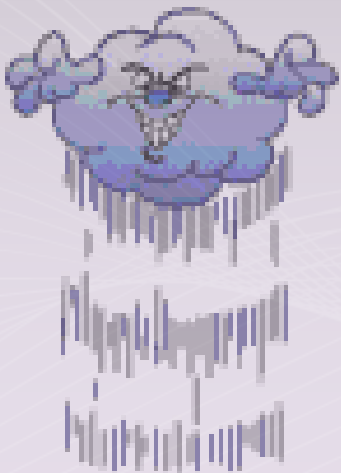




Chapter 1.1: Atoms, Compounds and Mixtures





Introducing Little Miss 'Element'



Hi! I am Little Miss “Element”
I am **PURE SUBSTANCE**
I **cannot** be broken down into any
simpler substance by means of a
chemical reaction* or electricity!



Elements

Definition of an element:

An element is a pure substance which cannot be split up into two or more simpler substances by chemical means.



Sugar is not an element as it can be broken down into carbon and water.

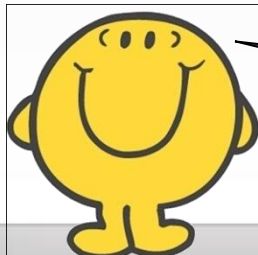
Examples of elements

Elements are made up of tiny particles

Elements can be further classified into two groups:

Atoms

Is the smallest particle of an element and has the same chemical properties of the element

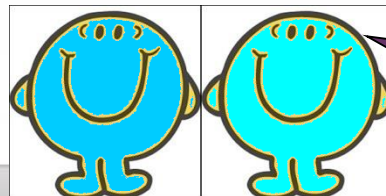


Hi, I am from the "Noble gas" family and I work alone

Molecules

Is made up of two or more atoms that are chemically bonded together

(note: these atoms are of the SAME element!!)

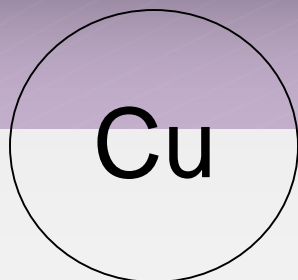


We same same!!

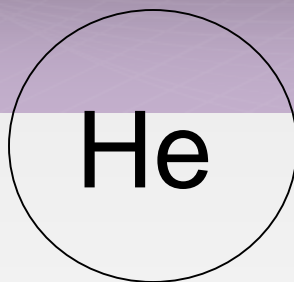
These are elements!



Atoms of same element



copper
element

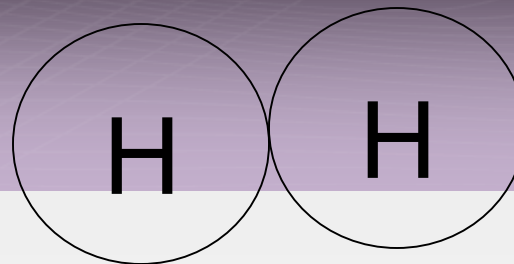


helium
element

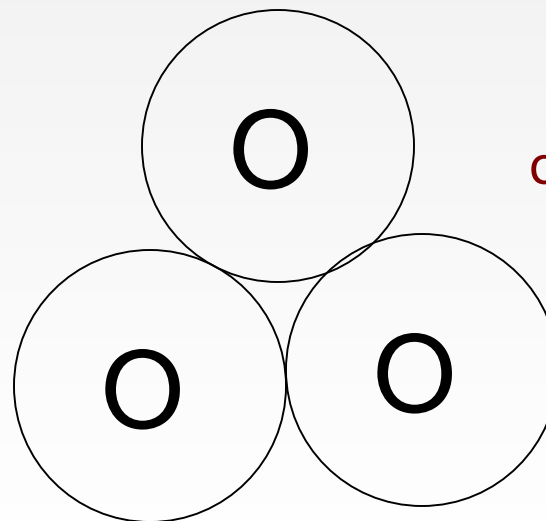


sodium
element

Molecules of same element



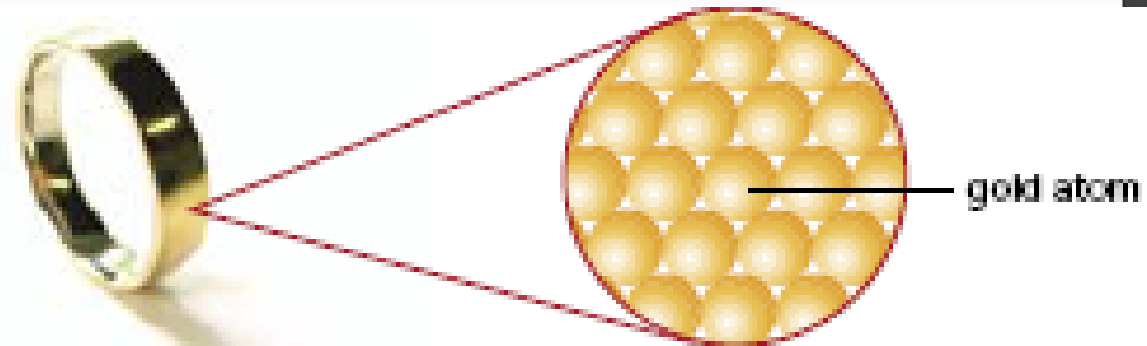
Hydrogen
gas element



ozone

An element is made of tiny particles called **atoms**.

The atoms of an element are different from that of another element.



Elements



Note that an element:

- Consists of only one kind of atom,
- Cannot be broken down into a simpler type of matter by either physical or chemical means
- Can exist as either atoms (ex: carbon) or molecules (ex: hydrogen).

What is an atom?



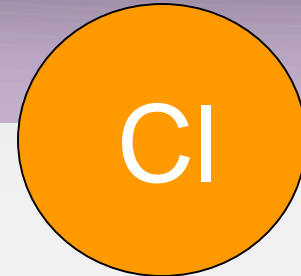
Examples of models of atoms:



Hydrogen
atom



Sodium
atom



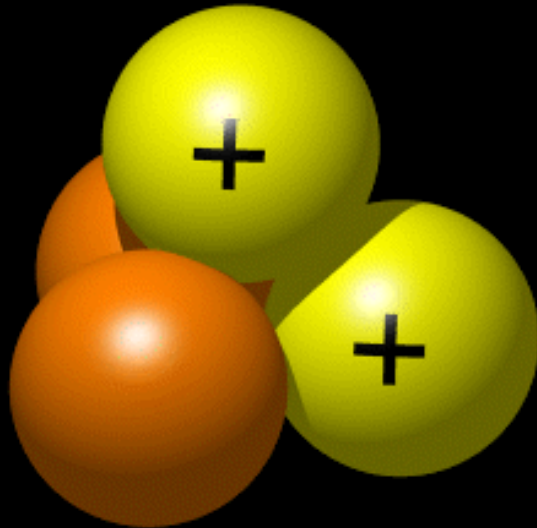
Chlorine
atom



Atoms



The nucleus is the massive center of the atom. It was discovered in 1911, but it took scientists another 21 years of experimenting to identify its parts.



Atoms have three parts:

- 1) Protons
- 2) Neutrons
- 3) Electrons.

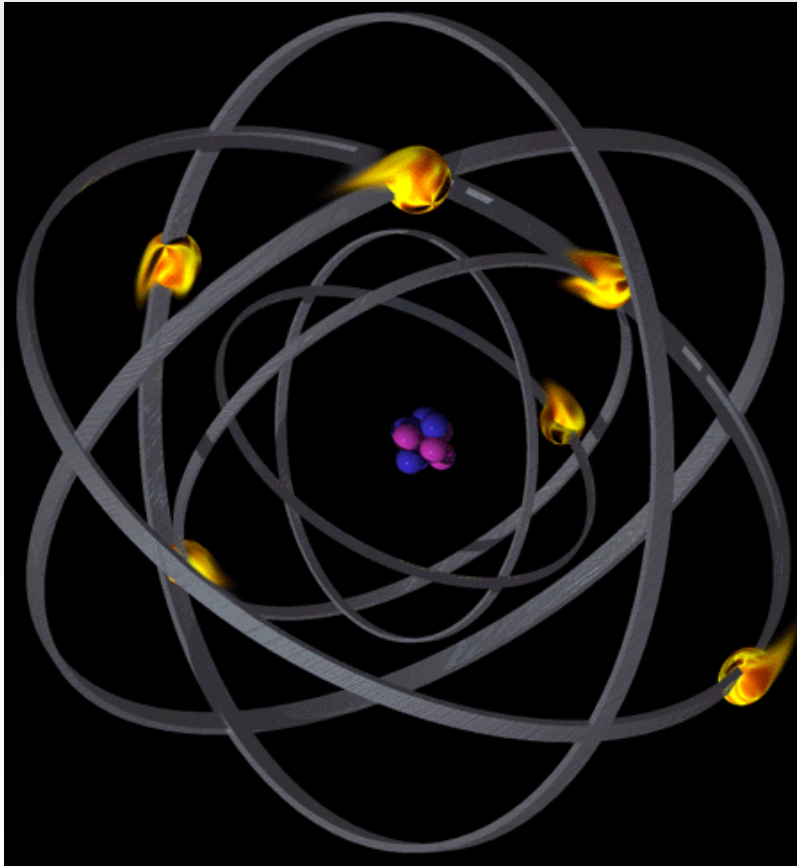


Carbon Atom





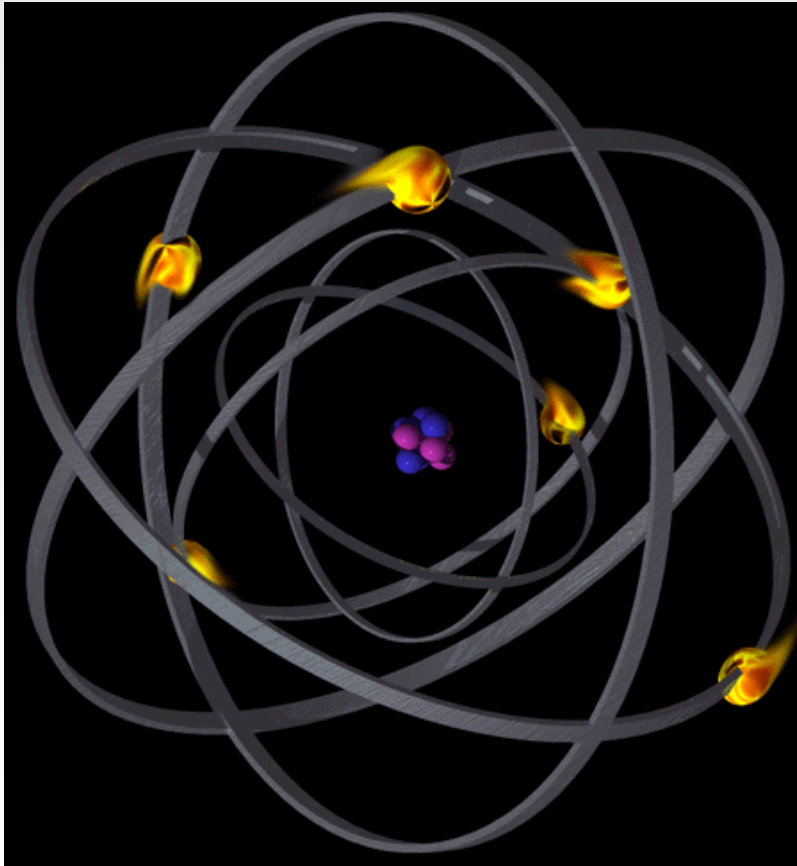
Protons



- They are positively charged.
- Are located in the nucleus.
- In this picture, the protons are the blue pieces in the center of the atom.



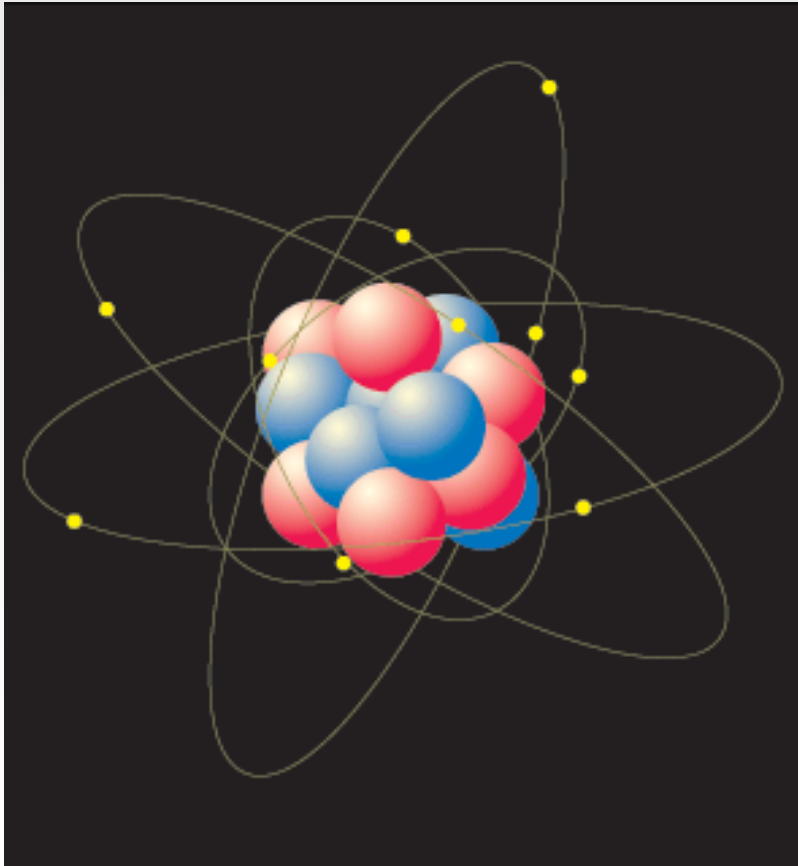
Neutrons



- Neutrons are neither positive nor negative.
- Neutrons are in the nucleus of an atom.
- In this picture, neutrons are the purple pieces in the center of the atom.



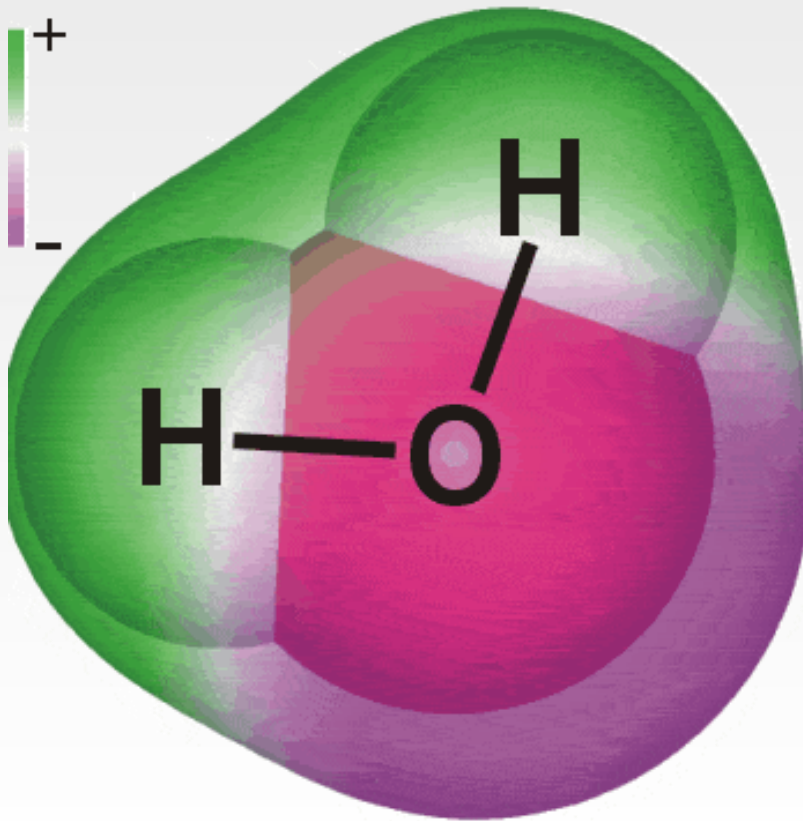
Electrons



- Electrons orbit around an atom. In this picture, they are the small yellow bits.
- They have a negative charge.
- They are lighter than protons or neutrons.



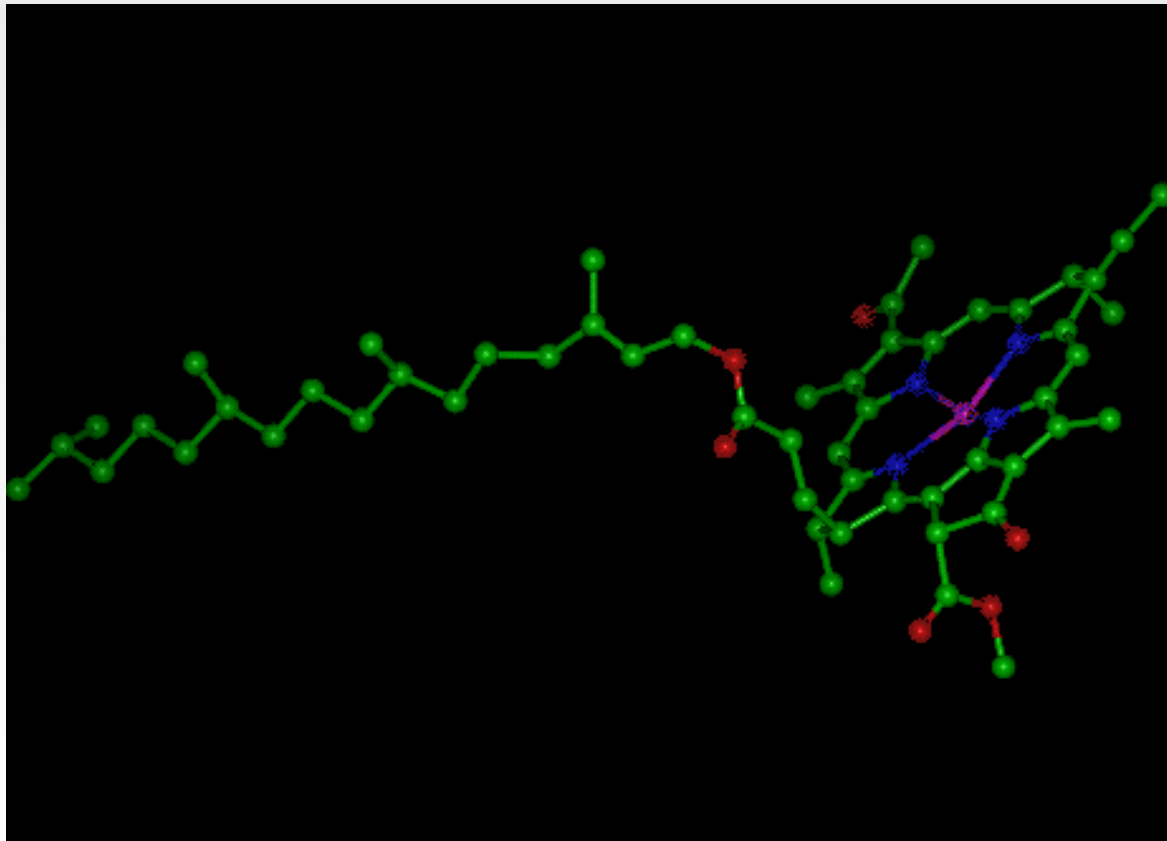
Molecules



- A molecule is a group of atoms bonded together. They are the smallest unit that make up a compound.
- This is a picture of a water molecule. It is two parts hydrogen and one part oxygen.

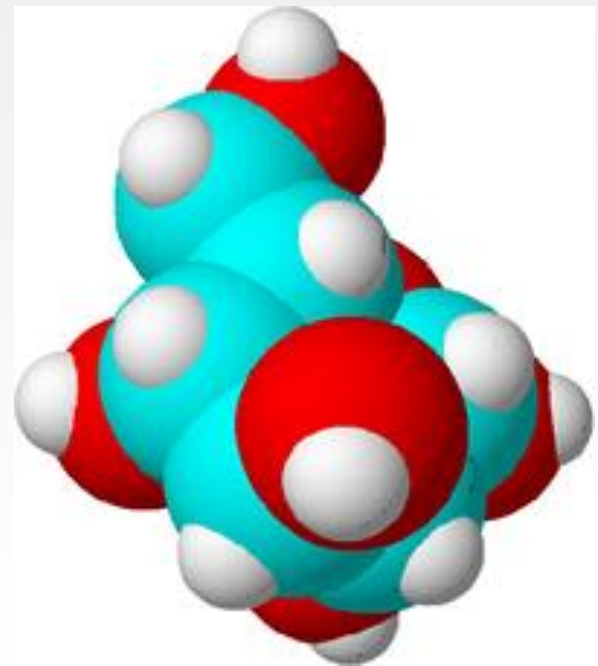


Chlorophyll Molecule





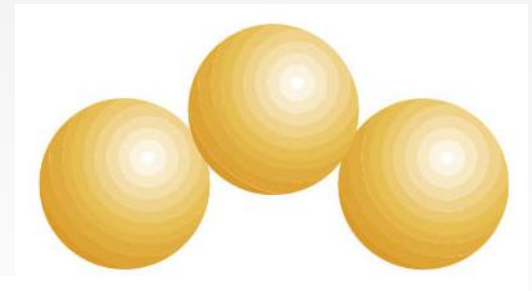
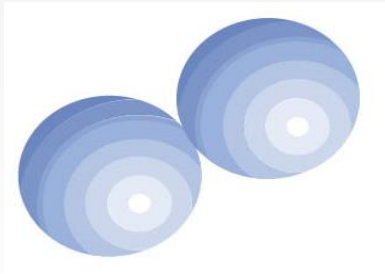
Sugar Molecule



Very few elements exist as atoms besides elements such as helium and neon.

Most elements exist as molecules.

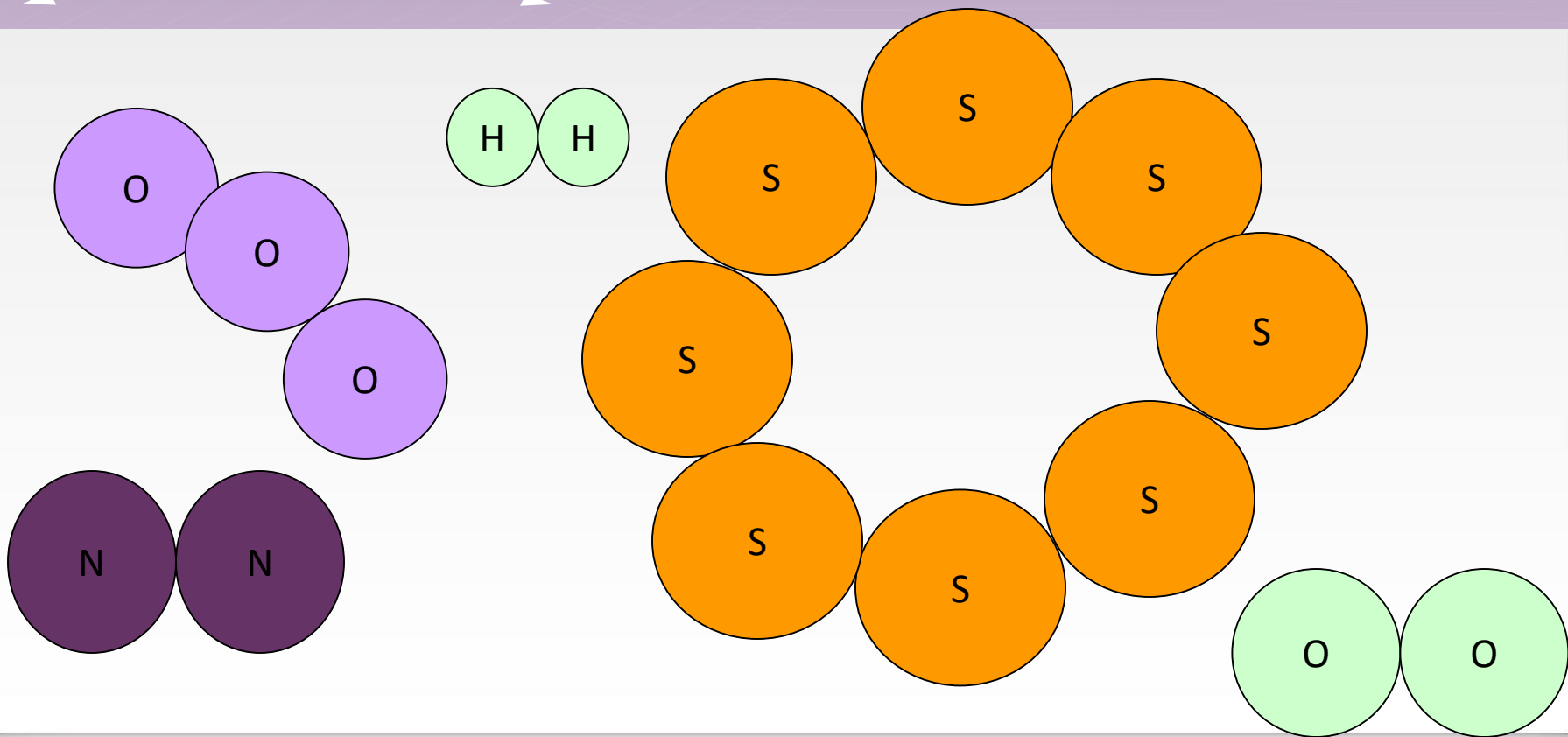
For example, hydrogen is H_2 .



Ozone is O_3 .



Examples of molecules (elements)



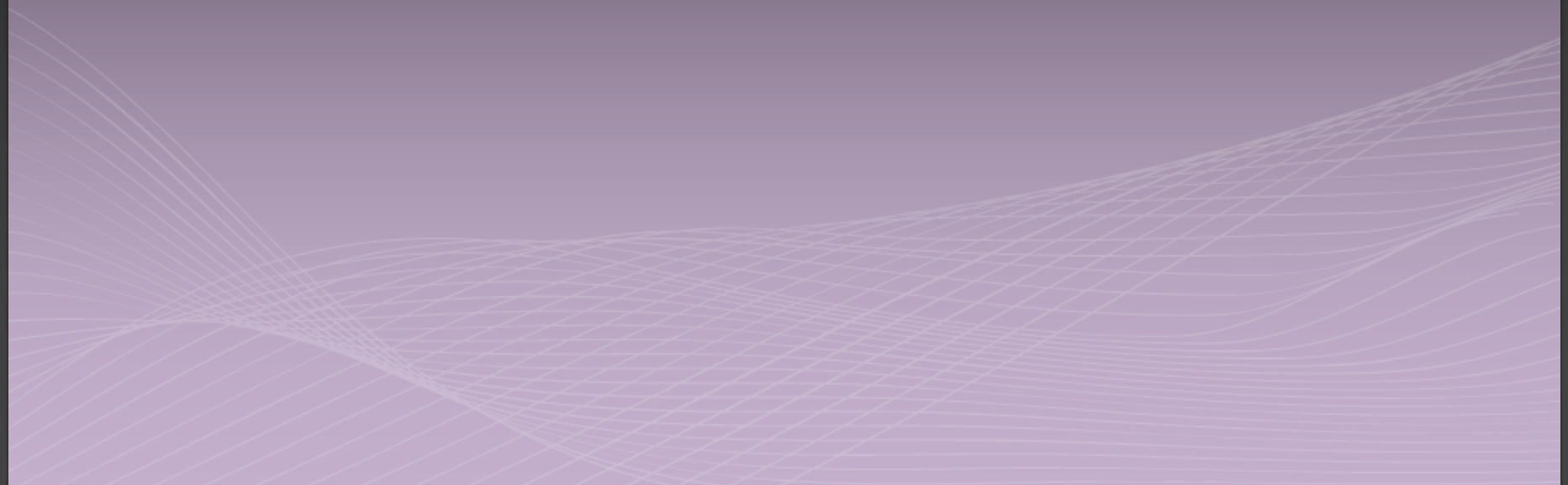


Revision Questions

- What are the three parts of an atom?
- Name the charge of each part of an atom (whether it's negative or positive).
- What is a water molecule made up of?
- Name three things that you can find in your house that are made of compounds.
- Which is smaller, elements or compounds?



The Periodic Table





Chemical Symbols of Elements

Chemists use symbols to represent elements.

For example, **O** represents **oxygen** while **Fe** represents **iron**.

Element	Symbol	Element	Symbol
Calcium	Ca	Mercury	Hg
Carbon	C	Neon	Ne
Hydrogen	H	Silicon	Si
Iron	Fe	Sodium	Na



Why is the Periodic Table important to me?



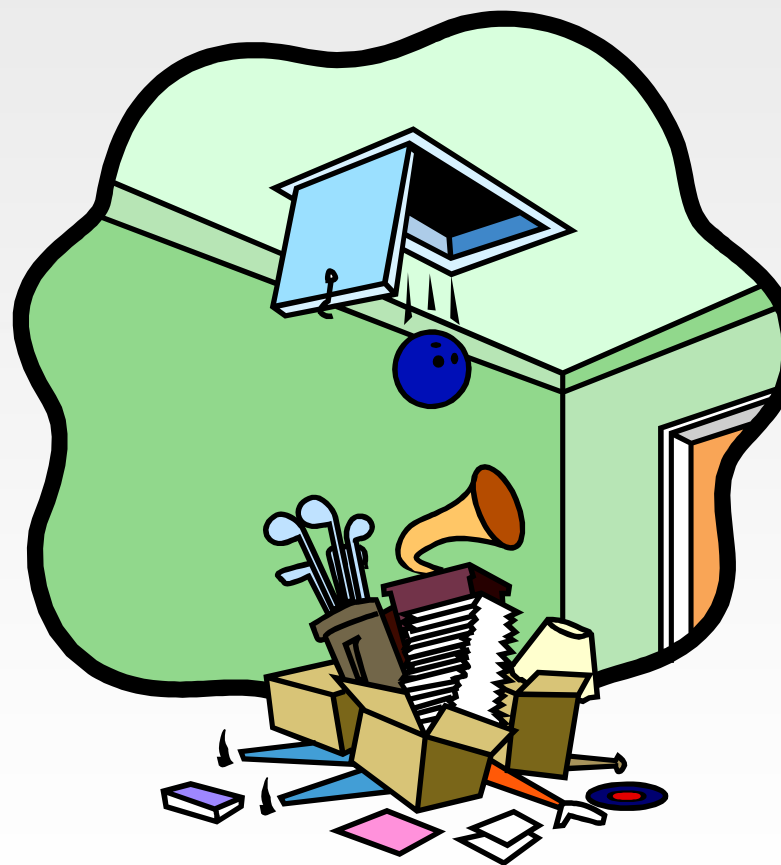
- The periodic table is the most useful tool to a chemist.
- You get to use it on every test.
- It organizes lots of information about all the known elements.



Pre-Periodic Table Chemistry ...



- ...was a mess!!!
- No organization of elements.
- Imagine going to a grocery store with no organization!!
- Difficult to find information.
- Chemistry didn't make sense.





Dmitri Mendeleev: Father of the Table

HOW HIS WORKED...

- Put elements in rows by increasing atomic weight.
- Put elements in columns by the way they reacted.

SOME PROBLEMS...

- He left blank spaces for what he said were undiscovered elements. (Turned out he was right!)





The Current Periodic Table

- Mendeleev wasn't too far off.
- Now the elements are put in rows by increasing ATOMIC NUMBER!!
- The **horizontal rows are called periods** and are labeled from 1 to 7.
- The **vertical columns are called groups** are labeled from 1 to 18.



Reihen	Gruppe I. — R'O	Gruppe II. — RO	Gruppe III. — R'O ³	Gruppe IV. RH ⁴ RO ³	Gruppe V. RH ³ R'O ³	Gruppe VI. RH ² RO ³	Gruppe VII. RH R'O ²	Gruppe VIII. — RO ⁴
1	II=1							
2	Li=7	Be=9,4	B=11	C=12	N=14	O=16	F=19	
3	Na=23	Mg=24	Al=27,3	Si=28	P=31	S=32	Cl=35,5	
4	K=39	Ca=40	—=44	Ti=48	V=51	Cr=52	Mn=55	Fo=56, Co=59, Ni=59, Cu=63.
5	(Cu=63)	Zn=65	—=68	—=72	As=75	So=78	Br=80	
6	Rb=86	Sr=87	?Yt=88	Zr=90	Nb=94	Mo=96	—=100	Ru=104, Rh=104, Pd=106, Ag=108.
7	(Ag=108)	Cd=112	In=113	Sn=118	Sb=122	Te=125	J=127	
8	Cs=133	Ba=137	?Di=138	?Ce=140	—	—	—	— — — —
9	(—)	—	—	—	—	—	—	
10	—	—	?Er=178	?La=180	Ta=182	W=184	—	Os=195, Ir=197, Pt=198, Au=199.
11	(Au=199)	Hg=200	Tl=204	Pb=207	Bi=208	—	—	
12	—	—	—	Th=231	—	U=240	—	— — — —



Classification of Elements – Metals and Non-metals

There are two major groups of elements – **metals** and **non-metals**.

Iron is a metal. Oxygen is a non-metal.

Metals and non-metals are grouped separately on the **Periodic Table**.

There are some elements called **metalloids** which behave like both metals and non-metals.



Groups...Here's Where the Periodic Table Gets Useful!!

- **Elements in the same group have similar chemical and physical properties!!**

- (Mendeleev did that on purpose.)

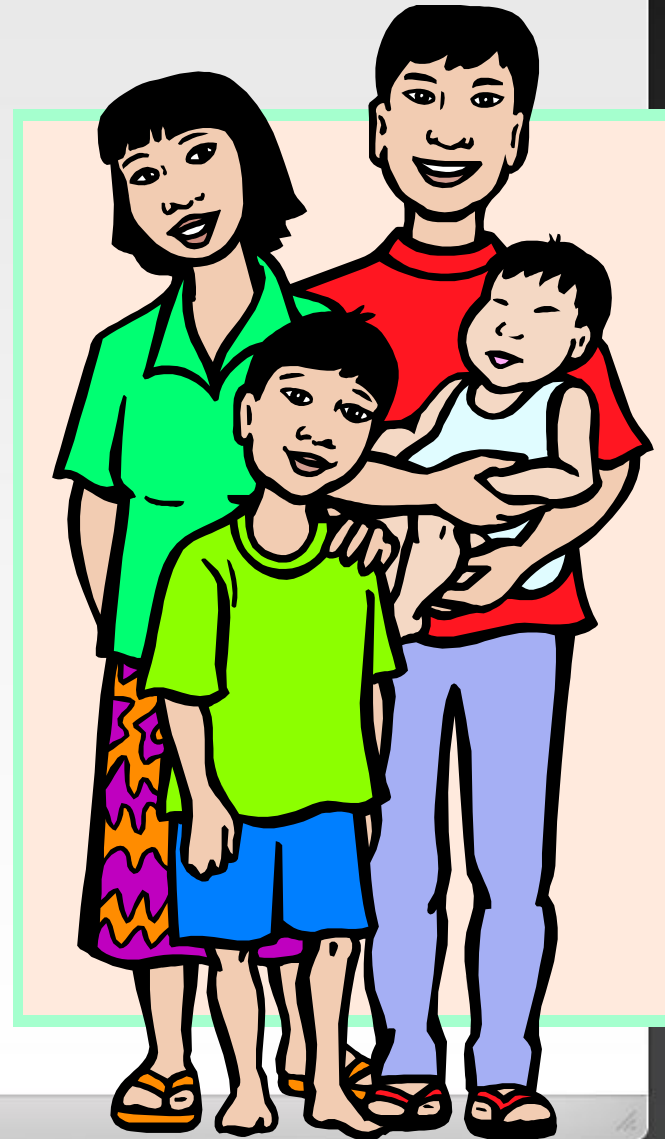
Why??

- They have the same number of valence electrons.
- They will form the same kinds of ions.

Families on the Periodic Table



- Columns are also grouped into families.
- Families may be one column, or several columns put together.
- Families have names rather than numbers. (Just like your family has a common surname.)





Hydrogen



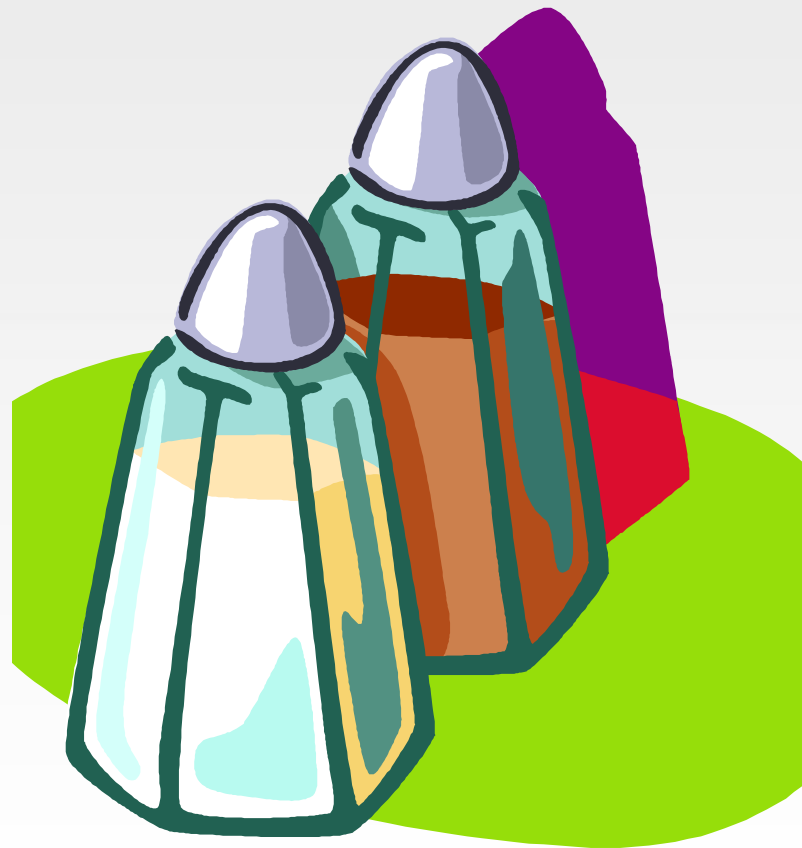
- Hydrogen belongs to a family of its own.
- Hydrogen is a diatomic, reactive gas.
- Hydrogen was involved in the explosion of the Hindenberg.
- Hydrogen is promising as an alternative fuel source for automobiles



Group 1



- 1st column on the periodic table (Group 1) not including hydrogen.
- Very reactive metals, always combined with something else in nature (like in salt).
- Soft enough to cut with a butter knife.
- Ex: Sodium (Na)





Group 2



- Second column on the periodic table. (Group 2)
- Reactive metals that are always combined with non-metals in nature.
- Several of these elements are important mineral nutrients (such as Mg and Ca)

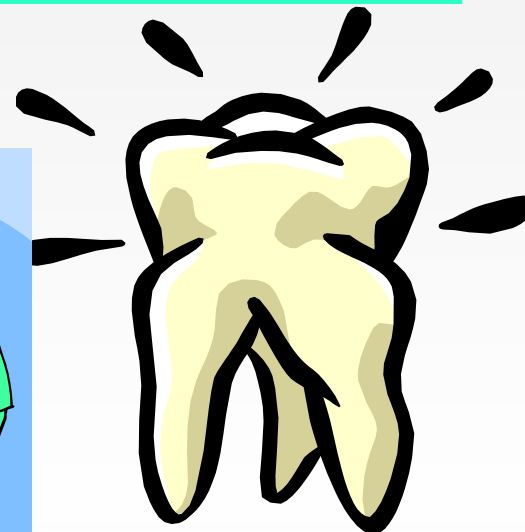
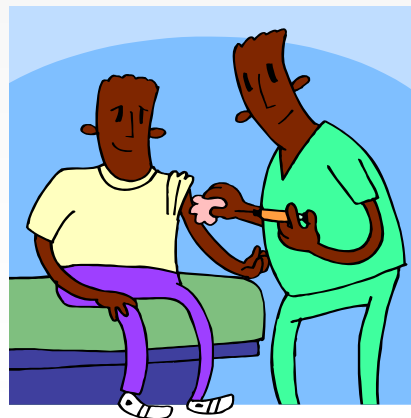
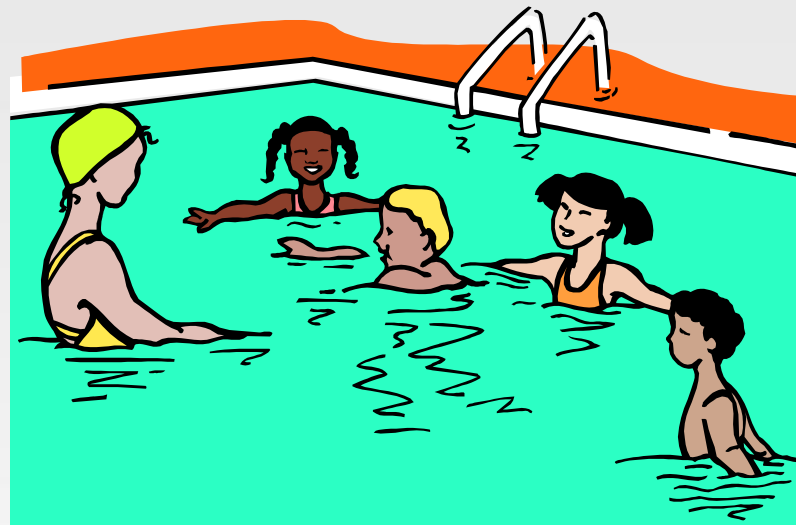




Halogens (Group 7)



- Elements in group 7
- Very reactive, volatile, diatomic, nonmetals
- Always found combined with other elements in nature .
- Used as disinfectants and to strengthen teeth.
- Example: Chlorine (Cl)





The Noble Gases





The Noble Gases (Group 8)



- Elements in group 8
- VERY unreactive, monatomic gases
- Used in lighted 'neon' signs
- Have a full valence shell.

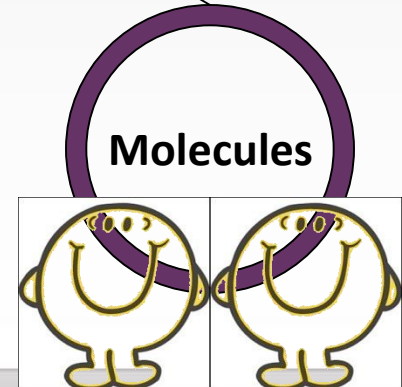
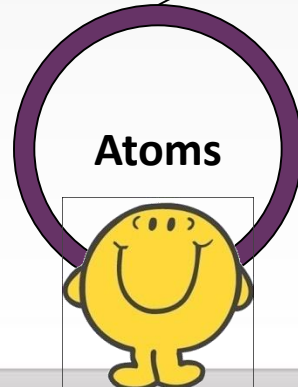
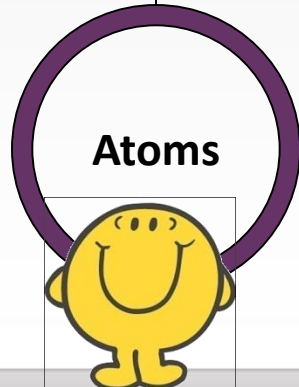
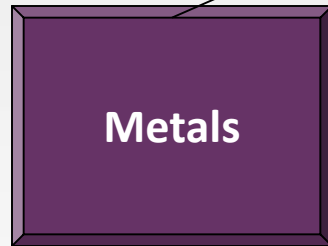




Summarising



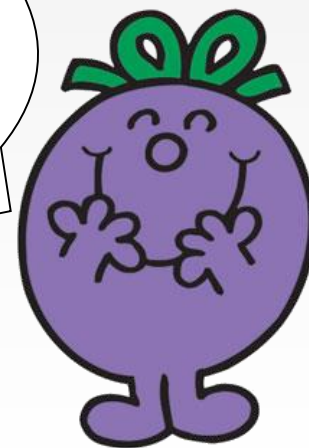
Elements





Introducing Little Miss Compounds”

I am also a **PURE SUBSTANCE**
I am made up of a fixed number of
two or more elements chemically
combined.



Little Miss Naughty

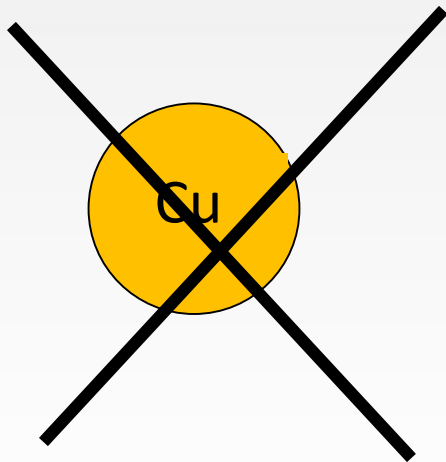
What is a compound?



A compound is a substance which is made up of two or more elements chemically combined together.

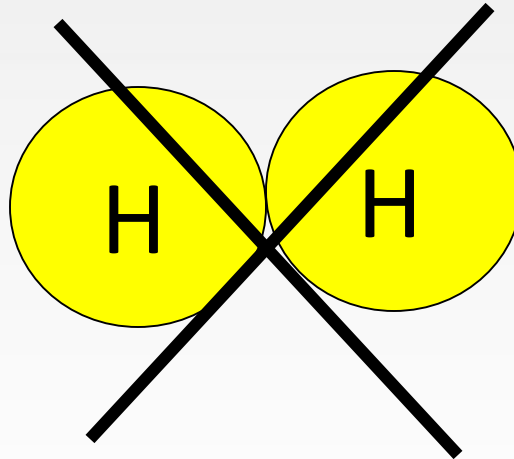
- Chemical reactions taking place.

Qn: Is this a compound?



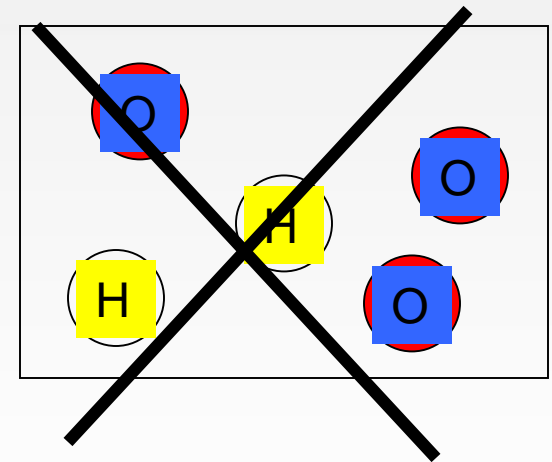
It only contains one type of element.

Qn: Is this a compound?



It only contains one type of element.

Qn: Is this a compound?



It is not chemically combined.

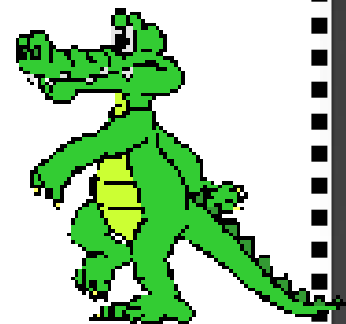


Compounds

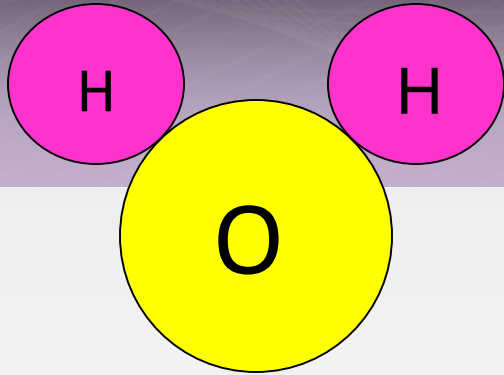


Note that a compound:

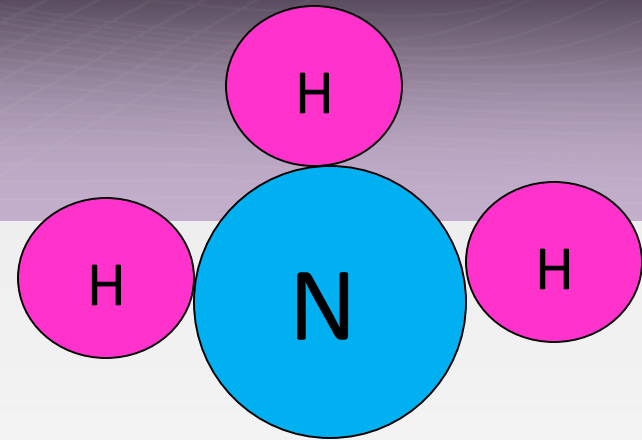
- Can be broken down into the elements that make it up by chemical means.
- Has properties that are different from its component elements.



So, what is a compound then?



Water



Ammonia gas

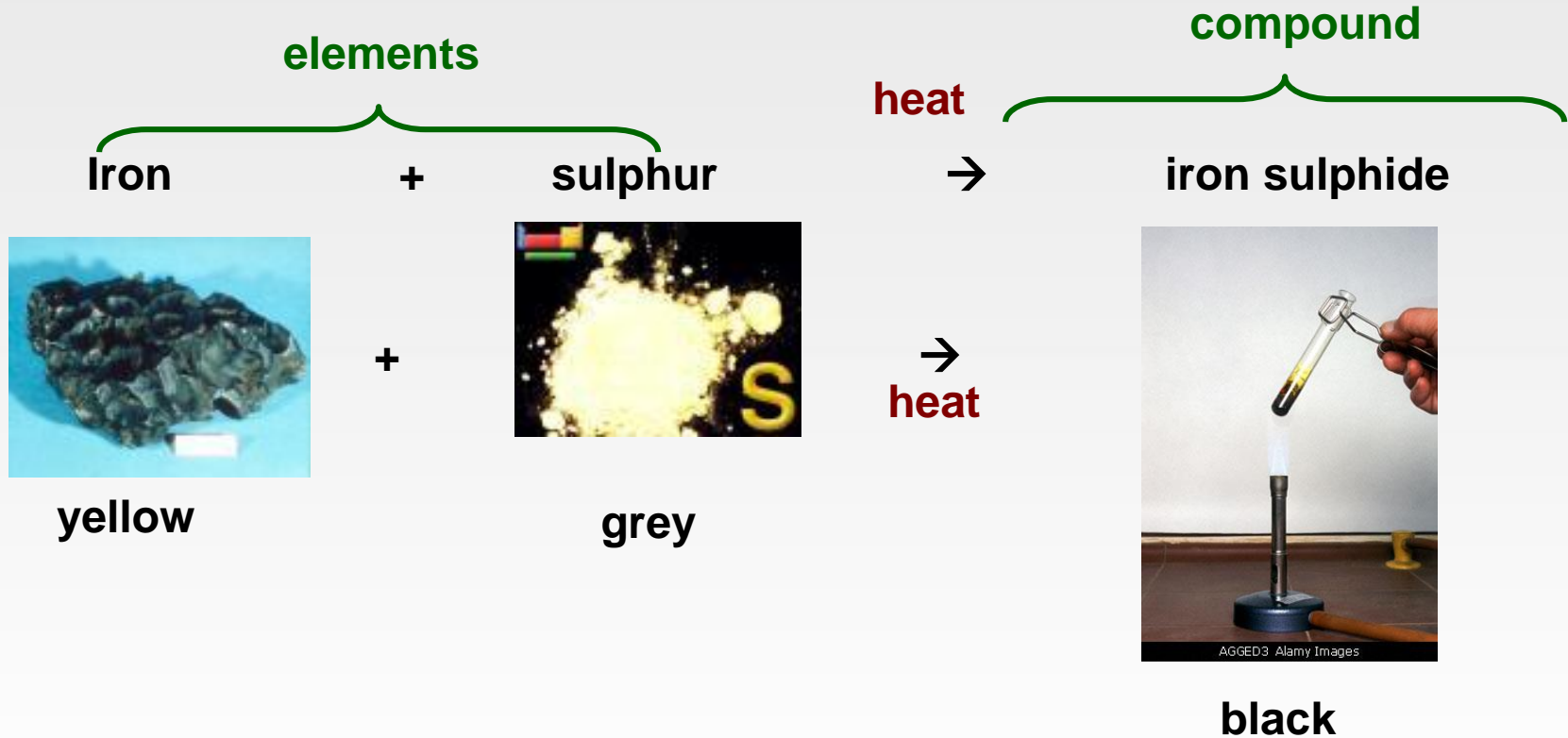
Consists of two or more elements

And

They are chemically combined together!

Making compounds from their elements

Example: Making iron sulphide compound





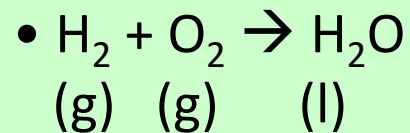
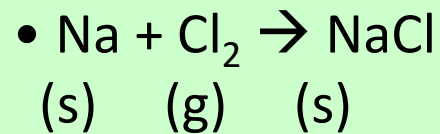
Chemical Reactions

I am formed by atoms of different elements. However, I do not have the same properties as them.



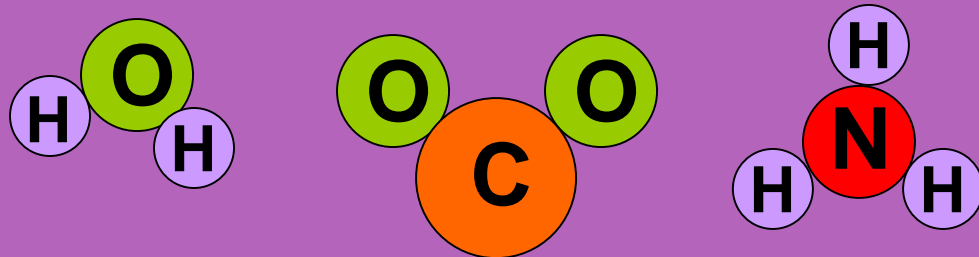
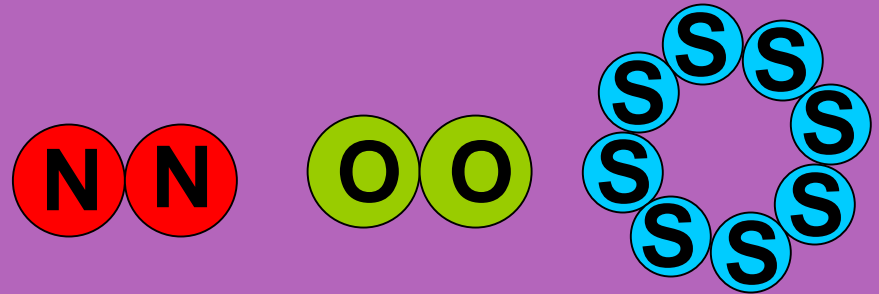
Little Miss Naughty

Examples



Molecules - Elements or compounds?

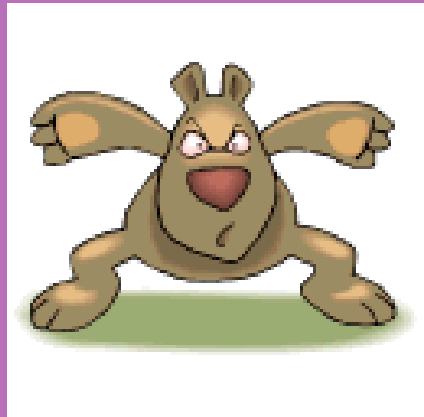
- A *molecule* consists of two or more atoms of the same element, or different elements, that are chemically bound together.
- It can be a molecule of an element
- E.g. N_2 , O_2 , S_8
- It can be molecule of a compound.
- H_2O , CO_2 , NH_3



Mixtures

Definition of a mixture:

A mixture is not a pure substance as it contains a mixture of atoms or molecules which are not chemically combined together.





Note that a mixture:

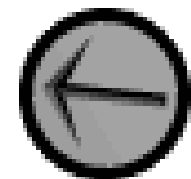
- Consists of two or more different elements and/or compounds NOT chemically combined.
- Can be separated into its components by physical means.
- Often has many of the properties of its component elements.



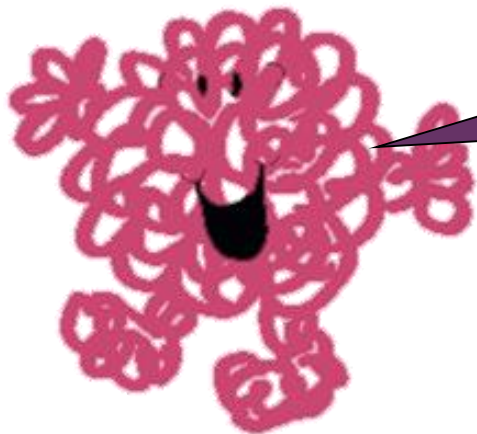
Mixtures

- Examples of mixtures include muddy water and air.

Air is made up of gases such as nitrogen and oxygen mixed together.



Little Mr 'Mixture'



I do not have a fixed composition of the substances.

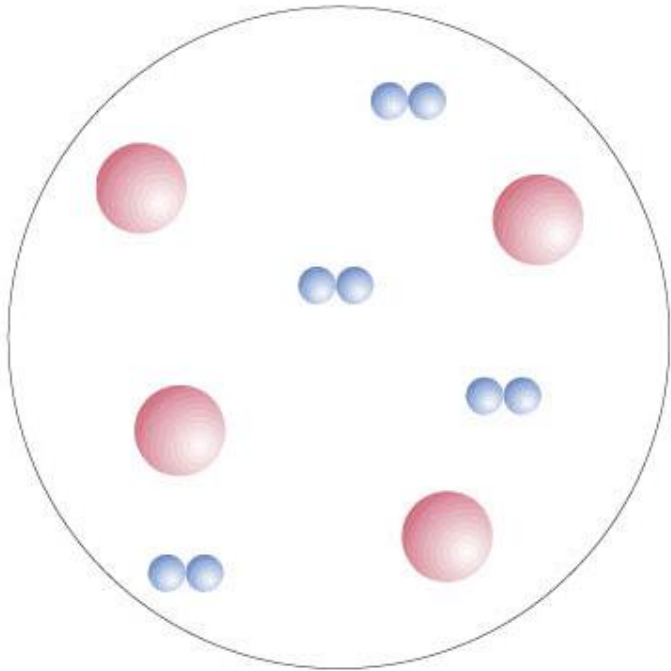
- A Mixture can be:
- element + element
 - element + compound
 - compound + compound

Mixtures can be separated into the elements that make them up by physical methods.



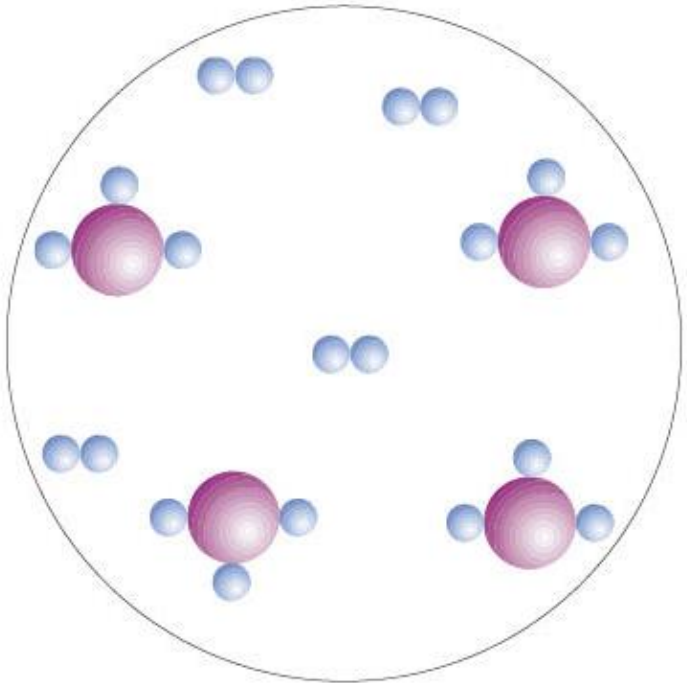


A mixture of 2 elements



**A mixture of two
elements, ex: neon (Ne)
and hydrogen (H₂)**

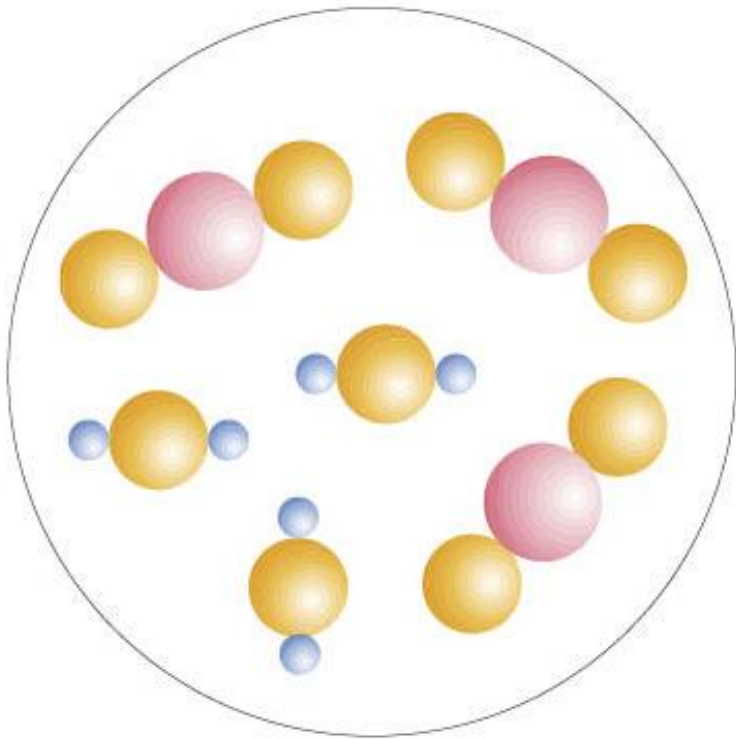
A mixture of 1 element and 1 compound



**A mixture of one element
and one compound, ex:
hydrogen (H₂) and
ammonia (NH₃)**



A mixture of 2 compounds



**A mixture of two
compounds, ex: water
vapour (H₂O) and
carbon dioxide (CO₂)**

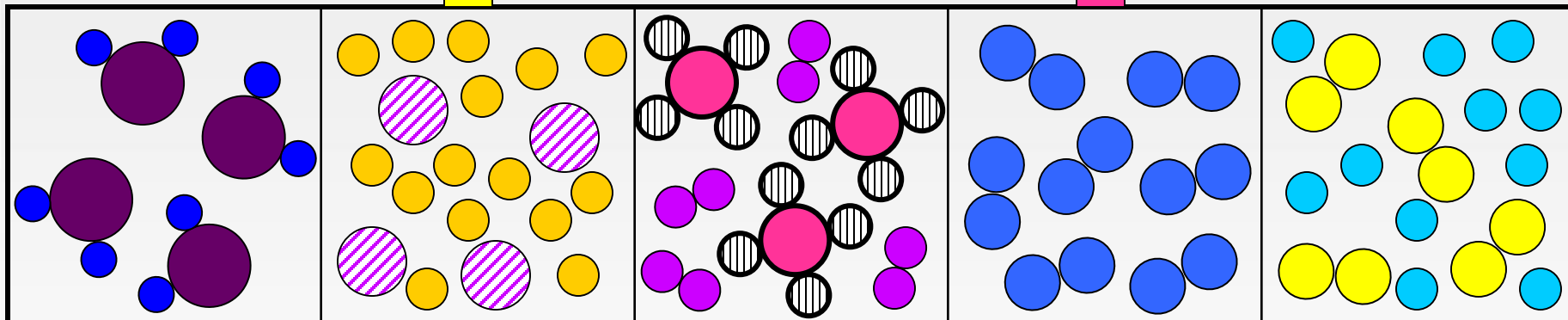
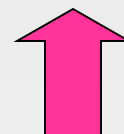


Can you differentiate?



Mixture of 2
elements

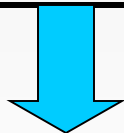
Molecules of
an **element**



Compound

Mixture of
element &
compound

Mixture of
2 elements





Conclusion

An element is a pure substance which cannot be split up into two or more simpler substances by chemical means.

A compound consist of a fixed number of different kinds of atoms chemically combined together.

A mixture is not a pure substance as it contains a mixture of atoms of molecules which are not chemically combined together.

Comparison between mixtures and compounds



	Mixture	Compound
Separation /breakdown	Components <u>can be separated by physical methods</u>	Elements in a compound <u>Cannot be separated by physical methods</u>
Properties (chemical / physical)	Same properties as its components	Properties are unique and different from its elements