MS. Structure and Properties of Matter

A Performance Expectations MS.PS1.SPM

1 Develop models to describe the atomic composition of simple molecules and extended structures. MS.PS1.1

2 Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. MS.PS1.3

3 Develop a model that predicts and describes changes in particle motion, temperature, and phase (state) of a substance when thermal energy is added or removed. [MS.PS1.4

4 Use evidence to illustrate that density is a property that can be used to identify samples of matter. MS.PS1.7

6 Plan and conduct an investigation to demonstrate that mixtures are combinations of substances MS.PS1.8

B Science and Engineering Practices MS.SPM.SEP

1. Developing and Using Models MS.SPM.SEP.1
   a. Develop a model to predict and/or describe phenomena. (MS-PS1-1),(MS-PS1-4) MS.SPM.SEP.1A
2. Planning and Carrying Out Investigations MS.SPM.SEP.2
   a. 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 many data are needed to support a claim. (MS-PS1-8) MS.SPM.SEP.2A
   b. Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. (MS-PS1-8) MS.SPM.SEP.2B
3. Engaging in Argument from Evidence MS.SPM.SEP.3
   a. 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. (MS-PS1-7) MS.SPM.SEP.3A
4. Obtaining, Evaluating, and Communicating Information MS.SPM.SEP.4
   a. 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. (MS-PS1-3) MS.SPM.SEP.4A

C Disciplinary Core Ideas MS.SPM.DCI

1 PS1.A: Structure and Properties of Matter MS.SPM.DCI.PS1.A

- a (NYSED) Substances are made of one type of atom or combinations of different types of atoms. Individual atoms are particles and can combine to form larger particles that range in size from two to thousands of atoms. (MS-PS1-1) MS.SPM.DCI.PS1.A.1
- b (NYSED) Each substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MSPS1-3),(MS-PS1-7)(Note: ThisDisciplinaryCore Ideais also addressed by MS-PS1-2.) MS.SPM.DCI.PS1.A.2
- c (NYSED) In a solid, the particles are closely spaced and vibrate in position but do not change their relative locations. In a liquid, the particles are closely spaced but are able to change their relative locations. In a gas, the particles are widely spaced except when they happen to collide and constantly change their relative locations. (MSPS1-4) MS.SPM.DCI.PS1.A.3
- d Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1) MS.SPM.DCI.PS1.A.4
- e (NYSED) The changes of state that occur with variations in temperature and/or pressure can be described and predicted using these models of matter. (MS-PS1-4) MS.SPM.DCI.PS1.A.5
- f (NYSED) Mixtures are physical combinations of one or more samples of matter and can be separated by physical means. (MS-PS1-8) MS.SPM.DCI.PS1.A.6

2 PS1.B: Chemical Reactions MS.SPM.DCI.PS1.B

- a (NYSED) Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different particles, and these new substances have different properties from those of the reactants. (MS-PS1-3)(Note: This Disciplinary Core Idea is also addressed by MS-PS1-2 and MS-PS1-5.) MS.SPM.DCI.PS1.B.1

3 PS3.A: Definitions of Energy MS.SPM.DCI.PS3.A

- a (NYSED) The term “heat” as used in everyday language refers both to thermal energy (the motion of particles 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. (secondary to MS-PS1-4) MS.SPM.DCI.PS3.A.1
- a (NYSED) Temperature is not a form of energy. Temperature is a measurement of the average kinetic energy of the particles in a sample of matter.(secondary to MS-PS1-4) MS.SPM.DCI.PS3.A.2

D Crosscutting Concepts MS.SPM.CC

1 Patterns MS.SPM.CC.1

- a Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MS-PS1-1),(MS-PS1-7),(MSPS1-8) MS.SPM.CC.1A
- b Graphs, charts, and images can be used to identify patterns in data. (MS-PS1-1), (MS- PS1-4) MS.SPM.CC.1B

2 Cause and Effect MS.SPM.CC.2

- a Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4) MS.SPM.CC.2A

3 Scale, Proportion, and Quantity MS.SPM.CC.3

- a Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-PS1-1) MS.SPM.CC.3A

1 Structure and Function MS.SPM.CC.4

- a Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS1-3) MS.SPM.CC.4A

1 Interdependence of Science, Engineering, and Technology MS.SPM.CC.5

- a 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. (MS-PS1-3) MS.SPM.CC.5A

1 Influence of Science, Engineering and Technology on Society and the Natural World MS.SPM.CC.6

- a The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MSPS1-3) MS.SPM.CC.6A