

What's the Matter?

Matter is anything that takes up space and has mass. **Mass** is the *stuff* that matter is made of, or the amount of particles in a substance or object. Matter has physical and chemical properties and can undergo physical and chemical changes.

What are some examples of matter? Well, just look around you and everything you see, touch, smell, and breathe are examples of matter.

What is a **property**?

A property describes how an object looks, feels, or acts. Properties can be physical or chemical. Properties can also be quantitative or qualitative. A **qualitative** property of matter is observed and generally can't be measured with a numerical result. A **quantitative** property of matter is one that can be measured numerically, such as height, length, or weight.

What are examples of **physical properties**?

Physical properties can be observed. Examples of physical properties can be color, weight, volume, size, shape, density, boiling point, or freezing point.

What are examples of **chemical properties**?

A chemical property is usually one that can only be seen when a substance undergoes a chemical change. These properties cannot be observed by touching or looking. Chemical properties become apparent when the structure of the substance is altered chemically.

An example of this would be adding baking soda and vinegar and watching it bubble and give off a gas. The bubbling is an indicator that the properties of the two initial ingredients have recombined to form a new substance or substances.



A simple equation of what happens when you add baking soda to vinegar:



What is a **chemical change**?

A **chemical change** is a change that results in a new substance (or substances) being formed. The important word to remember is **new**. A chemical change involves the making or breaking of bonds between atoms. A chemical change makes a new substance that wasn't there before.

What are examples of chemical changes?

Some examples of chemical changes are nails rusting over time, batter turning into a cake in the oven, wood or paper burning to ashes, the digestion of food, and the baking soda and vinegar example above.

Vocabulary	
matter	quantitative
mass	qualitative
physical properties	chemical properties
property	

What is a **physical change**?

A **physical change** is a change in a state of matter. For example, when ice melts, the H₂O molecule is going from a solid (ice) state to a liquid (water) state of matter. The actual molecule or the arrangement of the atoms has not changed—just its state of matter. A physical change can also be a change in appearance of matter. For example, a piece of paper is made of paper molecules, and when you tear the piece of paper in half, both halves are still made of paper molecules. The atoms and molecules that make up the substance are not physically changed.

Physical or Chemical Change?

Put a check to indicate whether you think the item is a physical change or a chemical change.

	Physical Change	Chemical Change
1. ice melting		
2. cutting a pineapple into pieces		
3. adding vinegar to baking soda		
4. a piece of rusting metal		
5. a campfire		
6. crumbling a piece of paper		
7. sour milk		
8. shattering a drinking glass		
9. dissolving sugar in water		
10. burning paper		
11. boiling water		
12. burning a match		



Try This Experiment

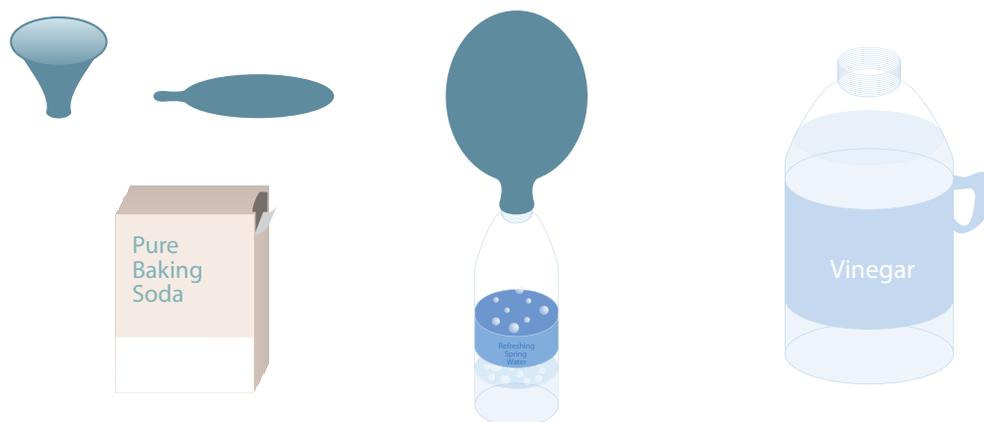
How do you know that a gas is produced as a result of mixing baking soda and vinegar?

Materials

- $\frac{1}{4}$ cup (56 grams) of baking soda
- $\frac{1}{4}$ cup (60 milliliters) of vinegar
- 1 small, empty water bottle
- 1 balloon
- 1 funnel

Procedure

1. Stretch the balloon out before using it.
2. Using the funnel, fill the balloon with the baking soda.
3. Pour the vinegar into the empty water bottle.
4. Attach the opening of the balloon to the mouth of the water bottle—be careful not to get any baking soda into the bottle.
5. Count to three and lift up the part of the balloon that contains the baking soda so that the baking soda falls into the bottle.



Questions

1. What are the physical properties of the baking soda?
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2. What are the physical properties of the vinegar?

3. What happened inside the water bottle when you added the baking soda to the vinegar? What did you see in the bottle?

4. Did anything happen to the balloon? If so, what do you think caused it?

5. What type of change occurred inside the bottle when you added the baking soda to the vinegar?

6. Fill in the definitions in the vocabulary box below.

Vocabulary	
matter	
mass	
property	
qualitative	
quantitative	
physical change	
chemical change	

Answers with explanations

	Physical Change	Chemical Change	Explanation
1. ice melting	√		This is a physical change because H ₂ O is changing from a solid state to a liquid state. The H ₂ O molecule remains the same, just in a different state of matter.
2. cutting a pineapple into pieces	√		This is a physical change. The molecules that make up the pineapple are not being changed—just their size is being changed.
3. adding vinegar to baking soda		√	This is a chemical change because a new substance is being produced—the carbon dioxide gas and atoms are being rearranged.
4. a piece of rusting metal		√	This is a chemical change because the iron in the nail is being changed into a new substance: rust.
5. a campfire		√	This is an example of a chemical change because the burning wood is being changed into new substances: smoke and ash.
6. crumpling a piece of paper	√		This is an example of a physical change because the paper molecules are the same. The appearance of the paper is the only thing changing.
7. sour milk		√	This is an example of a chemical change because the atoms of the milk have been rearranged to form a new substance: sour milk. You cannot do anything to the milk to get rid of the sour part.
8. shattering a drinking glass	√		This is an example of a physical change because the actual pieces of glass are not being changed. They are just being broken into smaller pieces.
9. dissolving sugar in water	√		This is a physical change because there is NO new substance being formed. When you mix sugar with water, you simply get sugar water.
10. burning paper		√	This is an example of a chemical change because two new substances are formed: smoke and ash.
11. boiling water	√		This is an example of a physical change because the H ₂ O is changing to another state of matter (liquid to gas). No new substance is formed. The molecules of water are just spaced out more.
12. burning a match		√	This is an example of a chemical change. The match head changes into ash and smoke and you cannot use the match again.

Answers

1. What are the physical properties of the baking soda?

White, odorless, solid, crystalline solid.

2. What are the physical properties of the vinegar?

Clear liquid, characteristic smell, acidic taste.

3. What happened inside the water bottle when you added the baking soda to the vinegar? What did you see in the bottle?

Foam and bubbles began to appear. The bubbles indicate that a gas is being formed.

4. Did anything happen to the balloon? If so, what do you think caused it?

As the gas formed, it had nowhere to go so it went up and into the balloon, making it inflate.

5. What type of change occurred inside the bottle when you added the baking soda to the vinegar?

A chemical change.

6. Fill in the definitions in the vocabulary box below.

Vocabulary	
matter	anything that takes up space and has mass
mass	the amount of stuff in a substance
property	how an object looks, feels, or acts
qualitative	a property of matter that can be observed and generally cannot be measured with a numerical result
quantitative	a property of matter that can be measured numerically
physical change	a physical change is a change in a state of matter or appearance
chemical change	a chemical change is a change that results in a new substance(s) being formed