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. • In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change their relative locations. • Solids may be formed from molecules, or they may be extended structures with repeating subunits. • The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. Chemical Reactions • Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. • The total number of each type of atom is conserved, and thus the mass does not change. • Some chemical reactions release energy, others store energy. Definitions of Energy • The term heat as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning-it refers to the energy transferred due to the temperature difference between two objects. • The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever	

	is the appropriate building block for the system's material. The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (or total internal energy) of a system depends jointly on the temperature, total number of atoms in the system, and the state of the material. Developing Possible Solution • A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. Optimizing the Design Solution • Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process-some characteristics may be incorporated into the new design. • The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution.
Cross-cutting Concepts	Patterns • Macroscopic patterns are related to the nature of microscopic and atomic-level structure Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems Scale, Proportion and Quantity • Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. Energy and Matter • Matter is conserved because atoms are conserved in physical and chemical processes • The transfer of energy can be tracked as energy flows through a designed or natural system. Structure and Function • Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. Interdependence of Science, Engineering, and Technology • Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems. Influence of Science, Engineering, and Technology on Society and the Natural World

	• The uses of technologies and any limitations on their uses are driven by individual of societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, nature, resources, and economic conditions. Thus technology use varies from region to region and over time.
Science and Engineering Practice	• Develop and use a model to predict and/or describe behavior • Develop a model to describe unobservable mechanisms • Analyze and interpret data to determine similarities and differences in findings • Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints • Gather, read and synthesize information from multiple, appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. • Science knowledge is based upon logical and conceptual connections between evidence and explanations. • Laws are regularities or mathematical descriptions of natural phenomena

I Know About Motion and Stability: Forces and Interactions



☐ I can apply Newton's Third Law to design a solution to a problem involving the motion or two colliding objects (Emphasis of practical problems could include the impact of collisions between two cars, between a car and a stationary object, and between a meteor and a space vehicle. All are limited to vertical OR horizontal interactions in one dimension).

☐ I can plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object (Emphasis is on Newton's First Law- balanced and unbalanced forces in a system, Newton's Second Law-qualitative comparisons of forces, mass and changes in motion, and frame of reference and specification of units. Assessment is limited to forces and changes in motion in one dimension in an inertial reference frame and to change in one variable at a time).

☐ I can ask questions about data to determine the factors that affect the strength of electric and magnetic forces (Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor. Assessment is limited to questions that include proportional reasoning and algebraic thinking).

☐ I can construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of the interacting objects (Examples of evidence for arguments could include data generated from simulations or digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system. Assessment does not include Newton's Law of Gravitation or Kepler's Laws).

☐ I can conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact. (Examples of this phenomenon could include the interactions of magnets, electrically charged strips of tape, and electrically charged pith balls. Examples of investigations could include first-hand experiences or simulations. Assessment is limited to electric and magnetic fields; and to qualitative evidence for the existence of the fields).

A little primer for my teacher:

Common Core	RIST.8.1- Cite textural evidence to support analysis of what the test says explicitly as well as inferences drawn from the text.	RIST.8.3- Follow precisely a multistep procedure when carrying our experiments, taking measurements, or performing technical tasks.
	WHST.8.1- Write arguments focused on discipline specific content.	WHST.8.7- Conduct short research projects to answer a question, including a self-generated question, drawing on several sources and generating additional related, focused

		questions that allow for multiple avenues of exploration.
	MP-8.2- Reason abstractly and quantitatively.	NS.8.C.5- Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (temperature, above/below contexts, elevation above/ below sea level, credits/debits, positive/ negative electrical charge); use positive and negative numbers to represents quantities in real world contexts, explaining the meaning of zero in each situation).
	EE.A-8.3- Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.	EE.B-8.3- Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form, using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between form as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.
	EE.B-8.4- Use variable to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.	
Vocabulary	Newton's First Law, Newton's Second Law, Newton's Third Law, motion, colliding, forces, mass, electric forces, magnetic forces, gravitational interaction, exerting	
Disciplinary Core Ideas	Forces and Motion • For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's Third Law). • The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the	

	force needed to achieve the same change in motion. For any given object, a large force causes a larger change in motion. • All positions of objects and the directions of forces and motions must be described in an arbitrarily chose reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared. <u>Types of Interactions</u> • Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. • Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have a large mass (e.g.-planets and the sun) • Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test objects (a charged object, or a ball, respectively).
Cross-cutting Concepts	<u>Cause and Effect</u> • Cause and effect relationships may be used to predict phenomena in natural or designed systems <u>Systems and System Models</u> • Models can be used to represent systems and their interactions- such as inputs, processes, and outputs- and energy and matter flows within systems. <u>Stability and Change</u> • Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales. <u>Influence of Science, Engineering, and Technology on Science and the Natural World</u> • The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions.
Science and Engineering Practice	• Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. • Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will

	be recorded, and how much data to serve as the basis for evidence that can meet the goals of the investigation. • Apply scientific ideas or principles to design an object, tool, process or system. • Construct and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. • Scientific knowledge is based upon logical and conceptual connections between evidence and explanations.

I Know About Energy

☐ I can construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of the object and the speed of the object (Emphasis is on the descriptive relationship between kinetic energy and mass separately from kinetic energy and speed. (i.e., riding a bicycle at different speeds, rolling rocks of different sizes downhill, and getting hit by a whiffle ball vs. a tennis ball).

☐ I can develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system (Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects at varying distance could include: the Earth and either a roller coaster car at varying positions on a hill, or objects on varying heights of shelves, changing the direction/orientation of a magnet, and a balloon with a static electrical charge being brought closer to a classmate's hair. Models could include: diagrams, pictures, representations, or written descriptions. Assessment is limited to two objects and magnetic, electric, or gravitational interactions).

☐ I can apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer (Examples of devices could include an insulated box, a solar cooker, and a styrofoam cup. Assessment does not include calculations of the total amount of solar heat transferred).

☐ I can plan an investigation to determine the relationship among the energy transferred, the type of matter, the mass, and the change in average kinetic energy of the particles as measured by the temperature of the sample (Examples of experiments could include comparing different water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added. Assessment does not include calculations of the total amount of solar heat transferred).

☐ I can conduct, use, and present arguments to support the claim that when kinetic energy of an object changes, energy is transferred to or from the object (Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperatures changes or motion of an object. Assessment does not include calculations of the total amount of energy).

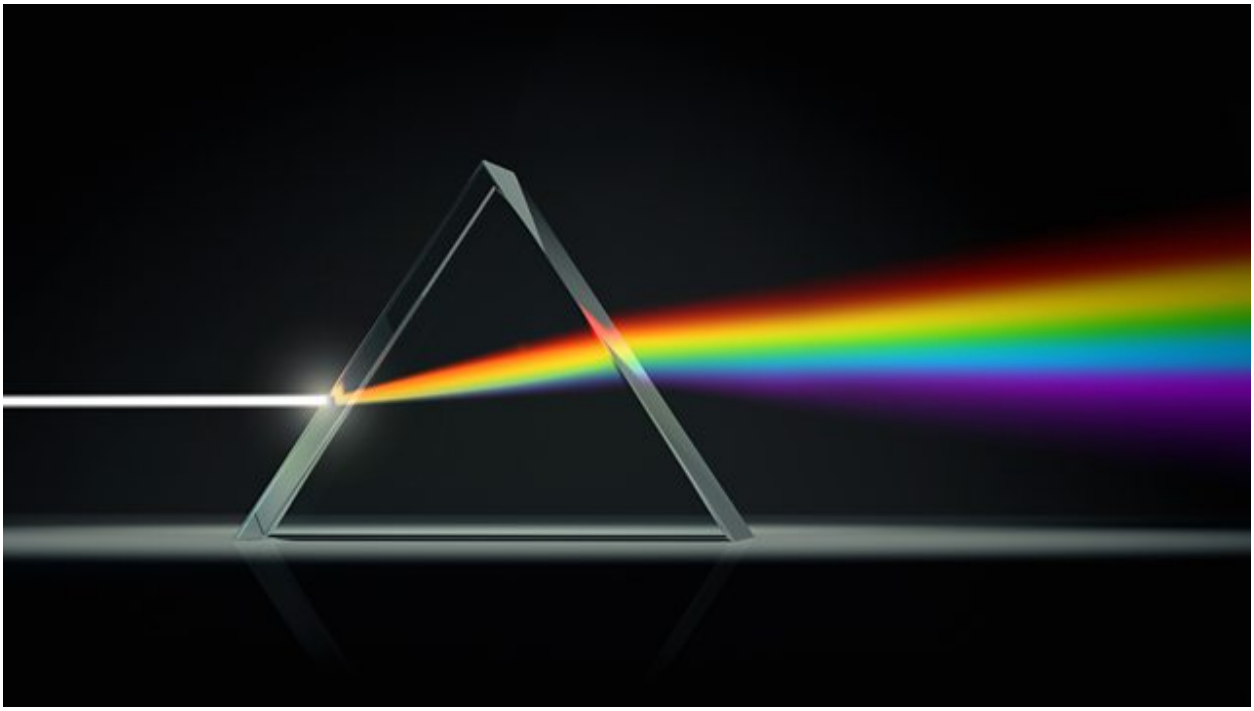
A little primer for my teacher:

Common Core	RIST.8.1- Cite textural evidence to support analysis of what the test says explicitly as well as inferences drawn from the text.	RIST.8.3- Follow precisely a multistep procedure when carrying our experiments, taking measurements, or performing technical tasks.
	RIST.8.7- Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (in a flowchart, diagram, model, graph, or table).	WHST.8.1- Write arguments focused on discipline specific content.
	WHST.8.7- Conduct short research projects to answer a question, including a self-generated question, drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.	SL.8.5- Include multi-media components (graphics, images, sounds, music) and visual displays in presentations to clarify information.
	RP.8.A.1- Understand the concept of ratio and use ratio language to describe a ratio relationship between two quantities.	RP.8.A.2- Recognize and represent proportional relationships between quantities.
	EE.A-8.1- Know and apply the properties of integer exponents to generate equivalent numerical expressions.	EE.A-8.2- Use square root and cube root symbols to represent solutions to equations of the form $x^2=p$ and $x^3=p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.
	F.A-8.3- Interpret the equation $y=mx+b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.	SP.B-8.5- Summarize numerical data sets in relation to their context.
Vocabulary	Graphical displays, kinetic energy, mass, speed, potential energy, thermal energy, energy transfer, proportional, particles, matter, exerts	
Disciplinary Core Ideas	Definitions of Energy • Motion energy is properly called Kinetic Energy; it is proportional to the mass of the moving object and grows with the square of its speed.	

	• A system of objects may also contain stored (potential) energy, depending on their relative position. • Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. <u>Conservation of Energy and Energy Transfer</u> • When the motion energy of an object changes, there is inevitably some other change in energy at the same time. • The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. • Energy is spontaneously transferred out of hotter regions or objects into colder ones. <u>Relationship Between Energy and Forces</u> • When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. <u>Defining and Delimiting an Engineering Problem</u> • The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that is likely to limit possible solutions. <u>Developing Possible Solutions</u> • A solution needs to be tested, and then modified on the basis of the test results in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem.
Cross-cutting Concepts	<u>Scale, Proportion, and Quantity</u> • Proportional relationships (For example, speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes. <u>Systems and System Models</u> • Models can be used to represent systems and their interactions, such as inputs, processes, and outputs- and energy and matter flows within systems. <u>Energy and Matter</u> • Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion). • The transfer of energy can be tracked as energy flows through a designed or natural system.
Science and	• Develop a model to describe unobservable mechanisms.

Engineering Practice	• Plan an investigation individually and collectively, and in the design; identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how much data is needed to support a claim. • Construct and interpret graphical displays of data to identify linear and non-linear relationships. • Apply scientific ideas or principles to design, construct, and test the design of an object, tool, process, or system. • Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation for a phenomenon. • Scientific knowledge is based upon logical and conceptual connections between evidence and explanations.

I Know About Waves



☐ I can use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. (Emphasis is on describing waves with both qualitative and quantitative thinking. Assessment does not include electromagnetic waves and is limited to standard repeating waves).

☐ I can develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials (Emphasis is on both light and mechanical waves. Models could include drawings, simulations, and written descriptions. Assessment is limited to qualitative applications pertaining to light and mechanical waves).

☐ I can integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals (Emphasis is on a basic understanding that waves can be used for communication purposes. Examples could include using fiber optic cable to transmit light pulses, radio wave pulses in wifi devices, and conversion of stored binary patterns to make sound or text on a computer screen. Assessment does not include binary counting or the specific mechanism of any given device).

A little primer for my teacher:

Common Core	RIST.8.1- Cite textural evidence to support analysis of what the test says explicitly as well as inferences drawn from the text.	RIST.8.2- Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
	RIST-8.9- Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic	WHST.8-9- Draw evidence from informational texts to support analysis, reflection, and research.
	SL.8.5- Integrate multi-media and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.	MP-8.2- Reason abstractly and quantitatively.
	MP-8.4- Model with mathematics.	RP.8-A-1- understand the concept of ratio and use ratio language to describe a ration relationship between two quantities
	RP.8.A-2- Recognize and represent proportional relationships between quantities.	F.A-8.3- Interpret the equation y=mx+b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear.

Vocabulary	Wave, amplitude, wave energy, qualitative, quantitative, reflected, refracted, absorbed, transmitted, mechanical waves, light waves, sound waves, standard repeating waves, digitized signals, encode, analog, binary pattern, electromagnetic, radiation, wavelength, amplitude, frequency, medium
Disciplinary Core Ideas	<u>Wave Properties</u> • A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. • A sound wave needs a medium through which it is transmitted. <u>Electromagnetic Radiation</u> • When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. • The path that light travels can be traced as straight lines, except at the surfaces between different transparent materials (e.g. air and water, air and glass, water and glass) where the light bends. • A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. • Because light can travel through space, it cannot be a matter wave, like sound or water waves. <u>Information Technologies and Instrumentation</u> • Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information.
Cross-cutting Concepts	<u>Patterns</u> • Graphs, charts, and images can be used to identify patterns in data <u>Structure and Function</u> • Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. • Structures can be designed to serve particular functions. <u>Influence of Science, Engineering, and Technology on Society and the Natural World</u> • Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations. <u>Science as a Human Endeavor</u> • Advances in technology influence the progress of science and science has influenced advances in technology.
Science and Engineering Practice	• Develop and use a model to describe phenomena. • Use mathematical representations to support scientific conclusions and design solutions

	• Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings. • Scientific knowledge is based upon logical and conceptual connections between evidence and explanations.