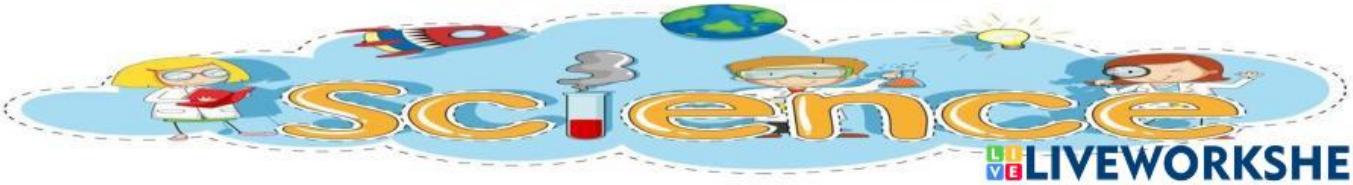
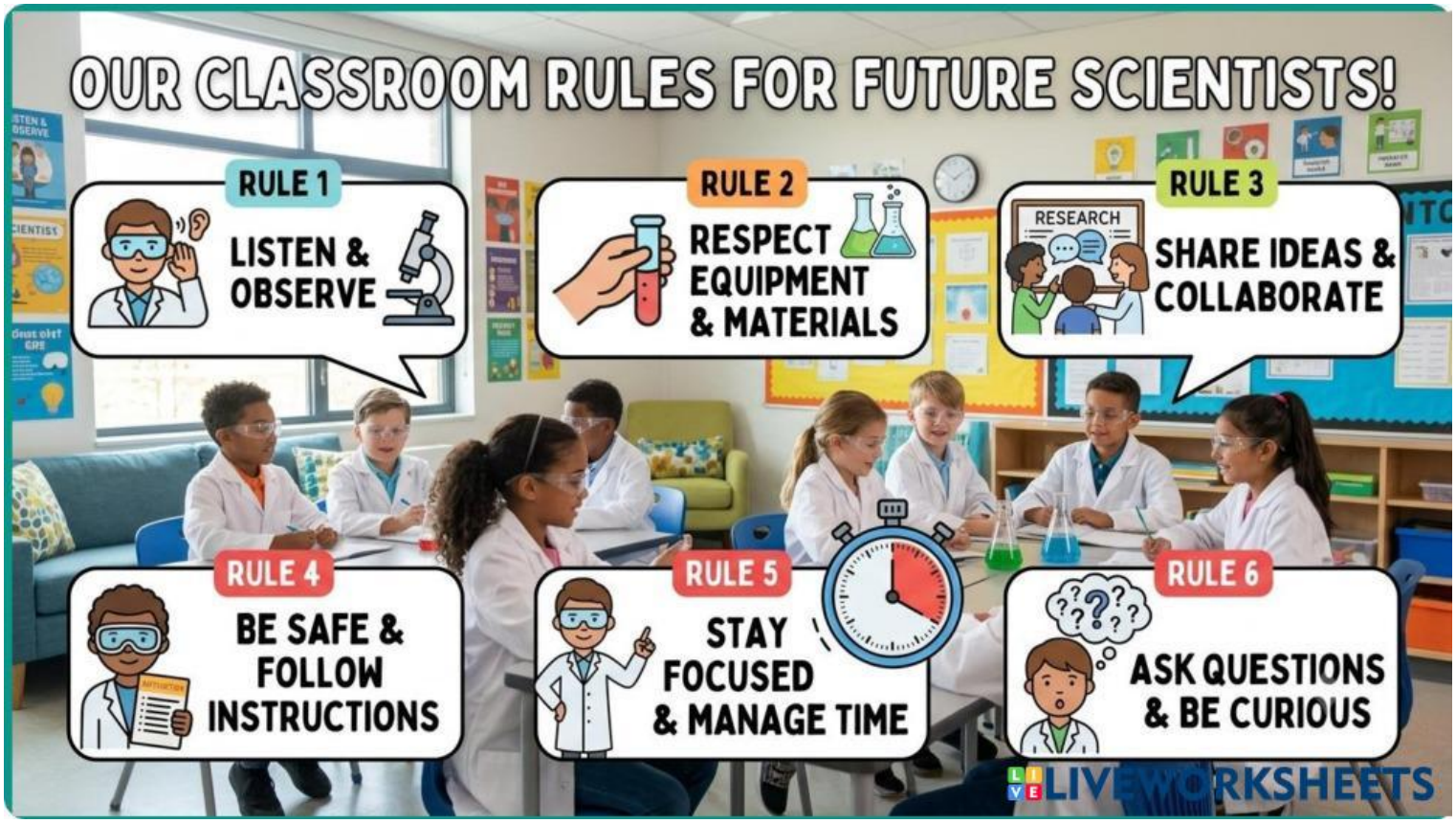
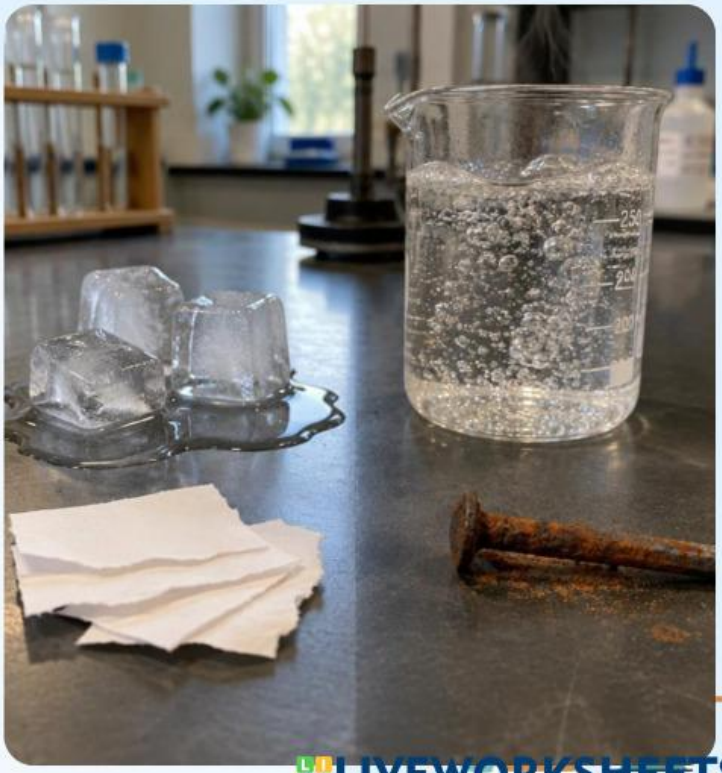



OUR CLASSROOM RULES FOR FUTURE SCIENTISTS!
RULE 1
LISTEN & OBSERVE
RULE 2
RESPECT EQUIPMENT & MATERIALS
RULE 3
RESEARCH
SHARE IDEAS & COLLABORATE
RULE 4
BE SAFE & FOLLOW INSTRUCTIONS
RULE 5
STAY FOCUSED & MANAGE TIME
RULE 6
ASK QUESTIONS & BE CURIOUS
LIVEWORKSHEETS

Physical and Chemical Changes

Exploring how matter transforms around us



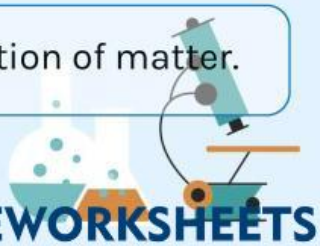
The Mystery of Falling Leaves

Every autumn, vibrant green leaves turn brilliant red, orange, and gold. Later, they dry up, turn brown, drift to the ground, and slowly decay into soil.

Did the leaf simply change its outfit, or did it turn into something completely new? Let us investigate!

Lesson Objectives

1. **Distinguish** between physical and chemical changes using observable evidence.
2. **Identify five key clues** that signal a chemical change has taken place.
3. **Explain** changes at the particle scale and apply conservation of matter.



Key Vocabulary

Physical Change - Alters form or state without new substances.

Chemical Change - Forms entirely new substances with new properties.

Reactants & Products - Starting materials versus new substances made.

Conservation - Total matter never increases or decreases.

What Is a Physical Change?

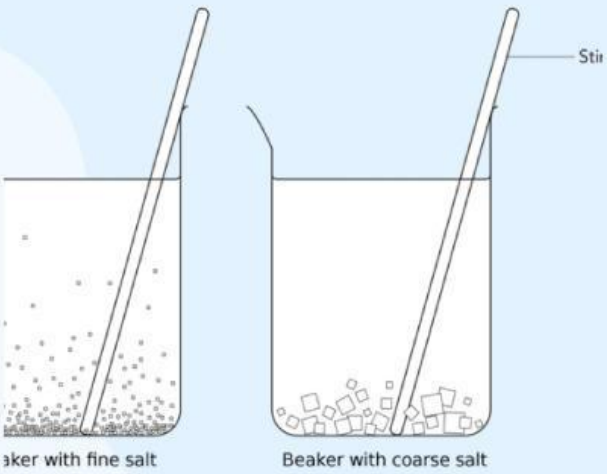
In a **physical change**, matter changes its shape, size, or state, but the material itself stays the same.

- **Tearing paper:** It looks smaller, but each piece is still paper.
- **Melting ice:** Solid ice turns to liquid water, but particles remain .

Dissolving: Physical or Chemical?

When you stir table salt into warm water, the salt crystals dissolve(disappear) in water. But did a new substance form?

No! The salt particles simply separated and spread evenly among water molecules. If you gently evaporate the water, white salt crystals reappear.



Remember

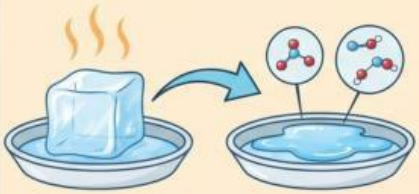
Dissolving is physical because no new substances are created.

UNDERSTANDING PHYSICAL CHANGES

WHAT IS A PHYSICAL CHANGE?

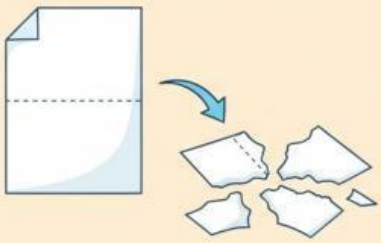
The form, appearance, or state of a substance changes, but the substance itself stays the same.

MELTING ICE



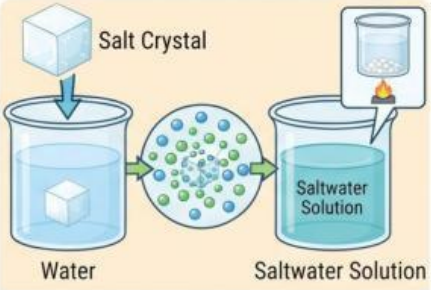
Before: Solid Ice (H_2O molecules in fixed lattice) → **After:** Liquid Water (H_2O molecules free to move). The water substance remains the same.

TEARING PAPER



Before: Intact sheet of paper → **After:** Many smaller pieces of paper. The material (cellulose fibers) remains the same.

DISSOLVING SALT



Before: Salt crystal and water → **After:** Salt particles spread out in water. The salt can be recovered by evaporating the water. The substance is unchanged.

What Is a Chemical Change?

In a **chemical change**, starting substances (**reactants**) inter a chemical reaction to create completely new substances (**products**) with new properties.

When shiny iron nails sit outside in damp air, iron bonds with oxygen to form crumbly reddish-brown iron oxide (rust). Rust behaves very differently from metallic iron!

Chemical changes cannot be undone by simple physical actions like filtering or evaporating.

UNDERSTANDING CHEMICAL CHANGES

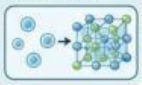
WHAT IS A CHEMICAL CHANGE? Atoms are rearranged to form completely new substances with new properties.

REACTANTS (starting materials) → **PRODUCTS** (new substances).

IRON RUSTING

Iron (Fe) + Oxygen (O_2) → Rust (Fe_2O_3)

The product rust has completely new properties from the iron and oxygen.



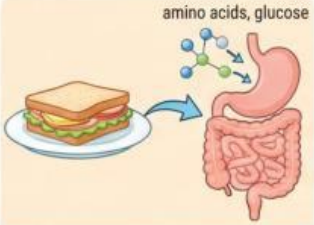
BURNING CANDLE

Wax and wick + Oxygen

Carbon dioxide, Water vapor, Water vapor, & Heat

A combustion reaction that releases energy.

DIGESTION OF FOOD



Food + Digestive Enzymes

Food + Digestive Enzymes → Smaller nutrient molecules.

Complex food molecules are broken down into simpler ones the body can use.

DECOMPOSITION OF LEAVES

Fallen Leaves + Soil Organisms

→ Soil & Humus

Leaves break down into new, nutrient-rich soil components.

Comparing the Two Changes

Physical Change

Crushing chalk breaks it into fine powder. The tiny grains are still calcium carbonate with identical chemical makeup.

Chemical Change

Dropping an effervescent tablet in water produces vigorous bubbling as carbon dioxide gas is manufactured.

COMPARISON OF PHYSICAL AND CHEMICAL CHANGES

PHYSICAL CHANGES

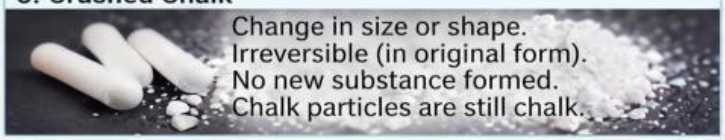
1. Melting Ice

Change of state (solid to liquid).
Reversible.
Molecular arrangement changes, not molecules themselves.

2. Salt Dissolving in Water

A substance (solute) dissolves into another (solvent).
Reversible (by evaporation).
Particles spread out. Properties of salt and water are retained.

3. Crushed Chalk



Change in size or shape.
Irreversible (in original form).
No new substance formed.
Chalk particles are still chalk.

CHEMICAL CHANGES

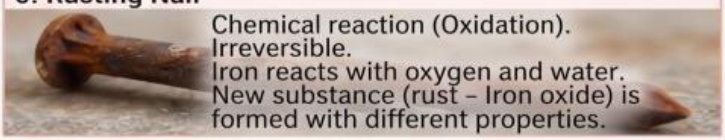
4. Effervescent Tablet in Water

Chemical reaction.
Produces gas bubbles (Effervescence).
Irreversible.
New substances (gas, dissolved chemicals) are formed.

5. Yeast + Sugar Balloon Experiment

Chemical reaction (Fermentation).
Irreversible.
Produces gas (CO_2) which inflates inflates the balloon.
New substance formed.

6. Rusting Nail



Chemical reaction (Oxidation).
Irreversible.
Iron reacts with oxygen and water.
New substance (rust – Iron oxide) is formed with different properties.

New Substance	No new substance	**Chemical Change**	New substance(s) formed
Reversibility	Usually reversible	Usually irreversible	Usually irreversible
Properties	Same properties	New properties	New properties
Energy Change	Small change (if any)	Large change (if any)	Large change (often)
Atomic Level	Molecules stay same	Molecules stay same	Atoms rearrange

Figure 3.3: Comprehensive Comparison of Physical and Chemical Changes

Quick Knowledge Check

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

1. A bicycle chain rusting in humid weather
2. Tearing a sheet of notebook paper
3. Dissolving a sugar cube in hot tea
4. Melting chocolate under warm sunlight

Quick Knowledge Check

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

1. A bicycle chain rusting in humid weather
2. Tearing a sheet of notebook paper
3. Dissolving a sugar cube in hot tea
4. Melting chocolate under warm sunlight