

PS01B Matter and Changes

Name: _____

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Did you know?

- 1 Matter is anything that has mass and volume.
- 2 Chemistry is the study of matter and the changes that matter undergoes (see Fig 1).
- 3 Materials can change either the way they look or feel in a physical way or rearrange their atoms in a chemical change.
- 4 Physical properties can be observed without changing the identity of the substance.
- 5 Chemical properties are observed only when a substance is changed into a new substance.



Figure 1 - Metals burn to make colors.

So, why is it important to me?

- 6 Believe it or not, the observations you are likely to make when trying to identify an unknown food are very similar to the observations that a chemist makes when trying to learn about a new material.
- 7 Chemists rely on smell, color, state (that is, whether it is a solid, liquid or gas), temperature, volume, mass (which is related to weight, as you'll discover in a later section), and texture. There is, however, one property you might use to learn about a food, but that you should definitely not use to learn about a chemical - taste!

What are the big ideas I need to know?

- 8 There are two basic types of properties that are used to identify or describe matter: physical properties and chemical properties.
- 9 Chemists learn a lot about the nature of matter by studying the changes that matter can undergo. Chemists make a distinction between two different types of changes that they study - physical changes and chemical changes. Physical changes are changes that do not alter the identity of a substance (see Fig 2).



Figure 2- Melting snow is an example of a physical change - not a chemical one.

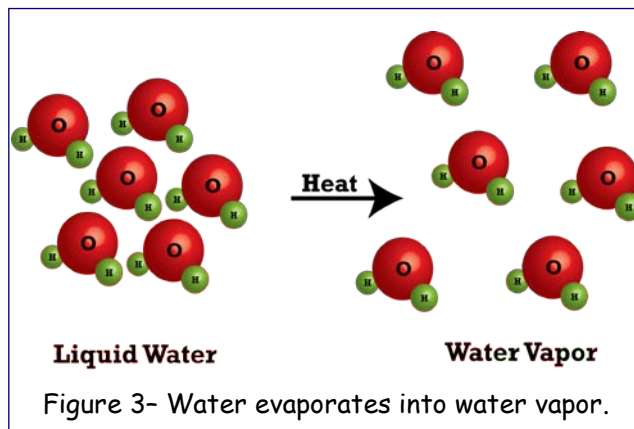
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10 Physical properties are those that can be observed without changing the identity of the substance. Typical physical properties are smell, color, state (that is, whether it is a solid, liquid or gas), temperature, volume, mass, and texture, hardness, and melting temperature.

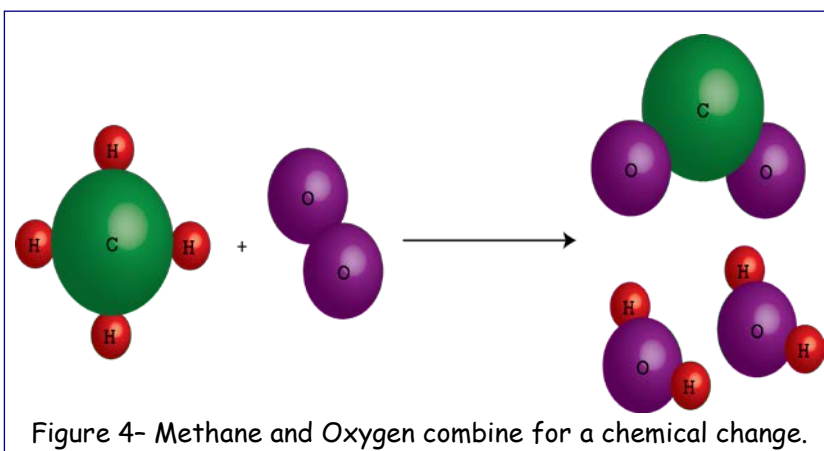
11 On the left (See Fig 3), we have water molecules, H_2O , that are held in liquid form. Each molecule contains two atoms of hydrogen and one atom of oxygen chemically bonded. When we heat the liquid water, it changes to water vapor, also H_2O .



12 The physical properties change; we can see the liquid water but the water vapor cannot be seen. But even though the physical properties have changed, the molecules are exactly the same as before. We still have each water molecule containing two hydrogen atoms and one oxygen atom. The only difference is that we added heat to change the state of the water from liquid to vapor. Physical changes are changes that do not alter the identity of a substance.

13 Chemical changes are changes that occur when one substance is turned into another substance. Chemical changes are frequently harder to reverse than physical changes.

14 In contrast to the act of ripping paper, the act of burning paper actually results in the formation of new chemicals (carbon dioxide and water, to be exact). Notice that whereas ripped paper can be at least partially reassembled, burned paper cannot be "unburned." In other words, burning only goes in one direction. The fact that burning is not reversible is a good indication that it involves a chemical change.



15 On the left (see Fig 4) we have a molecule of methane, CH_4 , and two molecules of oxygen, O_2 , while on the right we have two molecules of water, H_2O and one molecule of carbon dioxide, CO_2 (See Figure 3). In this case, not only has the appearance changed with the structure of the molecules has changed. The new substances do not have the same chemical properties as the original ones. This is a chemical change.

What about?

- 16 For the most part, physical changes tend to be reversible - in other words, they can occur in both directions. We can freeze and melt water forever.
- 17 Energy is always involved in any change, either physical or chemical. Typical changes are thermal energy or heat, electrical energy, chemical energy and mechanical energy