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| **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 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? | All substances are made of atoms, which combine with one another in various ways. | Compare and contrast models of simple molecules to those with extended structures. | Atoms  Bonding  Compounds  Elements | 3.1.10.B (1)  3.4.10.A (1)  3.4.10.A (6)  3.4.10.A (9) | 3.2.7.A2  3.2.10.A2 | S8.A.3.2  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 or both of them.  . | How can one explain and predict interactions between objects within systems? | 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. | Plan and carry out investigations to illustrate the factors that affect the strength of electric and magnetic forces. | Current  Electric charge Electromagnetic Forces  Resistance | 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  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 any two objects can cause changes in one or both of them. | How can one explain and predict interactions between objects within systems? | Explain that the mechanical advantages produced by simple machines helps to do work (physics) by either overcoming a force or changing the direction of the applied force. | Given a scenario involving simple machines, qualitatively compare the mechanical advantage of each. Based on this analysis, argue which machine is best for the task. | Distance  Force  Mechanical advantage  Simple machines  Work | 3.4.4.C (11)  3.4.7.C (3)  3.4.10.C (2) |  | S8.A.1.1  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 or systems of objects can be predicted and explained using the concept of energy transfer and conservation. | How is energy transferred and conserved? | Temperature is a measure of the average kinetic energy of particles of matter. | Generate and defend a model that explains the Kinetic Theory. | Kinetic energy Temperature  System  Potential energy  Total energy | 3.4.10.B (3)  3.1.10.B (1) | 3.2.8.B3 | S8.A.3.2  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 |
| **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 |