Elements: the building blocks of substances

Lesson plan and teacher's notes · Form 1 Chemistry · 1 period of 40 minutes

School	(write school name)	**Teacher**	(write name)
Date	(date)	**Class**	Form 1
Subject	Chemistry	**Enrolment**	Boys ___ Girls ___ Total ___
Time	40 minutes	**Topic**	Elements: the building blocks of substances

Learners say what an element is, sort elements into metallic and non-metallic, give uses of common elements, draw particle diagrams of a metal, a monoatomic gas and a diatomic gas, and tell an element from a compound. The lesson starts from everyday objects such as a copper wire, a pot and a weather balloon.

Specific outcomes

By the end of the lesson, learners should be able to:

1. Say what an element is
2. Sort elements into metallic and non-metallic elements
3. Give uses of common metallic and non-metallic elements
4. Draw particle diagrams of a metal, a monoatomic gas and a diatomic gas
5. Tell an element from a compound

Prior knowledge

- Everything is made of particles
- Atoms are the smallest particles of an element
- Solids, liquids and gases

Teaching and learning materials

- a copper wire or any metal object
- a pencil or a piece of charcoal
- chalk and board
- exercise books

References

Ministry of Education (CDC) Form 1 Chemistry syllabus and module; 25Schools learners' note: Elements: the building blocks of substances.

Lesson development

Stage and time	Teacher activities	Learner activities
Introduction 5 min	Show a metal object and a dull non-metal object. Ask what they are made of and tell learners that everything around us is made of elements.	Name objects and suggest what they are made of.
Development: what an element is 8 min	Teach the meaning of an element: one kind of atom, cannot be broken down by chemical means. Explain that most elements occur combined in compounds and give the meaning of a compound.	Copy the meaning and give examples of elements and a compound.
Development: metallic and non-metallic 12 min	Teach that metallic elements lose electrons and are shiny, conduct electricity and have high melting and boiling points, while non-metallic elements gain electrons and are dull, brittle and poor conductors. Give uses such as copper and lead.	Sort a list of properties into metallic and non-metallic and give two uses.
Development: particle diagrams 12 min	Draw potassium as closely packed single particles, helium as single atoms far apart and oxygen as pairs far apart. Work the helium and oxygen example.	Draw the three particle diagrams and label each one.
Conclusion 3 min	Ask how an element differs from a compound. Set the homework.	Answer orally and copy the homework.

Teacher's content notes

Read these before the lesson. They are what you need to know, not what to copy onto the board.

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, because they occur combined with other elements in compounds.

Compounds

A compound is a pure substance formed when two or more different elements combine chemically in a fixed ratio. An element has only one kind of atom, so this is how an element is different from a compound.

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. For example, copper is used for electrical wires and alloys, and lead is used in car batteries.

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.

Questions to ask during the lesson

Question	Expected answer
A learner looks at the air around her and asks what it is made of. (a) Say what an element is. (b) Say what is meant by a pure substance with one kind of atom. (c) Say whether an element can be broken down by chemical means.	(a) A pure substance made of only one kind of atom that cannot be broken down into simpler substances by chemical means. (b) It is an element. (c) No.
A teacher holds up a shiny wire that conducts electricity. (a) Say whether the wire is metallic or non-metallic. (b) Name two properties of metallic elements. (c) Say how a metallic element ionises.	(a) Metallic. (b) Any two of: shiny, conduct electricity, high melting and boiling points. (c) By losing electrons.
A learner draws two gases for the class, one with single atoms far apart and one with atoms joined in pairs. (a) Say what a diatomic gas is and give an example. (b) Say what a monoatomic gas is and give an example. (c) Say how the particles of potassium are arranged.	(a) A gas whose particles are pairs of joined atoms, such as oxygen. (b) A gas made of single atoms that are not joined to each other, such as helium. (c) Uncombined and closely packed.
A learner says copper and lead are both useful in everyday life. (a) Name one use of copper. (b) Name one use of lead. (c) Say how a compound is different from an element.	(a) Electrical wires and alloys. (b) Car batteries. (c) 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.

Worked examples for the board

Example 1: helium and oxygen

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.

Example 2: sorting two pieces

A learner has one piece that is shiny and conducts electricity and another that is dull, brittle and a poor conductor. The shiny piece is a metallic element because metals are shiny and conduct electricity. The dull, brittle piece is a non-metallic element because non-metals are dull, brittle and poor conductors.

Example 3: a metal as particles

A learner draws potassium as a metallic element. The particles are uncombined, so each one is a single atom, and they are closely packed because this is a solid metal. This is different from helium, whose particles are uncombined but far apart.

Board plan

Write the title and the key words. Left: the meaning of an element and a compound. Centre: the table of metallic and non-metallic properties. Right: the three particle diagrams drawn side by side.

Feature	Metallic element	Non-metallic element
Electrons	Loses electrons to form ions	Gains electrons to form ions
Appearance	Shiny	Dull
Electricity	Conducts electricity	Poor conductor
Other properties	High melting and boiling points	Brittle

Metallic and non-metallic elements

Mistakes to expect

Learners often think	Put it right
An element is any pure-looking substance.	An element is a pure substance made of only one kind of atom that cannot be broken down into simpler substances by chemical means.
Most elements are found alone in nature.	Most elements do not exist alone in nature. They occur combined with other elements in compounds.
All gases that are elements have single atoms.	A monoatomic gas such as helium has single atoms, but a diatomic gas such as oxygen has atoms joined in pairs.
A compound is the same as an element.	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.

Differentiation

Learners who struggle

Give learners a table with the properties already written in a mixed list and ask them to place each one under metallic or non-metallic. Draw the three particle diagrams on the board step by step.

Learners who finish early

Ask learners who finish early to explain why the particles of potassium are drawn closely packed while the particles of helium are drawn far apart, and to write one use for copper and one use for lead.

Hearing or visual impairment

For learners with hearing impairment, write each key word on the board and point to each diagram while speaking. For learners with visual impairment, let them hold the metal and non-metal objects, and describe each particle diagram aloud as single particles, pairs, close together or far apart.

No projector, no printing

Use any metal object and any dull non-metal object that the school has. Draw the particle diagrams with chalk dots and circles on the board and in exercise books.

If time is short

Teach what an element is, the metallic and non-metallic properties, and the helium and oxygen particle diagrams. Leave the uses and the compound comparison for the next lesson.

Evaluation

Question or task	A correct answer shows
A learner picks up two pieces of material from the school workshop. One is shiny and conducts electricity and the other is dull and brittle. (a) Name the piece that is a metallic element. (b) Name the piece that is a non-metallic element. (c) Give the properties that helped you decide.	(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.
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.	(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.
A learner says that an element and a compound are the same thing because both are pure substances. (a) Say what an element is. (b) Say what a compound is. (c) Say how they differ.	(a) A pure substance with only one kind of atom. (b) A pure substance formed when two or more different elements combine chemically in a fixed ratio. (c) An element has only one kind of atom, a compound has different elements combined.

Homework

A mechanic in a garage in Lusaka uses copper wire to repair electrical connections and lead in a car battery. (a) Say whether copper and lead are metallic or non-metallic elements. (b) Name two properties of metallic elements. (c) Draw and describe the particle diagram of a metallic element such as potassium.

Extra practice with answers

Question	Answer

1. A learner has a piece of copper wire and a piece of dull, brittle material from a science kit. (a) Say which piece is likely to be a metallic element. (b) Give two properties that helped you decide. (c) Name one use of copper.	(a) The copper wire. (b) Any two of: shiny, conducts electricity, high melting and boiling points. (c) Electrical wires and alloys.
2. A learner is asked to draw helium and oxygen as particles for a poster in the classroom. (a) Describe the particles of helium. (b) Describe the particles of oxygen. (c) Say what is the same in both diagrams.	(a) Single atoms that are not joined, far apart. (b) Atoms joined in pairs, far apart. (c) The particles are far apart in both.
3. A girl says that every element is found alone in nature as one kind of atom. (a) Say whether she is right. (b) Say where most elements are found. (c) Say what a compound is.	(a) No. (b) Combined with other elements in compounds. (c) A pure substance formed when two or more different elements combine chemically in a fixed ratio.
4. A mechanic looks at a car battery that contains lead and wires made of copper. (a) Say whether lead is a metallic or non-metallic element. (b) Name the use of lead in the car. (c) Say how metallic elements ionise.	(a) Metallic. (b) Car batteries. (c) By losing electrons.
5. A teacher draws potassium as closely packed single particles on the board and oxygen as pairs. (a) Say what potassium is. (b) Say what oxygen is, in particle terms. (c) Say how the particles of potassium differ from those of oxygen.	(a) A metallic element with uncombined, closely packed particles. (b) A diatomic gas with atoms combined in pairs, far apart. (c) Potassium particles are closely packed and uncombined, but oxygen particles are in pairs and far apart.

Answers to the learners' check-yourself questions

1. What is an element?
   A pure substance made of only one kind of atom that cannot be broken down into simpler substances by chemical means.
2. Name two properties of metallic elements.
   Any two of: shiny, conduct electricity, high melting and boiling points.
3. What is a diatomic gas? Give an example.
   A gas whose particles are pairs of joined atoms, such as oxygen.
4. Name one use of copper and one use of lead.
   Copper: electrical wires and alloys. Lead: car batteries.
5. How is a compound different from an element?
   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. 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

(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 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.

   (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.

Teacher's reflection

What went well:

What I will change next time:

Learners who need follow-up: