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MATTER ELEMENTS ATOMS REACTIONS BIOCHEMISTRY ACTIVITIES

**STATES
OF
MATTER**

Chemical vs. Physical Changes

It is important to understand the difference between **chemical** and **physical** changes. The two types are based on studying chemical reactions and states of matter. We admit that some changes are obvious, but there are some basic ideas you should know. Physical changes are about **energy** and states of matter. Chemical changes happen on a molecular level when you have two or more molecules that interact and create a new molecule or two.



ELECTRICITY CHARGES THE NEON WITH ENERGY AND THE GAS BECOMES A PLASMA.

When you step on a can and crush it, you have forced a physical change. The shape of the object has changed. It wasn't a change in the state of matter, because the energy in the can did not change. When you melt an ice cube (H_2O), you have also forced a physical phase change by adding energy. That example caused a change in the state of matter. You can cause physical changes with forces like motion, temperature, and pressure.

Looking at Molecules

Chemical changes happen on a much smaller scale. While some experiments show obvious chemical changes, such as a color change, most chemical changes that happen between molecules are not seen. When iron (Fe) rusts, you can see it happen over a long period of time. The actual molecules have changed their structure (the iron **oxidized**). Melting a sugar cube is a physical change, because the substance is still sugar. Burning a sugar cube is a chemical change. Fire activates a chemical reaction between sugar and reactions (O_2). The oxygen in the air reacts with the sugar, and the chemical bonds are broken.



THESE PIPES ARE IN THE MIDDLE OF CHEMICAL CHANGES AS THEY RUST.

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Some chemical changes are extremely small. They happen over a series of steps. The result might have the same number of atoms, but it will have a different

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MATH

structure or combination of atoms. The sugars glucose, galactose, and fructose all have six carbon atoms, twelve hydrogen atoms, and six oxygen atoms (C₆H₁₂O₆). Even though they are made of the same atoms, they have very different shapes and are called **structural isomers**. Those isomers have atoms bonded in different orders. Also, each of the sugars goes through different chemical reactions because of the differences in their molecular structure. Scientists say that the arrangement of atoms allows for a high degree of **specificity**, especially in the molecules you find in living things.

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