

Learning Unit	
<b>Subject</b>	Chemical Reactions
<b>Title</b>	Molecular Models
<b>Authors</b>	Alexandra Jales
<b>School</b>	FORAVE – ASSOCIAÇÃO PARA A EDUCAÇÃO TECNOLÓGICA DO VALE DO AVE
<b>Description of the unit</b>	Molecular models are used to represent organic molecules in order to make it easier for students to understand the covalent bonds between atoms and to improve spatial vision.
<b>Contents</b>	<p><b>Molecular Models</b></p> <ul style="list-style-type: none"> <li>• Elementary substances</li> <li>• Compound substance</li> </ul>
<b>Learning Outcomes / Skills</b>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Construct molecular models of elementary substances and compound substances.</li> <li>• Describe the composition of atoms, recognizing that atoms with the same number of protons belong to the same chemical element and are represented by a chemical symbol.</li> </ul>
<b>Target students/class</b>	Secondary school secundário (15 – 17 years old)
<b>Prerequisites</b>	<p>Students should be able to:</p> <ul style="list-style-type: none"> <li>• Identify different chemical elements</li> <li>• Distinguish between elementary and compound substances</li> <li>• Recognize molecules</li> </ul>
<b>Time expected</b>	2 hours
<b>Interdisciplinary links</b>	--
<b>Methodology</b>	Explanation of contents and carrying out laboratory activities.
<b>Human Resources (internal and/or external)</b>	Physics and Chemistry Teacher



Learning Unit	
<b>Resources</b>	<ul style="list-style-type: none"> <li>●Molecular models</li> <li>●Writing Materials</li> </ul>
<b>Lesson Plan</b>	<p><b><u>1st Lesson:</u></b></p> <p><b>Summary:</b> Elementary and compound substances. Molecular models and their usefulness.</p> <p>With students organised into groups, present the following motivating questions: - <b>What are elementary substances and compound substances?</b></p> <p>After a brief moment of reflection on the question, the teacher should ask for answers, moderate the students' interventions and their discussion, systematising the main ideas.</p> <p>Conclude with the students that elementary substances are substances whose structural units are made up of a single type of atom, i.e. atoms of a single element. They can be made up of single atoms or atoms organized into giant structures or molecules.</p> <p>Compound substances are substances whose structural units are made up of more than one type of atom, i.e. atoms from two or more elements.</p> <p>Ask students to discuss the meaning of a chemical element, based on the composition of atoms.</p> <p>Conclude with the students that atoms are made up of protons, neutrons and electrons. Atoms of the same type, i.e. atoms of the same chemical element, have the same number of protons.</p> <p>Point out that chemical elements are represented by chemical symbols. Currently, there are 118 known chemical elements.</p> <p>Provide students with molecular models so that they can interact with them and become familiar with them. Point out that given the small size of atoms and molecules, we can't observe them directly. We will therefore use models to represent them, using spheres of different colors and sizes to represent atoms and groups of spheres to represent molecules.</p> <p><b><u>2nd Lesson:</u></b></p> <p><b>Summary:</b> Carrying out a practical activity with molecular models.</p>



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	<p>With the students organized into groups, provide the activity guide sheet, which consists of building molecular models that represent some molecules, taking into account their constitution.</p>
<b>21st Century Skills</b>	<p>Critical thinking: students will be able to analyse data during practical experiments and communicate their conclusions.</p> <p>Collaboration: students will be able to collaborate within their groups and with others and help each other understand the content and experimental activities.</p> <p>Communication: Students should be able to share conclusions and doubts with their classmates and teacher.</p> <p>Information research: Students are asked to gather information from various sources.</p> <p>Media and technological proficiency: students will be able to use online sources to clarify doubts.</p>
<b>Assessment</b>	<p><b>Class observation:</b></p> <ul style="list-style-type: none"> <li>● Laboratory work observation grid.</li> <li>● Quality of oral participation.</li> <li>● Participation in the activities.</li> <li>● Interest, commitment, sociality.</li> <li>● Behaviour</li> </ul>
<b>Remarks</b>	--



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<b>Date</b>	

## 1. Theoretical framework

Molecular models are systems of three-dimensional representation of chemical entities (molecules) by means of spheres, rods and other elements of different colours that are connected to each other.

## 2. Goals

To build molecular models that represent some molecules, taking into account their constitution.

To distinguish between elementary and compound substances.

## 3. Materials

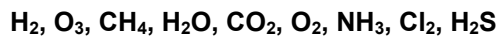
Teaching molecular models. The number of beads required is shown in the following table.

atoms	Colour of the spheres	Number of shperes
Oxygen	Red	8
Nitrogen	Blue	1
Chlorine	Green	2
Sulphur	Yellow	1
Carbon	Black	2
Hydrogen	White	13

## 1. Planning and execution



1.1 Build molecular models to represent the following molecules:



1.2. Build models of two other molecules of your choice (one elementary and one compound) and ask a classmate to write down the chemical formula corresponding to these molecules.

1.3. Then swap with your classmate and write down the chemical formulas of the molecular models he or she has built.

## 2. Analysis and discussion

2.2. How useful are molecular models?

2.3. Name some limitations that may result from the analysis of these models.

