The Mystery of Everyday Changes

A Story About Physical and Chemical Changes

One Saturday morning, Maya and Arjun were helping their mother prepare breakfast.

“Mom, why does everything change when we cook?” Maya asked.

“What do you mean?” Mom smiled.

“Well, ice melts into water, bread turns brown when toasted, and eggs become solid when cooked!”

“That’s a wonderful observation!” Mom said. “Scientists classify changes into two main types: **physical changes** and **chemical changes**.”

“What’s the difference?” Arjun asked.

“In a **physical change**, a substance changes its shape, size, or state, but no new substance forms.”

“Like ice melting into water?” Maya asked.

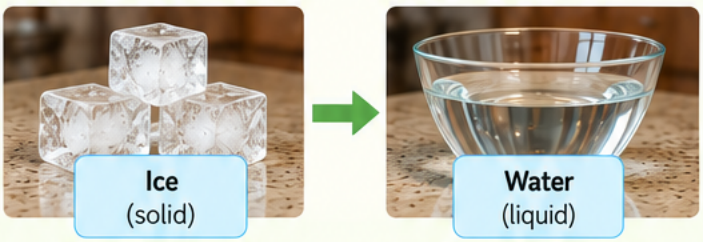
“Exactly! But when bread is toasted, chemical reactions produce new substances that change its color, smell, and taste. That’s a chemical change.”

“So chemical changes create new substances!” Arjun exclaimed.

“Correct! Let’s explore more examples around our home!”

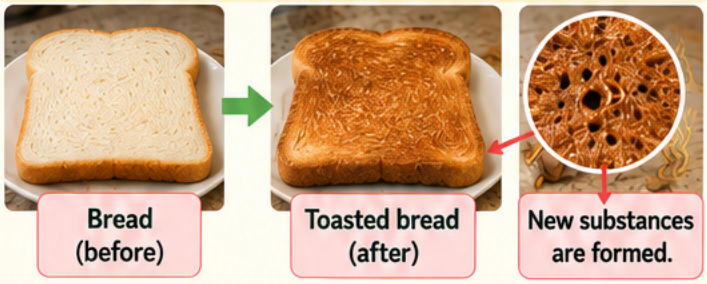


A Physical Change: Melting Ice



The ice changes from a solid to a liquid, but it is still the same substance. No new substance is formed.

A Chemical Change: Toasting Bread



When bread is toasted, chemical reactions produce new substances that change its color, smell, and taste.

Science Fact: Physical changes do not form new substances, while chemical changes produce one or more new substances.

Science Fables

The Lemonade Experiment



After breakfast, Mom brought out some lemons, sugar, and water.

“Who wants to make lemonade?”

“Me!” Maya and Arjun shouted.

Mom carefully cut a lemon in half.

“Is cutting a lemon a physical or chemical change?” she asked.

“Physical!” Maya answered. “Its shape changes, but no new substance forms.”

“Excellent!”

Next, Mom squeezed lemon juice into a pitcher of water.

Arjun added sugar and stirred.

“Look! The sugar disappeared!” he exclaimed.

“Did it really disappear?” Mom asked.

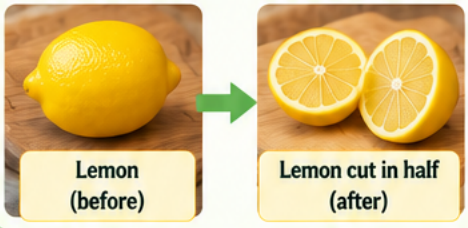
“No!” Maya replied. “It dissolved in the water.”

“Correct! The sugar molecules spread throughout the water, but they remain sugar molecules.”

“So cutting, squeezing, dissolving, and mixing are physical changes!” Arjun said.

Mom smiled. “Exactly!”

1. Cutting a Lemon (Physical Change)



Cutting changes the shape and size of the lemon, but no new substance is formed.

2. Squeezing Lemon Juice (Physical Change)



Squeezing releases lemon juice, but it is still the same substance. No new substance is formed.

3. Dissolving Sugar (Physical Change)



The sugar molecules spread throughout the water, but they are still sugar molecules. No new substance is formed.

Science Fact:

Cutting, grinding, dissolving, and mixing are common physical changes because no new substances are formed in these processes.

Science Fables

The Candle Experiment



That evening, Mom placed a candle on the dining table and carefully lit it.

“Look at the wax near the flame,” she said.

“It’s melting!” Maya noticed.

“Is that a physical or chemical change?” Mom asked.

“Physical!” Arjun replied. “Solid wax becomes liquid wax, but no new substance forms.”

“Correct! But something else is happening near the flame.”

“What is it?” Maya asked.

“The candle wax is also burning. Wax vapor reacts with oxygen in the air, producing new substances, including carbon dioxide and water vapor.”

“So burning is a chemical change!” Maya exclaimed.

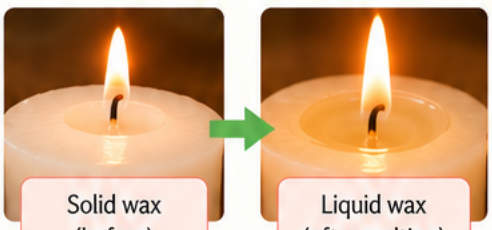
“Exactly! A burning candle shows both types of changes.”

Mom blew out the candle.

“The melted wax will become solid again when it cools, but the wax that burned cannot simply be recovered by cooling.”

“Two changes in one candle!” Arjun said excitedly.

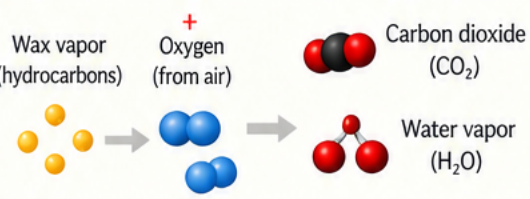
1. Melting Candle Wax (Physical Change)



The wax near the flame melts from a solid to a liquid, but no new substance is formed. This is a physical change.

2. Burning Candle Wax (Chemical Change)





Wax vapor reacts with oxygen in the air, producing new substances, including carbon dioxide and water vapor. This is a chemical change.

3. After the Candle is Blown Out



The melted wax will become solid again when it cools, but the wax that burned cannot simply be recovered by cooling.

Science Fact:

Melting candle wax is a physical change, while burning candle wax is a chemical change because new substances form.

Science Fables

The Rusty Bicycle Mystery



The next morning, Maya and Arjun were playing in the backyard.

Arjun noticed reddish-brown patches on his old bicycle.

“Mom! Why is my bicycle turning brown?”

Mom walked over.

“That’s rust! When iron reacts with oxygen and moisture, new substances form.”

“So rusting is a chemical change!” Maya said.

“Exactly! Rust contains hydrated iron oxides, often represented by the simplified formula $Fe_2O_3 \cdot xH_2O$.”

“Can we wash the rust away and turn it back into iron?” Arjun asked.

“Not simply. Rusting is difficult to reverse under ordinary conditions.”

Maya thought for a moment.

“But melting ice can be reversed by freezing it again!”

“Correct!” Mom replied. “Some physical changes are reversible, while others are not.”

“Like breaking glass?” Arjun asked.

“Yes! Breaking glass is an irreversible physical change because no new substance forms.”

“So whether a change can be reversed doesn’t tell us if it’s physical or chemical!” Maya exclaimed.

“Exactly! What matters is whether a new substance forms.”

1. Rusting Iron (Chemical Change)



When iron reacts with oxygen and moisture, new substances form.

Rust contains hydrated iron oxides, often represented by the simplified formula $Fe_2O_3 \cdot xH_2O$.

2. Reversible Physical Change: Melting and Freezing Water



Ice (solid) ⇄ Water (liquid)

Melting ice is a physical change that can be reversed by freezing it again. No new substance is formed.

3. Irreversible Physical Change: Breaking Glass



Whole glass (before) → Broken glass (after)

Breaking glass is an irreversible physical change because no new substance is formed.

Science Fact:

Physical changes can be reversible or irreversible.
Rusting is a chemical change because new substances form.

Science Fables

The Great Science Detective Challenge!



That afternoon, Mom announced a challenge.

"Let's see how much you've learned!"

Maya and Arjun cheered.

"First question: Burning a matchstick?"

"Chemical change!" Arjun answered. "New substances form!"

"Correct! What about chewing food?"

"Physical change!" Maya replied. "Our teeth break food into smaller pieces."

"Excellent! But digestive enzymes also cause chemical changes by breaking food molecules into different substances."

"Wow! Digestion involves both types of changes!" Arjun said.

"Now, is breathing the same as cellular respiration?" Mom asked.

"No!" Maya replied. "Breathing moves air in and out of our lungs."

"And cellular respiration is a chemical process in our cells that releases usable energy from nutrients!" Arjun added.

"Perfect! Remember, both physical and chemical changes can absorb or release energy. In a closed system, total mass is conserved during both."

Mom smiled. "Now tell me the most important question to ask."

"Was a new substance formed?" Maya and Arjun shouted together.

"Congratulations, my little science detectives!"

1. Burning a Matchstick (Chemical Change)



Burning a matchstick produces new substances, such as carbon dioxide, water vapor, and ash.

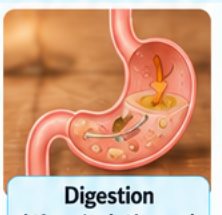
This is a **chemical change.**

2. Chewing and Digesting Food (Both Changes)



Chewing (Physical Change)

Breaks food into smaller pieces.



Digestion (Chemical Change)

Enzymes break food molecules into different substances.

Chewing is a physical change, but digestive enzymes cause chemical changes by breaking large food molecules into smaller molecules.

3. Breathing vs. Cellular Respiration



Breathing (Physical Process)

Moves air in and out of the lungs.



Cellular Respiration (Chemical Change)

Glucose + Oxygen → Carbon dioxide + Water + Energy
(New substances are formed.)

Breathing and cellular respiration are different. Cellular respiration is a chemical process that releases usable energy from nutrients.

Science Fact:

Cellular respiration and chemical digestion involve chemical changes. Both physical and chemical changes conserve mass in a closed system.

Science Fables

A Story About Physical and Chemical Changes

Science Element: Remember!

Physical vs. Chemical Changes

Physical Changes	Chemical Changes
No new substance forms	New substances form
Chemical composition stays the same	Chemical composition changes
May be reversible or irreversible	Often difficult to reverse
May absorb or release energy	May absorb or release energy

Everyday Examples

Physical Changes	Chemical Changes
 Melting ice	 Toasting bread
 Cutting a lemon	 Burning candle wax
 Dissolving sugar	 Rusting iron
 Breaking glass	 Burning a matchstick
 Melting candle wax	 Chemical digestion
 Grinding sugar	 Cellular respiration

Important Science Concepts

1. Reversible physical change

Melting ice and freezing water:



H_2O (solid) ⇄ H_2O (liquid)

2. Irreversible physical change

Breaking glass changes its shape and size, but no new substance forms.



3. Chemical change

Rusting iron:

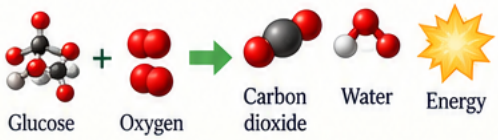


Iron + Oxygen + Moisture → Rust

($Fe_2O_3 \cdot xH_2O$)

4. Cellular respiration

Glucose + Oxygen → Carbon dioxide + Water + Energy



5. Conservation of mass

In a closed system, the total mass remains constant during both physical and chemical changes.



Total mass before = Total mass after

6. Energy changes

Both physical and chemical changes can absorb or release energy.



Absorbs energy (melting)

Releases energy (burning)

The Golden Rule

Was a new substance formed?

No → **Physical Change**



Yes → **Chemical Change**



Science Fables