

Building Molecular Models

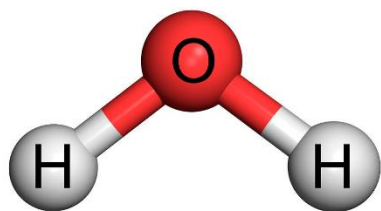
(adapted from Nelson Science Perspectives 9 Section 7.4 – Making Molecular Models)

Chemical formulas of molecules tell us how many atoms of each element there are in a molecule, but they do not convey any sense of the three-dimensional shapes of molecules. In this activity, you will use a molecular model set to build models of these shapes. Most elements form a fixed number of bonds – no more and no fewer. This number of connections is called their **combining capacity**. For example, a carbon atom forms four bonds, and a hydrogen atom forms one bond. The number of bonds formed depends on the number of valence electrons present and how many are required to either fill or empty a valence shell. The table below shows the combining capacity for the different elements:

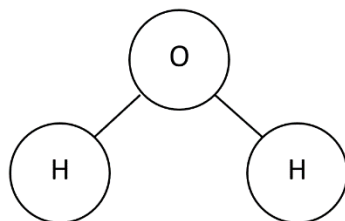
Element	Symbol	Combining Capacity
Hydrogen	H	1
Chlorine	Cl	1
Oxygen	O	2
Sulfur	S	2
Nitrogen	N	3
Carbon	C	4

Models of molecules can also be drawn as structural diagrams. In a structural diagram, chemical bonds are shown by a short straight line and the atoms are indicated by symbol names. When placing atoms around a central atom, they are placed evenly spaced around the central atom. See below. If the molecule is bent (Like H₂O), the drawing should be bent. Each connection must be represented by a straight line.

Molecular Model (3D)



Structural Diagram



Purpose: To build three dimensional models of common molecules.

Equipment and Materials:

- 1 Molecular Model Kit

Procedure:

1. Use the molecular model kits to build a model of each combination of elements listed in the table on the next page. You may have to use more than one atom of each type. Count to make sure that each atom in your model contains the correct number of bonds.

In the kits you are using:

Element	Color	Number of Holes
Hydrogen	White	1
Chlorine	Green	1
Oxygen	Red	2
Sulfur	Red	2
Nitrogen*	Tan/Blue	3
Carbon	Black	4

* Nitrogen - there are not many of these so you will need to share these with each other

Hint: The number of holes in the atom illustrates the combining capacity of the molecule

2. Complete the table below (the first row is done for you):
 - a) Count the number of atoms for each element in your model. Write a chemical formula for the molecule in the corresponding column of your table below.
 - b) Draw a structural diagram for each molecule that you build.
 - c) Look up/find the chemical name and the common name of each molecule and record it in the table.
 - d) Identify the common use of each molecule and list it in the table.
3. Upon completion of the table, answer the following questions:
 - a) Why do you think chemists find making models of molecules useful?
 - b) Usually the more connections a molecule has between atoms the stronger the overall bond is. Which molecule that you built had the strongest bond? Why?

Table: Building Models of Molecules

Element 1	Element 2	Element 3	Structural Diagram	Chemical Formula	Chemical Name	Common Name	Common Usage
O	O	-	O=O	O ₂	Dioxygen	Oxygen	Cutting metal with torches
H	O	-					
N	H	-					
H	Cl	-					
C	O	-					
C	Cl	-					
H	S	-					

Element 1	Element 2	Element 3	Structural Diagram	Chemical Formula	Chemical Name	Common Name	Common Usage
C	H	-					
C	H	-		C ₃ H ₈			
C	H	-		C ₂ H ₄			
C	H	-		C ₂ H ₂			
H	C	N		HCN			
H	C	O		H ₂ CO			
C	H	O		CH ₃ OH			
C	H	O		CH ₃ CH ₂ OH			