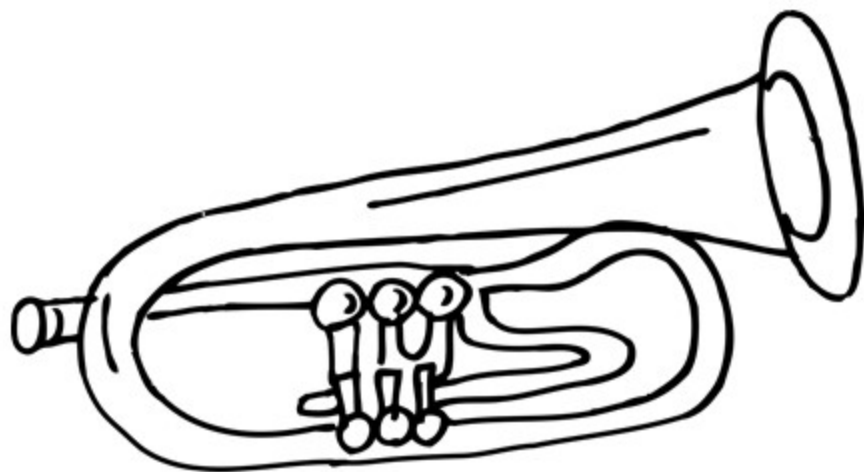


# MATTER: ELEMENTS, COMPOUNDS, AND MIXTURES

## Cornell Doodle Notes

**ESSENTIAL  
QUESTION:**

**How is matter classified  
based on its composition?**



# TOPIC QUESTION #1

## What is matter?

**MATTER**

**is anything that has mass  
and takes up space.**

**Did You Know:** everything in the universe is matter...as long as you can see, taste, touch and smell it



# TOPIC QUESTION #2

## What is a pure substance?

### ELEMENTS

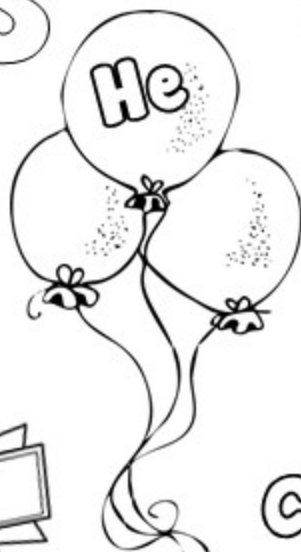
Elements are the purest form of matter, which cannot be broken down.

Any amount of a pure element retains the unique physical and chemical properties of that element.

S

Mg

Fe



Ca



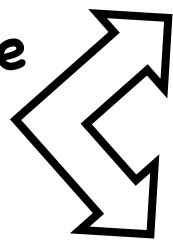
PERIODIC TABLE																	
H																	He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	
Fr	Ra	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg	Cn	Uut	Fl	Uup	Lv	Uus	Uuo	
La Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb Lu																	
Ac Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No Lr																	
□ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □																	

There are 118 elements, which are represented on the Periodic Table.

Chemical symbols are 1 or 2 letters, but only the first letter is capitalized!



every piece of matter in the universe is made up of elements



Some substances are pure = only made up of 1 **element**

Other substances are **mixtures** of elements together or elements chemically bonded together (**compound**)

1 IA <b>H</b> Hydrogen 1.008 1	2 IIA <b>Li</b> Lithium 6.94 2-1	<b>Be</b> Beryllium 9.0122 2-2	3 <b>Na</b> Sodium 22.98976928 2-8-1	4 <b>Mg</b> Magnesium 24.305 2-8-2	5 <b>Sc</b> Scandium 44.955908 2-8-9-2	6 <b>Ti</b> Titanium 47.87 2-8-10-2	7 <b>V</b> Vanadium 50.9415 2-8-11-2	8 <b>Cr</b> Chromium 51.9961 2-8-13-1	9 <b>Mn</b> Manganese 54.938044 2-8-13-2	10 <b>Fe</b> Iron 55.845 2-8-14-2	11 <b>Co</b> Cobalt 58.933 2-8-15-2	12 <b>Ni</b> Nickel 58.693 2-8-16-2	13 <b>Cu</b> Copper 63.546 2-8-18-1	14 <b>Zn</b> Zinc 65.38 2-8-18-2	15 <b>Ga</b> Gallium 69.723 2-8-18-3	16 <b>Ge</b> Germanium 72.630 2-8-18-4	17 <b>As</b> Arsenic 74.922 2-8-18-5	18 <b>Se</b> Selenium 78.971 2-8-18-6	19 <b>Br</b> Bromine 79.904 2-8-18-7	20 <b>Kr</b> Krypton 83.798 2-8-18-8	21 <b>Rb</b> Rubidium 85.4678 2-8-18-8-1	22 <b>Sr</b> Strontium 87.62 2-8-18-8-2	23 <b>Y</b> Yttrium 88.90584 2-8-18-9-2	24 <b>Zr</b> Zirconium 91.224 2-8-18-10-2	25 <b>Nb</b> Niobium 92.90637 2-8-18-11-2	26 <b>Mo</b> Molybdenum 95.95 2-8-18-13-1	27 <b>Tc</b> Technetium (98) 2-8-18-13-2	28 <b>Ru</b> Ruthenium 101.07 2-8-18-15-1	29 <b>Rh</b> Rhodium 102.91 2-8-18-16-1	30 <b>Pd</b> Palladium 106.42 2-8-18-18	31 <b>Ag</b> Silver 107.87 2-8-18-18-2	32 <b>Cd</b> Cadmium 112.41 2-8-18-18-2	33 <b>In</b> Indium 114.82 2-8-18-18-3	34 <b>Sn</b> Tin 118.71 2-8-18-18-4	35 <b>Sb</b> Antimony 121.76 2-8-18-18-5	36 <b>Te</b> Tellurium 127.60 2-8-18-18-6	37 <b>I</b> Iodine 126.90 2-8-18-18-7	38 <b>Xe</b> Xenon 131.29 2-8-18-18-8	39 <b>Cs</b> Caesium 132.90545196 2-8-18-18-8-1	40 <b>Ba</b> Barium 137.327 2-8-18-18-8-2	41 <b>La</b> Lanthanides 57-71	42 <b>Hf</b> Hafnium 178.49 2-8-18-32-10-2	43 <b>Ta</b> Tantalum 180.94788 2-8-18-32-11-2	44 <b>W</b> Tungsten 183.84 2-8-18-32-12-2	45 <b>Re</b> Rhenium 186.21 2-8-18-32-13-2	46 <b>Os</b> Osmium 190.23 2-8-18-32-14-2	47 <b>Ir</b> Iridium 192.22 2-8-18-32-15-2	48 <b>Pt</b> Platinum 195.08 2-8-18-32-16-2	49 <b>Au</b> Gold 196.97 2-8-18-32-18-1	50 <b>Hg</b> Mercury 200.59 2-8-18-32-18-2	51 <b>Tl</b> Thallium 204.38 2-8-18-32-18-3	52 <b>Pb</b> Lead 207.2 2-8-18-32-18-4	53 <b>Bi</b> Bismuth 208.98 2-8-18-32-18-5	54 <b>Po</b> Polonium (209) 2-8-18-32-18-6	55 <b>At</b> Astatine (210) 2-8-18-32-18-7	56 <b>Rn</b> Radon (222) 2-8-18-32-18-8	57 <b>Fr</b> Francium (223) 2-8-18-32-18-8-1	58 <b>Ra</b> Radium (226) 2-8-18-32-18-8-2	59 <b>Ac</b> Actinides 89-103	60 <b>Rf</b> Rutherfordium (261) 2-8-18-32-11-2	61 <b>Db</b> Dubnium (268) 2-8-18-32-12-2	62 <b>Sg</b> Seaborgium (269) 2-8-18-32-12-2	63 <b>Bh</b> Bohrium (270) 2-8-18-32-13-2	64 <b>Hs</b> Hassium (277) 2-8-18-32-14-2	65 <b>Mt</b> Meitnerium (278) 2-8-18-32-15-2	66 <b>Ds</b> Darmstadtium (281) 2-8-18-32-17-1	67 <b>Rg</b> Roentgenium (282) 2-8-18-32-17-2	68 <b>Cn</b> Copernicium (285) 2-8-18-32-18-2	69 <b>Nh</b> Nihonium (286) 2-8-18-32-18-3	70 <b>Fl</b> Flerovium (289) 2-8-18-32-18-4	71 <b>Mc</b> Moscovium (290) 2-8-18-32-18-5	72 <b>Lv</b> Livermorium (293) 2-8-18-32-18-6	73 <b>Ts</b> Tennessine (294) 2-8-18-32-18-7	74 <b>Og</b> Oganesson (294) 2-8-18-32-18-8
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Atomic Number → 1  
 Symbol → H  
 Name → Hydrogen  
 Atomic Weight → 1.008  
 Electrons per shell → 1

State of matter (color of name)  
 GAS LIQUID SOLID UNKNOWN

Subcategory in the metal-metalloid-nonmetal trend (color of background)

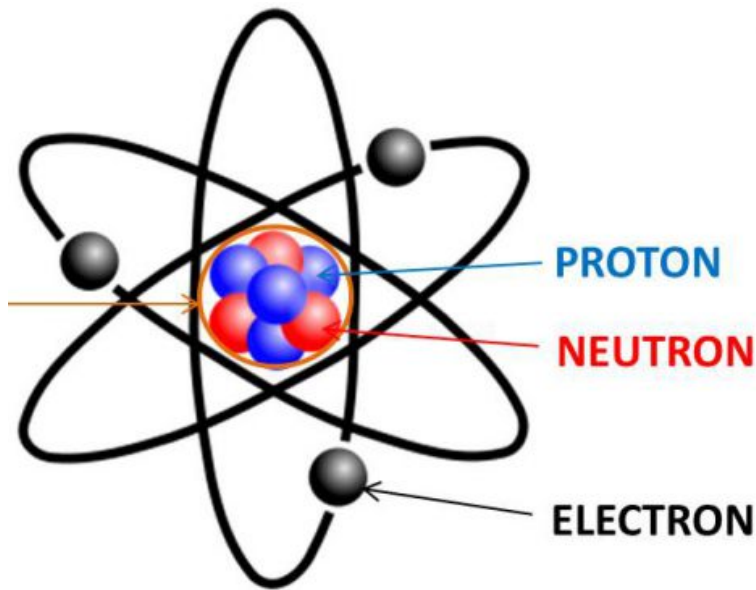
- Alkali metals
- Alkaline earth metals
- Transition metals
- Lanthanides
- Actinides
- Post-transition metals
- Metalloids
- Reactive nonmetals
- Noble gases
- Unknown chemical properties

57 <b>La</b> Lanthanum 138.91 2-8-18-18-9-2	58 <b>Ce</b> Cerium 140.12 2-8-18-18-9-2	59 <b>Pr</b> Praseodymium 140.91 2-8-18-18-9-2	60 <b>Nd</b> Neodymium 144.24 2-8-18-21-8-2	61 <b>Pm</b> Promethium (145) 2-8-18-21-8-2	62 <b>Sm</b> Samarium 150.36 2-8-18-21-8-2	63 <b>Eu</b> Europium 151.96 2-8-18-21-8-2	64 <b>Gd</b> Gadolinium 157.25 2-8-18-21-8-2	65 <b>Tb</b> Terbium 158.93 2-8-18-21-8-2	66 <b>Dy</b> Dysprosium 162.50 2-8-18-21-8-2	67 <b>Ho</b> Holmium 164.93 2-8-18-29-8-2	68 <b>Er</b> Erbium 167.26 2-8-18-30-8-2	69 <b>Tm</b> Thulium 168.93 2-8-18-31-8-2	70 <b>Yb</b> Ytterbium 173.05 2-8-18-32-8-2	71 <b>Lu</b> Lutetium 174.97 2-8-18-32-9-2
89 <b>Ac</b> Actinium (227) 2-8-18-32-18-9-2	90 <b>Th</b> Thorium 232.04 2-8-18-32-18-10-2	91 <b>Pa</b> Protactinium 231.04 2-8-18-32-20-9-2	92 <b>U</b> Uranium 238.03 2-8-18-32-21-9-2	93 <b>Np</b> Neptunium (237) 2-8-18-32-22-9-2	94 <b>Pu</b> Plutonium (244) 2-8-18-32-24-8-2	95 <b>Am</b> Americium (243) 2-8-18-32-25-8-2	96 <b>Cm</b> Curium (247) 2-8-18-32-25-9-2	97 <b>Bk</b> Berkelium (247) 2-8-18-32-27-8-2	98 <b>Cf</b> Californium (251) 2-8-18-32-28-8-2	99 <b>Es</b> Einsteinium (257) 2-8-18-32-29-8-2	100 <b>Fm</b> Fermium (257) 2-8-18-32-30-8-2	101 <b>Md</b> Mendelevium (257) 2-8-18-32-31-8-2	102 <b>No</b> Nobelium (259) 2-8-18-32-32-8-2	103 <b>Lr</b> Lawrencium (260) 2-8-18-32-32-8-3

# TOPIC QUESTION #2

**What is a pure substance?**

## ELEMENTS & their ATOMS



**Every element is made up of atoms**

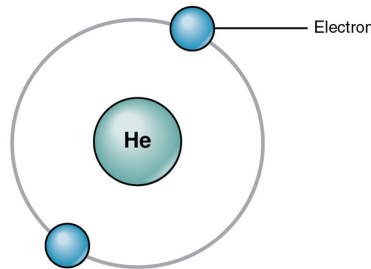
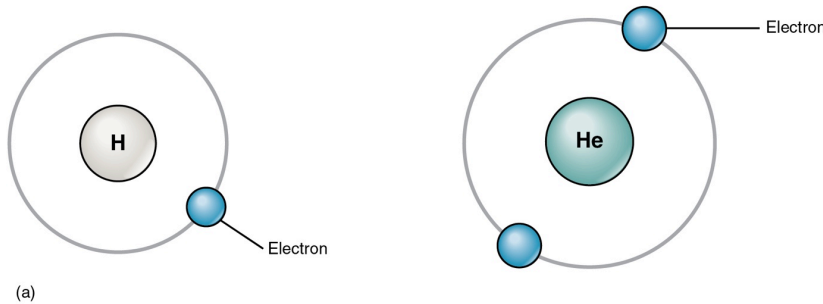
- The element **HELIUM** is made up of helium atoms
- The element **CARBON** is made up of carbon atoms
- The element **NEON** is made up of neon atoms

**Every atom has 3 basic pieces**

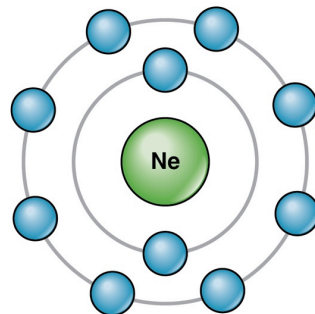
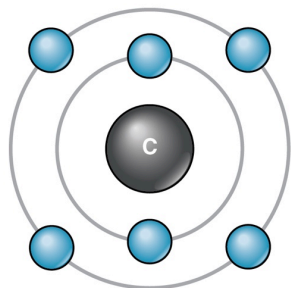
# TOPIC QUESTION #2

## What is a pure substance?

# ELEMENTS & their ATOMS



**What makes each atom different is the size of their atoms**  
(how many protons, neutrons and electrons it has)



**The amount of protons, neutrons and electrons in any atom of an element cause that element to have unique properties**

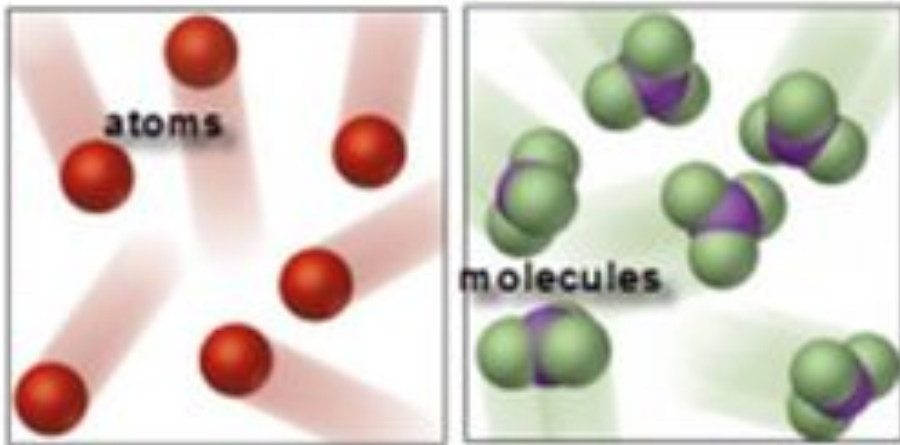
(b)

(c)

# TOPIC QUESTION #2

**What is a pure substance?**

## ELEMENTS & their ATOMS



*A molecule is 2 or more atoms chemically bonded together*

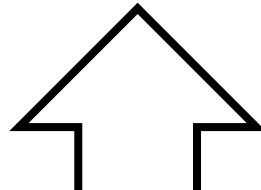
**When drawing elements down to their molecular structure (the atoms), we use different color circles to represent the atoms and DO NOT draw all the protons, neutrons and electrons**

# TOPIC QUESTION #3

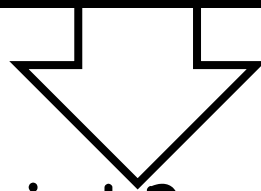
## What are Properties?

### Physical Properties

*Describes the physical characteristics*



**Every element has 2 types of  
properties**



### Chemical Properties

*Describes how the substance reacts  
with other substances*



# TOPIC QUESTION #3

## What are Properties?

### PHYSICAL PROPERTIES

*Describes the physical characteristics*



Volume



Mass



Size



Weight



Length



Boiling Point



Color



Temperature



Luster



Hardness

# TOPIC QUESTION #3

## What are Properties?

### CHEMICAL PROPERTIES

*Describes how the substance reacts with other substances*



Toxicity



Heat of  
Combustion



Flammability



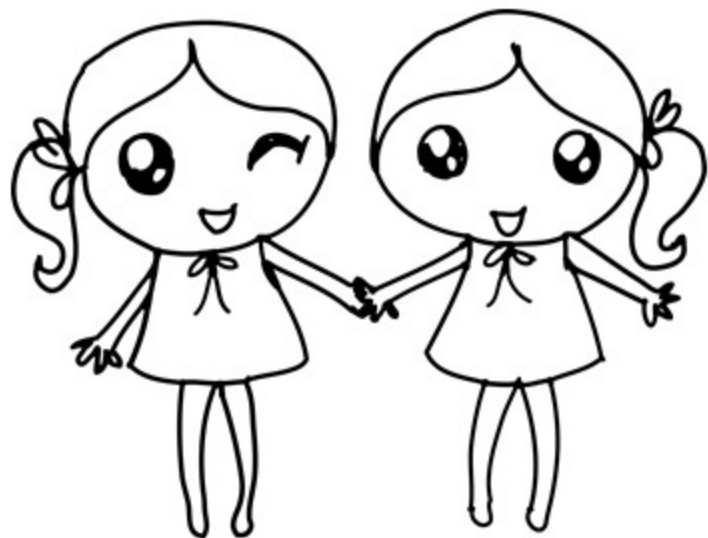
Reactivity

# TOPIC QUESTION #4

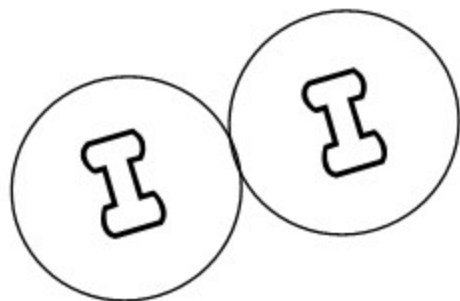
## What is a diatomic element?

DIA TOMIC

"two atoms"



=



**A diatomic element is an element which in its pure form is always bonded to itself ...kind of like twins that are always together!  
There are 7 diatomic elements!**

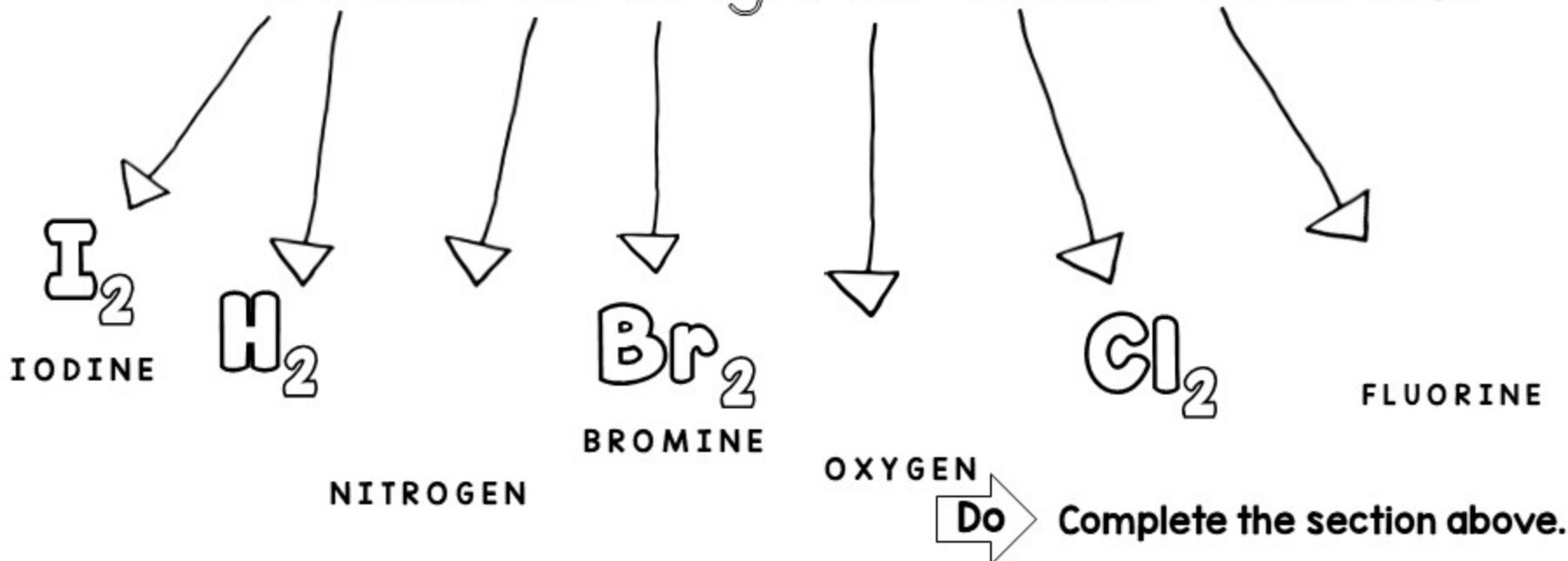
# TOPIC QUESTION #4

## What is a diatomic element?



(This is a bit mean but it helps!)  
There's a mnemonic device to  
remember these!

"I Have No Bright Or Clever Friends!"

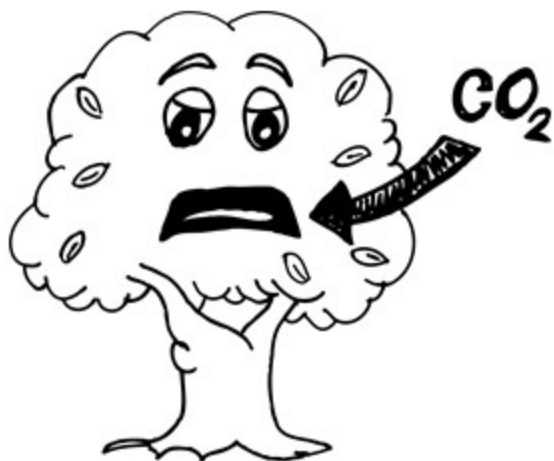


# TOPIC QUESTION #5

**What is matter that is composed of more than one element?**

## COMPOUNDS

**Compounds are pure substances that are made of two or more elements chemically bonded together.**



**A compound has different properties than the individual elements in it.**

# TOPIC QUESTION #5

**What is matter that is composed of more than one element?**

Energy must be taken in or given off when a compound is broken apart or put together!

Separating the elements in a compound requires a chemical reaction.

$\text{NaHCO}_3$   
BAKING SODA



$\text{NaCl}$   
TABLE SALT



CHEMICAL  
FORMULAS

Do

Circle each element symbol with a different color in the above chemical formulas.

represent how many atoms of each element are part of the compound.

# TOPIC QUESTION #6

**What is matter that is composed of more than one substance?**

## MIXTURES

**Mixtures are not pure substances.**

**Their parts are not chemically combined; they are only physically combined.**

**When substances are combined into a mixture they keep their own properties because a new substance has not been formed.**



**THERE ARE  
TWO TYPES**

# TOPIC QUESTION #6

**What is matter that is composed of more than one substance?**

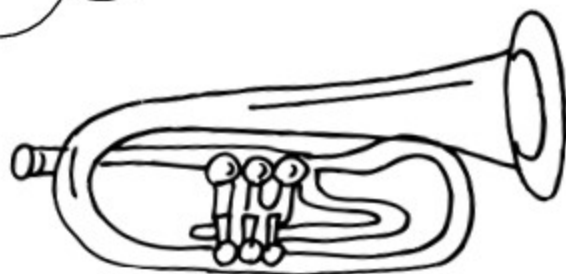
**The parts ARE evenly mixed and they stay evenly mixed.**

**HOMOGENEOUS MIXTURES**

**ALSO KNOWN AS SOLUTIONS**

**AIR  
(A SOLUTION  
OF GASES)**

**ICED TEA  
(SUGAR  
+  
WATER)**



**BRASS (COPPER + ZINC)**



# TOPIC QUESTION #6

**What is matter that is composed of more than one substance?**

**HETEROGENEOUS MIXTURES**

**The parts are NOT evenly mixed.**

**SOUP**



**KETCHUP**



**Particles can be seen in a beam of light.**

**COLLOIDS**



**MILK**

**SUSPENSIONS**

**Particles settle and form layers over time.**