

PHENOMENA, DRIVING QUESTIONS AND STORYLINE

CHEMISTRY OF MATERIALS

This unit explores concepts and issues related to the question: How do the properties of materials affect their usefulness and impact on the environment?

Phenomenon	Driving Questions	Guiding Questions	Activities	PE	Storyline/Flow (How an activity leads to subsequent activities)	
Materials like plastics, metals, and glass are all useful, but they can also affect the environment.	How do a material's properties affect its uses?	What information would help you decide which material is best for making a single-use drink container? (Activity 1)	1, 2, 3, 4, 5	MS-PS1-3	Materials for drink containers introduce the properties, production, and wastes for three materials, and introduce advantages and disadvantages of using materials for various purposes.	
		How can scientists use physical properties to identify elements? (Activity 2)				All materials are made from a limited number of elements (each having characteristic properties and atoms).
		How do the properties of materials determine their uses? (Activity 3)				Properties such as color, solubility, density, and melting and boiling point determine the uses of materials.
		How can you use the mass and volume of an object to calculate its density? (Activity 4)				A substance's density can be calculated and used both to identify substances and to select substances for various uses.
		How can information be evaluated for bias? (Activity 5)				Although Web resources may have points of view and biases, it is possible to obtain information about the resources used to make materials, the advantages of these materials for solving problems, and the impact of these materials on society.

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Even though we can't see atoms, they make up all the stuff around us.	Why do materials have unique properties?	How do atoms combine to form molecules? (Activity 6) How do the structures of particles in substances vary? (Activity 7)	6, 7	MS-PS1-1	Substances have specific structures that can be modeled by arranging atomic models in various ways. A closer look at particles explains more properties, such as density and solubility.
Some substances, such as water, can exist as a solid, liquid, or gas.	What happens to the particles in a substance as it changes temperature or changes from one state to another?	How does the particle structure of matter explain the differences between solids, liquids, and gases? (Activity 8) What happens when gas particles are heated or cooled? (Activity 9) What happens to the particles and temperature of a substance as it changes state? (Activity 10)	8, 9, 10	MS-PS1-4	At room temperature, some substances are solid while others are liquid or gas. Particle models, including models of the distances between particles and their motions, help explain the differences between the states of matter. Particle motion also helps explain the properties of a substance as temperature changes. Increased temperature indicates increased particle motion (kinetic energy). Decreased temperature indicates decreased particle motion (kinetic energy). Transfer of thermal energy to a substance increases the substance's average kinetic energy (temperature) except during a change of state.

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Materials like plastics, metals, and glass are all useful, but they can also affect the environment.	How do a material's properties affect its uses?	How are plastics engineered for various uses? (Activity 11)	11, 12, 13	MS-PS1-3 MS-PS1-1	Plastics are synthetic materials that can be designed with a variety of structures and functions.	
		How do the structures of plastics relate to their varied properties? (Activity 12)				The structure of a plastic causes it to have specific properties that allow plastics to be engineered to have a wide range of properties and, thus, uses.
		What are the benefits and trade-offs of different plastics? (Activity 13)				Synthetic materials, such as plastics, are made from natural resources and have many impacts, both positive and negative, on human health and the environment.