7th Grade Science Placemat

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Matter and Its Interactions

Structure and Properties of Matter

PS1.A.1: Make models describing compositions of simple molecules & extended structures
Develop models to describe the atomic composition of simple molecules and extended structures. [Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms. (MS-PS1-1)

PS1.A.2: Analyze data on the properties of substances before and after chemical reactions
Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. [Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.] (MS-PS1-2)

PS1.A.3: Present information about synthetic materials and their impact on society
Gather, analyze, and present information to describe that synthetic materials come from natural resources and how they impact society.[Clarification Statement: Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples of new materials could include new medicine, foods, and alternative fuels.] (MS-PS1-3)

PS1.A.4: Describe thermal energy changing motion, temperature, and state of a substance
Develop a model that describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed. [Clarification Statement: Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawings and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.] (MS-PS1-4)

Chemical Reactions

PS1.B.1: Develop a model showing mass is conserved after a chemical reaction
Develop and use a model to describe how the total number of atoms remains the same during a chemical reaction and thus mass is conserved. [Clarification Statement: Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms that represent atoms.] (MS-PS1-5)

PS1.B.2: Construct a device that either releases or absorbs thermal energy
Construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.[Clarification Statement: 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. Examples of designs could involve chemical reactions such as dissolving ammonium chloride or calcium chloride.] (MS-PS1-6)

Motion and Stability: Forces and Interactions

Forces and Motion

PS2.A.1: Design a solution that minimizes the force during a collision
Apply physics principles to design a solution that minimizes the force of an object during a collision and develop an evaluation of the solution. (MS-PS2-1)

PS2.A.2: Provide evidence that change in an object's motion depends on forces and mass
Plan and conduct 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. [Clarification Statement: Emphasis is on balanced (Newton's First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton's Second Law), frame of reference, and specification of units.] (MS-PS2-2)

Types of Interaction

PS2.B.1: Analyze factors that affect strength of electric & magnetic forces
Analyze diagrams and collect data to determine the factors that affect the strength of electric and magnetic forces. [Clarification Statement: 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.] (MS-PS2-3)

PS2.B.2: Graph evidence supporting gravitational interactions depend on mass of object
Create and analyze a graph to use as evidence to support the claim that gravitational interactions depend on the mass of interacting objects. [Clarification Statement: 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.] (MS-PS2-4)

PS2.B.3: Evaluate electric and magnetic fields exist between objects
Conduct an investigation and evaluate the experimental design to provide evidence that electric and magnetic fields exist between objects exerting forces on each other even though the objects are not in contact. . [Clarification Statement: 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.] (MS-PS2-5)

Energy

Definitions of Energy

PS3.A.1: Use data to describe kinetic energy to the mass and speed of an object
Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object. [Clarification Statement: Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a wiffle ball versus a tennis ball.] (MS-PS3-1)

PS3.A.2: Make a model showing potential energy changes when distance changes
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. [Clarification Statement: Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects within System interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate's hair. Examples of models could include representations, diagrams, pictures, and written descriptions of System.] (MS-PS3-2)

PS3.A.3: Design a device that minimizes or maximizes thermal energy transfer
Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. [Clarification Statement: Examples of devices could include an insulated box, a solar cooker, and a Styrofoam cup.] (MS-PS3-3)

PS3.A.4: Determine relationships among energy transferred, matter, mass, and temperature
Plan and conduct an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the temperature of the sample. [Clarification Statement: Examples of experiments could include comparing final 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.] (MS-PS3-4)

Conservation of Energy and Energy Transfer

PS3.B.1: Present arguments claiming if kinetic energy changes, energy is transferred
Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. [Clarification Statement: 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 temperature changes or motion of object.] (MS-PS3-5)

Waves and Their Applications in Technologies for Information Transfer

Wave Properties

PS4.A.1: Use mathematical representations to describe waves using amplitude and energy
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.[Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking.] (MS-PS4-1)

PS4.A.2: Use a model to describe that waves are reflected, absorbed, or transmitted
Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. [Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.] (MS-PS4-2)

Engineering, Technology, and Application of Science

Defining and Delimiting Engineering Problems 6-8

ETS1.A.1: Define constraints of design using scientific principles & impacts on environment
Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions. (MS-STS1-1)

Developing Possible Solutions

ETS1.B.1: Evaluate solutions to determine if they meet criteria & constraints of the problem
Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. (MS-ETS1-2)

ETS1.B.2: Analyze design solutions, identify best elements & combined into a new solution
Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success. (MS-ETS1-3)

ETS1.B.3: Develop model to generate data for iterative testing to achieve optimal design
Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. (MS-ETS1-4)