Properties of Matter: Scope and Sequence

Lesson Number	Focus Question(s)	Main Learning Goal	Science Content Storyline
1a/b	What changes in matter can we see?	Matter can undergo observable changes that can be described and categorized.	Matter is anything that takes up space and has mass (weight). Matter can change, and we can observe those changes. Changes happen when heat is added or taken away. Some changes are reversible and some aren't.
2a/b	What causes matter to change from a solid to a liquid or from a liquid to a solid?	Solids can become liquids when heat is added. Liquids can become solids when heat is removed and the liquid matter cools.	Heating and cooling (removing heat) can cause changes in matter. Matter in its solid form can become a liquid when heat is added. This is called *melting*. Matter in its liquid form can become a solid when heat is removed and the liquid matter cools.
3a	What is liquid water made of? What is solid water (ice) made of?	The atoms or molecules that make up a particular kind of matter are the same whether the matter is in a solid form, such as ice, or a liquid form, such as liquid water.	All matter is made up of very small pieces. Atoms are the smallest pieces of matter. When atoms combine, they form molecules, which are also very small pieces of matter. Each kind of matter, such as water, is made up of a particular arrangement of atoms or molecules. These atoms or molecules are the same whether the matter is in a solid form (ice) or in a liquid form (liquid water). Because atoms and molecules are too small to see, models can give us an idea of what real matter is made of.
3b	How do water molecules move in a solid and a liquid?	The atoms or molecules that make up a particular kind of matter are the same whether the matter is in a solid form, such as ice, or a liquid form, such as liquid water. But the arrangement and motion of the atoms and molecules change when heat is added or taken away.	The atoms or molecules that make up matter move in different ways in solid and liquid forms. In a solid state, atoms and molecules vibrate in a rigid structure. When heat is added to a solid, its atoms or molecules begin to move faster. When they move fast enough, they break away from their rigid structure and move around more freely as a liquid. When heat is taken away from a substance and the matter cools, the atoms or molecules slow down and move closer together. When they slow down enough, they form a rigid structure and vibrate in place as a solid.
4a	How does heat cause matter to change from a solid to a liquid and from a liquid to a solid?	Adding or removing heat changes the arrangement and motion of the atoms or molecules that make up a particular kind of matter. Solids can become liquids when heat is added and the molecules speed up and move around more freely. Liquids	Heating and cooling (removing heat) can cause changes in matter. When heat is added to a solid, its atoms or molecules begin to move faster. Melting happens when the atoms or molecules in a solid move fast enough to break away from their rigid structure and begin flowing around more freely as a liquid. When heat is taken away from a substance and the matter cools, the atoms or molecules slow down and move closer together.

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		can become solids when heat is removed (the matter cools) and the molecules slow down and vibrate in place.	Freezing happens when the molecules in a liquid slow down enough to form a more rigid structure and vibrate in place as a solid.
4b	What happens when solid matter becomes liquid matter and liquid matter becomes solid matter? Why do these changes happen?	Adding or removing heat changes the arrangement and motion of the atoms or molecules that make up a particular kind of matter. Solids can become liquids when heat is added and the molecules speed up and move around more freely. Liquids can become solids when heat is removed (the matter cools) and the molecules slow down and vibrate in place.	
5a/b	What is matter made of? How can matter change?	All matter is made up of very small pieces called *atoms* and *molecules*. Matter can change from a solid to a liquid when heat is added and the molecules begin to move faster. When they move fast enough, they break away from their rigid structure and flow around more freely as a liquid. Matter can change from a liquid to a solid when heat is removed and the molecules slow down. When they slow down enough, they join together in a rigid structure and vibrate in place as a solid.	All matter is made up of very small particles that are either atoms or combinations of atoms called *molecules*. Matter undergoes physical changes when heat is added or removed. These changes cause the molecules to move more rapidly or more slowly, but the structure of the molecules doesn't change. In physical changes, the matter is always the same substance, like water or butter, but the states of matter (solid, liquid, gas) are reversible. Solid matter can become liquid matter when heat is added, and liquid matter can become solid matter again when heat is removed and the matter cools down.
6	What happens when matter starts off as one thing and changes into something different?	By rearranging the atoms in molecules, matter can change into something entirely new.	Some changes in matter are different from physical changes. In a physical change, solid matter can become liquid matter, and liquid matter can become solid matter, but the substance itself remains the same. The molecules are just arranged and move differently. For example, water can become a solid or a liquid, but the

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			molecules (H_2O) are always the same. Another kind of change occurs when the atoms in molecules are rearranged, and the original substance becomes an entirely new substance with different properties. This is called a *chemical change*. The new substance may look or taste different from the original substance, or it may bubble or change color. When this type of change occurs, it means that the atoms in the original substance have recombined in new ways.
7	Is matter created or destroyed when it changes? How do you know?	When matter undergoes physical or chemical changes, atoms aren't created or destroyed. Comparing the mass of the matter before and after a physical or chemical change can provide evidence that the amount of matter is still the same.	Matter can change in physical ways, such as melting or freezing, or in chemical ways when atoms rearrange to form new substances. During these changes, the number of atoms remains the same. The movement and arrangement of the atoms or molecules may change, and the atoms may recombine to form new substances, but the matter itself always weighs the same, and the amount of matter (the number of atoms) doesn't change.