Elements, Atoms, and Compounds

The words in this sentence are made out of letters. There are only 26 letters to make words in English.

Everything in this room (desks, pencils, people, air) is made out of elements. There are only 118 elements on Earth.

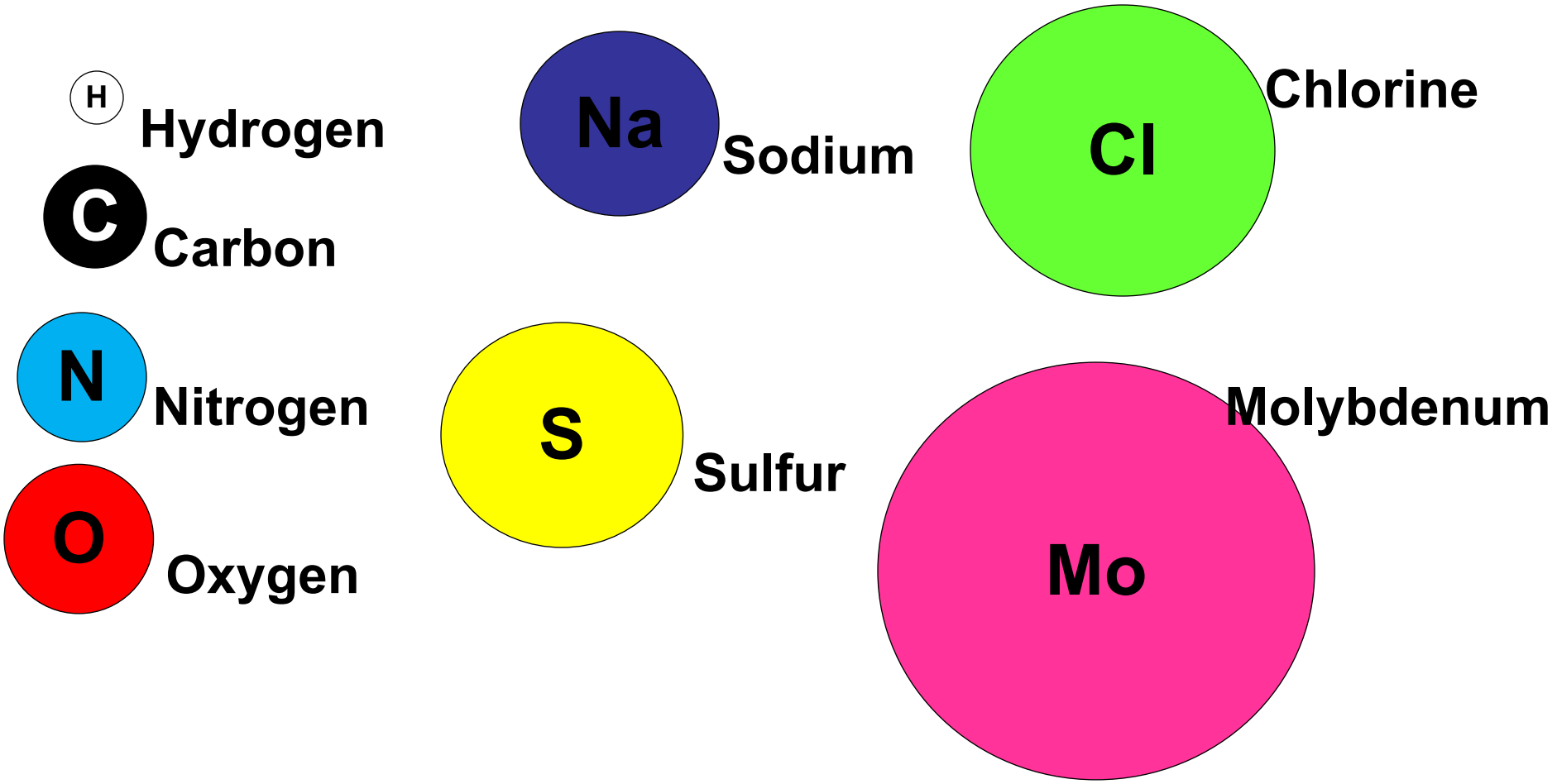
Only a few ingredients can make an infinite amount of recipes.

Question: If a kitchen only had 118 different ingredients (like sugar, salt, flour, eggs, vanilla, carrots), could you make only 118 different recipes?

Answer: No, you could make thousands, millions, billions of recipes (although some might not taste very good). In fact, you could make an infinite number of recipes!

In the same way, our universe only has about 118 different elements. These are stuck together in different combinations and designs to make EVERYTHING in the universe.

Here are some examples of different types of elements



This table shows all the elements in the Universe. It's called the Periodic Table of the Elements, and is the most famous table in chemistry

Everything is made of these different elements – including you!

Yellow Box = **Top 5 Elements** present in the human body
Green Box = **Second 5 Top Elements** present in the human body
Blue Box = **Trace elements that are required** by the human body
Violet Box = **Elements that are deleterious** to the human body.

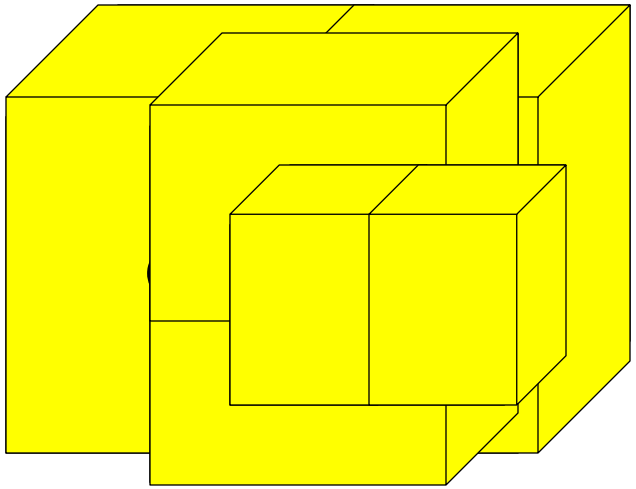
1 H Hydrogen 1.00794																	2 He Helium 4.003
3 Li Lithium 6.941	4 Be Beryllium 9.012182											5 B Boron 10.811	6 C Carbon 12.0107	7 N Nitrogen 14.00674	8 O Oxygen 15.9994	9 F Fluorine 18.9984032	10 Ne Neon 20.1797
11 Na Sodium 22.989770	12 Mg Magnesium 24.3050											13 Al Aluminum 26.981538	14 Si Silicon 28.0855	15 P Phosphorus 30.973761	16 S Sulfur 32.066	17 Cl Chlorine 35.4527	18 Ar Argon 39.948
19 K Potassium 39.0983	20 Ca Calcium 40.078	21 Sc Scandium 44.955910	22 Ti Titanium 47.867	23 V Vanadium 50.9415	24 Cr Chromium 51.9961	25 Mn Manganese 54.938049	26 Fe Iron 55.845	27 Co Cobalt 58.933200	28 Ni Nickel 58.6934	29 Cu Copper 63.546	30 Zn Zinc 65.39	31 Ga Gallium 69.723	32 Ge Germanium 72.61	33 As Arsenic 74.92160	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.80
37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.90585	40 Zr Zirconium 91.224	41 Nb Niobium 92.90638	42 Mo Molybdenum 95.94	43 Tc Technetium (98)	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.90550	46 Pd Palladium 106.42	47 Ag Silver 107.8682	48 Cd Cadmium 112.411	49 In Indium 114.818	50 Sn Tin 118.710	51 Sb Antimony 121.760	52 Te Tellurium 127.60	53 I Iodine 126.90447	54 Xe Xenon 131.29
55 Cs Cesium 132.90545	56 Ba Barium 137.327	57 La Lanthanum 138.9055	72 Hf Hafnium 178.49	73 Ta Tantalum 180.9479	74 W Tungsten 183.84	75 Re Rhenium 186.207	76 Os Osmium 190.23	77 Ir Iridium 192.217	78 Pt Platinum 195.078	79 Au Gold 196.96655	80 Hg Mercury 200.59	81 Tl Thallium 204.3833	82 Pb Lead 207.2	83 Bi Bismuth 208.98038	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)
87 Fr Francium (223)	88 Ra Radium (226)	89 Ac Actinium (227)	104 Rf Rutherfordium (261)	105 Db Dubnium (262)	106 Sg Seaborgium (263)	107 Bh Bohrium (262)	108 Hs Hassium (265)	109 Mt Meitnerium (266)	110 (269)	111 (272)	112 (277)	113	114				

58 Ce Cerium 140.116	59 Pr Praseodymium 140.90765	60 Nd Neodymium 144.24	61 Pm Promethium (145)	62 Sm Samarium 150.36	63 Eu Europium 151.964	64 Gd Gadolinium 157.25	65 Tb Terbium 158.92534	66 Dy Dysprosium 162.50	67 Ho Holmium 164.93032	68 Er Erbium 167.26	69 Tm Thulium 168.93421	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967
90 Th Thorium 232.0381	91 Pa Protactinium 231.03588	92 U Uranium 238.0289	93 Np Neptunium (237)	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (252)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium (259)	103 Lr Lawrencium (262)

The word “atom” comes from a Greek word that means “unable to be cut”

Imagine you had a piece of gold that you then cut in half…

… and you kept on cutting the leftover piece in half…

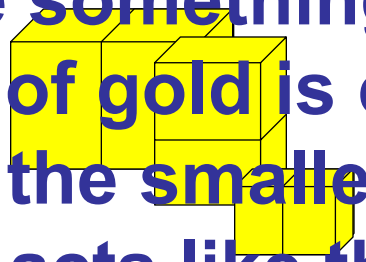


…and then you cut one of these smaller pieces in half…

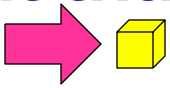
The word “atom” comes from a Greek word that means “unable to be cut”

…and kept going…kept going…

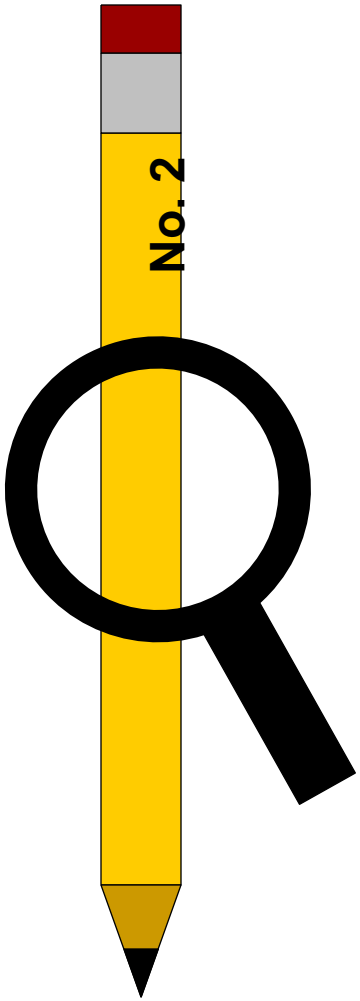
Eventually you would have 1 piece of gold left. If you cut it in half, you wouldn’t have gold any more – you’d have something else. This tiny, tiny single 1 piece of gold is called an atom of gold. An atom is the smallest particle of an element that acts like the element.

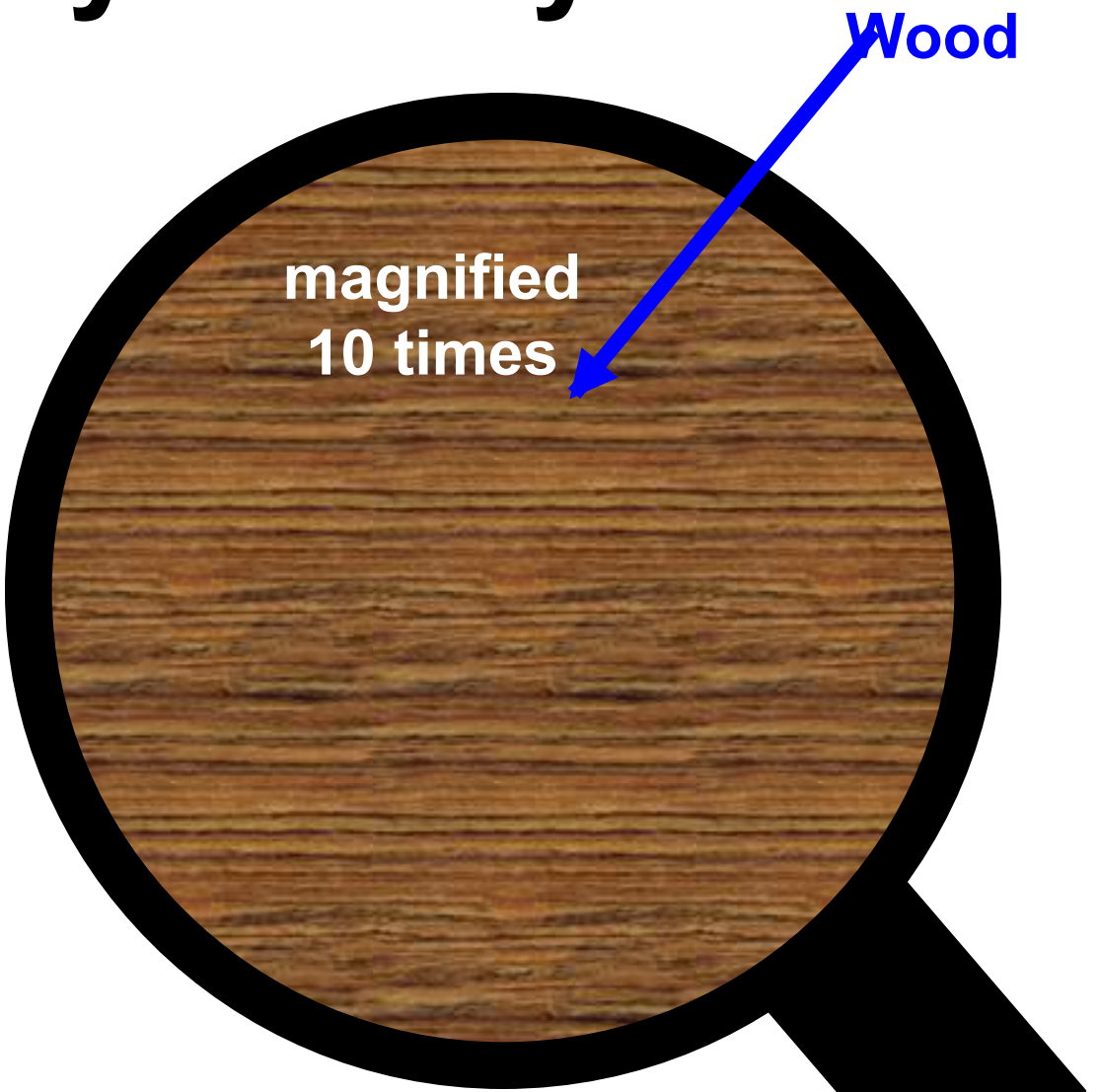


…and kept going…

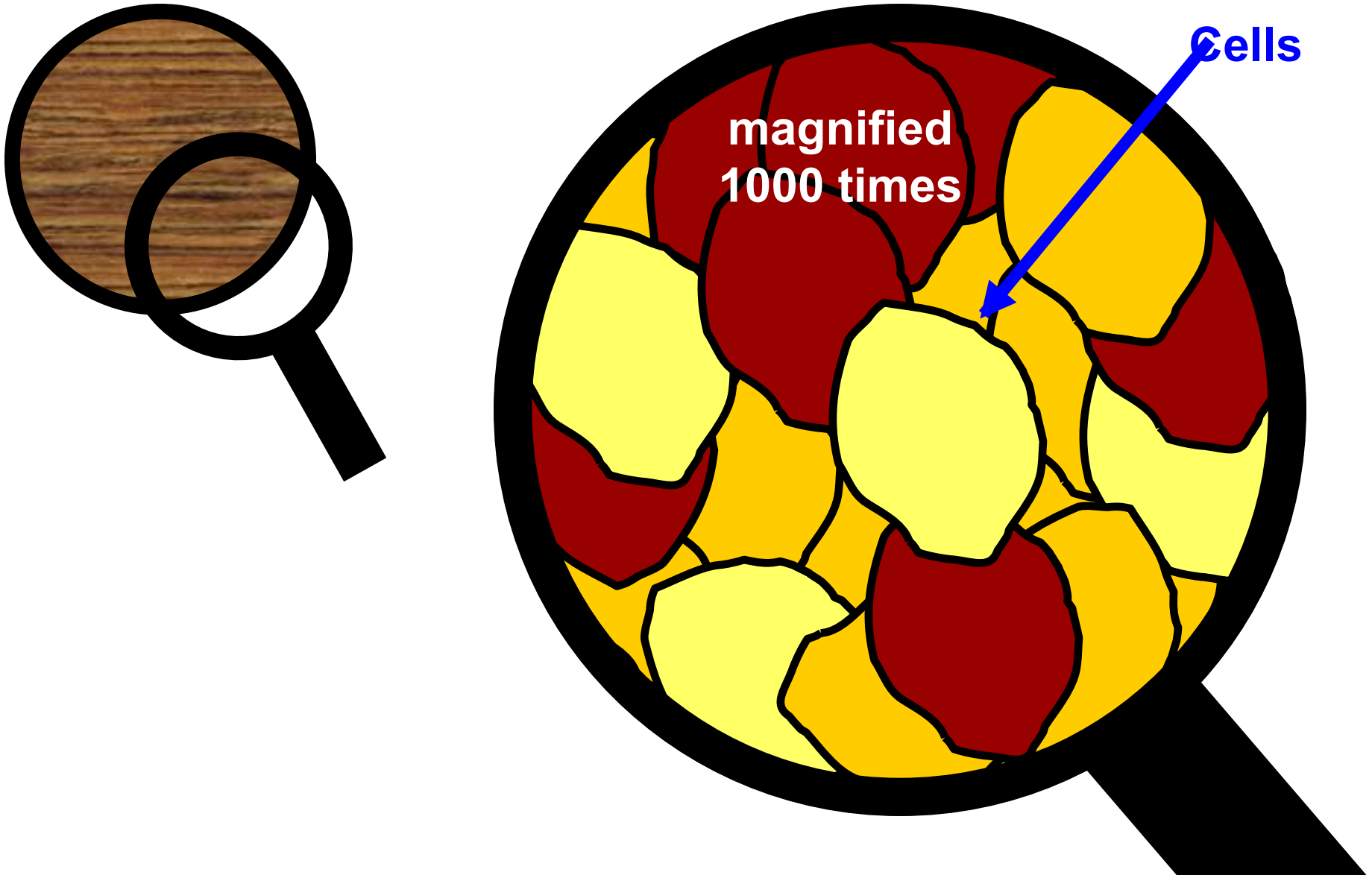
An atom of gold 

To find atoms you need to look very closely…

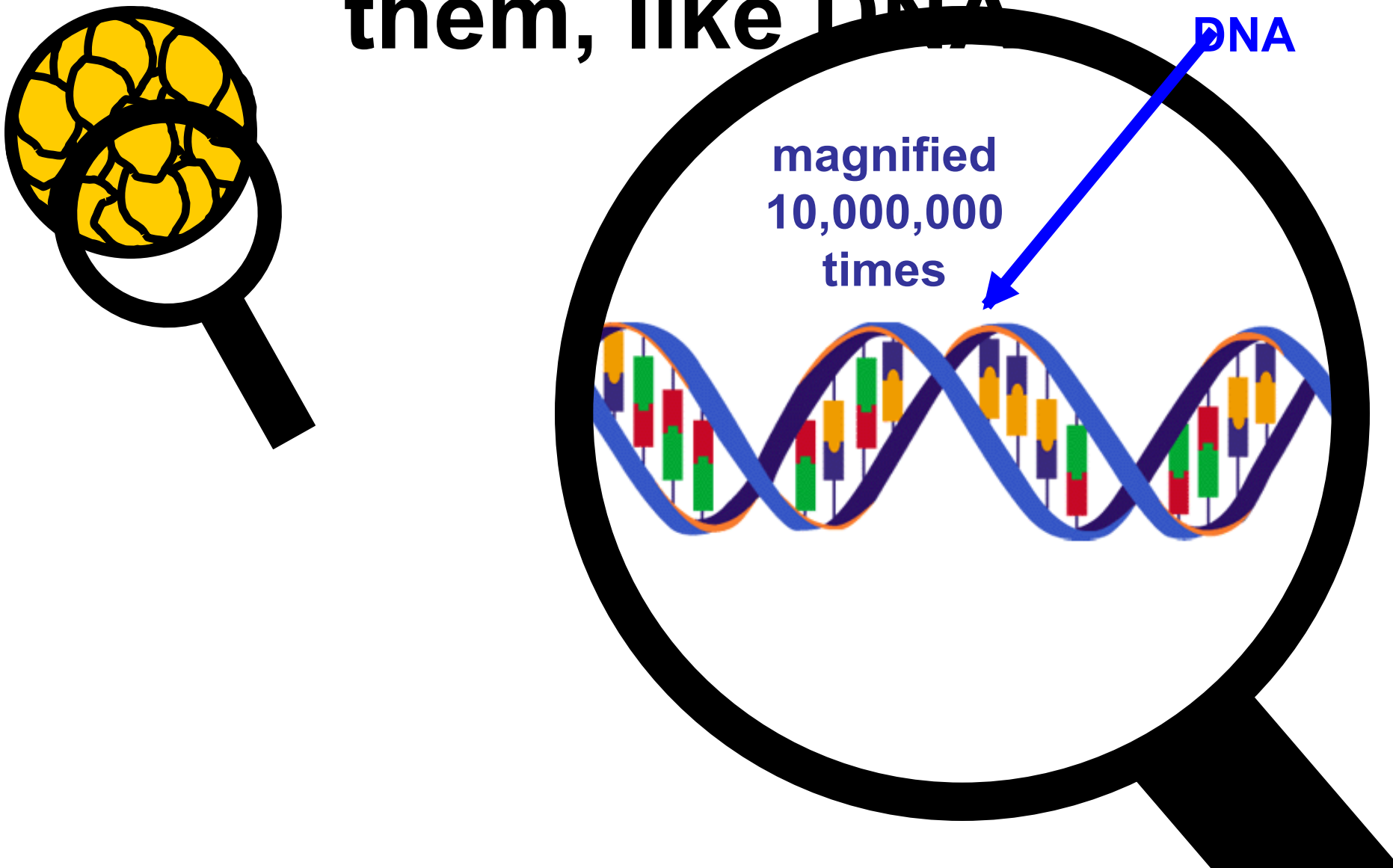




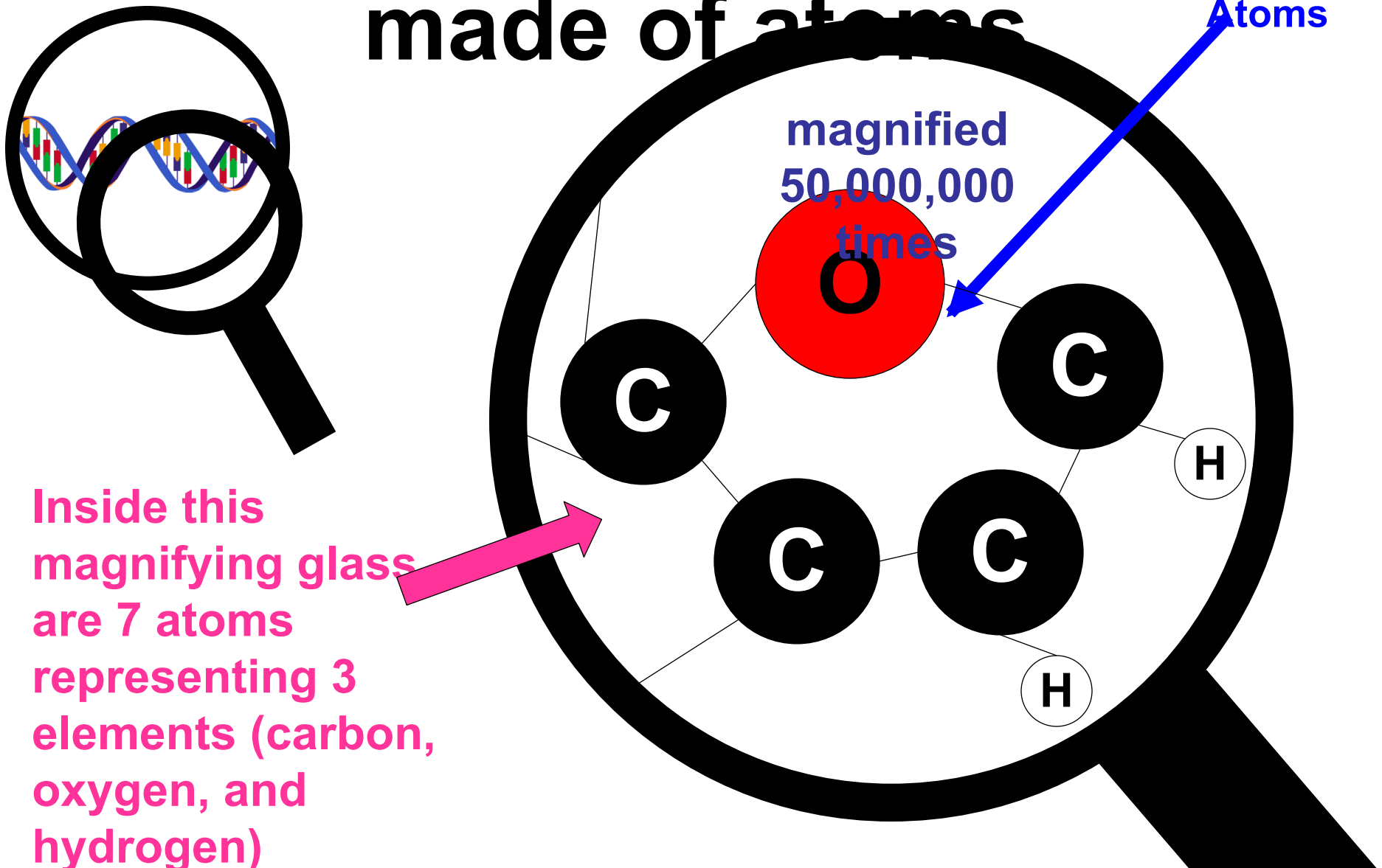
The wood is made of cells



Cells have parts inside them, like DNA

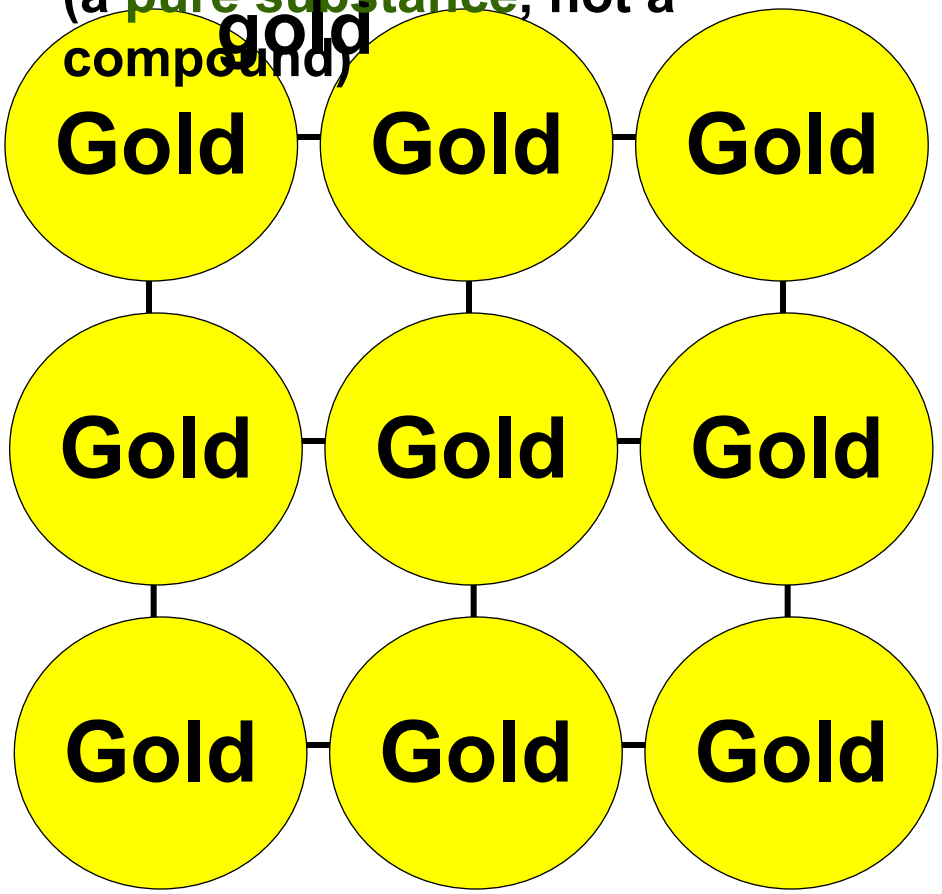


DNA and everything else are made of atoms

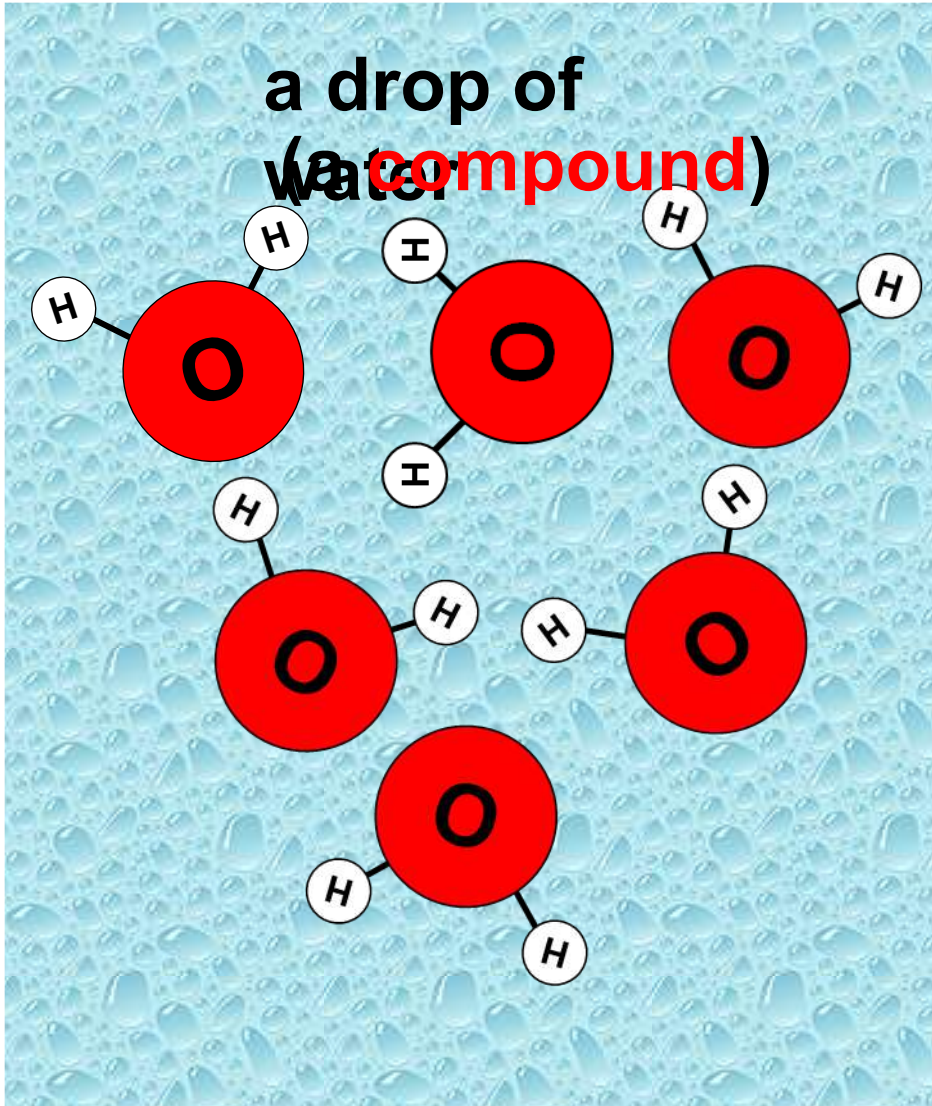


Some chemicals contain more than 1 type of element; these chemicals are called compounds

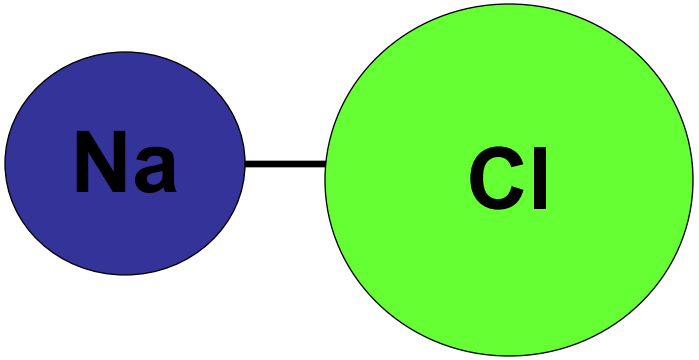
A piece of gold
(a pure substance, not a compound)

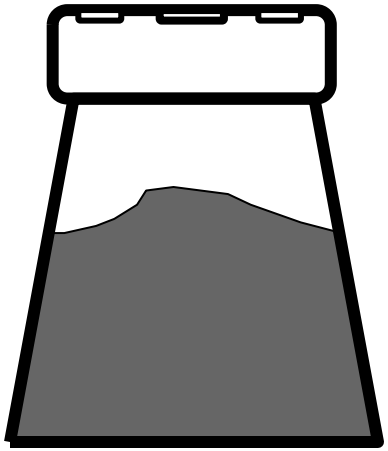


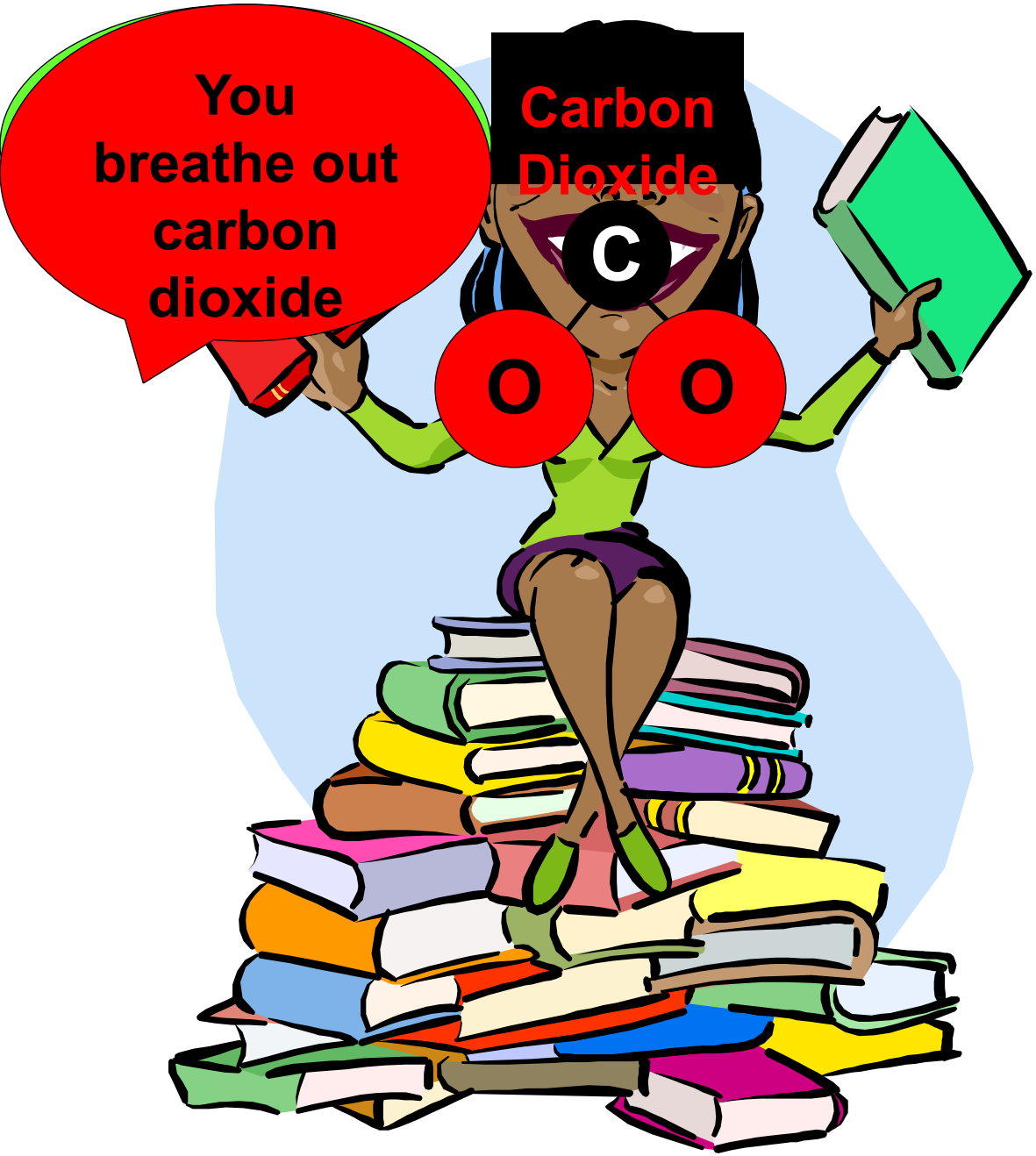
a drop of water
(a compound)



Salt is a compound: it is 1 chlorine atom attached to 1 sodium atom





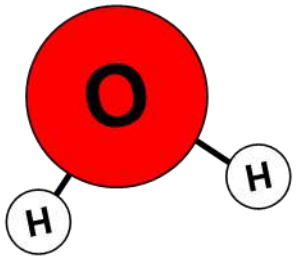


Oxygen

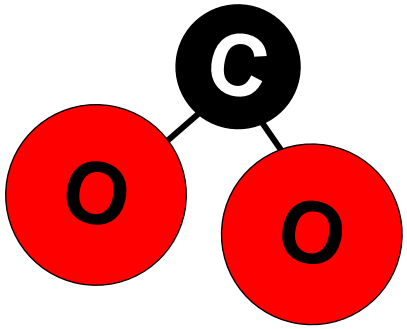
O O

Although some chemical compounds like water, salt, and carbon dioxide are very simple, others are more complicated…

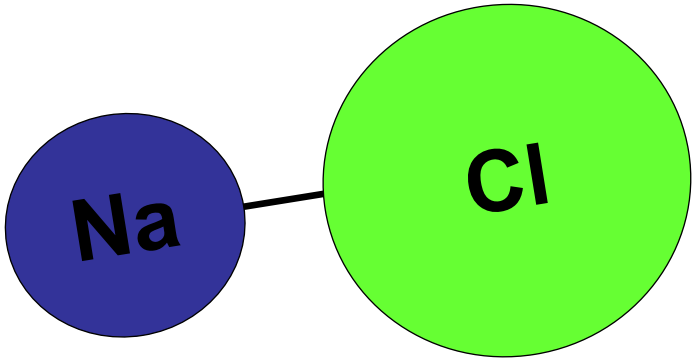
Water
(H_20)



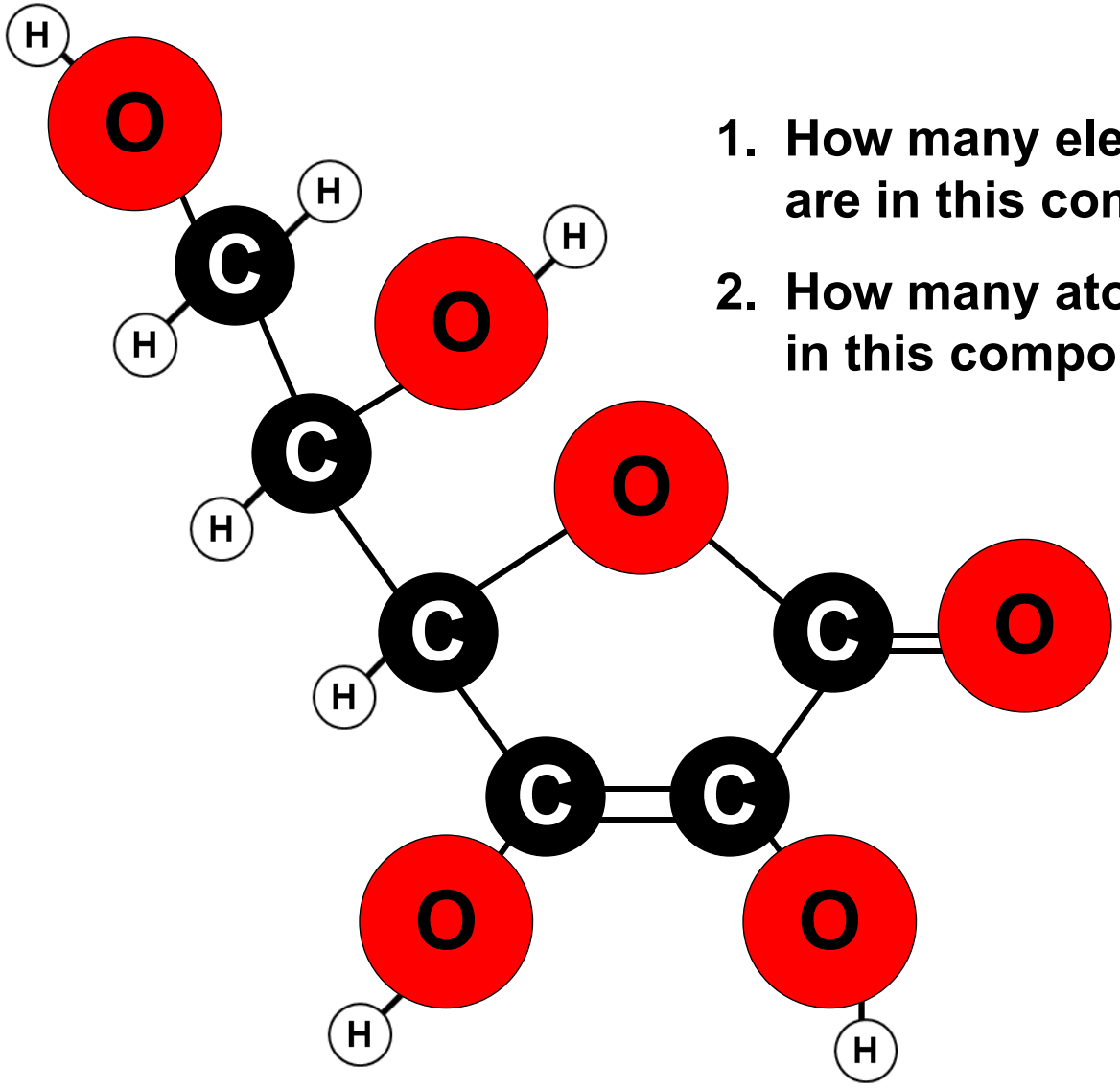
Carbon Dioxide
(CO_2)



Salt
(NaCl)

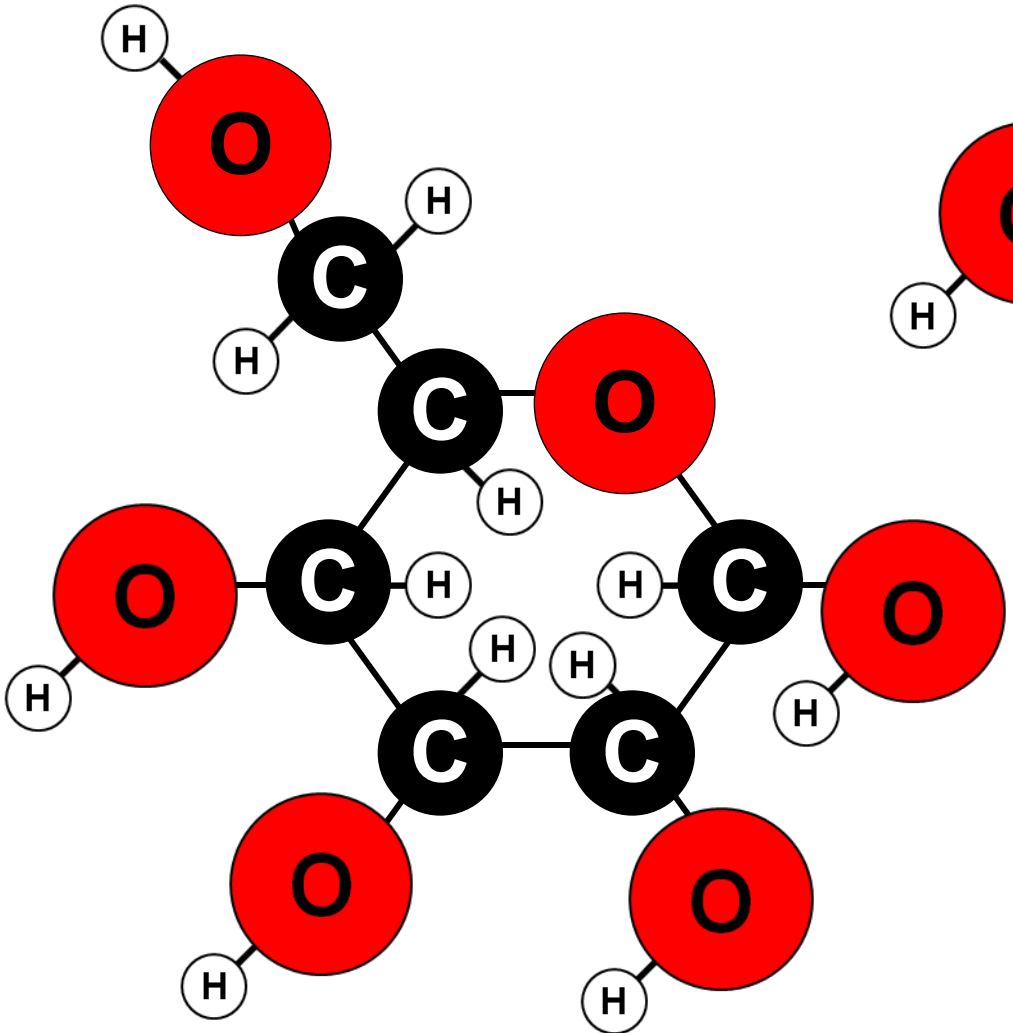


Vitamin C looks like this:

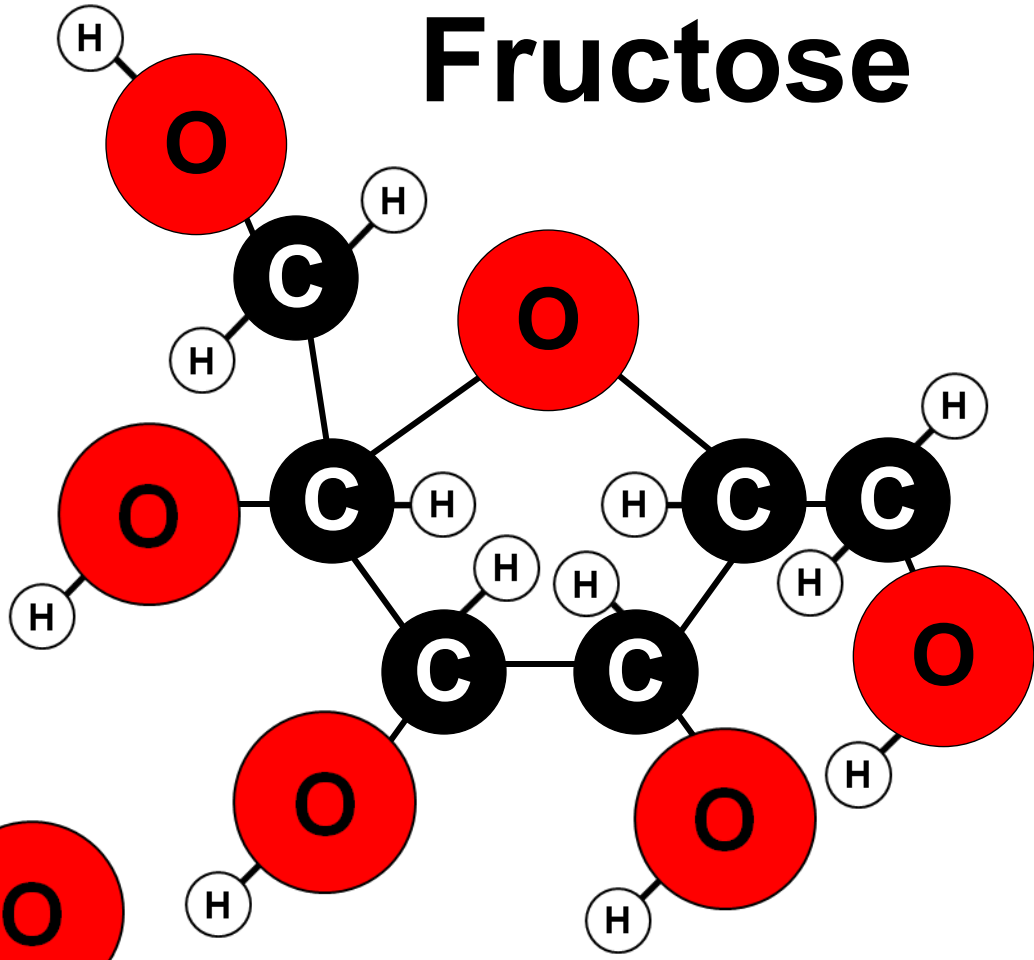


1. How many elements are in this compound?
2. How many atoms are in this compound?

Glucose

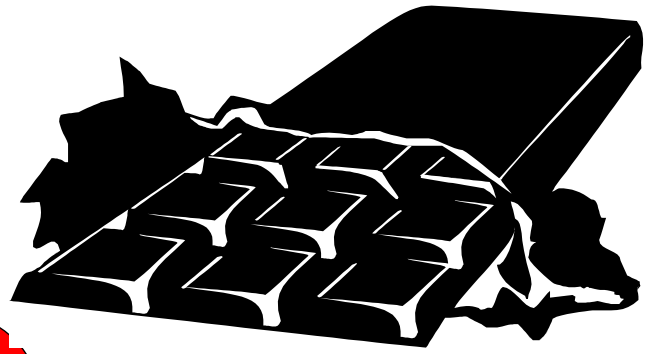


Fructose



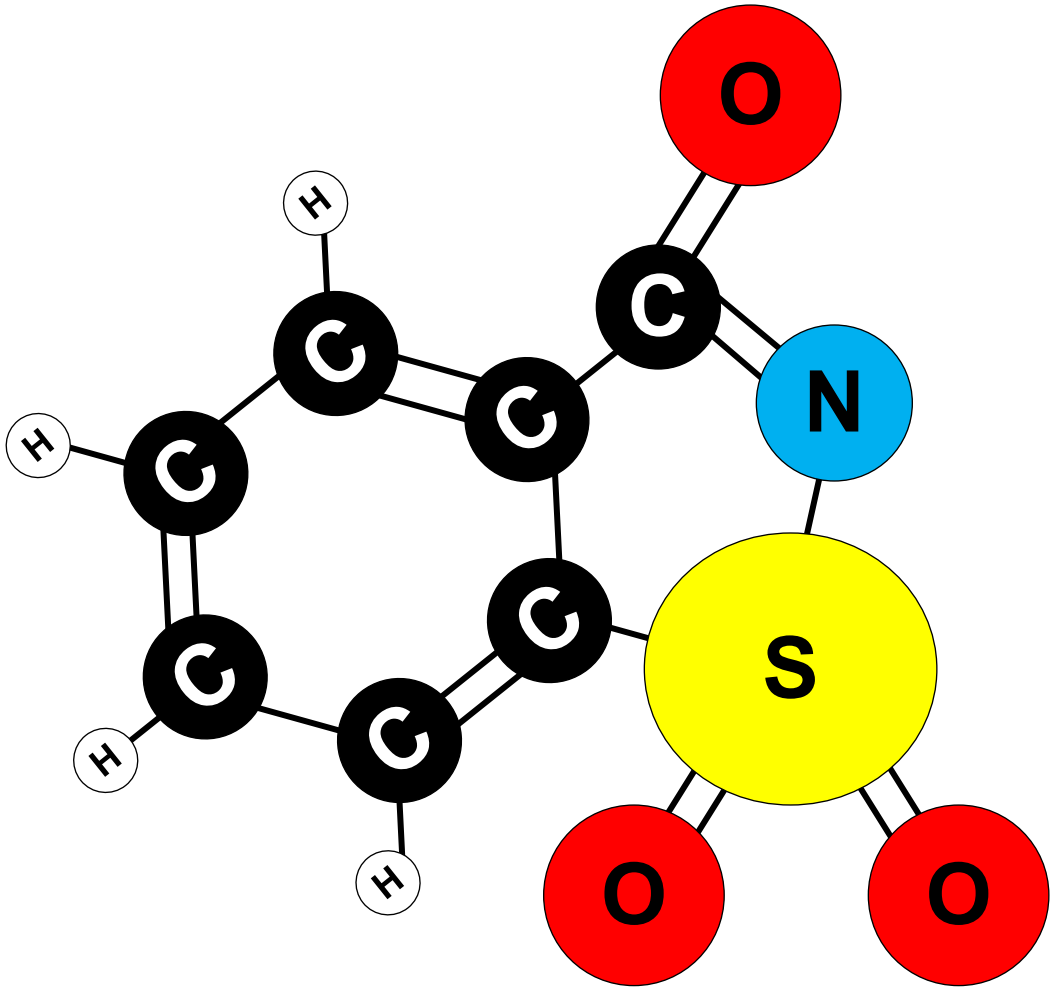
1. How many elements are in this compound?
2. How many atoms are in this compound?

Sucrose (sugar)

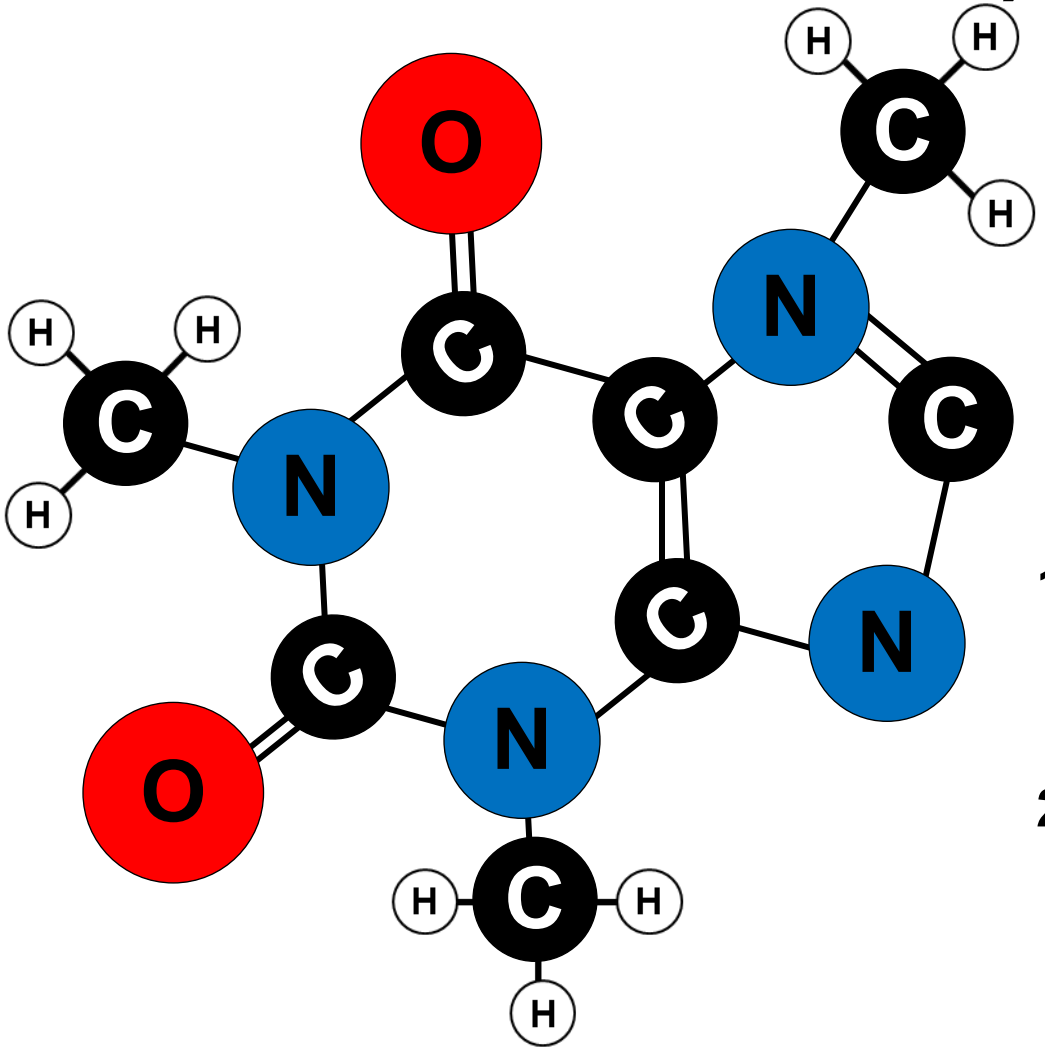


Sugar is just 1 glucose molecule combined with 1 fructose molecule

Saccharin: an artificial sweetener

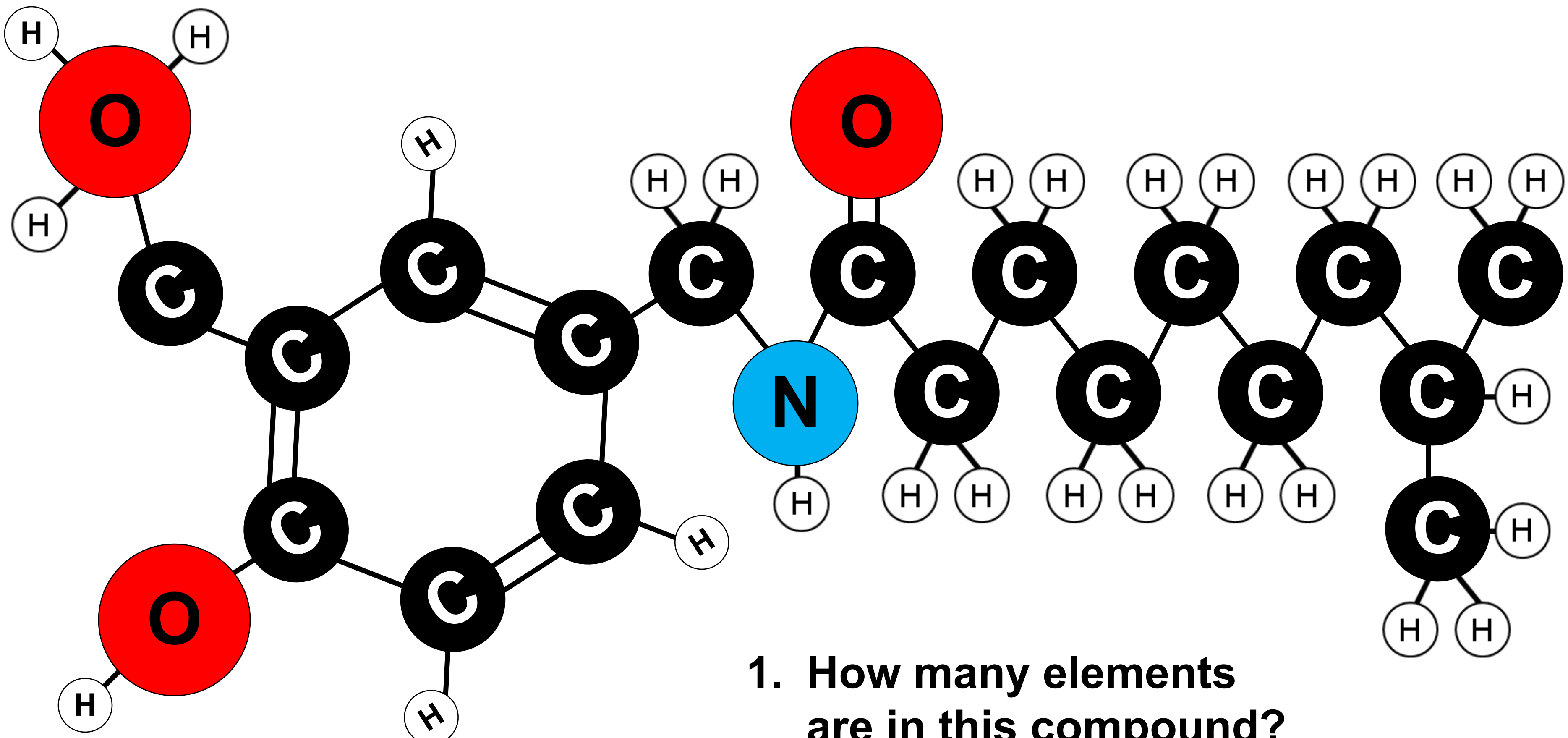


Caffeine: a chemical found in tea, coffee, and cacao (the plant used to make chocolate)



1. How many elements are in this compound?
2. How many atoms are in this compound?

Capsaicin is the chemical that makes hot foods HOT!



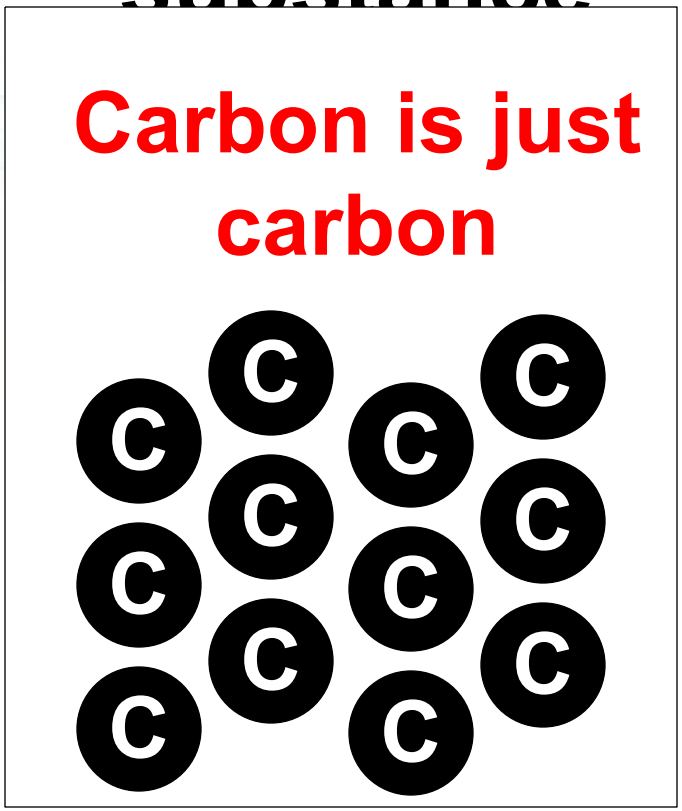
1. How many elements are in this compound?
2. How many atoms are in this compound?

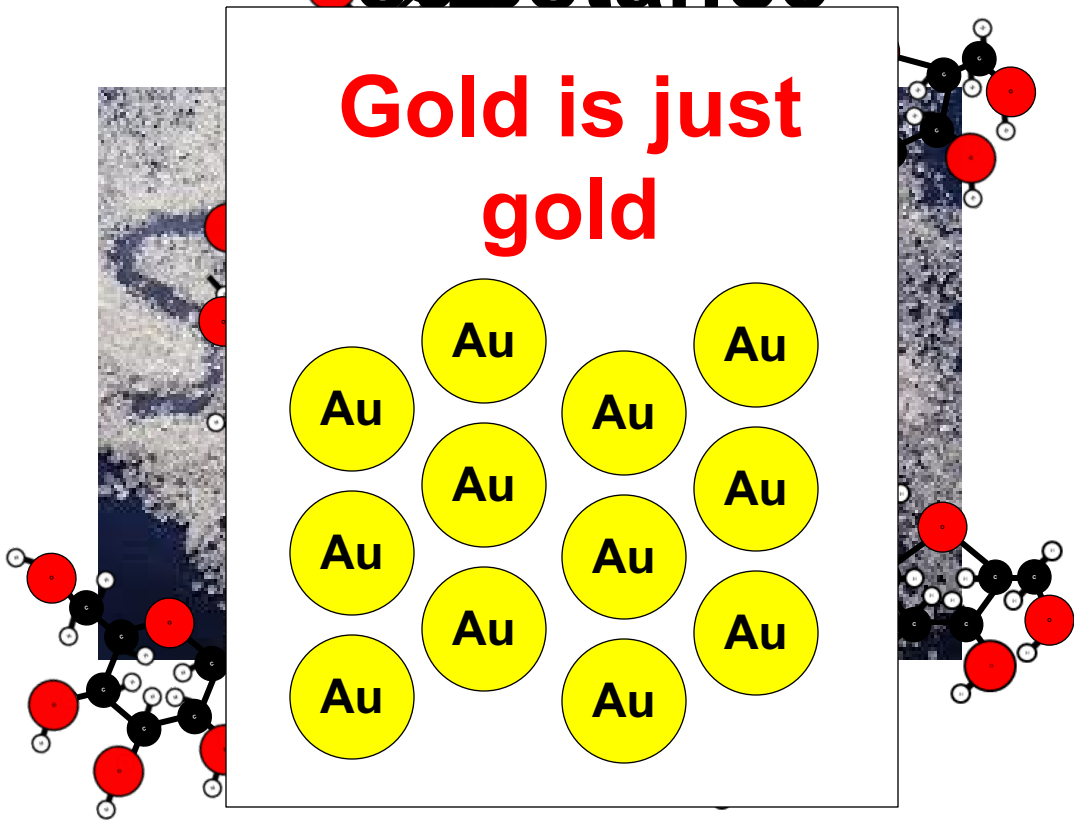
Some materials are **PURE SUBSTANCES**:
Matter made of the same type of chemical

All elements are pure substances

Water is a pure substance

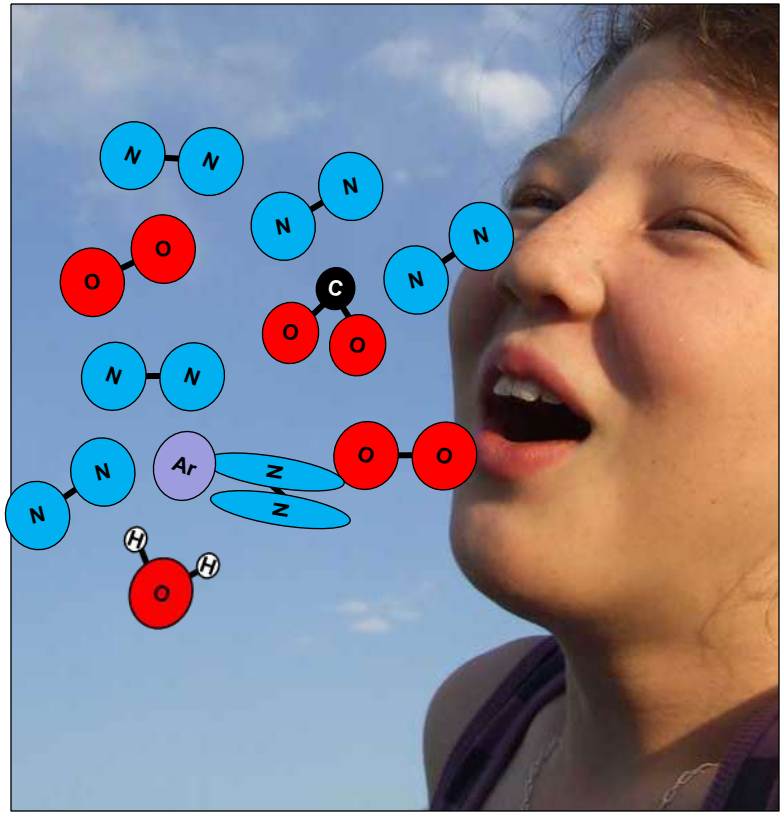
Sugar is a pure substance





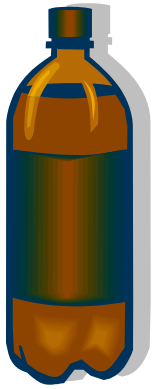
Most materials are MIXTURES:
Matter made of the many types of chemicals

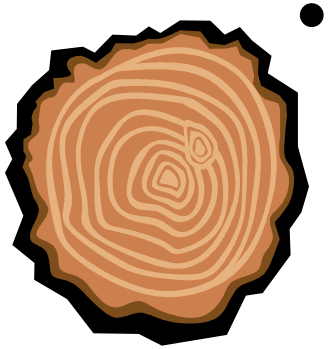
Air is a mixture

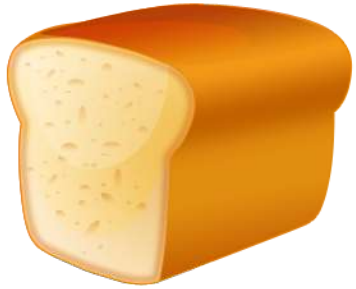


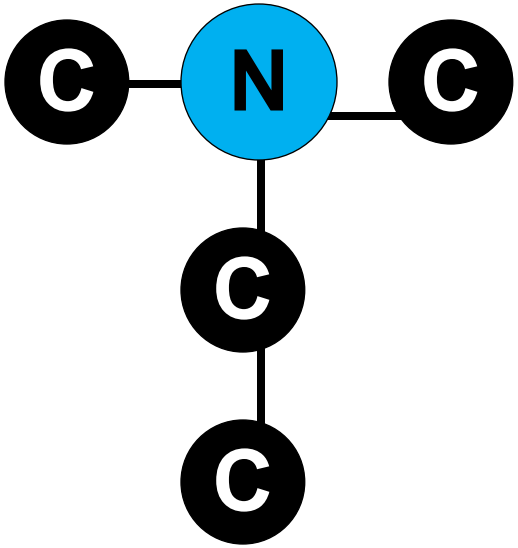
Other mixtures include:

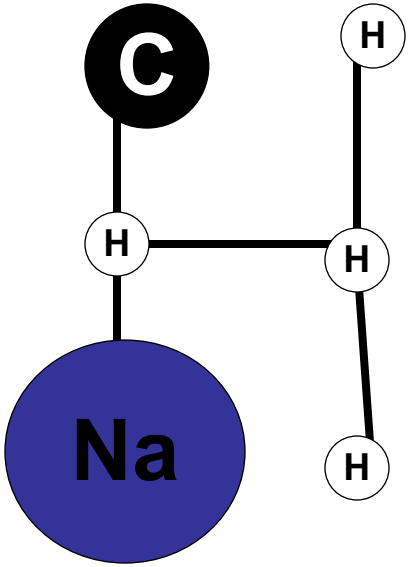
- Dirt
- Wood
- Bread
- Soda

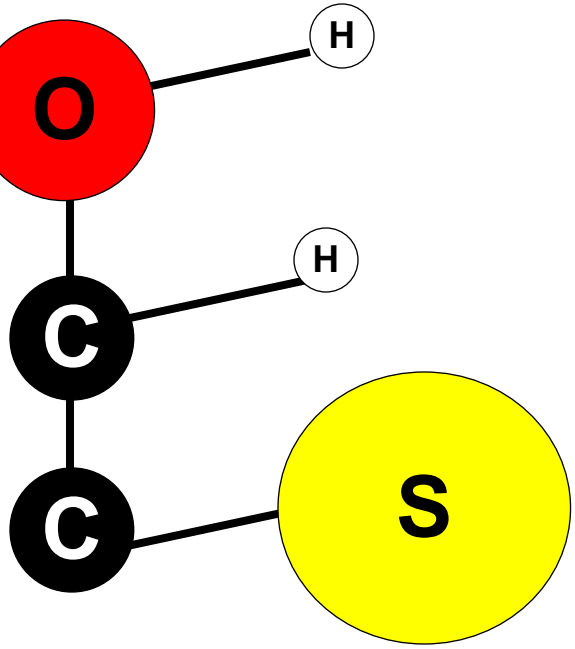


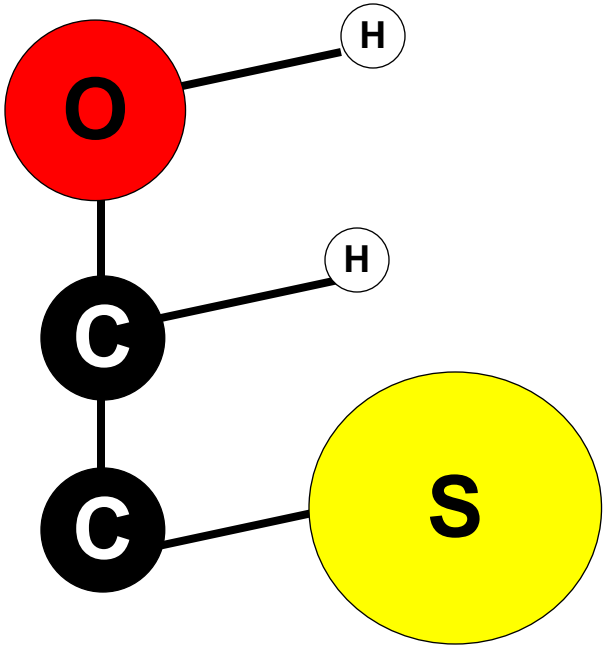


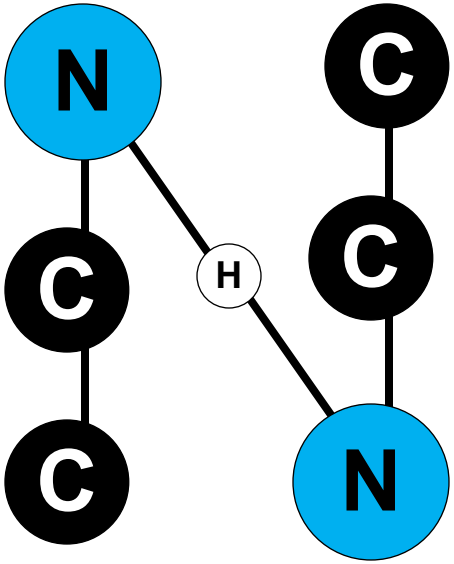


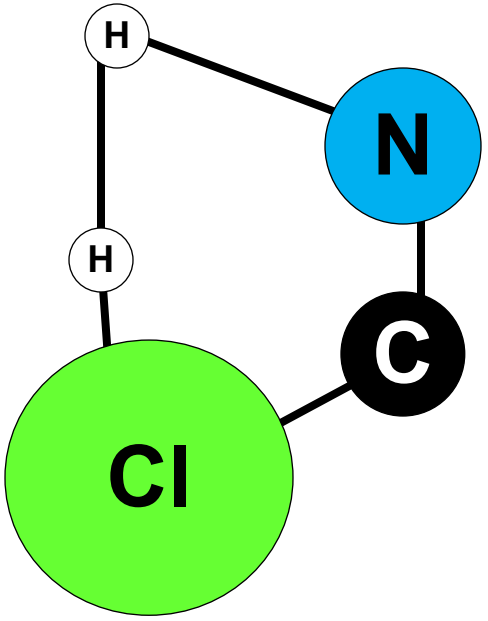

C
N
C
C
C


C
H
H
H
Na
H

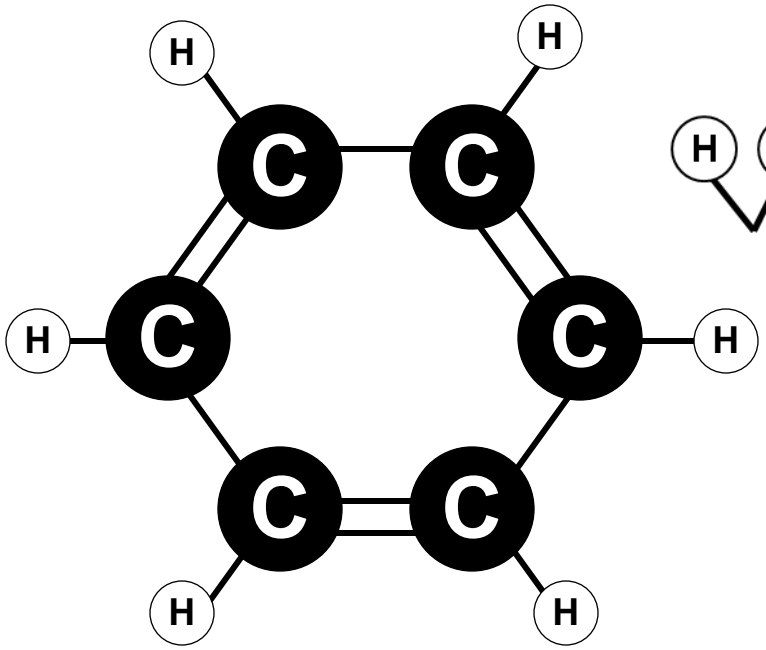

O
H
H
C
C
S

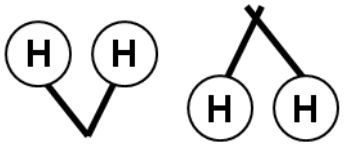

O
H
H
C
C
S

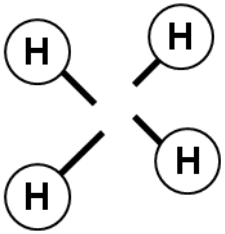

N
C
C
H
C
C
N

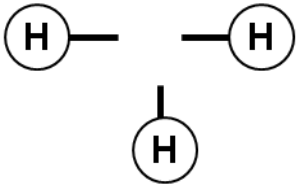

H
N
H
C
Cl

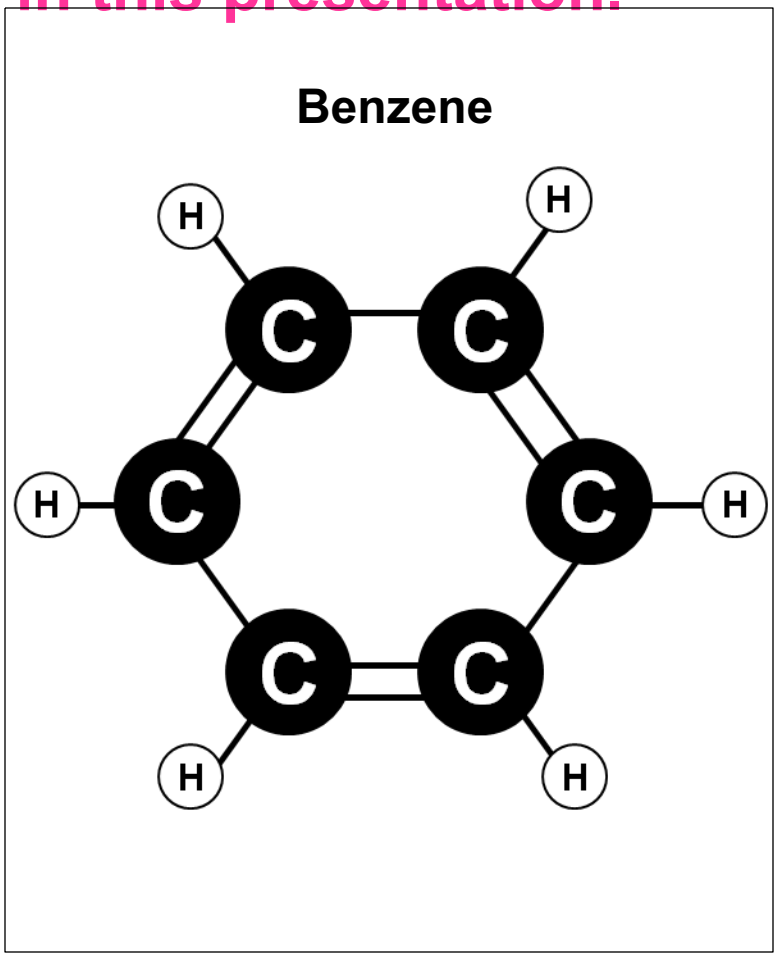
These are some carbon and hydrogen atoms I made and then used to make the chemicals in this presentation.











How to Make Rust