MIXTURES,
ELEMENTS
AND COMPOUNDS
EXPLAIN THE MEANING OF THE FOLLOWING WORDS AND GIVE AND EXAMPLE:

1. Mixture
2. Homogeneous
3. Heterogeneous
4. Solution
5. Element
6. Compound
1. **INTRODUCING MIXTURES**

Mixtures contain two or more substances that are not chemically joined. They can be made from both elements and compounds. Because they are not chemically joined, the different substances that make up a mixture can be separated easily.

The ratio of substances that make up a mixture isn't fixed. We can’t write a formula for a mixture.

Most common substances are mixtures. For example, the air in the atmosphere is a mixture of various gases.

Mixtures that appear uniform are called homogeneous.

Mixtures where more than one part is distinguishable are called heterogeneous.

### ACTIVITIES

1. Complete and add more examples:

<table>
<thead>
<tr>
<th>Mixture</th>
<th>Components</th>
<th>Homogeneous/Heterogeneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>air</td>
<td>Nitrogen, oxygen, argon,...</td>
<td></td>
</tr>
<tr>
<td>steel</td>
<td>Iron, carbon</td>
<td></td>
</tr>
<tr>
<td>granite</td>
<td>Various minerals</td>
<td></td>
</tr>
<tr>
<td>Tap water</td>
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<td></td>
</tr>
</tbody>
</table>

2. Does sand dissolve in water? Is a mixture of sand and water homogeneous or heterogeneous?

3. Copy and complete the text.

Sand _______ dissolve in water. When you mix sand and water you get a______ mixture. Sugar _____ in water to form a ________ mixture.
2. CLASSIFICATING MIXTURES

HETEROGENEOUS MIXTURES
In some mixtures, the components are clearly distinguishable. For example, most rocks contain a mixture of different minerals. Granite is a heterogeneous mixture because it is composed of minerals that are clearly distinguishable (each colour is a different mineral).

HOMOGENEOUS MIXTURES
In homogeneous mixtures, you can not distinguish each component with the naked eye. They have a uniform composition. For example sea water, air, and vinegar. Steel is a homogeneous mixture, however it is made from iron and carbon. A pure substance is different from a homogeneous mixture because a pure substance has only one component. It has a homogeneous look. It has unique properties that characterise it, for example, its density.

ACTIVITIES
1. Complete the following sentences:
Matter can be c__________ by its appearance as:
- H__________ : the appearance is not uniform. The c__________ can be distinguished.
- Homogeneous : its a__________ is u___________. The c_______ can not be distinguished.

2. What are the differences between pure substances and homogeneous mixtures. How are they similar?

3. Classify these things: homogeneous mixtures (1), heterogeneous mixtures (2), or pure substances (3):
- Sand and water (...)
- Oxygen (...)
- Iron (...)
- Water (...)
- Steel (...)
- Sugar (...)
- Juice (...)
- Cornflakes and milk (...)
- Water and oil (...)
- Butter and salt (...)
- Silver oxide (...)
- Salt and water (...)
- Plum cake (...)
- Petrol (...)
- Pizza (...)
- Aluminum (...)
- ...
3. SEPARATING MIXTURES

Here are some methods of separating mixtures in the laboratory. These techniques can only be used to separate a mixture of substances that are not chemically combined.

SEAVING
Separates: Solids particles of different sizes.
Example: A mixture of sand and pebbles.

FILTRATION
Separates: Insoluble solids from liquids.
Example: Sand from a sugar solution.

CRYSTALLIZING
Separates: Soluble solids from their solvent.
Example: Copper sulphate from water.

DISTILLATION
Separates: Mixtures of liquids with different boiling points.
Example: A solution of water and alcohol.

ACTIVITIES
1. What method would be suitable for separating a mixture of sand and salt solution?
2. Which types of substances can be separated using distillation?
3. Which methods of separation rely on the use of thermal energy?
4. WHAT ARE SOLUTIONS?

A solution is any homogeneous mixture. Solutions are usually liquid mixtures, that is, liquids with solid substances, such as water with sugar. The sugar is dissolved evenly throughout the liquid. The simplest solutions consist of two components: a solvent and a solute. The dissolved substance is called the solute and the substance that it dissolves into is called the solvent. Usually water is always solvent.

However, solutions can be solid, liquid or gaseous:

- Solids with solids: alloys are special solutions: all their components are solids. For example, steel (iron and carbon).
- Liquid within liquid: alcohol dissolved in water
- Solid within liquid: salt dissolved in water
- Gas within liquid: CO₂ dissolved in fizzy drinks.

ACTIVITIES

1. Copy these sentences. Fill in the blanks, choosing words from those below:
   solvent        solute        dissolves   soluble      solution

   When salt is mixed with water, the salt _______ in the water. Salt is ______ in water. The water is called the _______. The mixture is called a _________.

2. Find out which of these common substances will dissolve in water: sugar, sand, salt, talcum, powder, flour, bicarbonate of soda, oil, vinegar. Make a table of your results.

<table>
<thead>
<tr>
<th>substance</th>
<th>It will dissolve</th>
<th>It will not dissolve</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>
5. PURE SUBSTANCES: ELEMENTS AND COMPOUNDS

A pure substance has only one component. It has a homogeneous look. It has unique properties that characterize it, for example its density. These properties distinguish it from every other substance. Pure substances in nature can be either chemical compounds or elements.

Chemical compounds: a chemical compound contains two or more elements joined up. The atoms are from different elements. Compounds have a fixed composition, for example water is always made up of two atoms of hydrogen and one atom of oxygen. It can be expressed as H₂O. Compounds are different from their constituent elements, in other words, the elements that make them up.

Chemical elements: a chemical element cannot be broken down into simpler substances. Hydrogen and oxygen are chemical elements.

ACTIVITIES

1. Give two differences between the particles in a mixture of iron and sulphur and the particles in the compound iron sulphide.

2. Draw the particles to represent:
   A. Magnesium oxide (one magnesium atom for every oxygen atom)
   B. Hydrogen chloride (one hydrogen atom for every chlorine atom)
   C. Hydrogen sulphide (two hydrogen atoms for every sulphur atom)

3. Write the formula for each compound in question 2.

4. Which elements are present in these substances, and in what ratios?
   A. Zinc sulphide (Zn S)
   B. Sodium fluoride (NaF)
   C. Ammonia (NH₃)
6. THE STRUCTURE OF THE ATOM

All matter is made up of tiny particles called atoms. An atom is the smallest particle of matter which can exist alone. At the centre of an atom is a core called a nucleus. The nucleus is made up of particles called protons and neutrons. Protons have a positive charge (+). Neutrons have no charge. This means that the nucleus has a positive charge. Extremely small particles called electrons orbit the nucleus. And they are very small compared to protons and neutrons. Protons and neutrons are about the same size as each other. Electrons have a negative charge (-). They are attracted to the positively charged protons in the nucleus. Between the nucleus and the electrons there is nothing, so most of an atom is empty.

The atomic number of an atom is the number of protons in the nucleus. Each atom has a unique atomic number. When two or more atoms are chemically joined together, they form a molecule. Molecules can be a combination of the same or different type of atoms. For example: O₂, CO₂.

ACTIVITIES
1. Which two particles make up the nucleus of an atom?

2. What name is given to the number of protons in a particular atom?

3. Copy and complete:
   • Atoms are made up of ____________________________
   • Atoms combine to make ___________________________


5. Gold has atomic number 79. How many protons and electrons would you find inside an atom of gold?
Steve has mixed up salt, sand and iron filings. How can he separate them?

**Number the diagrams 1 to 8 in the right order.**

1. Salt, sand, and iron filings.
2. Warm the salty water.
3. Try to pour the sand and salty water through some filter paper.
4. Take out the iron filings with a magnet.
5. The salty water goes through the filter paper. The sand does not.
6. The salt will dissolve. The sand will not dissolve.
7. Add water to the salt and sand.
Draw a line from each label to the right part of the atom.

**Proton** This has a positive (+) electric charge.

**Neutron** This has no electric charge.

**Nucleus** This is the centre of the atom.

**Electron** This has a negative (−) electric charge. It is very light and speeds around the nucleus.

**Key**
- protons – red
- neutrons – yellow
- electrons – blue

An oxygen atom

Colour the parts of the atom to match the key.

Unscramble these letters then write the correct word next to each description.

- snobd  It is made of protons, neutrons and electrons.
- onis  Atoms that have gained or lost electrons so are negatively (−) or positively (+) charged.
- moat  Different versions of atoms of the same element. The atoms have the same number of protons and electrons, but different numbers of neutrons.
- stoopies  The forces that hold atoms together.
Everything on Earth is made from about 90 simple substances called elements. There are two main types of element: **metals** and **nonmetals**.

Here are some examples with their chemical symbols.

<table>
<thead>
<tr>
<th>Metals</th>
<th>Nonmetals</th>
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<tbody>
<tr>
<td>element</td>
<td>symbol</td>
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<tr>
<td>aluminium</td>
<td>Al</td>
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<tr>
<td>calcium</td>
<td>Ca</td>
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<tr>
<td>copper</td>
<td>Cu</td>
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<tr>
<td>gold</td>
<td>Au</td>
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<td>iron</td>
<td>Fe</td>
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<td>lead</td>
<td>Pb</td>
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<td>bromine</td>
<td>Br</td>
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<tr>
<td>carbon</td>
<td>C</td>
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<td>chlorine</td>
<td>Cl</td>
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<tr>
<td>fluorine</td>
<td>F</td>
</tr>
<tr>
<td>helium</td>
<td>He</td>
</tr>
<tr>
<td>hydrogen</td>
<td>H</td>
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</tbody>
</table>

Which elements have these symbols?

C _______ Ca _______ Cl _______ Cu _______

K _______ P _______ Pb _______ Fe _______

What are the symbols for these elements?

gold _______ silver _______ hydrogen _______ oxygen _______

nitrogen _______ bromine _______ sodium _______ aluminium _______

If two or more elements join together to make a new substance, this is called a **compound**.

Chemists use **formulae** like $\text{H}_2\text{O}$ to show how much of each element there is in a compound.
<table>
<thead>
<tr>
<th>English</th>
<th>Spanish</th>
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