Middle School - Physical Science

Grade	Big Idea	Essential Questions	Concepts	Competencies	Vocabulary	2002 Standards	SAS Standards	Assessment Anchor Eligible Content
6-8	Matter can be understood in terms of the types of atoms present and the interactions both between and within atoms.	How can one explain the structure, properties, and interactions of matter?	Pure substances are made from a single type of atom or compound; each pure substance has characteristic physical and chemical properties that can be used to identify it.	Plan investigations to generate evidence supporting the claim that one pure substance can be distinguished from another based on given characteristic properties.	Boiling point Characteristic Conductivity Density Flammability Malleability Melting point Odor Properties Pure Substance Reactivity Solubility	3.2.10.B(2) 3.4.7.A (1) 3.4.7.A (2)	3.2.6.A2 3.2.6.A4 3.2.6.A5 3.2.7.A1	S8.C.1.1.1 S8.C.1.1.2 S8.A.1.3 S8.A.2.1 S8.A.2.2
6-8	Matter can be understood in terms of the types of atoms present and the interactions both between and within atoms.	How can one explain the structure, properties, and interactions of matter?	Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it.	Given certain conditions (ex. temperature, pressure, space available), select appropriate materials, based on their physical and/or chemical properties, to be used to solve a problem.	Chemical change (e.g., combustion, precipitation) Conditions (e.g., concentration, alloy, pH, pressure, catalysts) Physical change (e.g., phase change/change of state, solubility)	3.6.10.C (1) 3.6.10.C (3) 3.4.7.A (3)	3.2.3.A1 3.2.3.A4 3.2.4.A4 3.2.6.A5 3.2.7.A1	S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.C.1.1.2
6-8	Matter can be understood in terms of the types of atoms present and the interactions both between and within atoms.	How can one explain the structure, properties, and interactions of matter?	The relationships of chemical properties of elements are represented in the repeating patterns within the periodic table.	Using what you know about the repeating pattern of chemical properties and atomic structure within the periodic table, predict the location of an unknown element based on its properties.		3.1.10.B (2) 3.4.10.A (2)	3.2.8.A2	S8.C.1.1.1 S8.A.3.3 S11.C.1.1.4
6-8	Matter can be	How can one explain the	All substances are made of	Compare and contrast models of	Atoms	3.1.10.B (1)	3.2.7.A2	S8.A.3.2

	understood in terms of the types of atoms present and the interactions both between and within atoms.	structure, properties, and interactions of matter?	atoms, which combine with one another in various ways.	simple molecules to those with extended structures.	Bonding Compounds Elements	3.4.10.A (1) 3.4.10.A (6) 3.4.10.A (9)	3.2.10.A2	S8.C.1.1.1
6-8	Matter can be understood in terms of the types of atoms present and the interactions both between and within atoms.	How can one explain the structure, properties, and interactions of matter?	The amount of matter is conserved regardless of what reaction or change in properties occurs, the total mass of the substances involved does not change.	Plan and carry out investigations to determine the effect on the total mass of a substance when the substance changes shape, phase, and/or is dissolved.	Chemical equation Conservation of mass Dissolve Mass Open vs. Closed Phase Change Physical Change Product Reactant System Yields (boiling, melting, freezing, sublimation)	3.4.7.A (4) 3.4.7.D 3.4.10.A (7) 3.2.10.B (2)	3.2.6.A3	S8.C.1.1.3 S8.A.1.3 S8.A.2.1 S8.A.2.2
6-8	Matter can be understood in terms of the types of atoms present and the interactions both between and within atoms.	How can one explain the structure, properties, and interactions of matter?	When two or more different substances are mixed, a new substance with different properties may be formed; such occurrences depend on the substances and conditions (e.g., temperature, pressure, pH, catalysts, etc.).	Investigate the interaction of two or more substances to determine whether a new substance is formed when materials are mixed.	Chemical change Compounds Elements Endothermic Exothermic Mixtures Precipitate Products Reactants	3.2.10.B (2) 3.4.7.A (2)	3.2.6.A4 3.2.7.A4	S8.C.1.1.1 S8.C.1.1.3 S8.A.1.3 S8.A.2.1 S8.A.2.2
6-8	Matter can be understood in terms of the types of atoms present and the interactions both between and within atoms.	How can one explain the structure, properties, and interactions of matter?	In a chemical process, the atoms that make up the original substances (reactants) are regrouped, and these new substances (products) have different properties from those of the reactants.	Develop representations of reactants and products showing how atoms regroup during chemical reactions and have new properties.	Balancing equations Products Reactants Yields	3.1.7.B (2) 3.4.7.A (4)	3.2.7.A4	S8.A.3.2 S8.C.1.1.3

6-8	Matter can be understood in terms of the types of atoms present and the interactions both between and within atoms.	How can one explain the structure, properties, and interactions of matter?	Using water as an example, explain the relationship between the physical properties of a substance and its molecular or atomic structure.	Compare and contrast the properties of water with other substances (freezing point, high specific heat, cohesion).	Cohesion Polarity Specific heat	3.4.10.A (5)	3.2.12.A1	S8.A.3.2 S8.C.1.1.2 S11.C.1.1.2 BIO.A.2.1.1
6-8	Matter can be understood in terms of the types of atoms present and the interactions both between and within atoms.	How can one explain the structure, properties, and interactions of matter?	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 relative locations.	Construct models comparing the arrangement and motion of molecules within solids, liquids and gases of the same substance.	Gas Liquid Kinetic vs. Potential energy Molecular motion Solid States of matter Temperature Thermal energy	3.1.7.B (2) 3.4.10.A (4)	3.2.6.A1 3.2.10.A3	S8.A.3.2 S8.C.1.1.2 S8.C.3.1.2
6-8	Matter can be understood in terms of the types of atoms present and the interactions both between and within atoms.	How can one explain the structure, properties, and interactions of matter?	The changes of state that occur with variations in temperature or pressure can be described and predicted.	Interpret a heating curve to determine the temperature at which a substance is solid, liquid and/or gas.	Phase change (boiling, melting, freezing, sublimation) Pressure Temperature	3.1.7.C (1) 3.4.10.A (4)	3.2.4.A5 3.2.6.A1	S8.C.1.1.2 S8.C.3.1.2 S8.A.1.1 S8.A.2.2 S8.A.2.1
6-8	Matter can be understood in terms of the types of atoms present and the interactions both between and within atoms.	How can one explain the structure, properties, and interactions of matter?	Some chemical reactions release energy, others absorb energy.	Design, construct and carry out an experiment that either releases or absorbs energy by chemical processes.	Electrical Endothermic Exothermic Colorimetric Photometric	3.2.10.B (2) 3.4.10.B (3)	3.2.7.A3 3.2.8.A3	S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.C.1.1.3 S8.C.2.1.3
6-8	Interactions between any two objects can cause changes in one	How can one explain and predict interactions between objects within systems?	Electromagnetic forces can be attractive or repulsive, and their sizes depend on	Plan and carry out investigations to illustrate the factors that affect the strength of electric and magnetic	Current Electric charge Electromagnetic	3.4.10.C (1) 3.2.10.B (2)	3.2.6.B4 3.2.10.B4	S8.A.1.3 S8.A.2.1 S8.A.2.2

	or both of them. .		the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects.	forces.	Forces Resistance			S8.C.3.1.1
6-8	Interactions between any two objects can cause changes in one or both of them.	How can one explain and predict interactions between objects within systems?	Gravitational forces are always attractive. There is a gravitational force between all objects. This force is dependent upon mass and distance between the objects.	Develop a simple model using given data that represents the relationship of gravitational interactions (force, mass, distance) and the motion of objects in space.	Gravitation Gravitational forces Law of universal gravity Mass Weight	3.1.7.B (1) 3.4.7.D (4)	3.2.5.B1 3.2.6.B1 3.2.7.B1	S8.A.3.2 S8.C.3.1.1
6-8	Interactions between any two objects can cause changes in one or both of them.	How can one explain and predict interactions between objects within systems?	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.	Communicate qualitative observations and information graphically and mathematically to represent how an object's relative position, velocity, and direction of motion are affected by forces acting on the object.	Acceleration Balanced Displacement Distance Force Motion graphs Net Force Newton's 1st Law Newton's 2nd Law Position Reference frame Speed Unbalanced Velocity	3.1.10.B (3) 3.4.7.C (1)	3.2.6.B1 3.2.5.B1 3.2.7.B1	S8.A.1.1 S8.C.3.1.1
6-8	Interactions between any two objects can cause changes in one or both of them.	How can one explain and predict interactions between objects within systems?	A pair of interacting objects apply equal and opposite forces on one another.	Design a qualitative solution to a problem involving the motion of colliding objects. (e.g. pool table, model car collision).	Acceleration Force Force pairs Mass Newton's 3rd Law	3.4.12.C (6)	3.2.5.B1 3.2.6.B1 3.2.7.B1	S8.C.3.1.1 S8.A.2.1 S8.A.2.2
6-8	Interactions between	How can one explain and	Explain that the mechanical	Given a scenario involving simple	Distance	3.4.4.C (11)		S8.A.1.1

	any two objects can cause changes in one or both of them.	predict interactions between objects within systems?	advantages produced by simple machines helps to do work (physics) by either overcoming a force or changing the direction of the applied force.	machines, qualitatively compare the mechanical advantage of each. Based on this analysis, argue which machine is best for the task.	Force Mechanical advantage Simple machines Work	3.4.7.C (3) 3.4.10.C (2)		S8.C.3.1.3
6-8	Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.	How is energy transferred and conserved?	Energy is transferred from hotter regions or objects and into colder ones by the processes of conduction, convection, and radiation.	Use and/or construct models to communicate the means by which thermal energy is transferred during conduction, convection, and radiation.	Conduction Convection energy Insulator Radiation Transfer Thermal energy	3.4.4.B (1) 3.4.4.B (2) 3.4.4.B (5) 3.2.10.B (4) 3.6.10.C (5) 3.6.10.C (6) 3.6.10.C (7)	3.2.7.B3 3.2.6.B3 3.2.6.B6	S8.A.3.2 S8.C.2.1.2
6-8	Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.	How is energy transferred and conserved?	Whenever a transformation of energy occurs, some of the energy in the system appears as thermal energy.	Compare, evaluate, and design a device that improves thermal energy transfer, and defend the selection of materials chosen to construct the device.	Energy transfer Thermal energy Law of conservation of energy	3.4.7.B (3) 3.6.10.C (5) 3.6.10.C (6) 3.6.10.C (7)	3.2.5.B3 3.2.7.B6	S8.A.2.1 S8.A.2.2 S8.C.2.1.3
6-8	Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.	How is energy transferred and conserved?	The term “heat” as used in everyday language refers both to thermal motion (the motion of atoms or molecules within a substance) and electromagnetic radiation (particularly infrared and light).	Demonstrate different methods of heat transfer used in technological systems. Cite advantages and disadvantages of each method.	Atoms Conduction Convection Electromagnetic Radiation Heat Kinetic Molecules Potential Substance Temperature Thermal energy	3.4.10.B (4) 3.6.10.C (7)	3.2.5.B3 3.2.6.B3 3.2.8.B3	S8.A.3.1 S8.C.2.1.2
6-8	Interactions of objects	How is energy transferred	Temperature is a measure of	Generate and defend a model that explains the Kinetic Theory.	Kinetic energy	3.4.10.B (3)	3.2.8.B3	S8.A.3.2

	or systems of objects can be predicted and explained using the concept of energy transfer and conservation.	and conserved?	the average kinetic energy of particles of matter.		Temperature System Potential energy Total energy	3.1.10.B (1)		S8.C.3.1.2
6-8	Interactions of objects or systems of objects can be predicted and explained using the concept of energy transfer and conservation.	How is energy transferred and conserved?	The amount of energy transfer needed to change the temperature of a sample depends on the nature of the matter, the size of the sample, and the environment.	Develop and conduct an experiment to rank the specific heat of various materials by comparing their rate of change in temperature.	Conduction Heat transfer Specific heat	3.2.10.B (2) 3.4.12.B (4)	3.2.6.B3 3.2.7.B3 3.2.7.B6	S8.A.1.3 S8.A.2.1 S8.A.2.2 S8.C.2.1.2
6-8	Waves are a repeating pattern of motion that transfers energy from place to place without overall displacement of matter.	How are waves used to transfer energy and information?	A wave has a repeating pattern with a specific wavelength, frequency, and amplitude.	Use a drawing or physical representation of wave properties to explain amplitude, frequency, and wavelength of different waves in the electromagnetic spectrum.	Amplitude Compressions Crest Frequency Trough Rarefactions Wave Wave length	3.4.7.C (5) 3.1.7.D (1)	3.2.7.B5	S8.A.1.1
6-8	Waves are a repeating pattern of motion that transfers energy from place to place without overall displacement of matter.	How are waves used to transfer energy and information?	A sound wave needs a medium through which it is transmitted.	Through the use of models, explain the transmission of sound waves through different mediums.	Longitudinal Medium Sound Wave Vacuum	3.2.10.B (2) 3.4.7.C (5)	3.2.5.B5	S8.A.3.2
6-8	Waves are a repeating pattern of motion that transfers energy from place to place without overall displacement of matter.	How are waves used to transfer energy and information?	When light shines on an object, it is reflected, absorbed, or transmitted through the object.	Construct explanations of how waves are reflected, absorbed or transmitted through an object.	Absorption Color Frequency Light Reflection Transmission	3.4.7.C (4) 3.4.7.C (5)	3.2.7.B5	S8.A.1.1

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6-8	Waves are a repeating pattern of motion that transfers energy from place to place without overall displacement of matter.	How are waves used to transfer energy and information?	Many modern communication devices use digitized signals (sent as wave pulses) as a more reliable way to encode and transmit information.	Apply scientific knowledge to explain the application of waves in common communication designs.	Decode Encode Transmit Wave pulse	3.4.7.B (3) 3.4.7.C (5)	3.2.7.B5 3.2.8.B6	S8.A.1.3 S8.A.2.1 S8.A.2.2