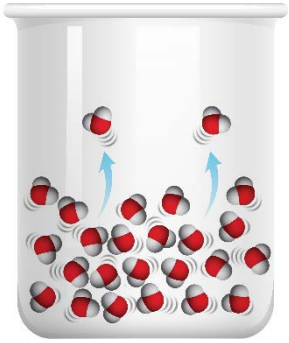
5th Grade - Lesson 4.1
Conservation of Mass
Teacher Background

In Lesson 4.1, students monitor the mass of substances during the process of melting, dissolving, and chemical change. Through their observations, students conclude that mass is conserved during all these changes.

Conservation of Mass

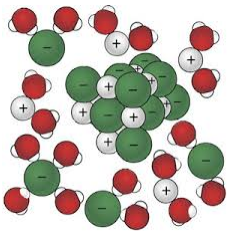
Conservation of mass is a law central to chemistry. The principle is that the mass of matter, in a closed system, will always be the same no matter what type of change happens to the matter. Whether it's a change in state, or dissolving, or a chemical reaction, or any combination of these, the amount of mass will not change.

The reason for this fundamental law is that the mass of the atoms stays the same during all these changes, and no atoms are gained or lost during any of these processes—they simply rearrange, whether it be chemical or physical.



Changes of State

In a state change such as evaporation, it might seem like the mass of water would decrease as water molecules evaporate from a sample of water. But the conservation of mass law is for a closed system, which means that matter cannot enter or leave the system. So if you allow water to evaporate inside a sealed container, the container with the water and the water vapor will have the same mass before, during, and after evaporation. This rule applies to any change of state in a closed system.



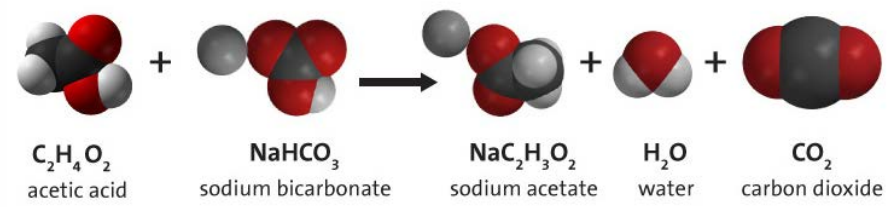
Dissolving

The same is true when substances interact and one substance dissolves in another. When a solute, like salt or sugar, is completely dissolved in water and seems to disappear, it might be natural to think that the mass of the solute has somehow decreased. But the process of dissolving merely spreads out the molecules or ions of the solute and intermixes them with the molecules of the solvent. No atoms are added or taken away from the system, so the mass stays the same.

Chemical Reactions

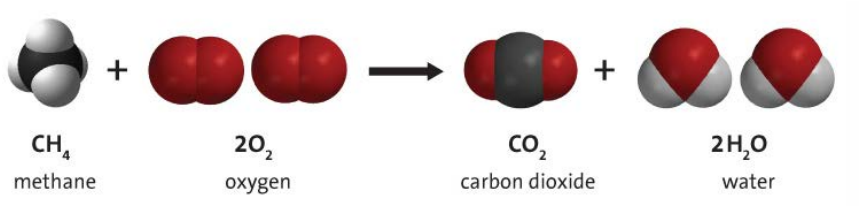
Even in a chemical reaction when atoms interact and create new products, mass is conserved. This is because the new substances created are composed of atoms that were present in the reactants. The atoms from the reactants come apart, rearrange and re-bond in a different arrangement to form the products. No new atoms have entered or left the system so the mass is conserved.

One example of a common chemical reaction is one between vinegar (acetic acid) and baking soda (sodium bicarbonate). Here is the chemical equation showing models of the molecules involved in the reaction.



If you count up the number of each type of atom on the left of the arrow (reactants), you'll see that there are an equal number on the right (products), just bonded in different arrangements. No new atoms are created during the reaction and no existing atoms disappear or are destroyed, so mass is conserved.

Another common reaction is methane reacting with oxygen to heat homes and gas stoves.



Again, you can see that all the atoms on the left in the reactants also appear on the right in the products, just rearranged. Since no atoms were created or destroyed in the reaction, mass is conserved.