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FREE LEARNING NOTES FOR ZAMBIA

FORM 1

Chemistry

Elements: the building blocks of substances

Lesson notes for learners · Competence-Based Curriculum

INSIDE

1. What is an element
2. Metallic and non-metallic elements
3. Drawing elements as particles
4. Check yourself

Everything around us, from the air we breathe and the food we eat to the copper wire in a phone charger, is made of elements. We take them for granted, yet each element has its own properties and uses. In this note you learn what an element is, how elements are sorted into metals and non-metals, and how to draw them as particles.

AFTER THESE NOTES YOU SHOULD BE ABLE TO

- Say what an element is
- Sort elements into metallic and non-metallic elements
- Give uses of common metallic and non-metallic elements
- Draw particle diagrams of a metallic element, a monoatomic gas and a diatomic gas
- Tell an element from a compound

KEY WORDS

element	a pure substance made of only one kind of atom that cannot be broken down into simpler substances by chemical means
metallic element	an element that loses electrons when it forms ions; it is shiny, conducts electricity and has high melting and boiling points
non-metallic element	an element that gains electrons when it forms ions; it is dull, brittle and a poor conductor of electricity
monoatomic	made of single atoms that are not joined to each other, like helium
diatomic	made of molecules with two atoms joined together, like oxygen
compound	a pure substance formed when two or more different elements combine chemically in a fixed ratio

1 What is an element

An element is a pure substance that has only one kind of atom. An element cannot be broken down into simpler substances by chemical means. The air we breathe is made up of elements, and so are many everyday things.

Most elements do not exist alone in nature. They occur combined with other elements in compounds. A compound is a pure substance formed when two or more different elements combine chemically in a fixed ratio.

2 Metallic and non-metallic elements

Elements are classified as metallic or non-metallic. Metallic elements ionise by losing electrons. They are shiny, they conduct electricity and they have high melting and boiling points. Non-metallic elements ionise by gaining electrons. They are dull, brittle and poor conductors of electricity.

Each group has many everyday uses, shown in the table.

Metallic element	Use	Non-metallic element	Use
Copper	Electrical wires and alloys	Oxygen	Respiration
Aluminium	Kitchen utensils, aeroplane bodies	Nitrogen and phosphorus	Fertilizers
Lithium	Rechargeable cells	Hydrogen and carbon	Fuels
Lead	Car batteries	Helium	Weather balloons
Calcium	Cement	Fluorine	Toothpaste
Gold and silver	Jewellery	Silicon	Electronic devices
Sodium	Soap, glass, street lights	Neon	Advertising signs
Magnesium	Fireworks	Argon	Light bulbs

Figure 1. Uses of some metallic and non-metallic elements

3 Drawing elements as particles

We can show elements with particle diagrams. In a metallic element such as potassium the particles are uncombined and closely packed. In a monoatomic gas such as helium the particles are uncombined and far apart. In a diatomic gas such as oxygen the particles are combined in pairs and are far apart.

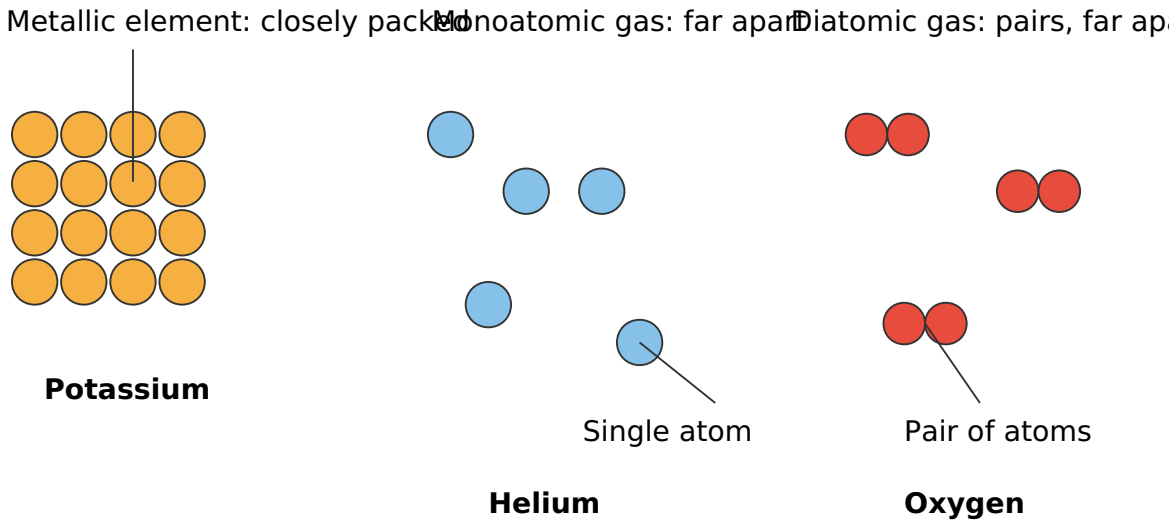

Figure 2. Particle diagrams of a metal, a monoatomic gas and a diatomic gas

WORKED EXAMPLE

Helium fills weather balloons and oxygen is breathed in. How do the particle diagrams of the two gases differ?

Helium is a monoatomic gas, so its diagram shows single atoms far apart

Oxygen is a diatomic gas, so its diagram shows atoms joined in pairs, far apart

Both gases have particles far apart, but only oxygen has them combined in pairs

TRY THIS

In groups, make two tables, one for metallic and one for non-metallic elements, with the headings name of element and where it is used or found. Use a periodic table to fill them in. Then draw the particle diagrams of potassium, helium and oxygen on a flip chart and present them to the class.

REMEMBER

- An element is a pure substance made of only one kind of atom and cannot be chemically broken into simpler substances
- Elements are metallic or non-metallic
- Metals are shiny, conduct electricity and have high melting and boiling points
- Non-metals are dull, brittle and poor conductors
- Metals are drawn as closely packed particles, monoatomic gases as single atoms far apart, diatomic gases as pairs far apart
- A compound is formed when different elements combine chemically in a fixed ratio

? Check yourself

1. What is an element?
2. Name two properties of metallic elements.
3. What is a diatomic gas? Give an example.
4. Name one use of copper and one use of lead.
5. How is a compound different from an element?
6. You are a learner at a school in Luangwa. Your teacher gives you a shiny piece of metal that conducts electricity, and a dull, brittle piece of yellow solid that does not. (a) Which sample is probably a metallic element? (b) Which is probably a non-metallic element? (c) Give the properties that help
7. A shop in Lusaka sells kitchen pots made of aluminium and weather balloons filled with helium. (a) Say whether aluminium and helium are metallic or non-metallic. (b) Describe what the particles of helium look like. (c) Explain why helium is different from oxygen in a particle diagram.

ANSWERS

1. A pure substance made of only one kind of atom that cannot be broken down into simpler substances by chemical means.
2. Any two of: shiny, conduct electricity, high melting and boiling points.
3. A gas whose particles are pairs of joined atoms, such as oxygen.
4. Copper: electrical wires and alloys. Lead: car batteries.
5. A compound is made of two or more different elements chemically combined in a fixed ratio, but an element has only one kind of atom.
6. (a) The shiny piece that conducts electricity. (b) The dull, brittle piece. (c) Metals are shiny and conduct electricity; non-metals are dull, brittle and poor conductors.
7. (a) Aluminium is metallic and helium is non-metallic. (b) Single atoms that are not joined, far apart. (c) Helium is monoatomic, with single atoms, while oxygen is diatomic, with atoms joined in pairs.

Written by 25Schools to follow the Form 1 Chemistry syllabus of the Zambian competence-based curriculum. Free for learners to read, download and share. More notes and quizzes at 25schools.com.