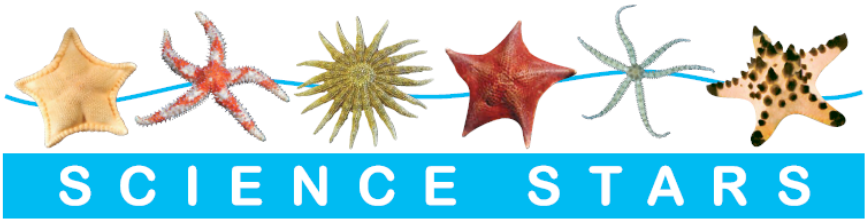
AQUARIUM OF THE PACIFIC®



Science Stars: 5th grade Lesson Plan

Lego Molecules

Standards

1.b. Students know all matter is made of atoms, which may combine to form molecules.

d. Students know that each element is made of one kind of atom and that the elements are organized in the periodic table by their chemical properties.

Suggested Time Allotment: 45 minutes
Pressed for time: 20 minutes

Introduce chemical formulas of common compounds, model how to build molecules, explain how to complete the worksheet, and have LEGOS available to students for to investigate independently.

Anticipatory set (engage):

What are all these things listed on the Periodic Table? What's the smallest piece of an element? Can you have an atom of pizza? Can you have an atom of gold? What happens when different kinds of atoms come together?

Objective:

Students use chemical formulas for common compounds to experiment with how atoms come together to make molecules with unique properties and characteristics.

Materials:

LEGOS – Blue, yellow, red, black, white, and green
(HINT: use ONLY one size of LEGO to represent one atom.)
Periodic table of Elements for reference
Molecules and Compounds worksheet

Prep:

Using the chemical formulas as a guide, prepare the correct number of LEGOS for each group to create their assigned molecule. Include one green and one white LEGO so each group can create a salt (NaCl) molecule and an extra yellow and 2 extra red LEGOS so they can create a carbon dioxide (CO_2) molecule.

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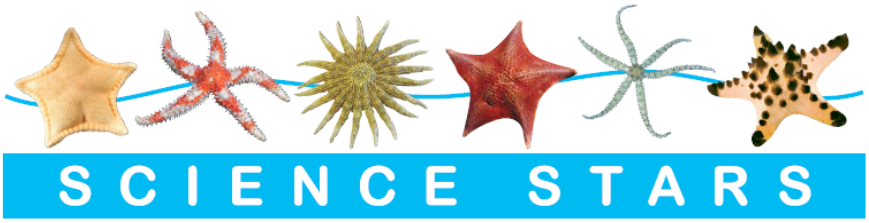

Background:
A chemical compound is a combination of two or more different elements that are bonded together and take on new physical and chemical properties from the individual elements. For example, rust is a chemical compound of iron and oxygen. Similar to how scientists write a chemical symbol for a single element, compounds are written as chemical formulas. A chemical formula identifies each element by its chemical symbol and indicates the number of atoms of each element in that compound. If a molecule of a certain compound contains more than one atom of a particular element, this quantity is indicated using a subscript number after the chemical symbol. For example, the chemical formula for rust (or iron oxide) is Fe_2O_3; which is made up of 2 atoms of iron (Fe) and 3 atoms of oxygen (O). When elements join to form compounds, they lose their original properties and take on new ones. Once combined into iron oxide, the individual iron (which is shiny) and oxygen (which is a gas) molecules lose their original properties and take on new ones; thus creating a new compound called rust (which is a fragile, dull, solid compound).

Vocab:
- Chemical formula
- Compound
- Molecule
- Atom
- Periodic Table

Modeling 1:
1. Model how to make a compound by using salt as an example.
2. Find the chemical formula for salt on the *Molecules and Compounds* worksheet.
3. Using the periodic table of elements, locate Na and Cl. Explain that using the chemical formula as a guide, we know that a salt molecule is made of one sodium atom (Na) and one chlorine atom (Cl)
4. Create a salt molecule by putting 1 green and 1 white LEGO together.
   (*At this point in the learning process, students don't need to worry about how the LEGOS are put together. They can be stacked together in any arrangement.)*
5. Model how to identify the atoms within a more complex molecule like emerald ($Be_3Al_2SiO_6$) using the periodic table to determine the type and number of atoms are in an emerald molecule. (3 Beryllium, 2 Aluminum, 1 Silicon, and 6 oxygen for a total of 12 atoms.)
6. If needed, have students create another simple molecule such as carbon dioxide (CO_2)
7. Model how to complete the first box on the worksheet.

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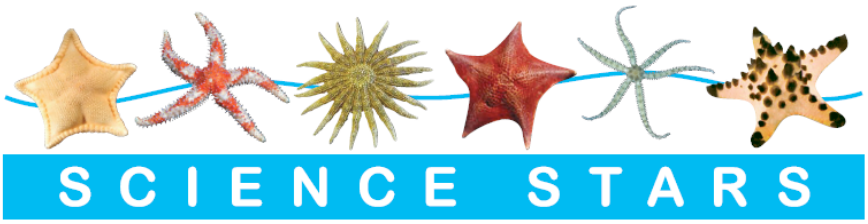


Guided Practice 1:

1. Working in pairs, students will assemble a unique molecule using the appropriate LEGOS, the name of the molecule, and its chemical formula.
2. Have the students fill in the blanks in the first box of the worksheet. List the compound's name, its chemical formula, and how many of each type of atom.

Check for understanding:
Check student's work to make sure they have correctly counted the atoms for each molecule. What type of atom is the blue LEGO? How did you know how many to put together for your molecule? What elements make up sugar? How are sugar and vitamin C similar? How are they different?

Modeling 2:

1. Model how to determine the identity of a mystery molecule by counting and identifying the atoms.
2. Model how to complete the second box of the worksheet by counting atoms, writing out the chemical formula, and finding the name of the compound.

Guided Practice 2:

1. Students will swap molecules with neighboring groups and identify the "mystery molecule."
2. After carefully counting atoms, they should correctly identify the new compound.

Check for understanding:
How many atoms make up an aspirin molecule? If you took away a hydrogen atom would you still have the same compound?

Independent practice: *Have students "collect" compounds and elements that they find in everyday life in a "Molecule and Atom Book." For each entry in the journal, students can record information such as atomic number, symbol, chemical formula, where it's found, and a drawing.*

Molecules and Compounds Worksheet

Atoms - Building Blocks Color Chart

Hydrogen (H)	Blue
Carbon (C)	Yellow
Oxygen (O)	Red
Nitrogen (N)	Black
Sodium (Na)	White
Chlorine (Cl)	Green

Chemical Formula of Common Compounds

Sand	SiO_2	Aspirin	$C_9H_8O_4$
Sugar	$C_6H_{12}O_6$	Advil	$C_{13}H_{18}O_2$
Rust	FeO_3	Baking Soda	$NaHCO_3$
Gasoline	C_8H_{18}	Ruby	Al_2O_3
Salt	$NaCl$	Emerald	$Be_3Al_2SiO_6$
Water	H_2O	Caffeine	$C_8H_{10}N_4O_2$
Vitamin C	$C_6H_8O_6$	Peppermint	$C_{10}H_7O$

My compound is _____, and the chemical formula is _____.

Count the atoms in one molecule

H atoms	C atoms	O atoms	N atoms	Na atoms

How many atoms are in one molecule of your compound? _____

Now to determine the identity of a mystery compound, we must count the number and types of atoms in a molecule.

Count the atoms in one molecule

H atoms	C atoms	O atoms	N atoms	Na atoms

How many atoms are in one molecule of your compound? _____

The chemical formula of the mystery compound is _____,

which means it can only be _____.

If you take away any atom from one of the molecules, will it still be the same compound?

Yes / No

Element:

Symbol:

Atomic Number:

Group:

Where it's found:

(Don't forget to include a picture)

Element:

Symbol:

Atomic Number:

Group:

Where it's found:

(Don't forget to include a picture)

Compound:

Formula:

Made of:

Where it's used:

(Don't forget to include a picture)

Compound:

Formula:

Made of:

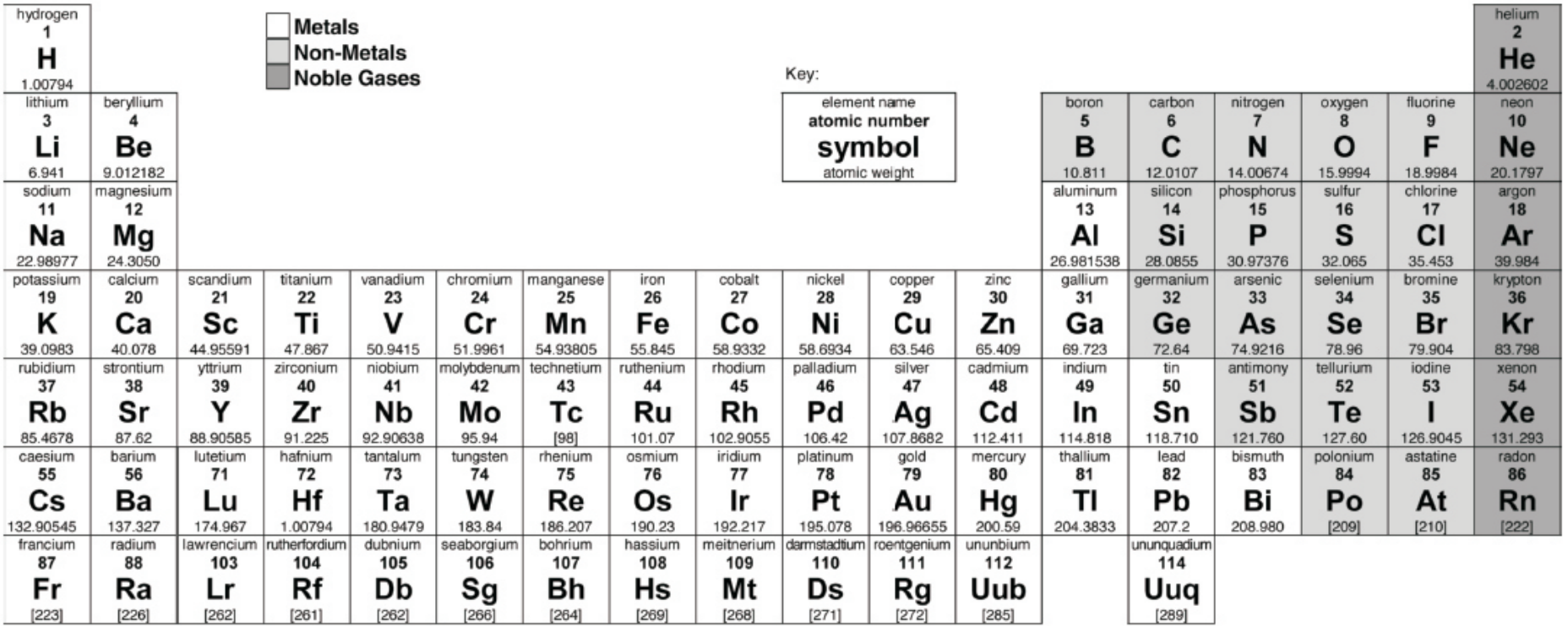
Where it's used:

(Don't forget to include a picture)

Elements and the Periodic Table

Pages for Atoms & Molecules Book

Periodic Table of the Elements



Notes: Elements with atomic weights in square brackets have no stable isotopes. Different sources list different atomic weights for elements. The difference arises from the differing atomic weights of various isotopes. We have tried to list the most stable isotope. For example, some sources list the atomic weight of seaborgium as 263 and others 266. The most stable isotope appears have an atomic weight of 266 so we list that weight here. Roentgenium is still the unofficial name of element 111 but it is the one recommended by the IUPAC so we list it here instead of the generic 'ununnium'. Aluminum, cesium, and sulfur are the American spellings for aluminium, caesium, and sulphur.
This table was downloaded from http://www.science-teachers.com/printable_periodic_tables.htm.

Molecules and Compounds Worksheet

Atoms - Building Blocks Color Chart

Hydrogen (H)	Blue
Carbon (C)	Yellow
Oxygen (O)	Red
Nitrogen (N)	Black
Sodium (Na)	White
Chlorine (Cl)	Green

Chemical Formula of Common Compounds

Sand	SiO_2	Aspirin	$C_9H_8O_4$
Sugar	$C_6H_{12}O_6$	Advil	$C_{13}H_{18}O_2$
Rust	FeO_3	Baking Soda	$NaHCO_3$
Gasoline	C_8H_{18}	Ruby	Al_2O_3
Salt	NaCl	Emerald	$Be_3Al_2SiO_6$
Water	H_2O	Caffeine	$C_8H_{10}N_4O_2$
Vitamin C	$C_6H_8O_6$	Peppermint	$C_{10}H_7O$

My compound is Baking Soda, and the chemical formula is $NaHCO_3$.

Count the atoms in one molecule

H atoms	C atoms	O atoms	N atoms	Na atoms
1	1	3	0	1

How many atoms are in one molecule of your compound? 6

Now to determine the identity of a mystery compound, we must count the number and types of atoms in a molecule.

Count the atoms in one molecule

H atoms	C atoms	O atoms	N atoms	Na atoms
7	10	1	0	0

How many atoms are in one molecule of your compound? 18

The chemical formula of the mystery compound is $C_{10}H_70$,

which means it can only be Peppermint.

If you take away any atom from one of the molecules, will it still be the same compound?

Yes / (No)

Element: Neon

Symbol: Ne

Atomic Number: 10

Group: noble gas

Where it's found:

Las Vegas, signs

(Don't forget to include a picture)

Element: Gold

Symbol: Au

Atomic Number: 79

Group: metal

Where it's found:

coins, jewelry

(Don't forget to include a picture)

Compound: water

Formula: H_20

Made of: hydrogen, oxygen

Where it's used:

drinking, washing, cooking

(Don't forget to include a picture)

Compound: Vitamin C

Formula: $C_6H_80_6$

Made of: carbon, hydrogen, oxygen

Where it's used:

oranges, vitamins

(Don't forget to include a picture)