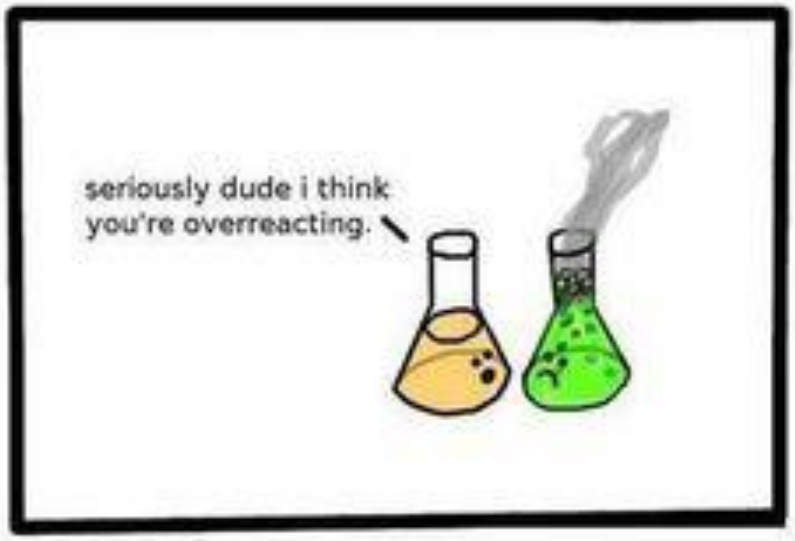
Name:

Regents Chemistry:

Notes: Unit 2: Matter



Name:

Key Ideas

1. Matter is classified as a pure substance or as a mixture of substances. (3.1q)
2. A pure substance (element or compound) has a constant composition and constant properties throughout a given sample, and from sample to sample. (3.1r)
3. Elements cannot be broken down by chemical change. (3.1u)
4. A compound is a substance composed of two or more different elements that are chemically combined in a fixed proportion. A chemical compound can be broken down by chemical means. A chemical compound can be represented by a specific chemical formula and assigned a name based on the IUPAC system. (3.1cc)
5. Mixtures are composed of two or more different substances that can be separated by physical means. When different substances are mixed together, a homogeneous or heterogeneous mixture is formed. (3.1s)
6. The proportions of components in a mixture can be varied. Each component in a mixture retains its original properties. (3.1t)
7. Elements and compounds can be differentiated by physical properties. Physical properties of substances, such as density, conductivity, malleability, solubility, and hardness, melting point, and boiling point differ among substances. (3.1w, 3.1dd, 5.2n)
8. Differences in properties such as density, particle size, molecular polarity, boiling and freezing points, and solubility permit physical separation of the components of the mixture. (3.1nn)
9. The three phases of matter (solids, liquids, and gases) have different properties. (3.1kk)
10. Some elements exist in two or more forms in the same phase. These forms differ in their molecular structure hence in their properties. (5.2f)
11. Elements and compounds can also be differentiated by chemical properties. Chemical properties describe how a substance behaves during a chemical reaction (3.1x, 3.1dd)
12. A physical change results in the rearrangement of existing particles in a substance. A chemical change results in the formation of different substances with changed properties. (3.2a)
13. During a physical change a substance keeps its chemical composition and properties. Examples of physical changes include phase changes, tearing or crushing, and dissolving (making a mixture). (5-8, 3.2a)
14. During a chemical change, substances react in characteristic ways to form new substances with different physical and chemical properties. Examples of chemical changes include burning of wood, cooking of an egg, rusting of iron, and souring of milk. (5-8, 3.2c)

Process Skills

1. Use a simple particle model to differentiate among properties of solids, liquids, and gases (3.1xxii)
2. Use particle models/diagrams to differentiate among elements, compounds, and mixtures (3.1xxxvi)
3. Describe the processes and uses of filtration, distillation, and chromatography in the separation of a mixture. (3.1xxiv)
4. Distinguish between chemical and physical changes (3.2i)

Word	Definition
Allotrope	1 of 2 or more different forms of an element (nonmetal) in the same phase but with different formulas and different physical/chemical properties.
Alloy	A solution where two metals are dissolved into each other in the solid phase.
Amalgam	A solution where a metal is dissolved into mercury.
Aqueous	A solution where a solute is dissolved into water.
Atom	The smallest part of an element that still retains the properties of that element.
Change	A transformation from one condition of matter to another.
Chemical Change	A reaction between two or more substances wherein a new substance(s) is formed. Chemical changes are indicated by release (or use) of large amounts of heat, color or odor changes, bubbling from within a liquid, or the formation of a precipitate in a solution.
Chemical Property	A property that can only be observed when a chemical change occurs.
Chromatography	A technique for separating components of a solution (mixture) based on how quickly different molecules dissolved in a mobile phase solvent move along a solid phase (e.g., chromatography paper).
Compound	Matter which results from the bonding of atoms of two or more elements to each other, decomposable into elements.
Diatomic Element	An element which is so reactive that it will forms one or more bonds with another atom of the same element to form a molecule consisting of the two atoms when there is no other element to bond with. Elements that do this are Br, I, N, H, Cl, H, O and F.
Distillation	A technique for separating components of a mixture based on the difference in the boiling points of the components.
Element	Matter which exhibits definite physical and chemical properties unique to itself and different from all other forms of matter and cannot be decomposed into simpler forms of matter.
Extensive	A property of a sample of matter which is dependent upon (will change with) the amount of the sample.
Filtration	A technique for separating heterogeneous mixtures based on phase or particle size.
Gas	A phase of matter characterized by the complete dissociation of matter particles from each other with the distances between the particles very large in comparison to the size of the particles and no attractive forces between them.
Heterogeneous	Matter that is unevenly distributed throughout a volume.
Homogeneous	Matter that is evenly distributed throughout a volume. AKA a solution.
Intensive	A property of a sample of matter which is not dependent on the amount of the sample.

Vocabulary

Liquid	A phase of matter characterized by matter loosely organized yet kept together by intermolecular or ionic attractive forces.
Matter	That which exists with mass and volume.
Mixture	Matter of different types that are in physical proximity to each other, yet not chemically combined.
Physical Change	A change resulting from the rearrangement of particles within a sample but no change to the particles themselves. Substances retain their physical and chemical properties. Examples include phase changes and formation of mixtures.
Physical Property	A property that can be observed without a chemical change occurring to the substance. Examples include color, density, melting point, boiling point, hardness, solubility.
Precipitate	A solid produced during a chemical reaction in a solution.
Solid	A phase of matter characterized by matter arranged in regular geometric patterns called crystal lattices with only vibration motion, no relative motion.
Solution	A homogeneous mixture consisting of a solute dissolved into a solvent.
Temperature	The average kinetic energy of a sample or system.
Tincture	A solution where a solute is dissolved into alcohol.

Lesson 1: Types of Matter

text: Ch 1, Sec 3, pp 21-27

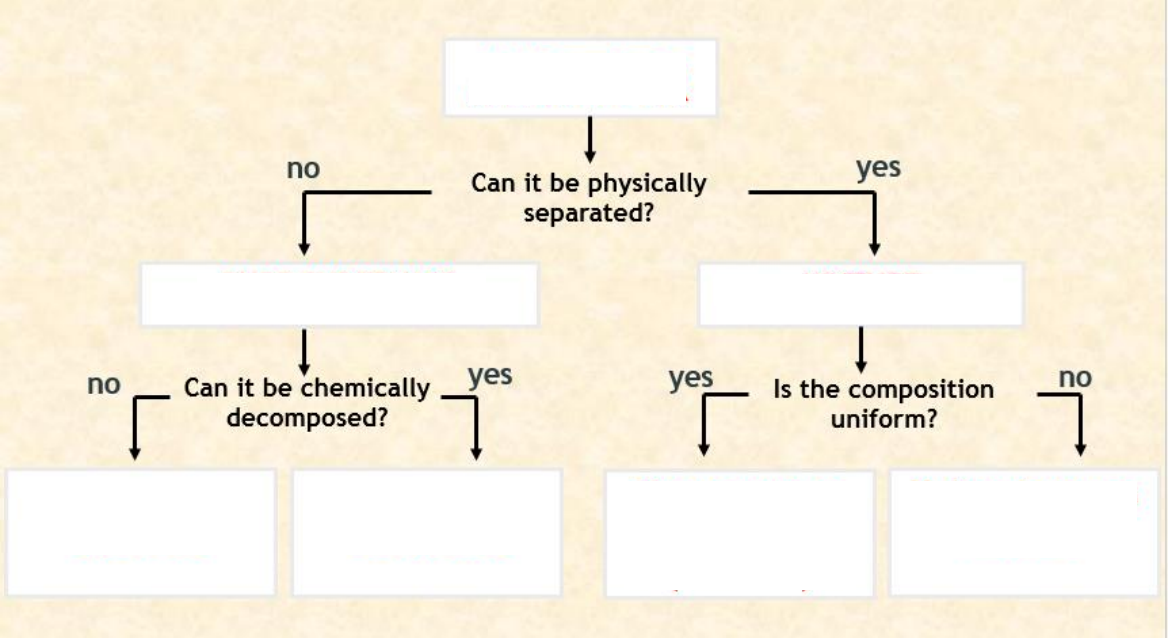
Objective:

- ***Differentiate between compounds, mixtures and elements***
- ***Determine if a mixture is homogeneous or heterogeneous***
- ***Identify the number of atoms in a substance based upon the chemical formula***

MATTER:

1. Has mass
2. Takes up space (volume)

Classification of Matter



PURE SUBSTANCE:

- Definite composition (each substance has exactly the same composition; identical particles)
- Definite properties

Are made of:

- one type of atom: element
  Ex: iron, gold, oxygen
- 2 or more types of atoms (combined chemically): compound
  Ex: salt, sugar, water

ELEMENTS:

- Substances that CANNOT be broken down chemically
- Made up of all the same type of ATOMS.

Elements symbols:

- 1 letter capitalized
- If second letter always lower case

Examples of elements: H, N, Pb

Types of Elements

MONOATOMIC ELEMENTS: Composed of single atoms not bonded to each other

Ex. Neon (Ne)

DIATOMIC ELEMENTS: 2 of the same elements bonded together

Ex. H_2

Elements that exist as diatomic molecules are: (You need to memorize these)

Br I N Cl **HOF**

Bromine (Br_2)

Iodine (I_2)

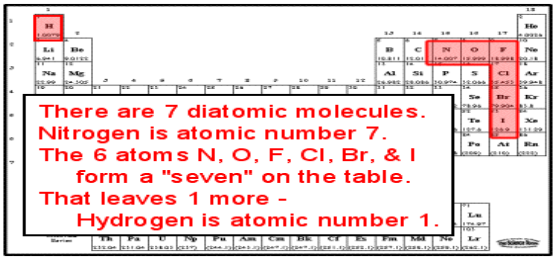
Nitrogen (N_2)

Chlorine (Cl_2)

Hydrogen (H_2)

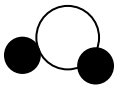
Oxygen (O_2)

Fluorine (F_2)



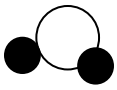
COMPOUNDS:

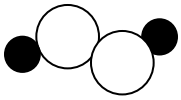
- Made up of atoms of two or more different elements chemically combined
- Have a fixed composition
    - Can be separated CHEMICALLY back into simpler substances
    - Represented by 2 or more DIFFERENT capital letters

Ex. H_2O 

SUBSCRIPTS: The little number following an element symbol. Indicates the # of ATOMS of ONLY THAT ELEMENT in the compound.

Example:

H_2O ($\_\_$ H and $\_\_$ O) 

H_2O_2 ($\_\_$ H and $\_\_$ O) 

Element or Compound?

- Br_2 _____
- $C_6H_{12}O_6$ _____
- NaBr _____
- Na _____
- Co _____
- CO _____

MIXTURES:

- 2 or more different substances that are PHYSICALLY combined
- Have varying composition

2 TYPES OF MIXTURES

HOMOGENEOUS:

- Substances are ***uniformly*** mixed; particles are ***evenly distributed***
- All solutions are homogeneous mixtures

Example:
Salt water NaCl $_{(aq)}$
(aq) aqueous (dissolved in water)

HETEROGENEOUS:

- Substances are not uniformly mixed

Examples:

Oil and water, Sand and water, Cat vomit

EXAMPLES: Classify each of the following as element, compound, or mixture. Then determine if homogenous or heterogenous:

Table salt NaCl (s) _____ _____

NaCl (aq) _____ _____

Iron _____ _____

Soil _____ _____

Air _____ _____

Lesson 2: Particle Diagrams

text: used throughout Ch 1

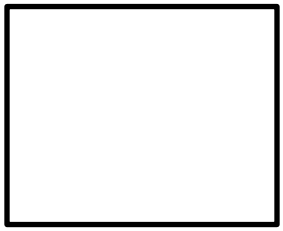
Objective:

- ***Construct and use particle diagrams to differentiate among elements, compounds, and mixtures***
- ***Construct and use particle diagrams to differentiate among solids, liquids and gases***

What are **PARTICLE DIAGRAMS:**

Show how the forms of matter look in a simple diagram form

MONATOMIC ELEMENT: Single atoms, not bonded to each other



DIATOMIC ELEMENT: 2 of the same elements bonded together

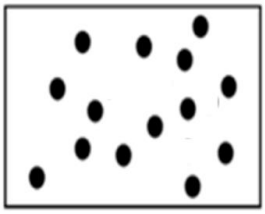
COMPOUND: Atoms of two or more different elements chemically bonded together in a definite, whole- number ratio

MIXTURE: Combinations of elements, compounds or both, in no fixed ratio, and not bonded together

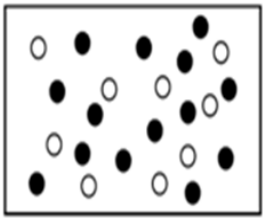
Homogenous Mixture (uniform):

Heterogeneous Mixture:

EXAMPLE: Classify as an element, compound or mixture



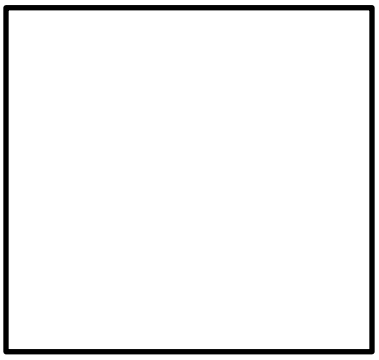
EXAMPLE: Classify as an element, a compound, or a mixture



STATES OF MATTER (a review)

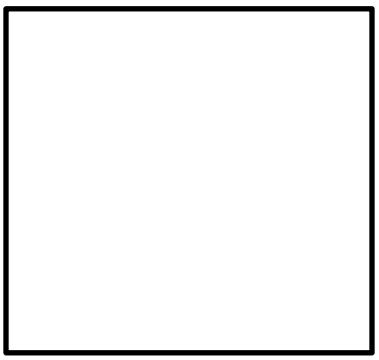
SOLIDS:

- Definite volume
- Definite shape
- Particles vibrate
- Symbol (s)



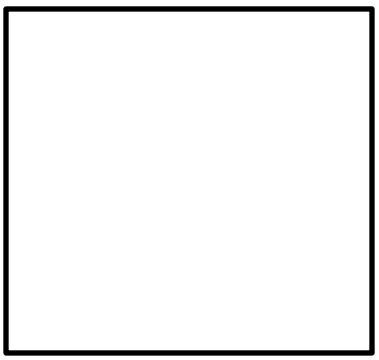
LIQUIDS:

- Definite volume
- Takes shape of container
- Constant motion
- Symbol (l) means liquid – *pure substance*
- Symbol (aq) means in water solution - *mixture*



GASES:

- No definite volume
- Fills a container (spread out)
- compressible
- Greatest amount of movement
- Symbol (g)



Lesson 3: Properties of Matter and Changes in Matter *Ch 1, Sec 2, pp 15-19*

Objective:

- ***Define and give examples of physical and chemical properties***
- ***Distinguish between physical and chemical changes***

PROPERTIES OF MATTER

Each substance has unique structure and therefore unique properties.

(Even within same element, can take different form and therefore different properties (graphite vs. diamond or molecular oxygen vs. ozone).

Physical vs. Chemical Properties

Physical properties: A property that can be observed without a chemical change occurring to the substance. IF you can see, hear, smell (sense) or measure it….

Examples:

Intensive properties do not change with the _____ of the sample.

Extensive properties do changes with the _____ of the sample.

MP, BP, and density for selected elements is at Table S. (These can change with external conditions such as atmospheric pressure, and are therefore measured at Standard Pressure (see Table A)).

Chemical properties: A property that can only be observed when a chemical change occurs, that is by reacting the substance and forming a new substance.

Examples:

Creating a mixture does not alter the properties of the substances within.

PROPERTIES AND CHANGES OF MATTER

PHYSICAL CHANGE:

- A change where the substance does not change
- NO NEW SUBSTANCE

Examples: phase changes (melting, freezing, boiling, evaporating, condensing), creating or separating a mixture (dissolving or crystallizing), crushing, tearing

CHEMICAL CHANGE:

- When a new substance is formed in a reaction
- A **NEW SUBSTANCE** is made

Signs of a Chemical property/change:

A new substance is made that has **different properties** than its elements:

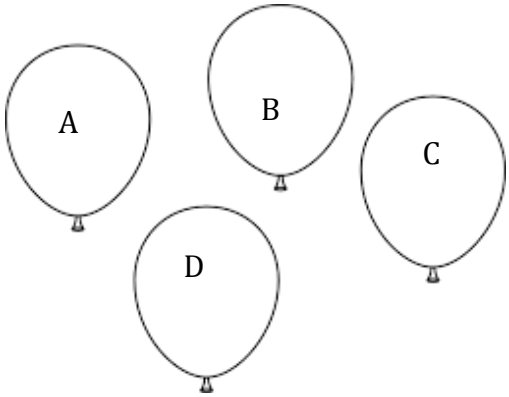
New color or odor
Bubbling (indicates a gas forming)
Precipitate (solid) forms from a solution
Large release or absorption of heat energy

Words to look for: reacts, combusts, corrodes, oxidizes, decomposes

EXAMPLES: Identify if the following are a physical or chemical change

- ☐ rusting iron _____
- ☐ dissolving in water _____
- ☐ burning a log _____
- ☐ crushing a compound _____

In Class: Balloon Demonstration



Balloon	A	B	C	D
Physical Properties				
Chemical Properties				

NOTES:

IN CLASS NOTES:

Using particle diagrams to show physical and chemical changes:

Lesson 4: Separation of Mixtures

text: Ch 13, Sec 1, pp 457-459

Objective:

- ***Determine how to separate different types of mixtures***
- ***Describe the processes and uses of filtration, distillation, and chromatography in the separation of a mixture***

SEPARATING A MIXTURE

BECAUSE substances retain their own properties in a mixture, mixtures can be separated by using these properties, e.g.:

1) boiling point/freezing pt

2) magnetism

3) solubility

4) density

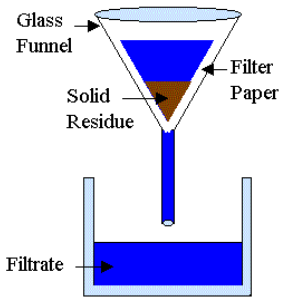
5) particle size

METHODS OF SEPARATION

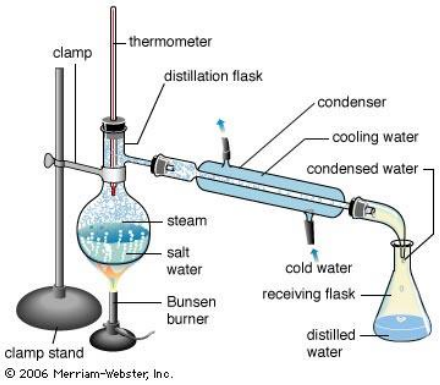
1. **FILTRATION:** Separates a solid from a liquid using filter paper

   Separation is based on particle size
   Solutions, e.g., NaCl(aq) CANNOT be separated in this way!!
   - *The solute (NaCl) will pass through the filter along with the solvent (the water).*

   Examples:



2. **DISTILLATION:** Separates mixtures of liquids by boiling point

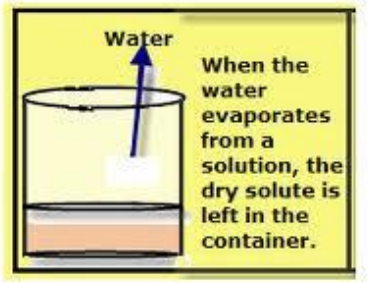


Examples:

3. **EVAPORATION:** Separates aqueous solutions – based on phase of water (liquid to gas) vs solid

   Example: Salt and Water

Unlike distillation, the water from the mixture is not captured and is lost to the surrounding air – this is an OPEN system



4. **CHROMATOGRAPHY:** Separates particles based on size and solubility (bigger particles move slower than smaller ones); Often used with colors (from Greek *chroma*).