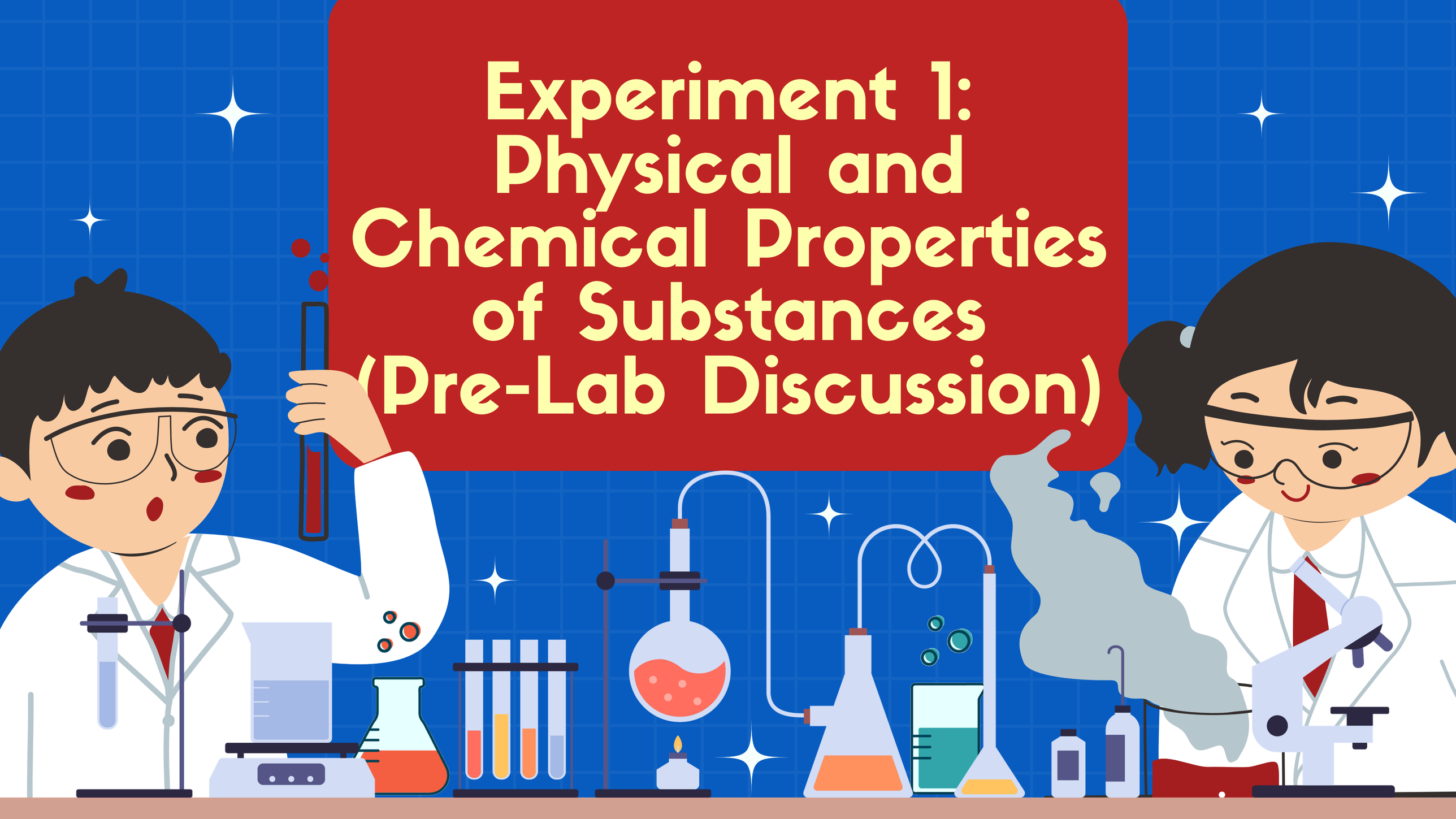
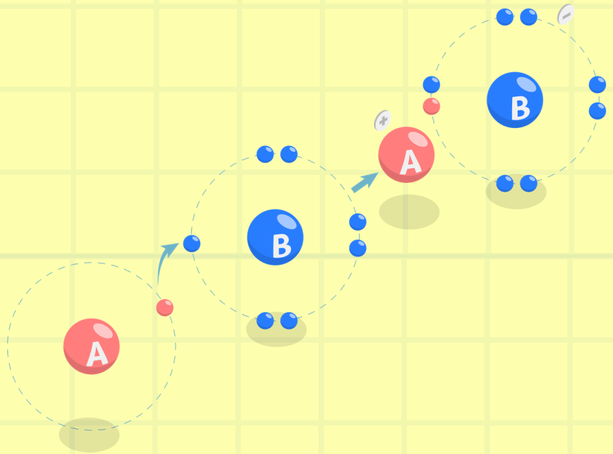
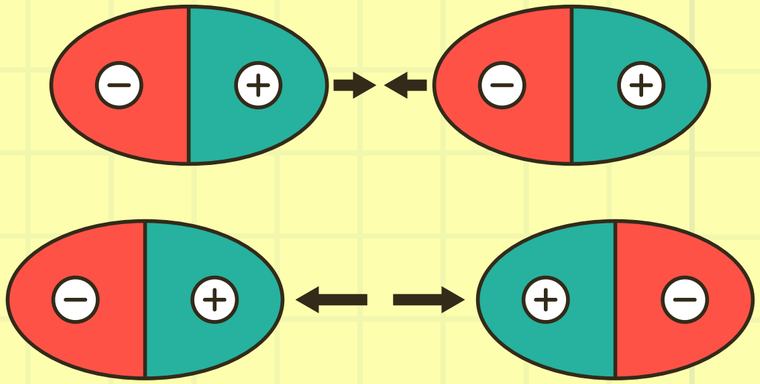
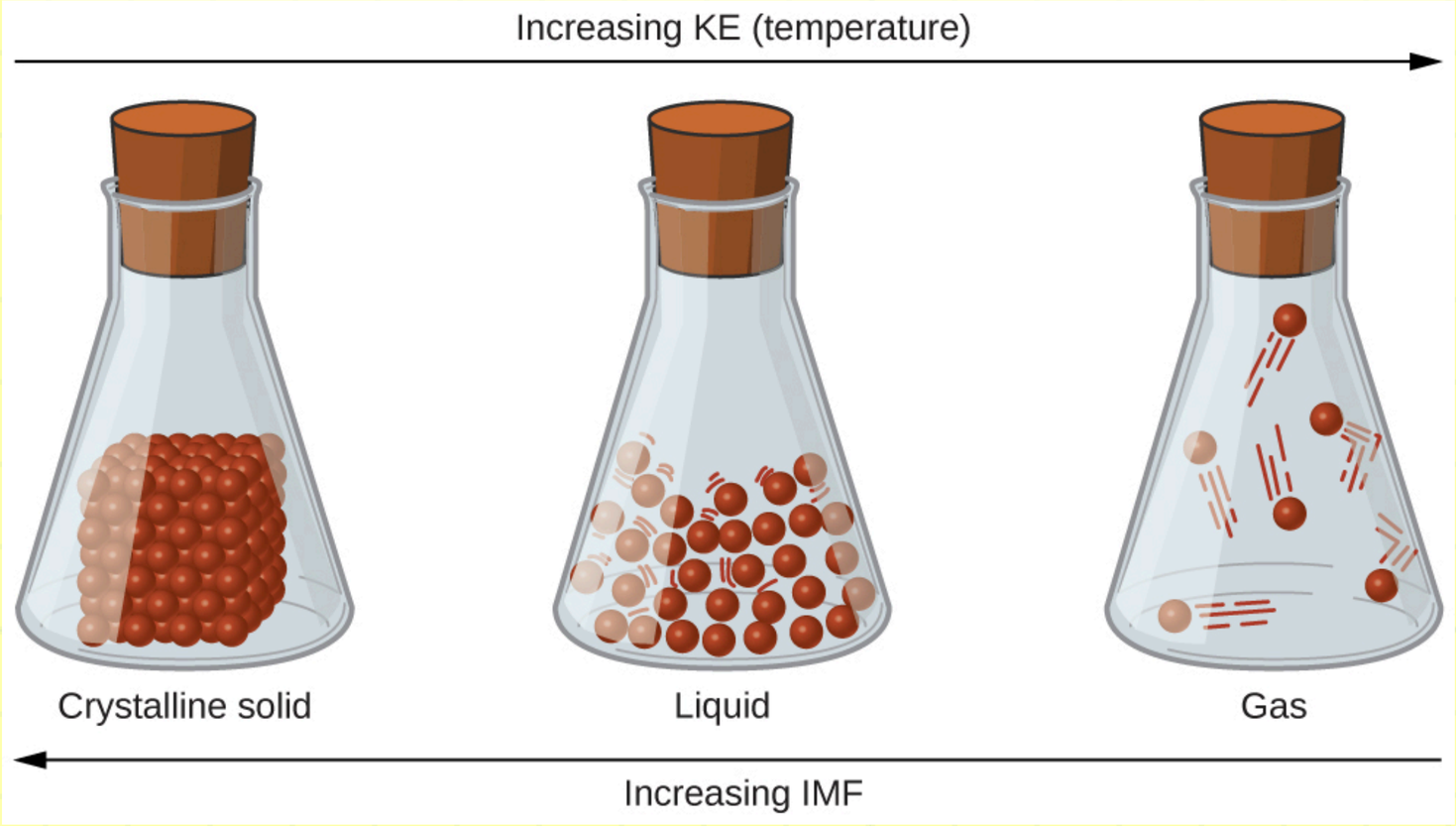
Experiment 1: Physical and Chemical Properties of Substances (Pre-Lab Discussion)



Quick recap!







- A substance's **physical and chemical properties** are largely determined by its **intramolecular bonds and intermolecular forces**.
- Intermolecular and intramolecular interactions govern the physical and chemical characteristics of any substance.

what is Change?

Everything around us is made of matter. Matter can undergo different kinds of changes due to heat, force, mixing, or chemical reactions.

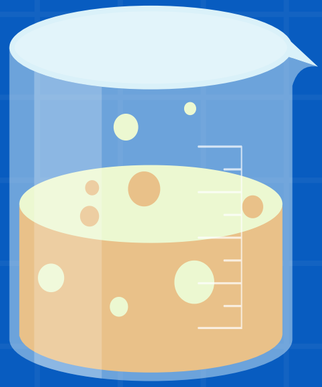
There are two main types of changes:

- Physical Change
- Chemical Change

Understanding the difference helps us predict what happens to substances and how they can be used safely.

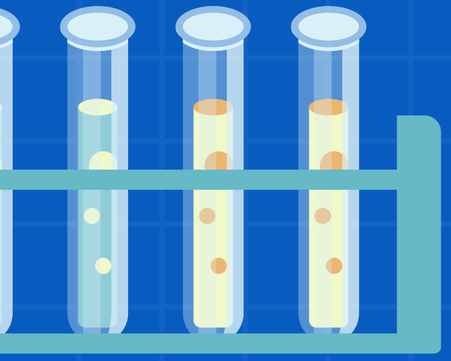
what is

Physical Change



A physical change happens when a substance **changes in size, shape, form, or state without becoming a different substance**. The substance remains the same even though it may look different.

Many physical changes can be reversed, meaning the substance can return to its original form.

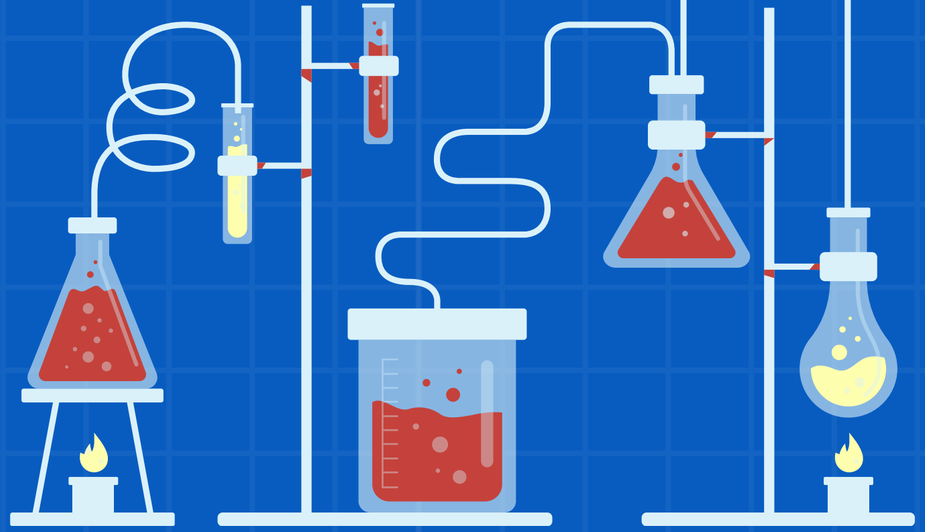


Characteristics of Physical Changes

- No new substance is formed.
- Only physical properties change.
- Usually reversible.
- The substance or material keeps its original identity.

examples of

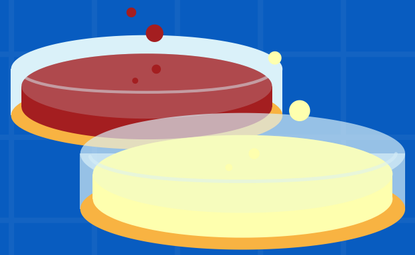
Physical Change

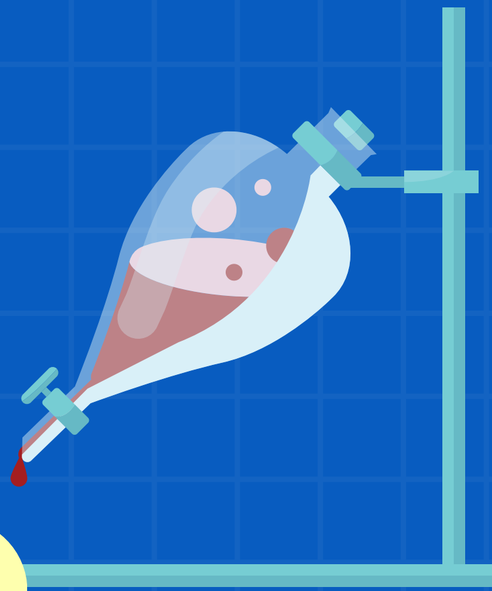


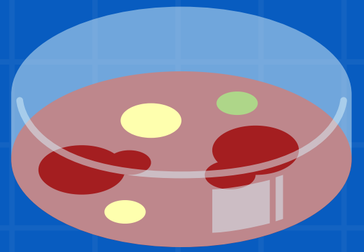
PHYSICAL CHANGE	WHY IS IT A PHYSICAL CHANGE?
Ice melts into water.	Water remains water.
Water freezes into ice.	Only the state changes.
Paper is folded.	Only the shape changes.
A rubber band is stretched.	It can return to its original size.
Sugar dissolves in water.	Sugar remains sugar and can be recovered by evaporation.

what is

Chemical Change





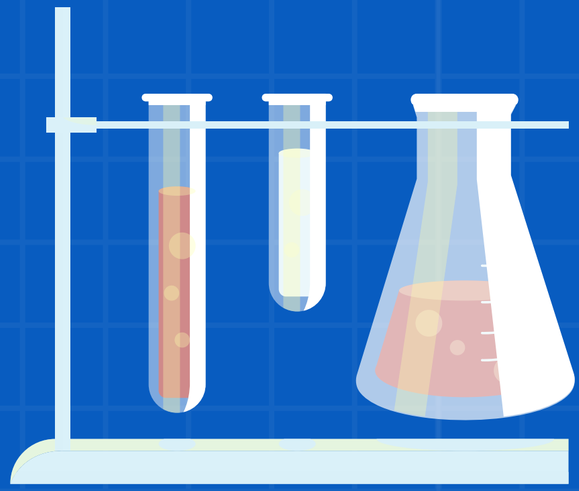


A chemical change happens when one or more materials react to form new substances with different properties.
The original materials cannot easily return to their original form.

Most chemical changes are irreversible.

Characteristics of Chemical Changes

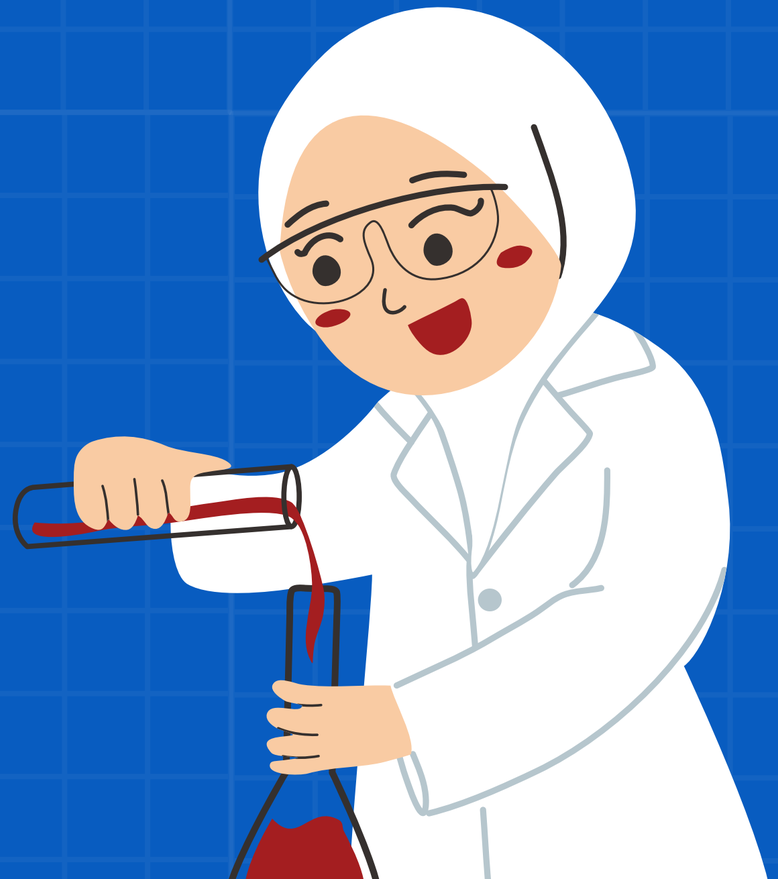
- New substances are formed.
- The original material changes permanently.
- Usually irreversible.
- New properties appear.



examples of

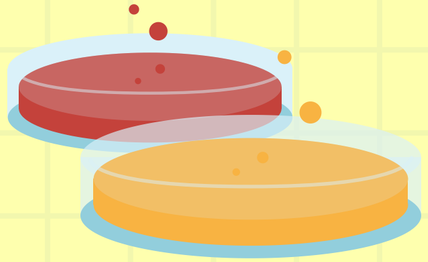
Chemical Change

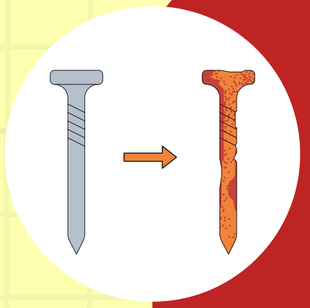
CHEMICAL CHANGE	WHY IS IT A CHEMICAL CHANGE?
Burning wood	Ash, smoke, and gases
Cooking an egg	Cooked egg with new texture and properties
Rusting iron	Rust
Baking bread	Bread with new texture and flavor
Souring milk	Sour milk products

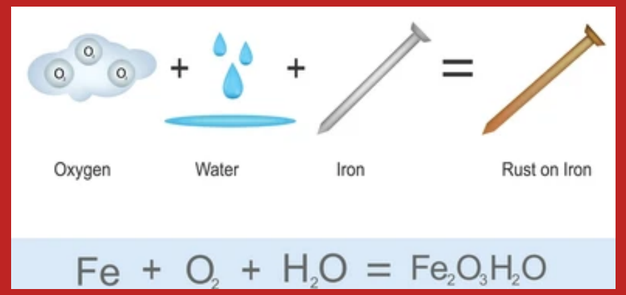


evidence of

Chemical Change





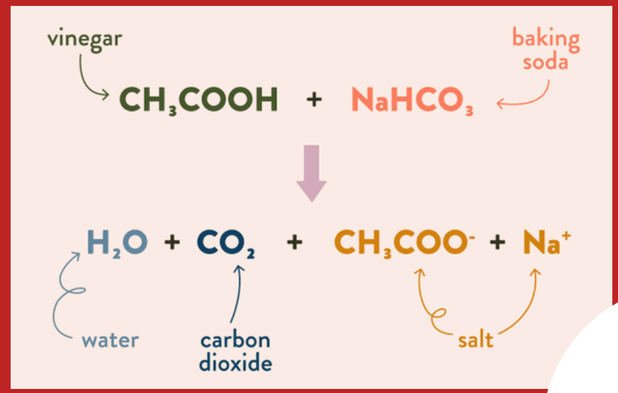


Color Change

A material changes color because a new substance forms.

Examples

Iron turns reddish-brown as it rusts.

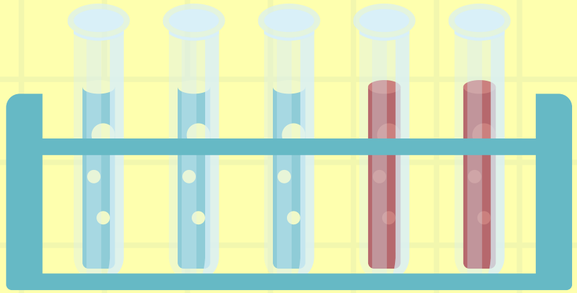


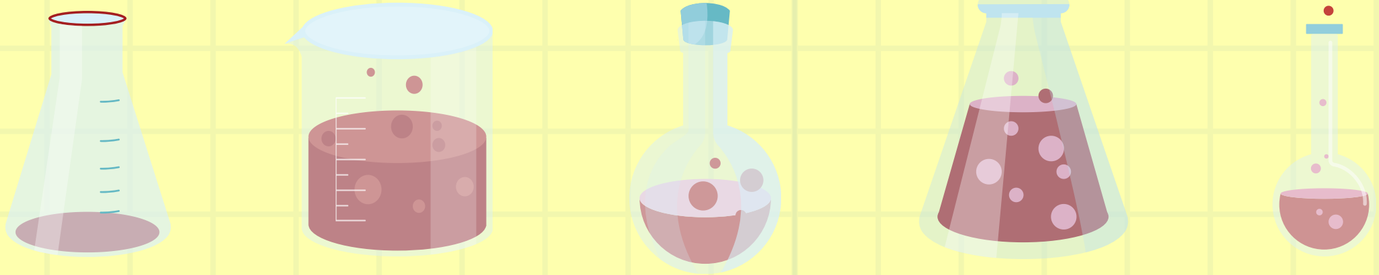
Gas Production

Bubbles or gas are produced without boiling.

Examples

Vinegar reacts with baking soda and releases carbon dioxide gas.





Temperature Change

The reaction becomes warmer or cooler without adding heat.

Examples

A disposable hand warmer becomes warm after being opened.

Formation of a Solid (Precipitate)

A new solid forms when two liquids are mixed.

Examples

Mixing milk with vinegar causes small white curds to form.

New Odor

A new smell develops because a different substance is produced.

Examples

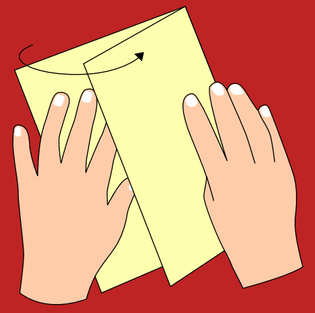
Food spoils and develops an unpleasant odor.

Reversible Change

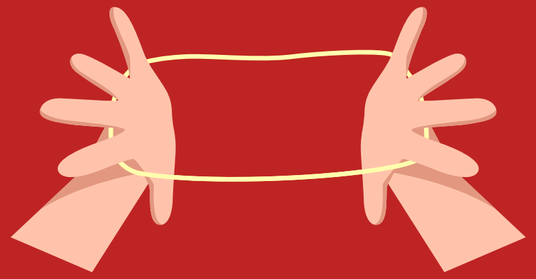
A reversible change is a change that can be undone, allowing the material to return to its original form.

melting ice

freezing water



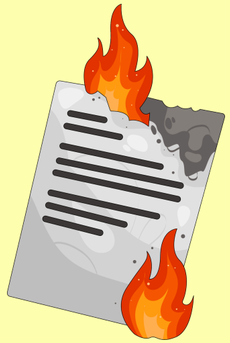
folding paper



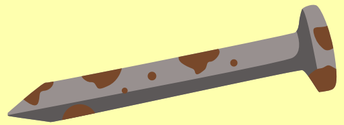
stretching a rubber band

Irreversible Changes

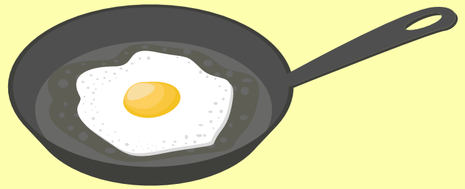
An irreversible change is a change that cannot easily be undone because a new substance has formed.



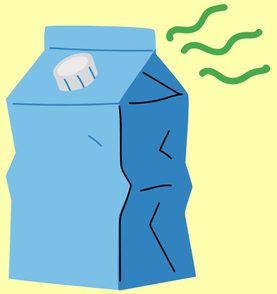
burning paper



rusting iron



cooking an egg



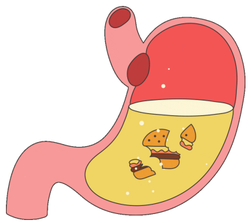
souring milk

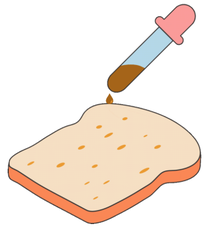
Physical Change	Chemical Change
No new substance is formed.	New substances are formed.
Changes appearance or state only.	Changes the material's composition.
Usually reversible.	Usually irreversible.
Original material remains the same.	Original material changes into something new.

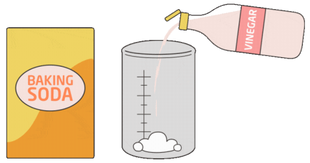
Activity:

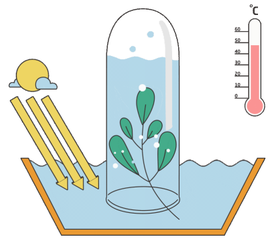
Classify the changes

Are the following changes physical or chemical changes?









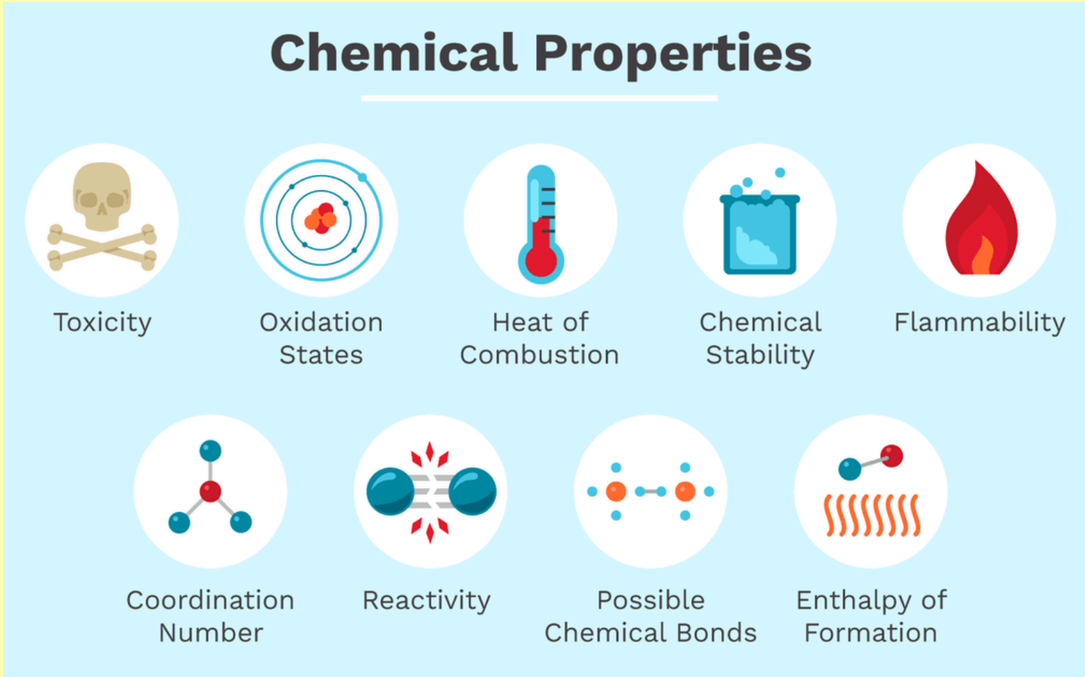
Physical Property of Matter

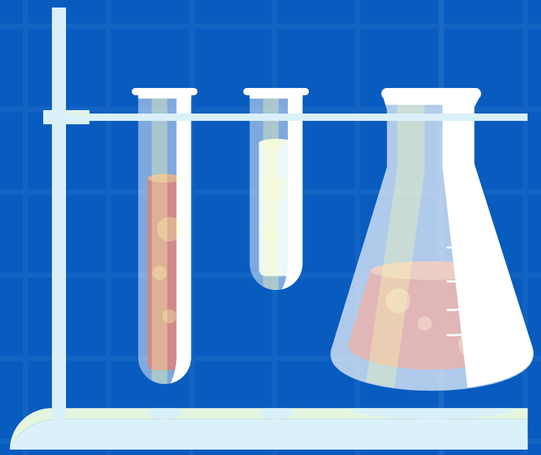
Observable without changing the substance

- Intensive property - does not depend on the size or amount of material
- Extensive property - depends on the size or amount of material

Chemical Property of Matter

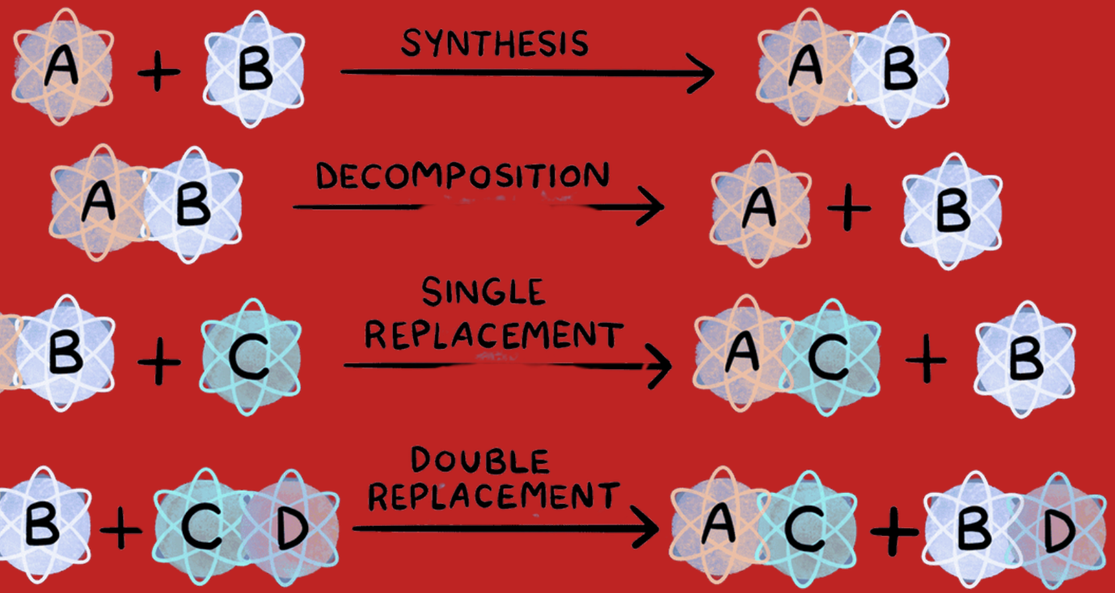
Measured when a substance is changed to a new matter

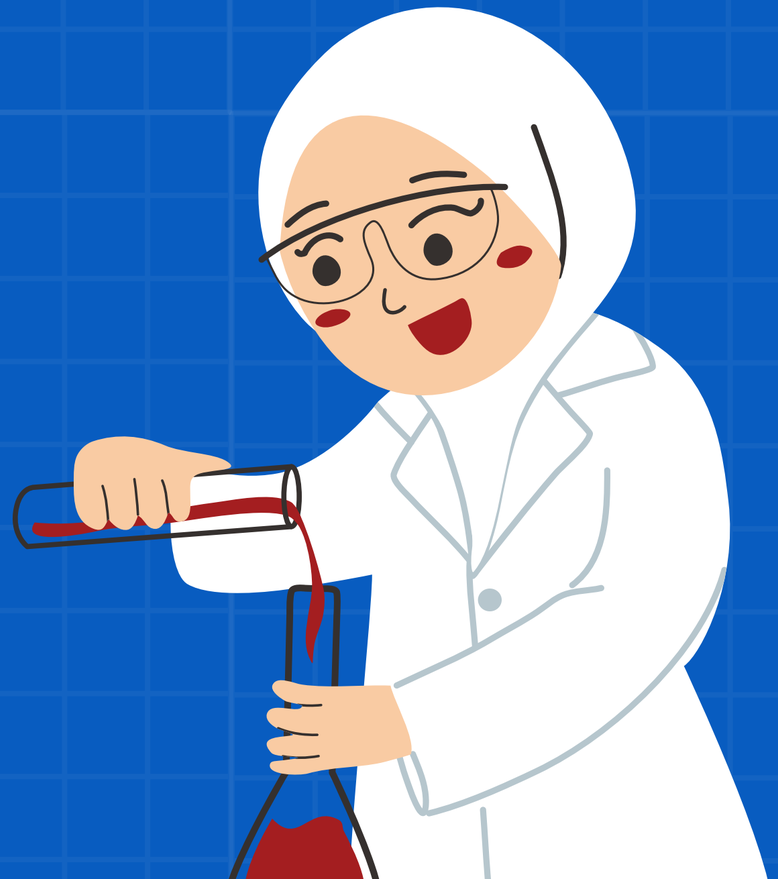




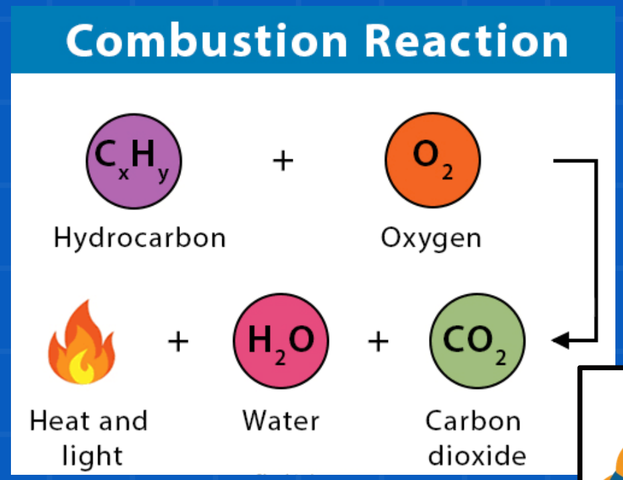
Chemical Reactions

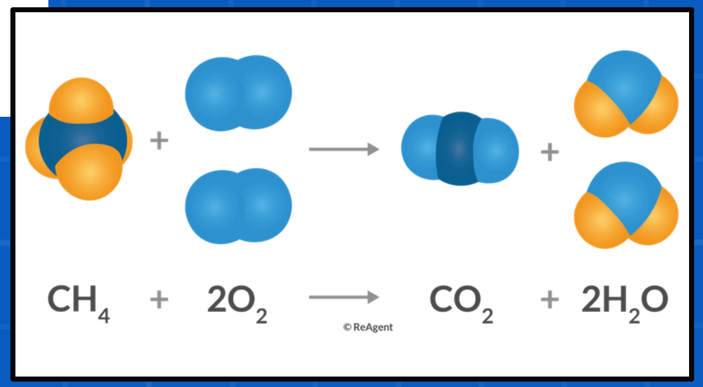
The 4 Main Types of Chemical Reactions

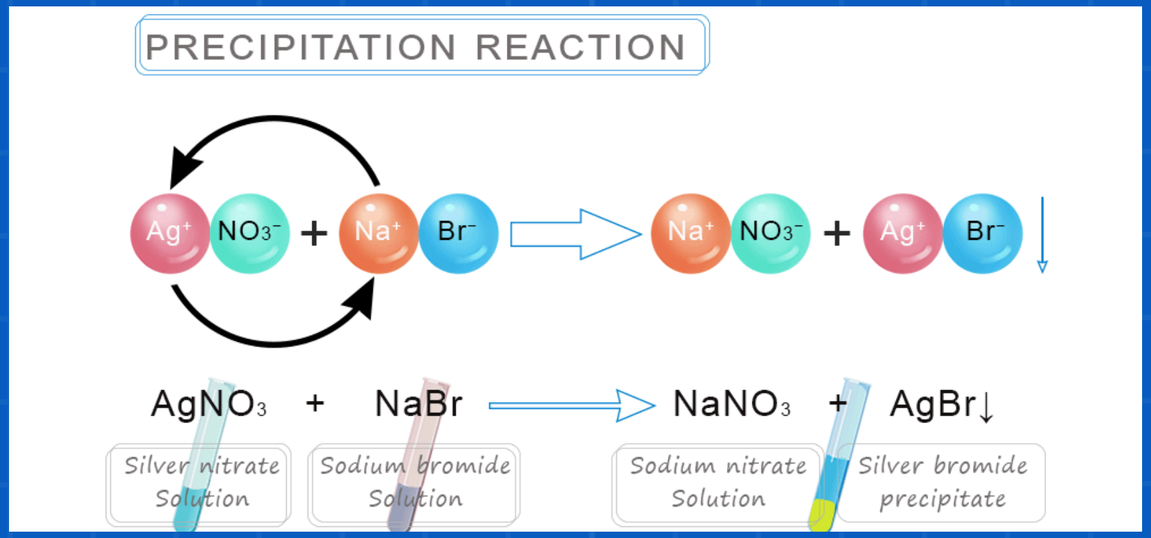


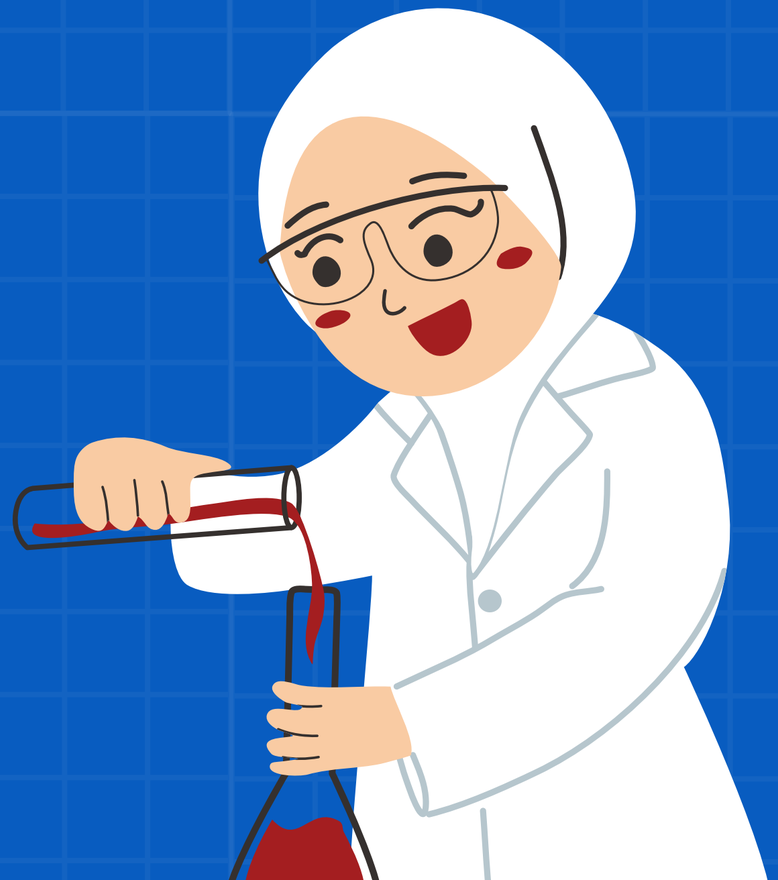


Chemical Reactions



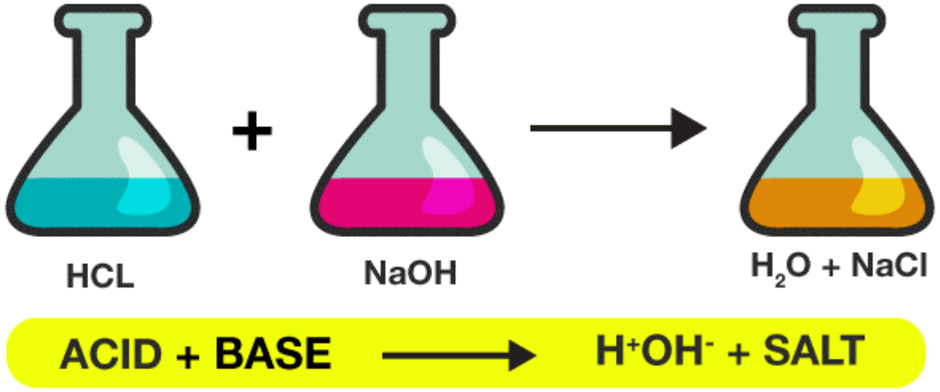




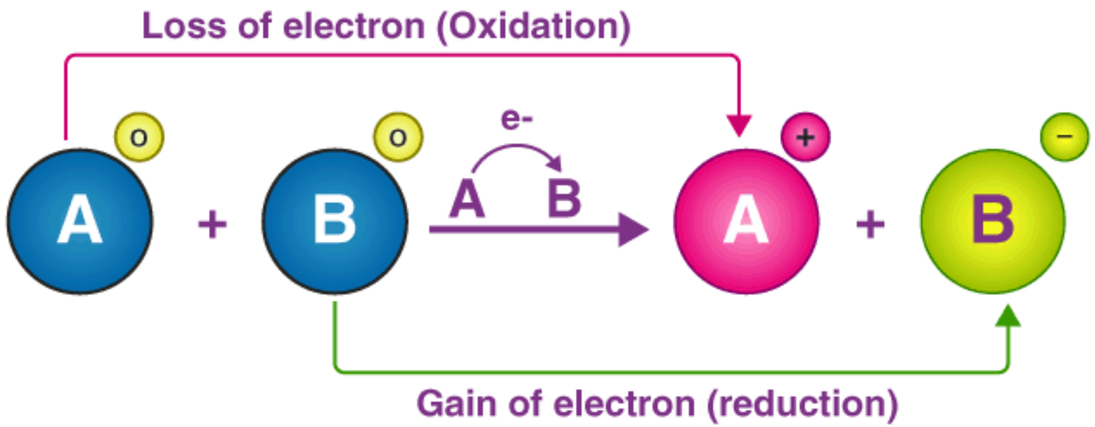


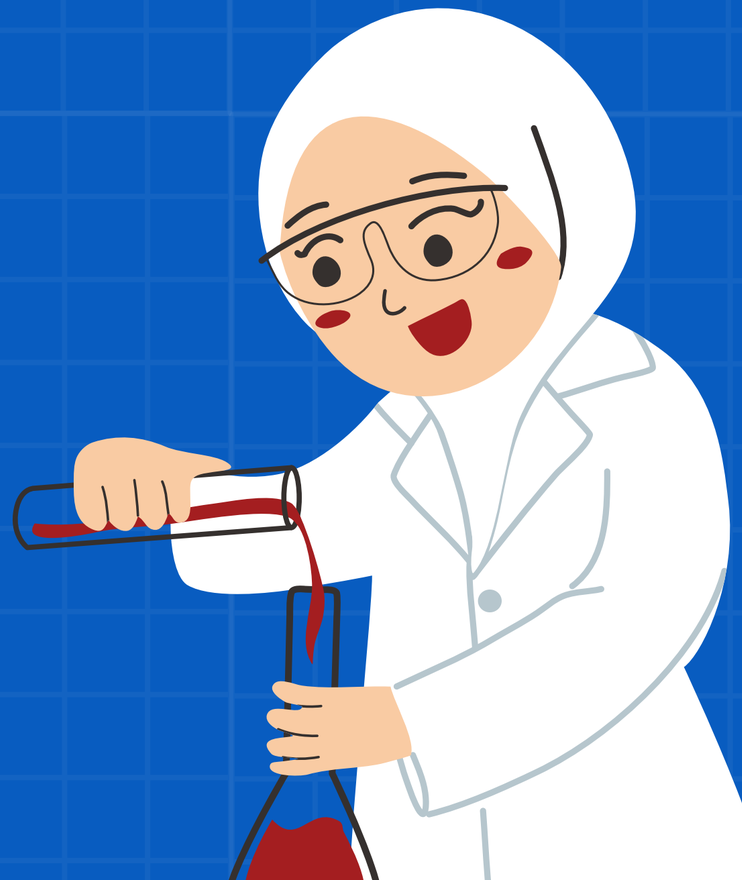
Chemical Reactions

Neutralization Reaction



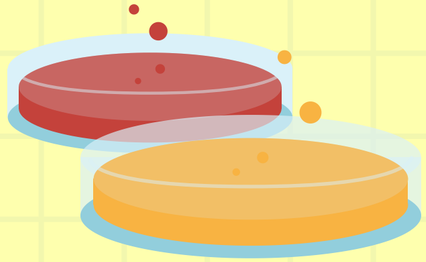
Redox Reaction





to be used

Materials



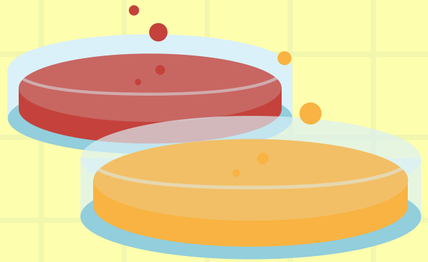
MATERIALS AND REAGENTS

**To be provided by the students*

APPARATUS	REAGENT
• Aspirator* • Beakers • Pasteur pipette* • Serological pipette • Test tube holder • Test tube rack • Test tubes • Graduated cylinder	• 1 M $CuSO_4$ solution • 1 M HCl solution • 1 M NaOH solution • Glacial acetic acid • 1 M H_2SO_4 solution • Cooking oil (around 5 mL only)* • $CuSO_4$ crystals • Distilled water • Ethanol • Hexane • Iron fillings • NaOH pellets • Phenolphthalein

to be used

Materials



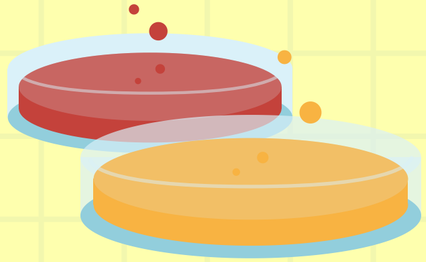
Part 1. Physical Properties of Substances
Solubility and Miscibility
Solvent: distilled water & hexane
Samples: $CuSO_4$ crystals, NaOH pellets, cooking oil, ethanol, acetic acid

Dispense 2 mL each of distilled water in five test tubes and label them properly. In the first test tube, add a pinch of $CuSO_4$ crystals. In the second test tube, add a pellet of NaOH. In the third test tube, add 10 drops of cooking oil. In the fourth test tube, add 10 drops of ethanol. In the last test tube, add 10 drops of acetic acid. Mix the contents of the test tubes well and take note of the resulting mixtures.

Repeat the process, but this time use hexane instead of distilled water as the solvent. Take note of the resulting mixtures.

to be used

Materials



Part 2. Chemical Properties of Substances

A. Neutralization Reactions with NaOH

In a test tube, dispense 1 mL of 1 M HCl. Add 3 drops of phenolphthalein. Observe the color of the solution. Add 1 M NaOH solution dropwise with regular swirling and take note how many drops of NaOH was used for the mixture to turn light pink in color.

Repeat the process in a separate test tube, but this time replace the 1 mL of HCl with a solution of 1 M acetic acid.

B. Precipitation Reaction with $CuSO_4$

In a test tube, dispense 2 mL of 1 M $CuSO_4$ solution. Add 1 M NaOH solution dropwise and observe what happens.

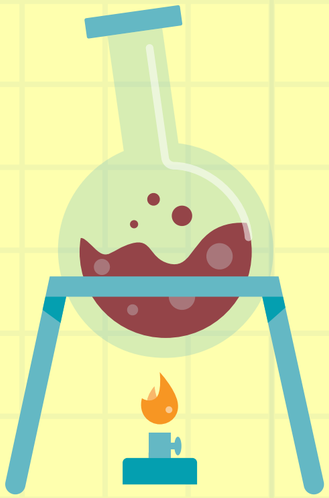
C. Redox Reaction with Copper

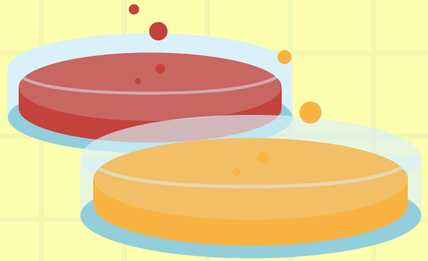
In a test tube, dispense 2 mL of 1 M $CuSO_4$ solution. Add a pinch of iron fillings. Shake the test tube vigorously. Take note of the appearance of the solution and the iron fillings.

Repeat the process but replace the 1 M $CuSO_4$ solution with 1 mL of 1 M H_2SO_4.

Pre-Lab Report

Do this before the experiment day!





EXPERIMENT 1 – PHYSICAL AND CHEMICAL PROPERTIES OF SUBSTANCES

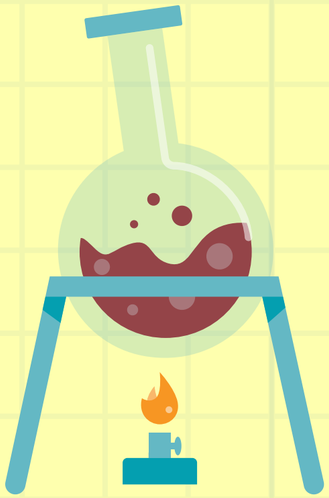
I. OBJECTIVE/S

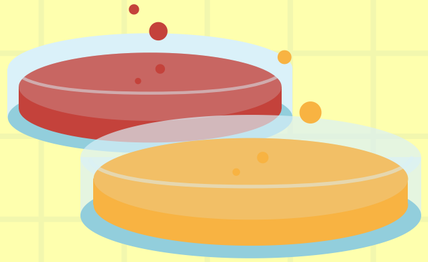
II. FLOWCHART OF PROCEDURE

III. SDS AND PRECAUTIONARY MEASURES (with HS and PS codes)

Pre-Lab Report

Do this before the experiment day!





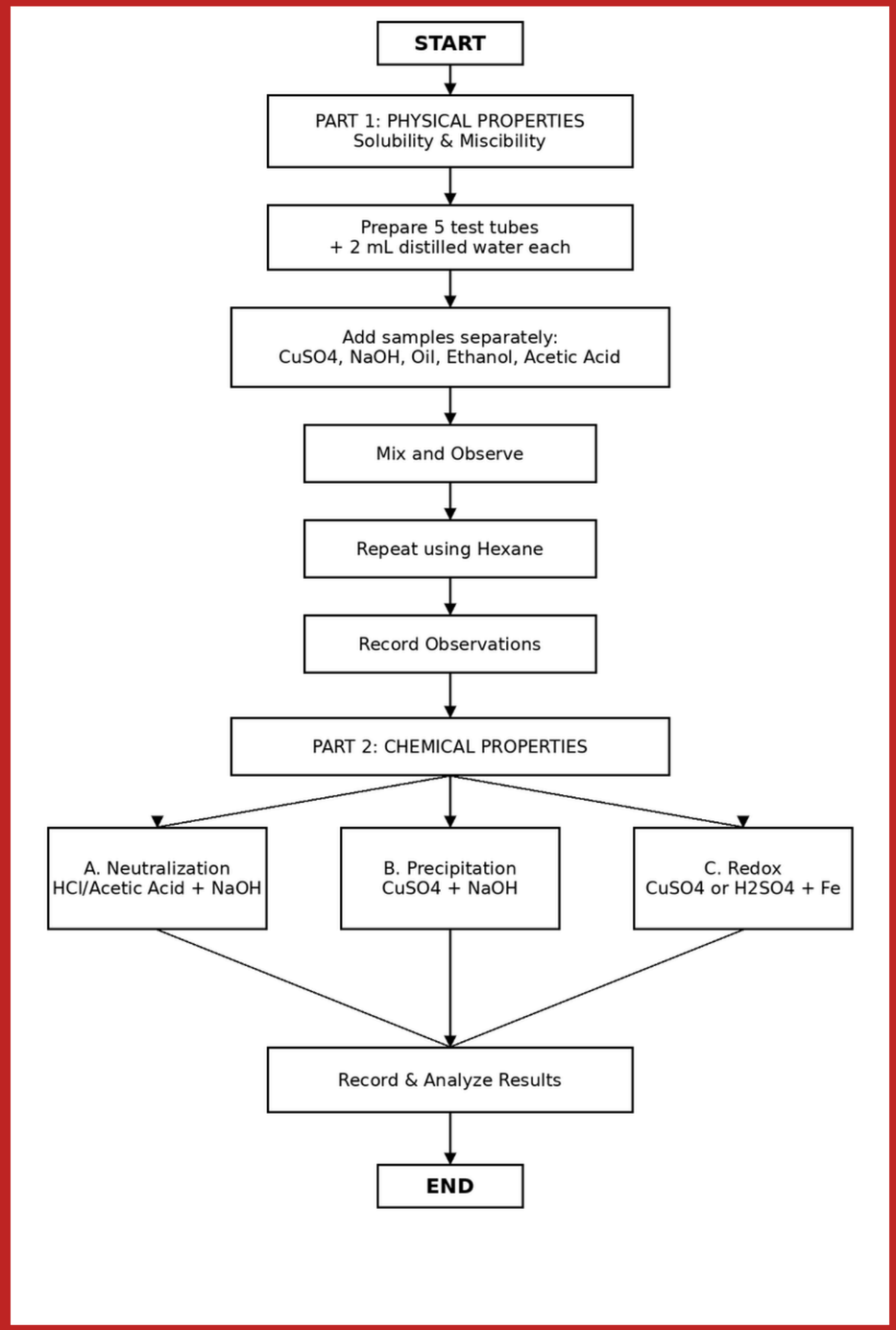
I. OBJECTIVES

- To analyze the physical and chemical properties of selected substances by comparing their solubility, miscibility, and reactivity in different chemical tests conducted during the experiment. (Cognitive)
- To demonstrate responsible laboratory behavior by following safety precautions, properly handling chemicals, and appreciating the importance of observing physical and chemical changes in substances. (Affective)
- To accurately perform laboratory procedures involving solubility, neutralization, precipitation, and redox reactions using appropriate glassware and equipment while recording observations systematically. (Psychomotor)

Pre-Lab Report

Do this before the experiment day!

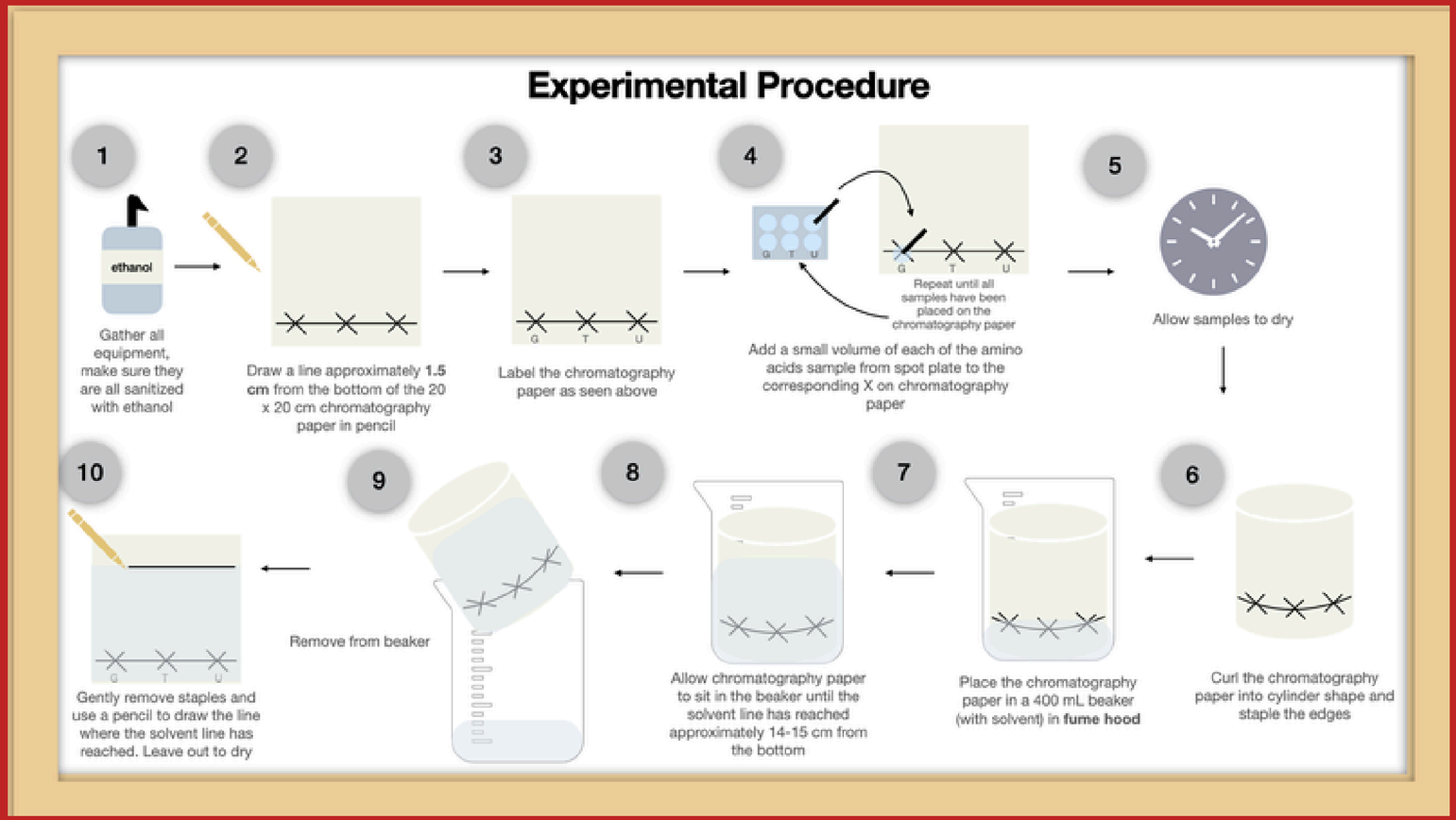
II. FLOWCHART OF THE PROCEDURE



Pre-Lab Report

Do this before the experiment day!

II. FLOWCHART OF THE PROCEDURE



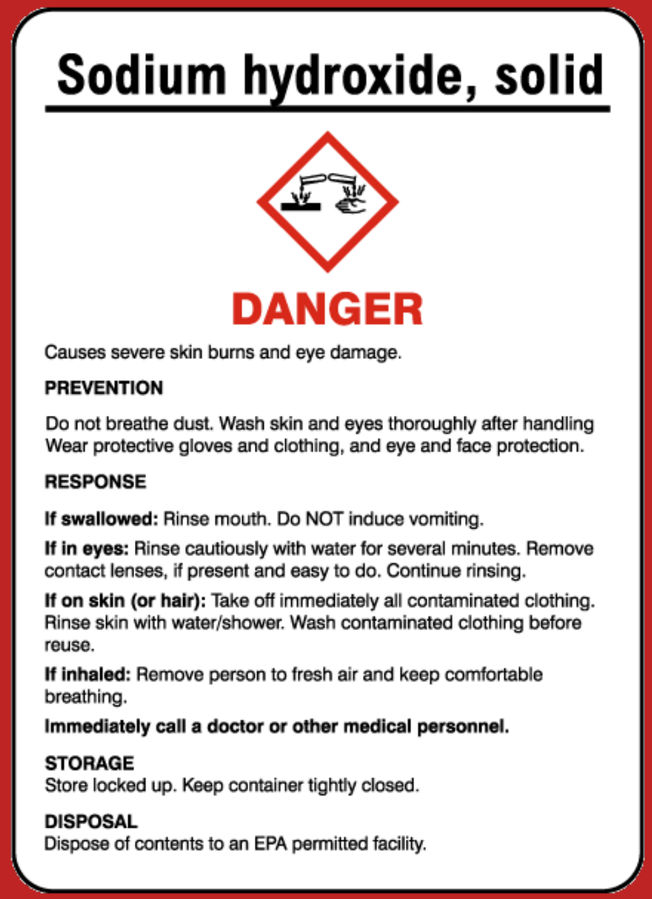
Pre-Lab Report

Do this before the experiment day!

III. SDS and Precautionary measures

III. SDS AND PRECAUTIONARY MEASURES (with HS and PS codes)

CHEMICAL NAME, FORMULA	HAZARD STATEMENTS	PRECAUTIONARY STATEMENTS
Formula: NaOH **Name:**		
Formula: HCl **Name**:		



Sodium hydroxide, solid

DANGER

Causes severe skin burns and eye damage.

PREVENTION

Do not breathe dust. Wash skin and eyes thoroughly after handling
Wear protective gloves and clothing, and eye and face protection.

RESPONSE

If swallowed: Rinse mouth. Do NOT induce vomiting.

If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

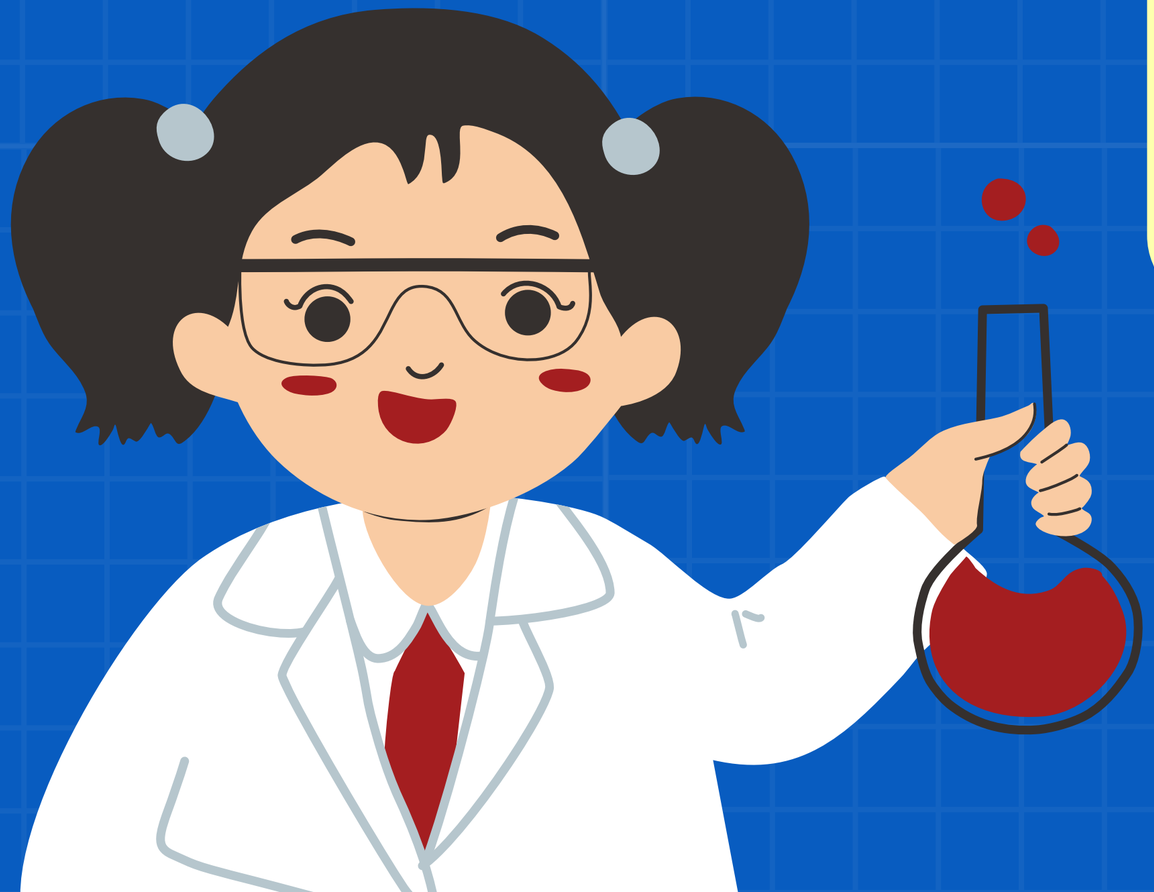
If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower. Wash contaminated clothing before reuse.

If inhaled: Remove person to fresh air and keep comfortable breathing.

Immediately call a doctor or other medical personnel.

STORAGE
Store locked up. Keep container tightly closed.

DISPOSAL
Dispose of contents to an EPA permitted facility.



Thank You for Listening!