

Classification of Matter

Elements, Compounds & Mixtures

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The Classification of Matter

Matter

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graph TD; Matter --> Elements; Matter --> Compounds; Matter --> Mixtures; Elements --- E_desc[Made of atoms that are alike.]; Compounds --- C_desc[Made of atoms of different elements chemically bonded together.]; Mixtures --- M_desc[Made of matter that is physically mixed but can be easily separated.];
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109

Elements

Made of atoms that are alike.

20 million +

Compounds

Made of atoms of different elements chemically bonded together.

infinite number

Mixtures

Made of matter that is physically mixed but can be easily separated.

Elements



Compounds



Mixtures





ELEMENTS

Elements

- Elements are the simplest form of matter.
- Everything in the Universe is made of elements. Hydrogen makes up 99% of the Universe.
- Elements are made of atoms which are similar. Atoms of different elements are different.
- There are currently 109 elements. Scientist believe the final number will be 118 elements.

Metals, Non-metals &

Metalloids

1 H																	2 He
3 Li	4 Be											5 B	6 C	7 N	8 O	9 F	10 Ne
11 Na	12 Mg											13 Al	14 Si	15 P	16 S	17 Cl	18 Ar
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba	*La	72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra	+Ac	104 Rf	105 Ha	106 Sg	107 Ns	108 Hs	109 Mt	110 110	111 111	112 112	113 113					

58 Ce	59 Pr	60 Nd	61 Pm	62 Sm	63 Eu	64 Gd	65 Tb	66 Dy	67 Ho	68 Er	69 Tm	70 Yb	71 Lu
90 Th	91 Pa	92 U	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

17 Non-metals
85 Metals
7 Metalloids

The arrangement of metals, non-metals and metalloids on the Periodic Table.

Diatomic Elements

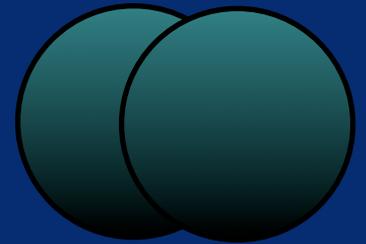
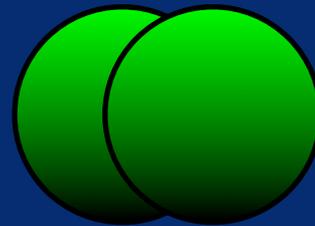
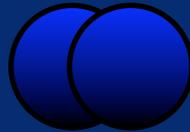
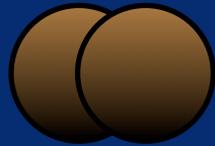
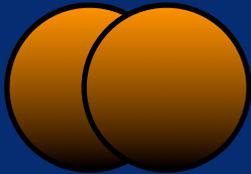
The smallest part of an element is an atom. Some elements have atoms that are always arranged in pairs.

We call these diatomic elements (di = two, atomic = atom).

Elements that are diatomic:

H, N, O, F, Cl, Br, I* and At*

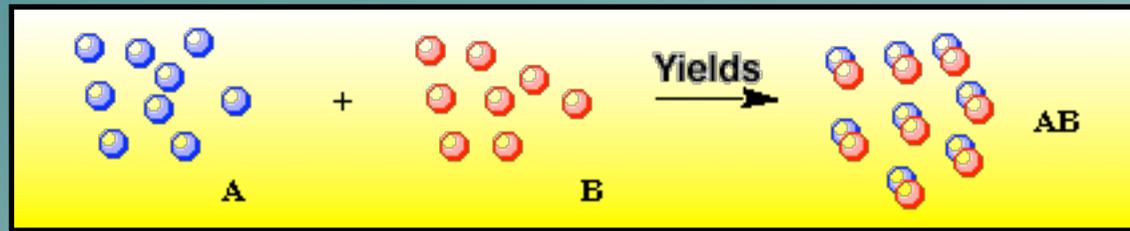
(*as gases)





COMPOUNDS

Compounds



- A chemist defines a compound as a combination of two or more substances chemically combined with new chemical and physical properties.
- Compounds have a fixed composition. The amount of each element in a compound is always the same ratio. In water, the ratio of H:O is always 2:1.

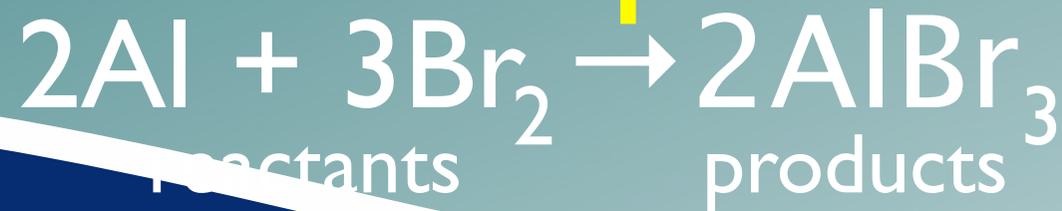
From elements to mixture to compound.



In the lab you mixed the elements iron and sulfur to make a heterogeneous mixture. You then heated the mixture to produce the compound iron sulfide.

Mixtures and Compounds

From Elements to Compound



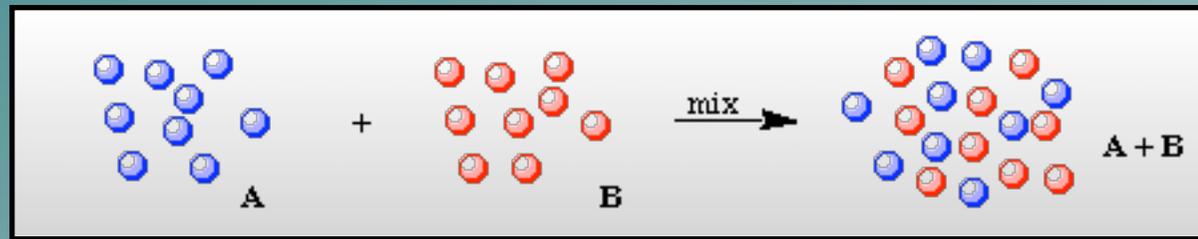
Aluminum is a silver metal. Bromine is a reddish brown liquid. They combine chemically they produce aluminum bromide, a compound that has different chemical and physical properties.

Formation of
Aluminum Bromide



MIXTURES

Mixtures



- A chemist defines a mixture as a combination of two or more substances in which each substance retains its own chemical and physical properties.
- In general, mixtures have no fixed composition. The amount of one or more components (substances) can usually vary over a wide range

2 Classifications of Mixtures

- Homogeneous - mixtures in which the particles are evenly mixed. Solutions and Colloids are homogeneous mixtures.
Examples: air, milk, salt water, colas, iced tea, fog, smoke...
- Heterogeneous - mixtures in which the particles are not evenly mixed.
Suspensions are heterogeneous mixtures.
Examples: salad dressing, blood, dirt, orange juice, ketchup, mustard...

Homogenous Mixtures:

Solutions

- Solutions are mixtures in which the solute particles are smaller than one nanometer in size (1 nanometer = 1×10^{-9} meter).
These particles are so small they:
 1. Don't separate upon standing.
 2. Cannot be take out with a filter.
 3. They do not scatter light.
- Examples of solutions are salt water, soda pop, tea, alloys* and clean air.
*Alloys are mixtures of metals: steel (Fe & C), 14K gold (Au & Cu), Bronze (Cu & Sn)

Parts of a Solution

Solvent > Solute

SOLVENT is the matter that is doing the dissolving
SOLUTE is the matter that is being dissolved.

Name of Solution	Solvent	Solute
Ocean Water	Water	Salt, O ₂ , CO ₂
Filtered Air	N ₂ (78%)	O ₂ (21%), H ₂ O, CO ₂
Colas	Water	Sugar, CO ₂ , flavoring
14 K Gold	Gold (58%)	Copper (42%)

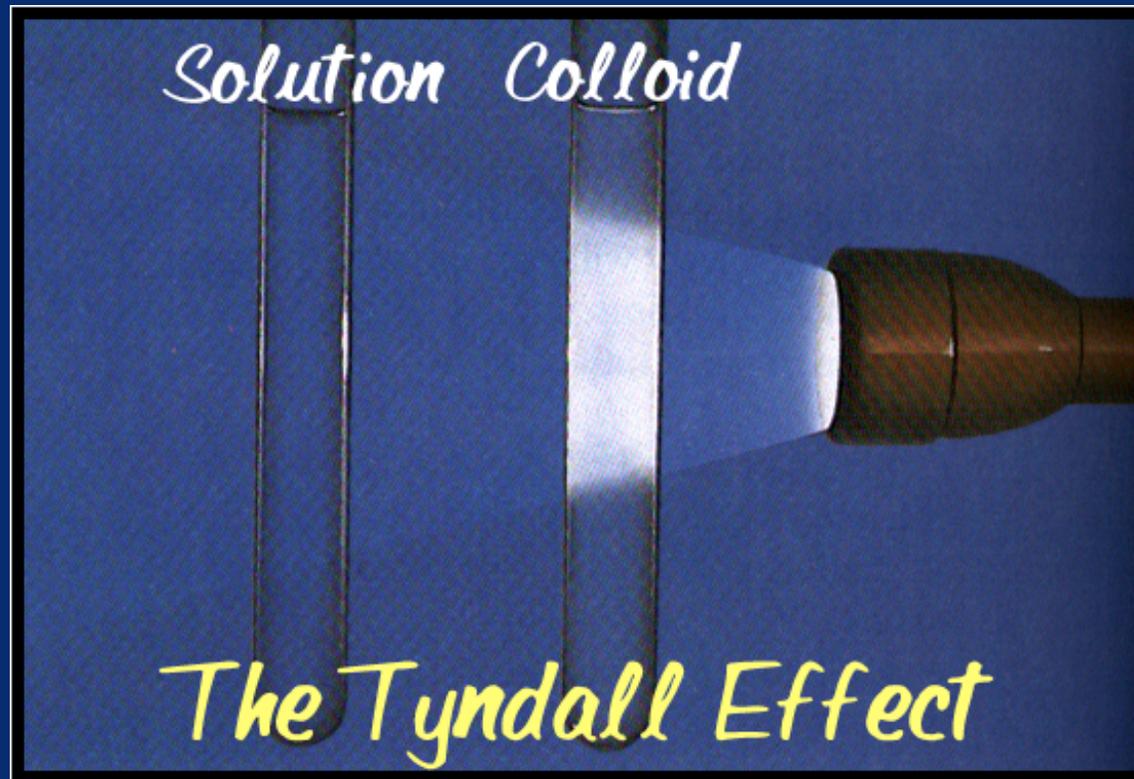
Homogenous Mixtures:

Colloids

- Colloids are mixtures in which the particles are between than one and one thousand nanometers in size. Collids:
 1. Don't separate upon standing.
 2. Cannot be separated with a filter.
 3. Do scatter light. (Tyndall Effect)
- Examples of colloids are fog, foam, smoke, jello, butter, whipped cream, egg white...

Tyndall Effect

The Tyndall Effect is a procedure of determining whether a mixture is a solution or a colloid. A beam of light is not visible in a solution, while in a colloid it is visible.

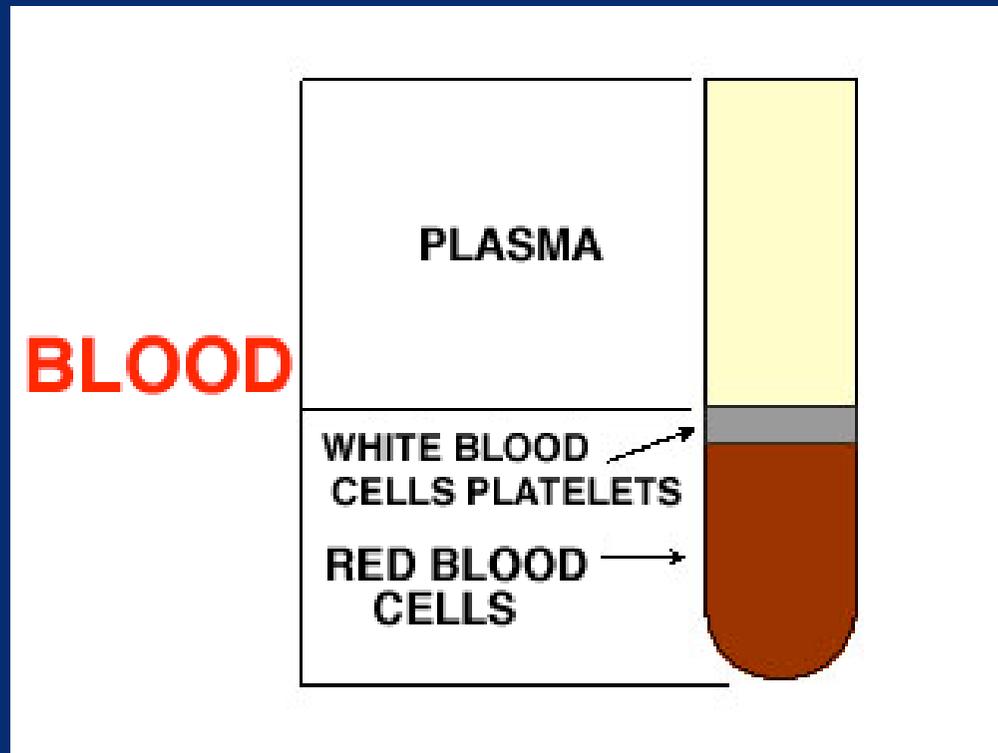


Heterogeneous Mixture: Suspensions

- Suspensions have particles that are larger than 1,000 nanometers - they can often be seen with the naked eye. Suspensions:
 1. Can be separated with a centrifuge.
 2. Can be separated with a filter.
 3. Do scatter light or stop beam.
- Examples of suspensions are paint, salad dressing, orange juice, ketchup... any mixture that states "Shake Before Using".

Suspension: Separating Blood

Blood is separated by spinning it in a centrifuge. The heavy red blood cells migrate to the bottom, while the lighter plasma rises to the top.



The Classification of Matter

