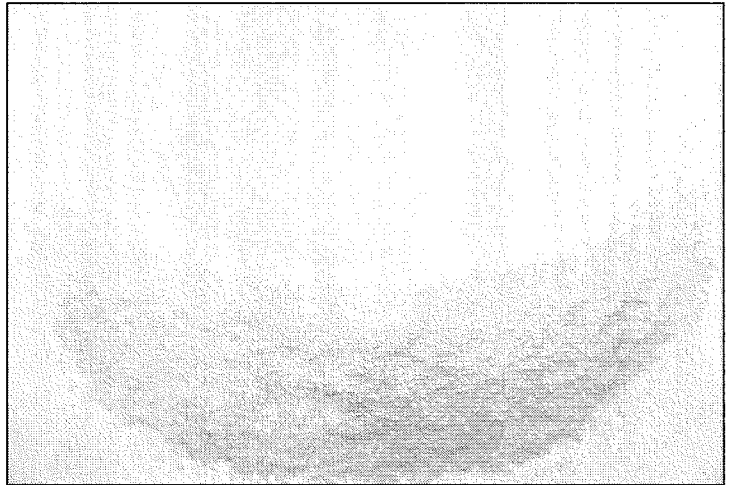


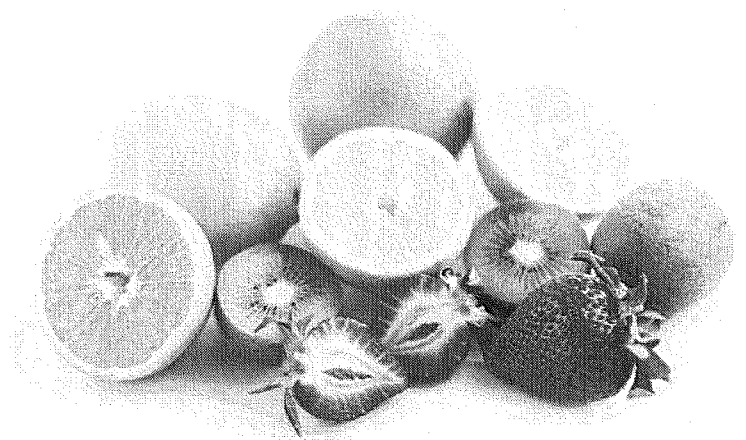
Study Material

All things on Earth are made up of a substance called matter.

Matter is defined as anything that has mass and takes up space. Everything around us is made of matter: the chairs we sit on, glass, paper, clothing, air! Matter can have many different characteristics and properties. They can change states: solid, liquid, gas. Matter has specific properties as well – burning, freezing, and evaporating. When matter is organized into a single type of matter we call it a substance.



A **pure substance** is only made up of one thing. For example: table salt and milk are pure substances. Things like fruit or milk are not substances.



There was a time when it was widely believed that matter was organized into only four elements: earth, wind, fire and water.

Many thousands of years later we know that there are many elements on Earth. **Elements** are pure substances that are unable to be broken down into any other substance. An element is the simplest substance that can exist.

hydrogen 1 H 1.0079																			helium 2 He 4.0026						
lithium 3 Li 6.941	beryllium 4 Be 9.0122																		boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180	
sodium 11 Na 22.990	magnesium 12 Mg 24.305																		aluminum 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.948	
potassium 19 K 39.098	calcium 20 Ca 40.078	scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.39	gallium 31 Ga 69.723	germanium 32 Ge 72.61	arsenic 33 As 74.922	selecnium 34 Se 78.66	bromine 35 Br 79.904	krypton 36 Kr 83.80								
rubidium 37 Rb 85.468	strontium 38 Sr 87.62	yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	niobium 42 Mo 95.94	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	rhodium 46 Pd 106.42	silver 47 Ag 107.87	cadmium 48 Cd 112.41	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29								
cesium 55 Cs 132.91	barium 56 Ba 137.33	* 57-70	lutetium 71 Lu 174.97	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	tungsten 74 W 183.84	rhenium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]							
francium 87 Fr [223]	radium 88 Ra [226]	** 89-102	actinium 89 Ac [227]	rutherfordium 103 Rf [261]	dubnium 104 Db [262]	seaborgium 105 Sg [266]	bohrium 106 Bh [264]	hassium 107 Hs [265]	meitnerium 108 Mt [268]	unnilium 109 Uun [271]	ununium 110 Uuu [272]	ununium 111 Uuu [272]	ununium 112 Uub [277]	ununquadium 114 Uuq [289]											

* Lanthanide series

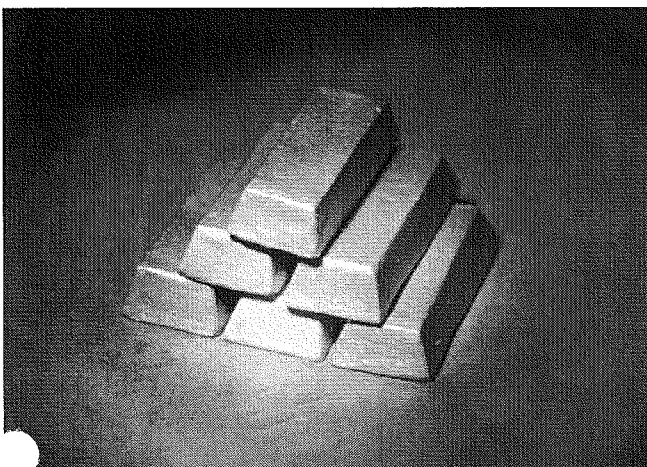
lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.04
actinium 89 Ac [227]	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	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]	mendeleevium 101 Md [258]	nobelium 102 No [259]

** Actinide series

Elements are organized in a **periodic table of the elements**.

Many of the elements on this table are familiar to you. The air

that you breathe is made up of oxygen (O). The silver (Ag) or gold (Au) earrings you saw in the store are made up of elements as well.



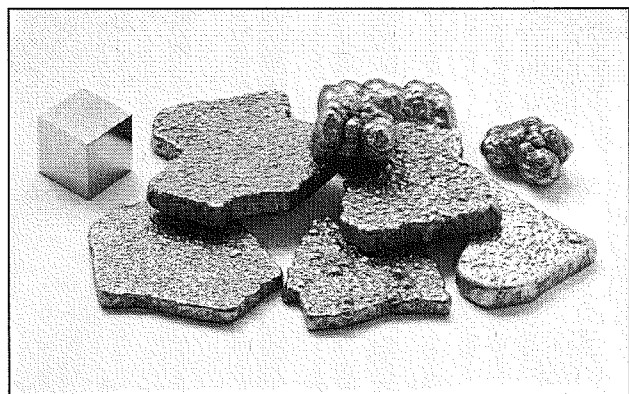
Elements are all around us. They are the building blocks of all things that are around us. The atoms that

are in elements can combine to make chemical bonds.

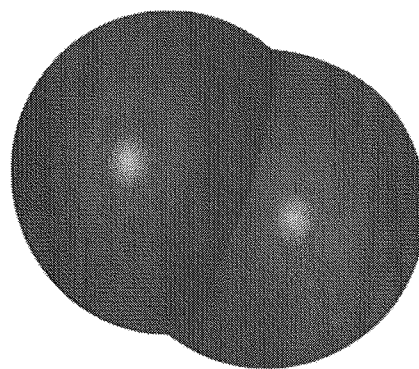
Atoms are small particles that make up elements. Atoms in one element can form bonds with atoms in other elements. When they do this in a specific ratio they can form compounds.

Compounds are pure substances that are made up of two or more elements that are chemically combined. Compounds have properties that are very different than the elements that created them.

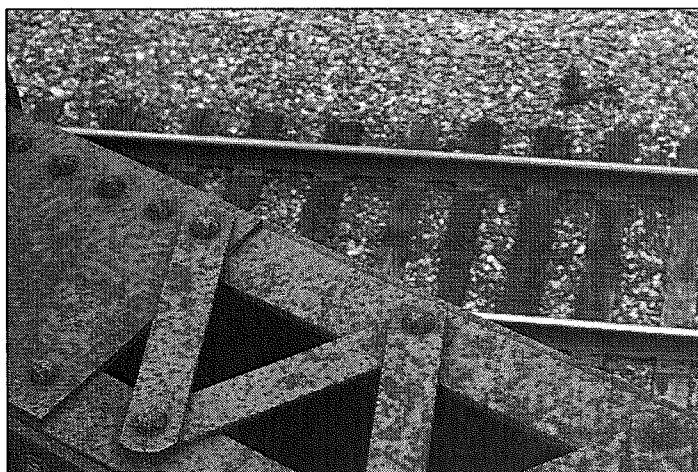
An example of a compound forming occurs when iron and oxygen chemically combine they form a substance known as rust.



Iron



Oxygen



Rust

Elements and compounds do not always combine perfectly. Sometimes they mix together in unusual ways. A **mixture** is created when two or more substances combine. These can be elements or compounds and they do not form in an organized manner.

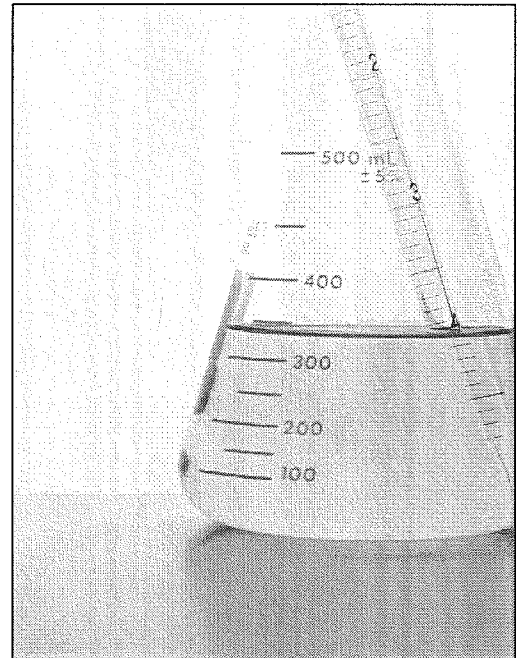
Mixtures are unique because they have properties of the elements and the compounds that make them up. Each element and compound also retains its original properties in the mixture.

There are two types of mixtures: heterogeneous mixture and homogeneous mixtures.

Heterogeneous mixtures are those that display clear parts or differences. Soil is made up of dirt, clay, rocks, grass, decaying material and many other things. As a result there are many different parts that are very visible.



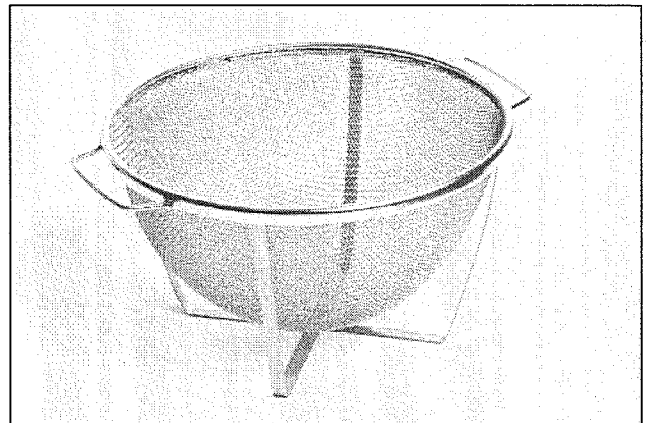
Homogeneous mixtures are so perfectly mixed together that one cannot tell the different parts that have made the mixture up. An example of a heterogeneous mixture is salt that is dissolved in water. The salt becomes so immersed in the water it cannot be seen. Homogeneous mixtures often do not even look like they are mixtures.



There are many ways to separate different types of mixtures.

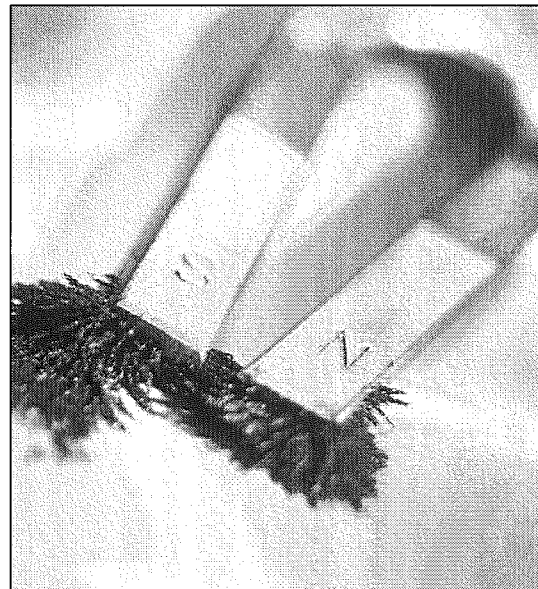
Filter (Filtration)

- When you filter a solution with a sieve or a filter paper. Filtration is a lot like making pasta – when the pasta is cooked you use a colander to separate the water from the pasta. A fine sieve or filter paper can do that in the same way.



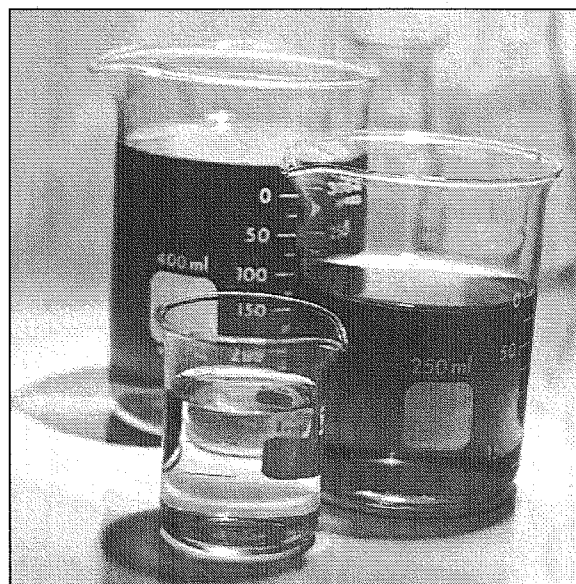
Magnet

- If the mixture you are working with has any metals present, a magnet can be used to pick up any metal easily by running the magnet slowly through the mixture.



Evaporation

- When a liquid mixture is evaporated any liquid will disappear leaving substances behind. This is great for solutions that have a lot of water in them.



Important Terms



Matter	Anything that has mass and takes up space.
Pure Substance	Something only made up of one thing.
Elements	Are pure substances that are unable to be broken down into any other substance.
Periodic Table	A table that organizes elements.
Atoms	Are small particles that make up elements.
Compounds	Are pure substances that are made up of two or more elements that are chemically combined
Mixture	Is created when two or more substances combine.
Heterogeneous Mixtures	Mixtures that display clear parts or differences.
Homogeneous Mixture	Are perfectly mixed together that one cannot tell the differ parts.
Filtration	Filtering a solution with a sieve or a filter paper.
Magnet	Can pick up any metal objects in a mixture.
Evaporation	Can allow liquid to evaporate-leaving only one substance.