Elements, compounds and graphs

Key:
- iron
- sulfur
Contents

Unit overview 3
Outcomes and essential content 3
Indicative time 5
Resources 5
Icons 7
Glossary 8
Unit overview

This unit introduces key concepts of chemistry: element, compound and reaction. There will also be practice in extracting information from a variety of graphs.

- Part 1 is about elements, atoms, symbols and the classification of elements as metals or non-metals.
- Part 2 distinguishes compounds from elements and mixtures.
- Part 3 provides experience in extracting information from column graphs, histograms, divided-bar and sector graphs, lines graphs and composite graphs.

Outcomes and essential content

By completing the activities and exercises in this unit, you are working towards achieving the following outcomes.

4.2 A student uses examples to illustrate how models, theories and laws contribute to an understanding of phenomena

4/5.2 Students learn about the nature and practice of science. Students learn to:

4.2e use examples which show that scientists isolate a set of observations, identify trends and patterns and construct hypotheses or models to explain these

4.2f give examples that demonstrate the benefits and limitations of using models

4.2g identify that the nature of observations made depends upon the understanding that the observer brings to the situation.

4.7 A student describes observed properties of substances using scientific models and theories.

4.7.4 Students learn about elements. Students learn to:

4.7.4a classify elements as metals or non-metals according to their common characteristics

4.7.4b identify internationally recognised symbols for common elements.
4.7.5 Students learn about mixtures. Students learn to:

4.7.5d identify situations where the processes of filtration, sedimentation, sieving, distillation, chromatography, evaporation, condensation, crystallisation and magnetic attraction are appropriate to separate components of a mixture.

4.7.6 Students learn about compounds and reactions. Students learn to:

4.7.6a distinguish between elements and compounds

4.7.6b identify when a chemical reaction is taking place by observing changes in temperature, the appearance of a new substance or the disappearance of an original substance

4.7.6c distinguish between compounds and mixtures.

4.11 A student identifies where resources are found, and describes ways in which they are used by humans.

4.11 Students learn about natural resources. Students learn to:

4.11a distinguish between natural and made resources

4.11b give examples of resources from living things and resources extracted from the air, Earth and oceans

4.11c identify fossil fuels and describe some of their uses

4.11d identify renewable and non-renewable sources of energy.

4.16 A student accesses information from identified secondary sources.

4/5.16 Students learn about gathering information from secondary sources. Students learn to:

4.16c extract information from column graphs, histograms, divided bar and sector graphs, line graphs, composite graphs, flow diagrams, other texts and audio/visual resources

4.17 A student evaluates the relevance of data and information.

4/5.17 Students learn about processing information. Students learn to:

4.17a collate information from a number of sources

4.17b distinguish between relevant and irrelevant information

4.17f identify trends, patterns, relationships and contradictions in data and information.

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Indicative time

This unit has been written to take approximately 15 hours. Each part should take approximately 5 hours.

Your teacher may suggest a different way to organise your time as you move through the unit.

Resources

Internet access is important for further information about elements and compounds.

Go to the website: http://www.cli.nsw.edu.au/Kto12. Select Science, then Stage 4 Junior Science, and follow the links to Elements, compounds and graphs.

Part 1: Elements

- copper, magnesium and zinc
- a ‘lead’ pencil (properly called a graphite pencil)
- some aluminium foil from the kitchen
- an iron nail (not galvanised, that is, coated with zinc or cadmium)
- three wires with alligator clips, battery holder, lamp, lamp socket and battery clip
- two ‘AA’ batteries
- steel wool or wet and dry paper or fine sand paper.

Part 2: Compounds

- bicarbonate of soda (baking soda or sodium hydrogen carbonate)
- vinegar (approximately 5% solution of acetic acid)
- a clean teaspoon
- a beaker
- matches
- 1 test tube
- a spirit burner (or Bunsen burner)
- a test tube holder
- copper carbonate
- safety goggles
• a mat or dish to go under your spirit burner and in case your test tube breaks
• a plastic teaspoon
• washing soda (sodium carbonate)
• 2 teaspoons
• lemon juice
• 4 test tubes
• a beaker to rest the test tubes in
• a screw-top jar containing limewater (made by adding half a teaspoon of calcium hydroxide, almost completely filling the jar with water, shaking and leaving for at least one day). Be careful not to shake the bottle. Leave the white solid at the bottom of the jar.

Part 3: Graphs
• ruler
• pencil
• protractor.
Icons

Here is an explanation of the icons used in this unit.

Write a response or responses as part of an activity. An answer is provided so that you can check your progress.

Compare your response for an activity with the one in the suggested answers section.

Complete an exercise in the exercises section that will be returned to your teacher.

Think about information or ideas, a question or problem. You need to pause and reflect. You may need to make notes.

Perform a practical task or investigation.

Stop and consider the risks to safety for yourself and others.

Access the Internet to complete a task or to look at suggested websites.
Glossary

The following words, listed here with their meanings, are found in the learning material in this unit.

alkane  compound with the formula \( C_nH_{2n+2} \); main part of the mixture, petroleum; a hydrocarbon that contains carbon and hydrogen

atmosphere  layer of a mixture of gases around the Earth

atom  smallest particle in a chemical that can take part in a chemical reaction

biosphere  part of the Earth’s atmosphere where life exists

brittle  something that breaks into pieces when you try to bend it

chemical property  property of matter; behaviour with other chemicals such as oxygen, water or acid.

column graph  graph using separate columns to compare quantities

composite graph  graph that displays complex data or makes comparisons of large quantities of data; often a combination of two types of graph

compound  pure substance that contains at least two different types of atoms joined together; heat is usually lost or gained when a compound is formed

conductor  material that allows the passage of electricity or heat

dependent variable  responding variable that changes as the independent variable is changed; usually plotted on the (vertical) y-axis of a graph

divided bar graph  graph that shows proportions of a whole; looks like rectangle divided into parts

ductile  property of matter; easily drawn into a wire shape

element  pure substance that contains only one type of atom

extrapolation  prediction beyond the plotted points of a graph

histogram  graph consisting of touching columns representing a frequency distribution

hydrocarbon  compound of hydrogen and carbon only

hydrosphere  part of the Earth's crust where water is found

independent variable  manipulated variable that is changed in an investigation; usually plotted on the (horizontal) x-axis of a graph

interpolation  prediction of a missing point between plotted points on a graph

line of best fit  straight line or smooth curved line drawn to minimise the distance between plotted graph points and the line

lithosphere  outer layer of the Earth; solid rocks of the Earth’s crust and the solid upper mantle

malleable  property of matter; easily hammered into shape

Material Safety Data Sheet (MSDS)  document providing risk and safety information for a chemical (normally an element or compound)
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>metal</td>
<td>element which has most of these properties: can be made to shine, is malleable and ductile and is a good conductor of electricity</td>
</tr>
<tr>
<td>mixture</td>
<td>mix of elements and/or compounds; has a range of properties depending on its components and their proportions; usually no heat is lost or gained when mixtures form (except solutions)</td>
</tr>
<tr>
<td>molecule</td>
<td>two or more atoms joined together into a particle</td>
</tr>
<tr>
<td>non-conductor</td>
<td>substance that does not allow passage of electricity or heat</td>
</tr>
<tr>
<td>non-metal</td>
<td>element which has most of these properties: is dull, brittle and does not conduct electricity</td>
</tr>
<tr>
<td>non-renewable</td>
<td>a resource that once used is lost forever, e.g. coal</td>
</tr>
<tr>
<td>petrochemical</td>
<td>chemical compound obtained from petroleum</td>
</tr>
<tr>
<td>physical property</td>
<td>property of a substance that can be observed without permanently changing the substance</td>
</tr>
<tr>
<td>pie graph</td>
<td>a graph that shows proportions of a whole; circle showing parts like slices of a round pie</td>
</tr>
<tr>
<td>pure substance</td>
<td>chemical with fixed properties; element or compound</td>
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<tr>
<td>renewable</td>
<td>resource that can be used over and over again, many times, e.g. wind</td>
</tr>
<tr>
<td>scattergram</td>
<td>plot of data on a graph that shows each data point, usually as a cross (X)</td>
</tr>
<tr>
<td>sector graph</td>
<td>circle showing parts as sectors of the circle; pie graph</td>
</tr>
<tr>
<td>symbol</td>
<td>sign which represents something</td>
</tr>
<tr>
<td>timeline</td>
<td>line that shows order in time for events</td>
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</table>