

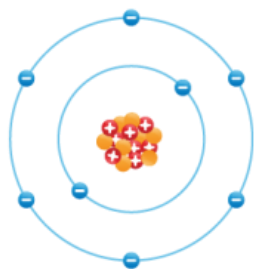


# **PROPERTIES OF MATTER**

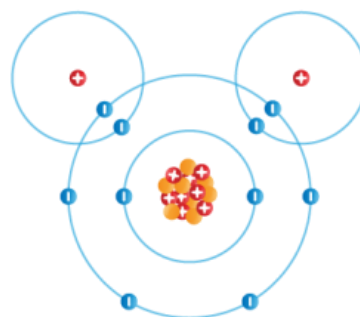
BY RUTH-ANNE VASSELL

# What is Matter?

Matter is the substance that creates everything with mass and space-occupying properties, i.e., matter is anything that takes up space. Atoms are the smallest, fundamental units of matter, while molecules are the building blocks of compounds (these are created when two or more atoms join).



Oxygen Atom



Water Molecule

Air, water, rocks, books, and even people are examples of matter. The mass of an object is the amount of material that makes it up, and it can be detected via the object's 'heaviness'. Therefore, different types of matter can be described by their mass for example, a car may have more mass than a bicycle.

## Properties of Matter

Understanding the properties of matter helps us make sense of the world, leading to countless innovations. Let us explore some key properties of matter and how they affect the behaviour and characteristics of different substances. The properties of matter can be categorized as:

- ✓ Physical properties
- ✓ Chemical properties

### Physical Properties

Physical properties of matter are characteristics that can be observed or measured without altering the substance's chemical composition. Some common physical properties of matter are colour, texture, shape, size, density, melting point, boiling point, solubility, conductivity (thermal and electrical), malleability, ductility, odour, lustre, hardness, transparency, magnetism, viscosity, state of matter.

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Date: \_\_\_\_\_

Class: \_\_\_\_\_

## Activity 1 – Key terms

Instructions: The table below has the names of some physical properties of matter. Complete the table by filling in definitions and examples for each property. The first three have been done for you.

<b>Physical Property</b>	<b>Definition</b>
State of matter	The different forms of matter inclusive of solid, liquid and gas. <i>Example (Water): Solid form - ice; liquid form – water; gaseous form – water vapour</i>
Melting point	The temperature by which a substance changes state from solid to liquid. <i>Example: The melting point of water is 0 °C</i>
Boiling point	The temperature by which a substance changes state from liquid to gas. <i>Example: The boiling point of water is 100 °C</i>
Conductivity	
Solubility	
Malleability	
Ductility	
Lustre	
Transparency	
Viscosity	
Magnetism	

These properties help scientists to categorize, identify, and describe different substances. It is important to note however, that not all physical properties apply to every type of matter, and some properties may change under specific conditions, such as pressure or temperature.

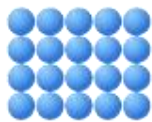
# States of Matter

Matter exists in several different forms, called states. As mentioned in the table above, the three (3) most familiar states are solid, liquid, and gas.

Chairs, balls, and books are examples of solids. Matter in the solid state has a set size and shape that does not change easily. Therefore, if a book was to be moved from a shelf to a table, its size and shape would remain the same. The particles in a solid are tightly packed, making most solids non-compressible, thus making the solid have a definite volume.

Water and milk are examples of liquids. Matter in the liquid state has a set size however, its shape depends on its container. One may pour 5 ml of water from a glass to a dish and the water would take the new shape of dish but the dish would still contain the same 5 ml of water. The particles in a liquid are less packed and slide over each other, making liquids more compressible than solids. Like solids, liquids have a definite volume.

Air is an example of a gas. Matter in the gaseous state has neither a set size nor shape. It can be expanded to fill a large container, or compressed into a smaller container. The particles in a gas are widely spread and have a lot of freedom to move around. Liquids therefore, are highly compressible and do not have a definite volume.



**Solid**



**Liquid**



**Gas**

## Activity 2 – Identify that State!

**Instructions:** Match the following phrases to the corresponding state of matter: solid, liquid and/or gas. You may write more than one state.

1. Has/have a definite volume

\_\_\_\_\_

2. Does/do not have a definite shape

\_\_\_\_\_

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Class: \_\_\_\_\_

3. Particle arrangement is very loose and free

\_\_\_\_\_

4. Can be easily compressed

\_\_\_\_\_

5. Has/have a definite size

\_\_\_\_\_

6. Particle arrangement is tightly compact

\_\_\_\_\_

7. Take/s the shape of its container

\_\_\_\_\_

8. Is not compressible

\_\_\_\_\_

9. Particles are loose enough to slide over each other

\_\_\_\_\_

10. Can expand to change its volume

\_\_\_\_\_

## Matter is Versatile!

Matter can change from one state to another. This can occur when a substance is cooled or heated to a certain point. For instance, heat can cause a liquid to change to a gas. The temperature by which a liquid changes to a gas is called the **boiling point**. When a gas cools, it can return to its liquid state (known as condensation), and if cooled sufficiently, can freeze into its solid state. The temperature at which a liquid becomes solid is called the **freezing point**. With an increase in temperature, a solid can then return to its liquid state where this temperature is known as the **melting point**. Different substances have different boiling points, melting points, and freezing points.

Fun Fact: Water has the same freezing and melting points at 0°C!

## Chemical Properties

The chemical properties of matter describe how a substance interacts and undergoes chemical changes, including its ability to react with other substances or undergo chemical reactions.

Some chemical properties include:

- Flammability: The ability or ease of a substance to burn/ignite, causing a fire or an explosion.

- Decomposition: The ability of a substance to break down into simpler compounds or elements through chemical reactions.
- Reactivity/Stability: The tendency of a substance to undergo chemical reactions with other substances (reactivity) or to resist chemical changes or decomposition over time (stability)
- Toxicity: The degree to which a substance is poisonous/harmful to living organisms.
- Acidity or basicity: The level of acidity or alkalinity of a substance, indicated by its pH value.
- Polymerization: The ability for small molecule to join together to form a larger, more complex molecule.
- Redox (reduction/oxidation) power: The ability for a compound to donate electrons (reducing agent) or accept electrons (oxidizing agent) in a reaction.

### Activity 3 – Recall in context!

**Instructions:** Answer the following questions on the lines provided.

1. Define flammability and provide an example of a substance that exhibits flammability.

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2. What does reactivity refer to in the context of chemical properties? Give an example of a substance that demonstrates high reactivity.

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Name: \_\_\_\_\_ Date: \_\_\_\_\_ Class: \_\_\_\_\_

3. Explain what stability means in relation to chemical properties. How does stability affect the durability of a substance?

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4. What does toxicity refer to in the context of chemical properties? Why is it important to understand the toxicity of substances?

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5. Define polymerization and describe how it occurs. Give an example of a polymerization process.

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6. What are redox reactions? Explain the transfer of electrons involved in redox reactions and give an example of a redox reaction.

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## Activity 4 – Which chemical property?

Instructions: Read the following questions and circle the correct answer

1. Which chemical property refers to the ability of a substance to burn or ignite in the presence of oxygen?
- a. Reactivity
  - b. Stability
  - c. Flammability
  - d. Oxidation

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Class: \_\_\_\_\_

2. The tendency of a substance to undergo chemical reactions with other substances is known as:
  - a. Decomposition
  - b. Reactivity
  - c. Polymerization
  - d. Corrosiveness
  
3. What property describes the ability of a substance to resist chemical changes or decomposition over time?
  - a. Stability
  - b. Flammability
  - c. Toxicity
  - d. Reactivity
  
4. The process in which a substance reacts with oxygen, resulting in a chemical change, is called:
  - a. Hydrolysis
  - b. Oxidation
  - c. Combustibility
  - d. Polymerization
  
5. The level of acidity or alkalinity of a substance is indicated by its:
  - a. Flammability
  - b. Stability
  - c. Acidity or basicity
  - d. Toxicity
  
6. Which property refers to the degree to which a substance is poisonous or harmful to living organisms?
  - a. Decomposition



Name: \_\_\_\_\_

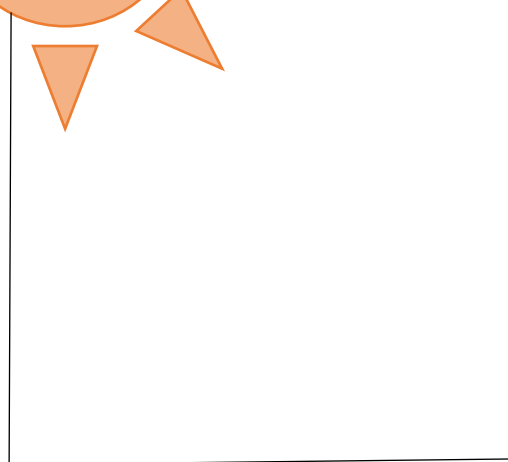
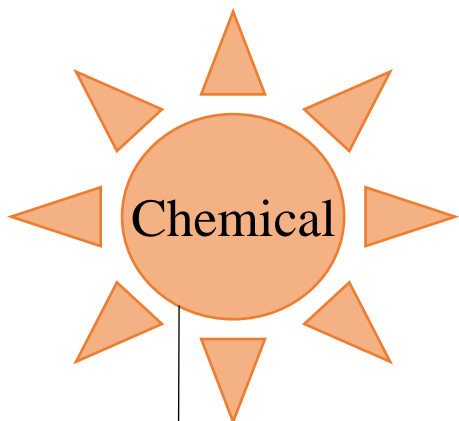
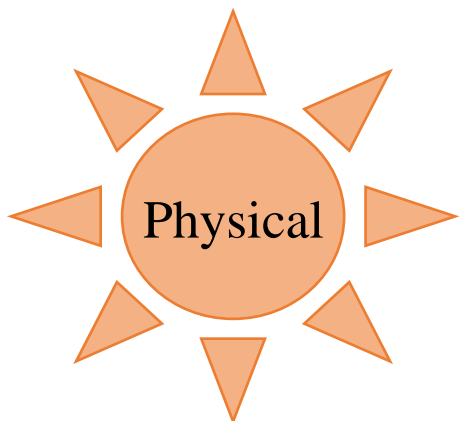
Date: \_\_\_\_\_

Class: \_\_\_\_\_

- b. Stability
  - c. Sensitivity to light
  - d. Toxicity
7. The breakdown of a substance into simpler compounds or elements through chemical reactions is called:
- a. Decomposition
  - b. Redox reactions
  - c. Oxidation
  - d. Corrosiveness
8. The process in which small molecules join together to form a larger, more complex molecule is known as:
- a. Reactivity
  - b. Stability
  - c. Polymerization
  - d. Hydrolysis
9. What are redox reactions?
- a. Chemical reactions with water
  - b. Reactions with oxygen
  - c. Reactions involving the transfer of electrons
  - d. Corrosive reactions

### Activity 5 – Physical or chemical?

Instructions: Draw lines to match the properties shown on the right to the correct category shown on the right. One has been done for you.



Ductility

Decomposition

Magnetism

Toxicity

State of matter

Conductivity

Basicity

Malleability

Stability

Polymerization



## Activity 6 – Detective chemistry!

Instructions: Oh no, there is a major problem in Matterland! There has been reported cases of different members of the Property family. It has been observed however, that several clues have been left behind. Analyse these clues to identify the different members and use it along with the hints provided to complete the fill in the blanks and find the family! The first one has been done for you.

Is that a shiny coin?  
Looks like it was  
dropped by Lustre<sup>1</sup>



Someone dropped juice in the  
lake and it dissolved in the  
water. This must be from  
\_\_\_\_\_ <sup>3</sup>



Oh no a fire! Maybe this  
was caused by  
\_\_\_\_\_ <sup>2</sup>



Cellulose is a component of the  
grass shown here. I think this  
would've been a good resting  
spot for \_\_\_\_\_ <sup>4</sup>



Wow broken glass, we need to  
be careful! I can see right  
through it just like  
\_\_\_\_\_ <sup>5</sup>



How sweet for someone to  
leave lemonade here. Wait,  
it's extremely sour yuck!  
With low pH, this was made  
by \_\_\_\_\_ <sup>6</sup>



Name: \_\_\_\_\_

Date: \_\_\_\_\_

Class: \_\_\_\_\_

## Where is The Property Family?



\_\_\_\_\_

6-1      4-1    4-8    5-11   5-4    4-8    5-11      6-1    6-6

\_\_\_\_\_

6-1      2-1    1-2    5-4      2-1    6-1    4-8    1-5



### **Key:**

First number → Question number in above activity found at the end of the black spaces

Second number → Letter number in the respective word

For example, 1-2:

1 → Lustre

2 → u

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Class: \_\_\_\_\_

# Properties of Matter

A	A	N	R	I	M	O	F	I	T	Y	U	S	B
T	S	T	I	T	A	U	L	N	R	C	T	T	O
M	T	O	S	N	L	A	A	O	A	O	R	Y	I
A	A	L	A	I	L	C	M	I	N	N	P	T	L
G	B	U	G	O	E	I	M	T	S	D	R	I	I
N	I	S	S	P	A	D	A	I	P	E	O	S	N
E	L	T	T	G	B	I	B	S	A	N	P	O	G
T	I	R	A	N	I	T	I	O	R	S	E	C	P
I	T	E	T	I	L	Y	L	P	E	A	R	S	O
S	Y	D	E	T	I	R	I	M	N	T	T	I	I
M	O	O	S	L	T	O	T	O	C	I	I	V	N
Y	A	X	P	E	Y	R	Y	C	Y	O	E	T	T
T	S	E	L	M	A	T	T	E	R	N	S	A	M
N	A	L	I	Q	U	I	D	D	S	O	L	I	D

- LUSTRE
- MALLEABILITY
- MAGNETISM
- DECOMPOSITION
- VISCOSITY
- ACIDITY
- STATES
- MELTING POINT
- CONDENSATION
- LIQUID
- STABILITY
- TRANSPARENCY
- PROPERTIES
- FLAMMABILITY
- BOILING POINT
- GAS
- MATTER
- SOLID
- REDOX

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Class: \_\_\_\_\_

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