

Science Benchmark: 05:01

The weight of an object is always equal to the sum of its parts, regardless of how it is assembled. In a chemical reaction or physical change, matter is neither created nor destroyed. When two or more materials are combined, either a chemical reaction or physical change may occur. Chemical reactions are indicated when materials heat or cool, give off light, give off gas, or change colors. In a chemical reaction, the materials are changed into new substances. In a physical change a new substance is formed.

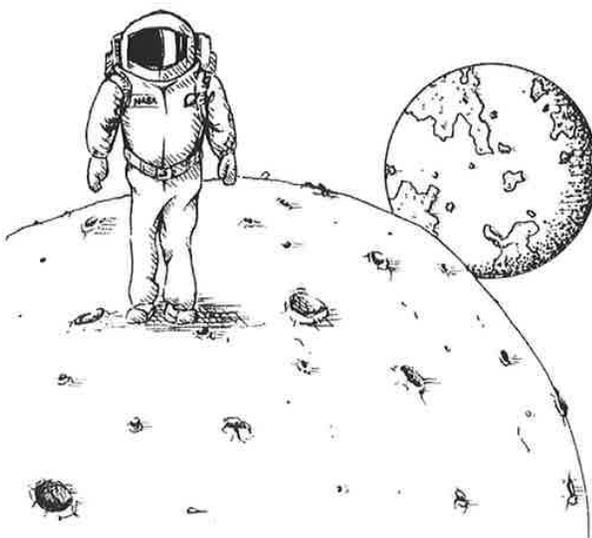
Standard 01:

Students will understand that chemical and physical changes occur in matter.

Shared Reading

What's the Matter?

Imagine that you are an astronaut, off to explore Mars. You start your journey strapped into the acceleration couch of the space shuttle. Suddenly the engines ignite and you feel pressed into the couch as you are flying through space. Even though the rockets are powerful, they aren't strong enough to send you directly to Mars. You transfer to your Mars Exploration Craft and begin the long journey through the solar system. This time the speed is slower. Day by day Earth and the moon slowly become smaller as you look out the window. You may be gone a long time. Packed in the cargo bay are all the supplies you'll need. Hopefully, you didn't forget anything because it is a long way to the grocery store. The *substances* you have with you must be enough.



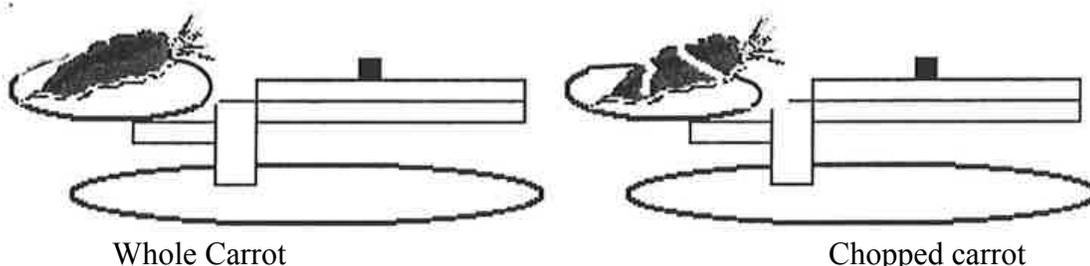
Substance – the material that something is made of

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Why did it take so much energy to get you started on your journey? You had to move the spaceship, the people, the air you breathe and all of your supplies. That's a lot of *matter*. Matter is all the "stuff" in the universe. You can define matter as something that has mass and volume. Matter can exist as a *solid*, *liquid*, or *gas*. So, the air in the space ship is matter, the water you must bring along to drink is matter, and the steel used to make the ship itself is matter. You'll have to bring all the matter you need with you, because matter can neither be created nor destroyed, even though it can undergo changes.

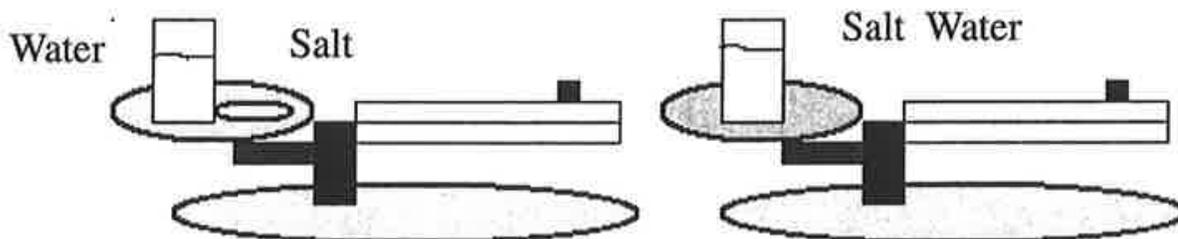
One way matter can be changed is with *physical change*. Imagine you have a carrot, If you weight the carrot and then chop it up, what will be the weight of all the pieces? Of course, they'll weigh the same as the whole carrot.

Physical Change



What happens if you find the *weight* of a piece of ice and then melt it? The liquid water will weigh the same as the ice. What about weight when something is *dissolved*? Weigh some salt and a glass of water, then pour the salt into the water and stir it until it dissolves. The salty water will weigh the same as the sum of the weight of the salt and water. Water is still water whether it is frozen into ice, melted into liquid water, or evaporate into water vapor. The salt disappears into the water, but if you taste the water, you can tell the salt is still there.

Physical Change



dissolve: the visual disappearance of one substance into another when they are mixed

gas: matter that has no definite shape or volume

liquid: matter that has a definite volume but no definite shape, and takes the shape of its container

matter: something that has mass and takes up space

physical change: change in form of matter but not what it is made of

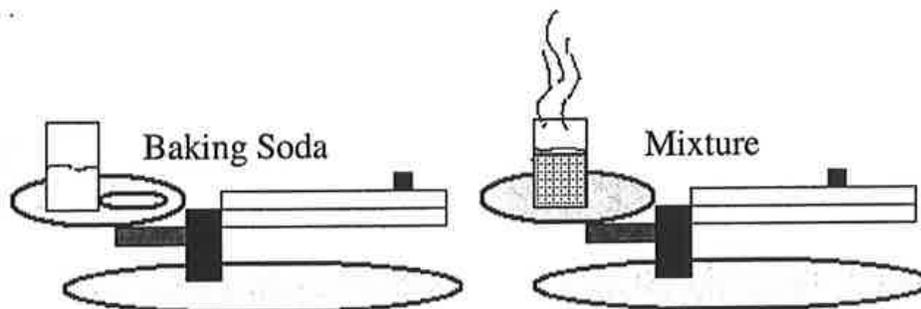
solid: matter that has a definite volume and holds its own shape

weight: the pull of gravity on matter.

Another way to change matter is through a *chemical change*. Combining the ingredients for a cake and baking it, creates a chemical change or reaction. The particles in the eggs, flour and other ingredients are still present, but rearranged as a new substance, a cake. If you weigh the *reactants*, the weigh the *product*, you will find they weigh the same if you collected the evaporated water. The ingredients in the cake weigh the same as the cake.

What would happen if the ingredients changed? Sometimes it might seem that matter vanishes, but it only changes form. If you combine vinegar and baking soda, an invisible gas is produced and the product will weigh less than the reactants. The weight of the escaped gas must be added to make up for the missing matter.

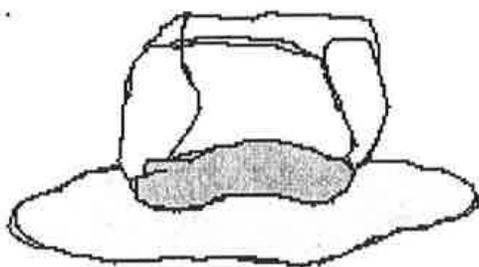
Chemical Change



How can you tell the difference between a physical change and a chemical change? It isn't always easy, but here are some guidelines to help you.

When you describe an object you are usually describing its physical properties. Color, size, roughness, texture, hardness, etc. are all physical properties. If you tear a piece of paper into pieces, you change some of those physical properties. If you melt an ice cube you are changing its physical properties. If the change is a physical change, the matter stays the same.

In a chemical change the physical properties will change too, but the matter is different at the end of the process. When rocket fuel is combined with oxygen, a lot of energy is released. The fuel is changed into a number of different gases. When you burn a piece of paper, it's not paper anymore. It is ashes, carbon dioxide, and a little steam. During a chemical reaction you may observe a change in color, *heat*, or a gas being produced or consumed.



Physical Change



Chemical Change

chemical change: one or more substances are changed to form a new substance

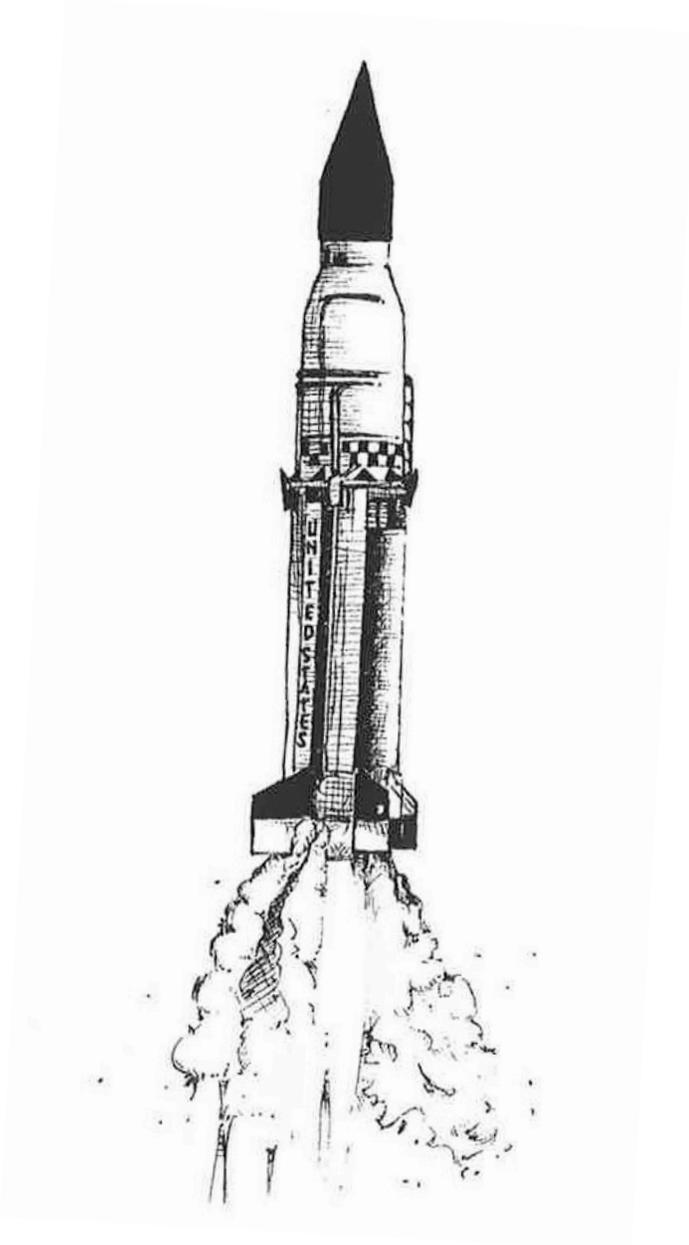
heat: energy being given off or absorbed

product: something that is made

reactants: the substances mixed together to produce a chemical change

Chemical reactions happen around us all the time. Every time a fire burns, wood and oxygen are used up. Smoke and ash are produced. When you eat, your body chemically changes foods for growth and energy. When you travel in a car, gasoline and air are chemically changed.

Astronauts constantly rely on chemical and physical changes. So do you in your everyday life. Can you list the chemical and physical changes in your day so far?



Science Language That Students Need to Understand and Use

1. **chemical change:** one or more substances are changed to form a new substance
2. **dissolve:** the visual disappearance of one substance into another when they are mixed
3. **gas:** matter that has no definite shape or volume
4. **heat:** energy being given off or absorbed
5. **liquid:** matter that has a definite volume but no definite shape, and takes the shape of its container.
6. **matter:** something that has mass and takes up space
7. **physical change:** change in form of matter but not what it is made of
8. **product:** something that is made
9. **reactants:** the substances mixed together to produce a chemical change
10. **solid:** matter that has a definite volume and holds its own shape
11. **substance:** the material that something is made of
12. **weight:** the pull of gravity on matter