CHEMICAL PROPERTIES

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Chapter 1

CHEMICAL PROPERTIES AND CHANGES

Let's review for just a minute. Remember, a physical property is a characteristics that can be observed or measured WITHOUT changing the identity of the substance. Tearing up a piece of paper is an example of a physical change. The paper is still paper no matter what size it is. The physical property we are observing is shape and size.

Now, things get a little different. Let's get started!

GOALS

- *Recognize chemical properties*
- *Identify chemical changes*
- *Describe the law of conservation of mass*

SECTION 1

Chemical Properties and Changes

It's your birthday! You decide to have a campout party cooking hotdogs and smores over the open campfire. Your parents gather up firewood, matches, and all the supplies for cooking.

When you arrive, your dad builds a big pile of firewood and lights it. Pretty soon, the fire is roaring. Everyone has a great time at the party and soon begins to head home. When you look at the campfire now, it is just a small pile of ash. The firewood is not the same as it was before. It's identity has changed. Where did the wood go? What property is responsible for the change?

A chemical property is any characteristic that gives a substance the ***ability*** to undergo a change that results in a new substance. Notice the word “ability”. How is a chemical property different than a physical property? The word ability is the key. You can see a physical change when you apply a physical property, but did the identity change? No. You cannot see a chemical change unless you apply the chemical property, and when you apply the chemical property, the identity of the substance has changed and cannot be put back the way it was originally.

A chemical change is a change in the identity of a substance due to the chemical properties. The new identity could be made up of one or more substances. Let’s look at some examples.

The first chemical property is one you are already familiar with, flammability.

Flammability is the ability for a substance to burn. Let’s say you are playing outside and see this strange stick. It looks like wood, but it has a really different color. How could you determine if it is wood? Well, obviously, you could try to burn it. If it does indeed burn, then it is most likely wood. Why did I say it is “most likely” instead of “it is”? Is wood the only substance that burns? And now that we have applied the chemical property of flammability, the identity of the substance has changed. Let’s go back to the campout party. How did the pile of firewood change as it burned? It started out as wood. As it burned, it changed to ash, smoke, and gas.

So, let's stop here and talk about a key question to ask yourself when trying to identify a physical change or a chemical change. The question you should ask yourself is "can I put it back the way it was"? Take the paper for instance. If you tear up a sheet of paper into 10 pieces, can you (theoretically) put it back the way it was? Yes, you could tape the pieces back together. By tearing it up and then taping it back together, did you change the identity of the paper? No, it is still paper. But, what if you burn the paper? Can you take the ash, smoke, and gas after it has burned and put it back to the original piece of paper? No, it has been changed to new substances and cannot be put back the way it was. So, tearing up the paper is a physical change, and burning the paper is a chemical change. Let's keep going!

Some substances react with oxygen in the air. Nails and an iron gate are examples of this property. The iron reacts with the oxygen in the air and will cause the item (nail) to corrode. The corrosion produces a new substance called iron oxide, also known as rust. Now, you might think, well I can just scrape off the rust and it is now the way it was. Wrong. You may be able to scrape off the rust, but the nail has chemically broken down and is not as strong as it once was. Take a chain that is locked around a gate. Which is easier to break, a brand new chain or one that is rusted?

Not only do materials react with oxygen in the air, but they also can react with sulphur in the air.

Silver is a substance that reacts with sulphur. The spoons on the left are made of pure silver. When exposed to air, the silver will tarnish. See how the spoon on the right has developed the grayish-brown film on it? The same thing has occurred with the coin. Are iron and silver the only things that react to oxygen and sulphur? No, these are just two examples. Many things can react with them.

Reacting with light is another chemical property you are probably familiar with but just didn't know it. What happens to an apple or banana that has been sliced and left sitting on the table? It starts to turn brown, doesn't it? The slices have been exposed to the light and oxygen and are now chemically changing. Where do you find the produce section at the grocery store? Is it in the front by the doors and windows? Another example of reacting with light is vitamins. What color are the bottles that vitamins come in? Aren't they usually a dark color? Why? The vitamins are protected by the dark bottles from undergoing a chemical change with the light.

Reacting with heat is another common chemical property. When you make those chocolate cupcakes with chocolate icing for Mrs. Maxey, the ingredients for the cupcakes are reacting with the heat in the oven to undergo a chemical change. Cupcake batter starts out as a liquid and ends as a solid. Since this is a change of state, you might think it was a physical change, but its not. Remember, the key question? Can you put it back the way it was? Can you pull the eggs out of the cupcake or the flour? No. The identity of the batter (mixture of sugar, flour, eggs, etc.) has changed to the chocolate cupcake.

There are too many things to discuss that are chemical properties, so we have only discussed a few. Here are a couple of other chemical properties: reacts with vinegar, reacts with electricity, and reacts with cold. Watch the two videos to see how vinegar and baking soda react when making a rocket. Works for making a volcanic eruption, too!

http://www.youtube.com/watch?v=OH05RbnPAig&feature=related

http://www.youtube.com/watch?v=WtUBFc9Gz_U&feature=related

Signs of a Chemical Change

How do you know if you have a new substance? Just because it looks different, does that mean it is a new substance? You could put a salad in a blender and it would definitely look different, but a chemical change would not have occurred. The carrots, lettuce, and other vegetables are still there, they just look different.

To determine whether a chemical change has occurred, you can look for signs or clues that are given as a result of a chemical change happening. Signs or clues to look for are:

bubbles, heat, light, smoke, sound, and color change.

Let's go back to our campfire, again. Think about the fire burning throughout the party. Does the fire give off heat? light? smoke? sound? Does the color change? Since the answer is yes to all of these, it is a pretty good indication that the wood burning is going through a chemical change.

What about an antacid tablet that you drop in water to take when you have an upset stomach? Which of the signs can you pick out in this video?

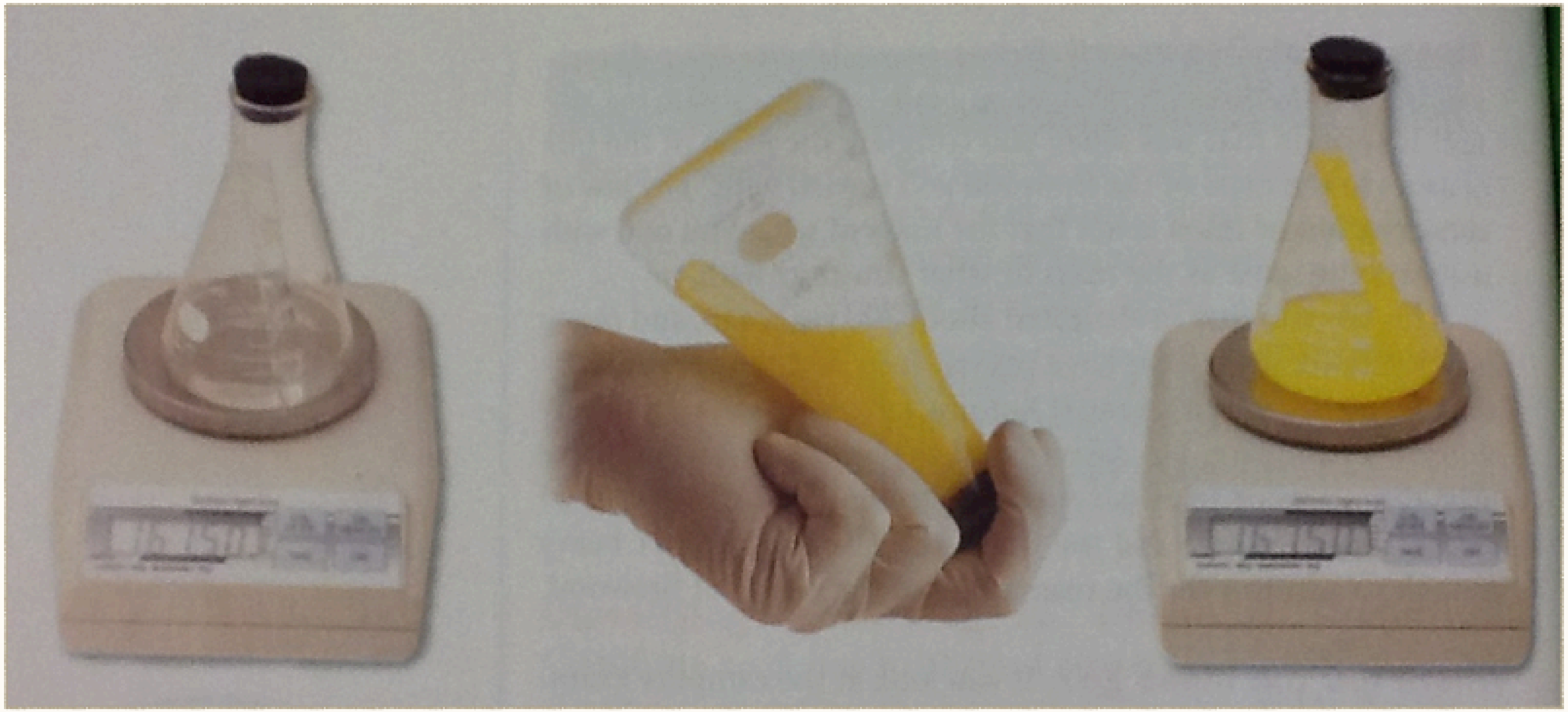
http://www.youtube.com/watch?v=bxjb2UJZ-5I

Law of Conservation of Mass

The law of conservation of mass states that the mass of what you end with is always the same as what you start with. So, this is saying that at the end of the campfire party, the mass of the pile of ash that is left is equal to the mass of the big pile of wood we started with. Does that make sense? How can that little pile of ash have the same mass as the big pile of wood?

It is actually fairly simple. If you could measure the mass of the oxygen used with all of the original firewood that was burned and then capture the smoke and gas given off and put it with the ash that is leftover, the two masses would all be equal.

Let’s look at another example.



In the photo on the left, you see a flask with a test tube inside. Each contain a clear liquid, but not mixed together. As you can see on the balance, the total mass is 16.150 g. In the second photo, the flask is turned upside down allowing the two liquids to mix and react. Notice the color change. Because the flask is sealed with a rubber stopper, nothing is allowed to escape. In the third photo, the flask is placed on the balance. Even though there has been a chemical change creating a new substance, the total mass has not changed. It is still 16.150 g. So, the law of conservation of mass prevails. Mass was not created or destroyed during the chemical change.

Review

Review 1.1

During a chemical change in matter, the amount of matter

- **A.** increases
- **B.** decreases
- **C.** stays the same
- **D.** increases and then decreases

Check Answer

Review 1.2

Which of the following is an example of a chemical property?

- **A.** density
- **B.** flammability
- **C.** color
- **D.** liquid

Check Answer

Review

Review 1.3

Which of the following is an example of a chemical change?

- A. frying an egg
- B. bleaching your hair
- C. shooting off fireworks
- D. all of the above

Check Answer

Review 1.4

Which of the following is an example of a chemical change?

- A. inflating a car tire
- B. gold melting
- C. water evaporating from a swimming pool
- D. bubbles forming from vinegar and baking soda

Check Answer