Physical and chemical changes

Physical Properties & Changes

Characteristics like colour and mass are called **physical properties**, which we can define as characteristics that can be seen and measured. We can identify physical properties for all types of matter, including all the ingredients and tools we use to bake a cake. For instance, a wooden stirring spoon has mass which we can measure. Because mass can be measured, we know that it's a physical property.

Changes that affect physical properties are called **physical changes**. With a physical change we see that a substance changes form but does not transform into a different substance. For example, to use an egg in our recipe, we need to crack it open. This is a physical change because the egg is now in two parts, but the egg did not transform into a chicken, or into any other substance for that matter; it is still an egg. If we were to take our wooden spoon and grind it down to sawdust, we could see another example of physical change. The spoon would change form, but it would still be wood.

Reversibility of Physical Changes

Sometimes physical changes can be reversed, and sometimes they cannot. We just looked at two examples of physical changes that could not be reversed, namely the cracked egg and the ground-up wooden spoon. We learned from the Humpty Dumpty nursery rhyme that you cannot put a broken egg back together again. The same goes for the wooden spoon; it would be impossible to change the sawdust back into a wooden spoon.

But, don't get fooled into thinking that all physical changes are irreversible. In fact, many physical changes can be reversed. Remember that when a substance changes physically, it is still the same substance, just in a different form. Water turning into ice is a great example of a reversible physical change. Water, which we know is made up of two hydrogen molecules and one oxygen molecule (H_2O), can be frozen, but that doesn't change the fact that it is still H_2O. If you let it thaw, you could drink it again.

Chemical Properties & Changes

Let's keep baking so we can learn about **chemical properties**, which are not as easy to see as physical properties. Chemical properties are characteristics of a substance that can only be observed during a reaction. For example, our wooden spoon will burn, but we can only know that for sure if we light it on fire and watch it burn. Once the wood burns, it transforms into ash. So, we see that with **chemical changes**, a substance transforms into a different substance. In other words, the identity of the object that undergoes a chemical

change gets altered; wood changed into ash, which is an entirely new substance with new chemical properties.

Once all of the ingredients are mixed together, the batter is ready to be baked in the oven. After a short time in the oven, the batter turns into a different substance that smells really good, called cake. So, we see that the heat from the oven created a chemical change, which resulted in a new substance.

Chemical changes produce one or multiple new substances from a chemical reaction

Characteristics such as smell, light, gas, heat, or colour can indicate a chemical change

Reversibility of Chemical Changes

Because substances transform into new substances when they undergo chemical change, it is easy to see that most chemical changes are irreversible. It is no easier to unbake a cake than it is to unburn a wooden spoon.

However, there are some chemical changes that are reversible. For example, when heat is applied to the reddish-brown gas known as nitrogen dioxide, it is chemically changed into two colourless gases called nitrogen monoxide and oxygen. If these gases are cooled, they will change back into the coloured nitrogen dioxide gas.

Lesson Summary

Let's review. **Physical properties** are characteristics that can be seen and measured. Changes that affect physical properties are called **physical changes**. With a physical change, a substance changes form, but does not transform into a different substance.

Many physical changes can be reversed, like water freezing to form ice. But some physical changes cannot, such as an egg being cracked or wood being ground into sawdust.

Chemical properties are characteristics of a substance that can only be observed during a reaction. Changes that affect chemical properties are called **chemical changes**. With a chemical change, a substance transforms into a different substance.

Most chemical changes are irreversible. For example, you cannot unbake a cake or unburn wood. However, there are some chemical changes that are reversible, such as nitrogen dioxide that is chemically changed by heat and then reforms when cooled.

Answer the following questions in your notebook.

1.This is an example of a reversible physical change.

a) Rust forming on an older vehicle
b) A log being chopped
c) An egg being cracked
d) Nitrogen gas being heated to form two new gasses
e) Water freezing to form ice

2. These characteristics of a substance can only be observed during a reaction.

a) Malleability
b) Physical properties
c) Density
d) Metabolic processes
e) Chemical properties

3. Which of the following statements is TRUE concerning chemical change?

a) All of the answers are true concerning chemical change
b) Chemical changes cause substances to transform into new substances
c) With chemical changes a substance changes form, but does not transform into a different substance
d) Ice thawing to form water is an example of a chemical change
e) Chemical changes are always easy to reverse

4. This is an example of an irreversible chemical change.

a) Chopping down a tree
b) All of the answers are correct
c) Breaking a wooden stick into two pieces
d) Burning wood to form ash
e) Grinding wood into sawdust

5. When a substance changes form, but does not transform into a different substance, it has undergone this process.

a) Chemical change
b) Physical change
c) Both a physical and chemical change
d) Irreversible transformation
e) Metamorphosis