

SNC2D CHEMISTRY

CHEMICAL REACTIONS

☞ Matter (P.140-143)

What Is Chemistry?

Chemistry is the study of substances – what they are made of, how they behave, and how they are used. An understanding of chemistry helps us buy and use products wisely.

CHEMISTRY

- ❖ the study of substances including:
 - what they are made of
 - how they behave
 - how they are used

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2DCHEM - Matter

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Matter

You and every object around you are made of matter. **Matter** is anything that has mass and takes up space (has volume). Matter does not include any form of energy, such as light, thermal, and sound. There are millions of forms of matter that have been discovered or synthesized.

MATTER

- ❖ anything that has mass and takes up space
- ❖ can be grouped as a metal or non-metal
- ❖ found in 3 states ☞ solid, liquid, and gas


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Matter

NOTE!
 More recently, plasma – a highly ionized gas that occurs at high temperatures – has been described as a fourth state of matter.



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Properties of Matter

To understand more about matter, many substances have been classified according to shared properties. A **property** of a substance is one of its features, such as its appearance, smell, or behaviour. We can match the properties of a substance to its use. For example, children's finger-paint must be non-toxic and easily washed off with water. The paint on the body of a car, however, must be long-lasting and water resistant.

PROPERTY
 ♦ a feature or characteristic that describes a substance

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Properties of Matter

Through observations, scientists have found it useful to categorize these properties as **physical** or **chemical**.

PHYSICAL	CHEMICAL
<ul style="list-style-type: none"> boiling/condensation point melting/freezing point malleability ductility colour state solubility crystal formation conductivity 	<ul style="list-style-type: none"> ability to burn flash point behaviour in air reaction with water reaction to heating

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Properties of Matter

When you observe matter – whether you see it, touch it, hear it, smell it, or taste it – you are observing a characteristic, called a **physical property**. Unlike a chemical property, a physical property does not involve a substance becoming a new substance. For instance, colour is a physical property. A substance simply has a certain colour: its colour has no relationship to the substance's ability to change into new substances.

PHYSICAL PROPERTY (P.142)

- ❖ describes the physical appearance and composition of a substance
- ❖ colour, texture, boiling point, ...

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Properties of Matter

In nature, substances often combine or react with each other. When one substance can interact with another, that characteristic behaviour can be called a **chemical property**. For example, dynamite explodes when exposed to a flame because the dynamite combines with oxygen in the air. This reaction produces new substances. A chemical property describes the behaviour of a substance as it becomes a new substance.

CHEMICAL PROPERTY (P.142)

- ❖ describes the behaviour of a substance as it becomes a new substance
- ❖ ability to burn, reaction with water, ...

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Physical or Chemical Property?

PRACTICE

1. Classify each of the following as a physical or chemical property.
 - (a) Water boils at 100°C. P
 - (b) Gasoline burns in air. C
 - (c) Yeast reacts with sugar to form carbon dioxide and ethanol. C
 - (d) Diamonds are capable of cutting glass. P
 - (e) Sugar dissolves in water. P

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Classifying Matter

All forms of matter can be classified as either a **pure substance** or a **mixture**, based on their physical and chemical properties. These two classes can then be further divided.

PRACTICE

2. Draw a flowchart showing how matter can be classified. Hint: start your diagram with the word "matter" and then use the terms below in your diagram.

- compounds
- elements
- mechanical mixtures
- mixtures
- pure substances
- solutions

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Classifying Matter

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Classifying Matter

A **pure substance** is matter that is made of only one kind of material. All samples of a pure substance have the same properties. Pure substances may be elements or compounds. For example, the element gold (Au) and the compound table salt (NaCl) are both examples of a pure substance.

PURE SUBSTANCE

- ❖ matter that contains only one type of material
- ❖ are uniform throughout

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 **Classifying Matter**

An **element** is a substance that cannot easily be broken down into smaller parts. Chemists have given each element a chemical symbol. For example, the chemical symbol "C" stands for the element carbon.

ELEMENT

- ❖ substance that cannot easily be broken down into smaller parts
- ❖ i.e. carbon (C), gold (Au), ...

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 **Classifying Matter**

A **compound** is a pure substance made of two or more elements in a particular ratio. Water is a common compound.

COMPOUND

- ❖ substance that contains two or more elements in a specific ratio
- ❖ i.e. water (H₂O), salt (NaCl), ...

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 **Classifying Matter**

Most products that we use are mixtures. A **mixture** is matter that is made of more than one pure substance. However, the substances in a mixture do not combine chemically. Instead, each substance remains in its original pure form, although each is not always easy to see distinctly once the mixture is made. For example, toothpaste is a mixture of different pure substances, including detergents (to help clean teeth) and titanium dioxide (which makes toothpaste white).

MIXTURE

- ❖ matter that contains two or more pure substances mixed together
- ❖ do **not** combine chemically

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Classifying Matter

In a **mechanical mixture**, the different substances that make up the mixture are visible. A chocolate chip cookie is an example of a mechanical mixture – different parts of the mixture are visible. So is a mixture of salt and pepper. A mixture in which the different parts are visible is called **heterogeneous**.

MECHANICAL MIXTURE (HETEROGENEOUS)

- ❖ different substances that make up the mixture are visible
- ❖ i.e. pizza, garbage, ...

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Classifying Matter

A **solution** is a mixture that is formed when one or more pure substances dissolve in another creating a **homogeneous** mixture. Solutions look like pure substances. For example, when sugar is completely dissolved, a sugar-water solution looks like pure water.

SOLUTION (HOMOGENEOUS)

- ❖ a mixture that looks like a pure substance (i.e. one substance is dissolved in the other)
- ❖ i.e. tea, coffee, ...

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✓ Check Your Learning

1. Complete the chart below using the words:


- helium (He)
- oxygen (O₂)
- water (H₂O)
- not possible

	ELEMENT	COMPOUND
ATOM	helium	not possible
MOLECULE	oxygen	water

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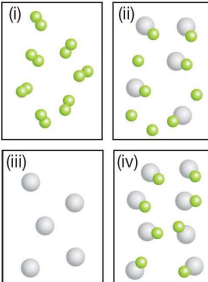
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 **Check Your Learning**


2. Identify each of the following as either:

- a pure substance or a mixture and
- if it is a pure substance, whether it is an element or a compound.

(i) pure substance & element
(ii) mixture
(iii) pure substance & element
(iv) pure substance & compound



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 **Check Your Learning**

3. Classify each of the following pure substances as either:

(i) an atom or a molecule, and
(ii) an element or a compound.

- salt (NaCl) molecule & compound
- silver (Ag) atom & element
- carbon dioxide (CO₂) molecule & compound
- chlorine gas (Cl₂) molecule & element
- gold (Au) atom & element
- sugar (C₁₂H₂₂O₁₃) molecule & compound
- hydrogen gas (H₂) molecule & element
- charcoal (C) atom & element

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 **Check Your Learning**

4. Classify each of the following as either:

(a) a pure substance or a mixture.
(b) an element, a compound, a mechanical mixture or a solution.

- air mixture solution
- carbon monoxide (CO) pure substance compound
- carbon (C) pure substance element
- vegetable soup mixture mechanical mixture
- gold (Au) pure substance element
- tea mixture solution
- pizza mixture mechanical mixture
- sugar (C₆H₁₂O₆) pure substance compound

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