

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 (CO₂) molecule.

Background:

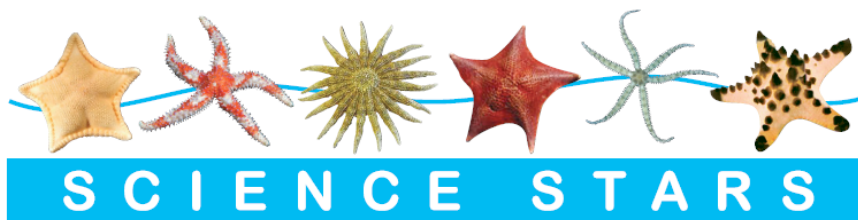
A chemical compound is a combination of two or more different elements that are bonded together and take on new physical and chemical properties from the individual elements. For example, rust is a chemical compound of iron and oxygen. Similar to how scientists write a chemical symbol for a single element, 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 ($\text{Be}_3\text{Al}_2\text{SiO}_6$) 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.



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

Sand	SiO_2	Aspirin	$\text{C}_9\text{H}_8\text{O}_4$
Sugar	$\text{C}_6\text{H}_{12}\text{O}_6$	Advil	$\text{C}_{13}\text{H}_{18}\text{O}_2$
Rust	FeO_3	Baking Soda	NaHCO_3
Gasoline	C_8H_{18}	Ruby	Al_2O_3
Salt	NaCl	Emerald	$\text{Be}_3\text{Al}_2\text{SiO}_6$
Water	H_2O	Caffeine	$\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2$
Vitamin C	$\text{C}_6\text{H}_8\text{O}_6$	Peppermint	$\text{C}_{10}\text{H}_7\text{O}$

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)

Compound:

Formula:

Made of:

Where it's used:

(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)

Periodic Table of the Elements

		<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Metals</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Non-Metals</div> <div style="border: 1px solid black; padding: 2px; margin: 2px;">Noble Gases</div> </div>															
		<div style="border: 1px solid black; padding: 2px; margin: 2px; display: flex; justify-content: space-between;"> element name atomic number </div> <div style="border: 1px solid black; padding: 2px; margin: 2px; display: flex; justify-content: space-between;"> symbol atomic weight </div>															
hydrogen 1 H 1.00794	helium 2 He 4.002602																
lithium 3 Li 6.941	beryllium 4 Be 9.012182																
sodium 11 Na 22.98977	magnesium 12 Mg 24.3050																
potassium 19 K 39.0983	calcium 20 Ca 40.078	scandium 21 Sc 44.95591	titanium 22 Ti 47.867	vanadium 23 V 50.9415	chromium 24 Cr 51.9961	manganese 25 Mn 54.93805	iron 26 Fe 55.845	cobalt 27 Co 58.9332	nickel 28 Ni 58.6934	copper 29 Cu 63.546	zinc 30 Zn 65.409	boron 5 B 10.811	carbon 6 C 12.0107	nitrogen 7 N 14.00674	oxygen 8 O 15.9994	fluorine 9 F 18.9984	neon 10 Ne 20.1797
rubidium 37 Rb 85.4678	strontium 38 Sr 87.62	yttrium 39 Y 88.90585	zirconium 40 Zr 91.225	niobium 41 Nb 92.90638	molybdenum 42 Mo 95.94	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.9055	palladium 46 Pd 106.42	silver 47 Ag 107.8682	cadmium 48 Cd 112.411	aluminum 13 Al 26.981538	silicon 14 Si 28.0855	phosphorus 15 P 30.97376	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.984
caesium 55 Cs 132.90545	barium 56 Ba 137.327	lutetium 71 Lu 174.967	hafnium 72 Hf 178.49	tantalum 73 Ta 180.9479	tungsten 74 W 183.84	rhenium 75 Re 186.207	osmium 76 Os 190.23	iridium 77 Ir 192.217	platinum 78 Pt 195.078	gold 79 Au 196.96655	mercury 80 Hg 200.59	tin 50 Sn 118.710	antimony 51 Sb 121.760	tellurium 52 Te 127.60	iodine 53 I 126.9045	xenon 54 Xe 131.293	krypton 36 Kr 83.798
francium 87 Fr [223]	radium 88 Ra [226]	lawrencium 103 Lr [262]	rutherfordium 104 Rf [261]	dubnium 105 Db [262]	seaborgium 106 Sg [266]	bohrium 107 Bh [264]	hassium 108 Hs [269]	meitnerium 109 Mt [268]	darmstadtium 110 Ds [271]	roentgenium 111 Rg [272]	unbinium 112 Uub [285]	lead 82 Pb 207.2	bismuth 83 Bi 208.980	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]	unquadium 114 Uuq [289]

lanthanum 57 La 138.9055	cerium 58 Ce 140.116	praseodymium 59 Pr 140.90765	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.964	gadolinium 64 Gd 157.25	terbium 65 Tb 158.9253	dysprosium 66 Dy 162.50	holmium 67 Ho 164.930	erbium 68 Er 167.259	thulium 69 Tm 168.934	ytterbium 70 Yb 173.04
actinium 89 Ac [227]	thorium 90 Th 232.038	protactinium 91 Pa 231.0359	uranium 92 U 238.0289	neptunium 93 Np [237]	plutonium 94 Pu [244]	americium 95 Am [243]	curium 96 Cm [247]	berkelium 97 Bk [247]	californium 98 Cf [251]	einsteinium 99 Es [252]	fermium 100 Fm [257]	mendelevium 101 Md [259]	nobelium 102 No [259]

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 'unununium'. 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

Sand
Sugar
Rust
Gasoline
Salt
Water
Vitamin C

Chemical Formula of Common Compounds

SiO ₂	Aspirin	C ₉ H ₈ O ₄
C ₆ H ₁₂ O ₆	Advil	C ₁₃ H ₁₈ O ₂
FeO ₃	Baking Soda	NaHCO ₃
C ₈ H ₁₈	Ruby	Al ₂ O ₃
NaCl	Emerald	Be ₃ Al ₂ SiO ₆
H ₂ O	Caffeine	C ₈ H ₁₀ N ₄ O ₂
C ₆ H ₈ O ₆	Peppermint	C ₁₀ H ₇ O

My compound is Baking Soda, and the chemical formula is NaHCO₃.

Count the atoms in one molecule

1

H atoms

1

C atoms

3

O atoms

0

N atoms

1

Na atoms

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

7

H atoms

10

C atoms

1

O atoms

0

N atoms

0

Na atoms

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

The chemical formula of the mystery compound is C₁₀H₇O,

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: H₂O

Made of: hydrogen, oxygen

Where it's used:

drinking, washing, cooking

(Don't forget to include a picture)

Compound: Vitamin C

Formula: C₆H₈O₆

Made of: carbon, hydrogen, oxygen

Where it's used:

oranges, vitamins

(Don't forget to include a picture)