CHAPTER 2

MATTER AND ENERGY

ENERGY is the ability to do work. Cause an object to move

TYPES OF MATTER

MATTER is anything that has mass and occupies space

A SUBSTANCE is matter with a definite, fixed and unvarying composition.

It has identical physical and chemical properties throughout.

A substance, sometimes called a pure substance, is either an element or a compound.

An ELEMENT is a substance that cannot be broken down by chemical means into a simpler substance

A COMPOUND is a substance that contains two or more different elements chemically combined. A compound can be broken down (decomposed) into its elements by chemical means.

A MIXTURE is composed of two or more different substances in varying amounts

Each substance retains its own physical and chemical properties

A mixture can be separated by physical means

TYPES of mixtures

A HOMOGENEOUS MIXTURE is uniform in composition, properties, and appearance (one phase)

A homogeneous mixture is called a solution and has uniform properties throughout

A HETEROGENEOUS MIXTURE is nonuniform, it contains two or more phases

CHAPTER 2

Table 1. The Names and Symbols of the 44 Most Common Elements

Element	Symbol	Element	Symbol
aluminum	Al	lithium	Li
antimony (stibium)	Sb	magnesium	Mg
argon	Ar	manganese	Mn
arsenic	As	mercury (hydrargyrum)	Hg
barium	Ba	neon	Ne
bismuth	Bi	nickel	Ni
boron	B	nitrogen	N
bromine	Br	oxygen	O
cadmium	Cd	phosphorus	P
calcium	Ca	platinum	Pt
carbon	C	potassium (kalium)	K
chlorine	Cl	radium	Ra
chromium	Cr	silicon	Si
cobalt	Co	silver (argentum)	Ag
copper (cuprum)	Cu	sodium (natrium)	Na
fluorine	F	strontium	Sr
gold (aurum)	Au	sulfur	S
helium	He	tin (stannum)	Sn
hydrogen	H	titanium	Ti
iodine	I	tungsten (wolfram)	W
iron (ferrum)	Fe	uranium	U
lead (plumbum)	Pb	zinc	Zn

CHAPTER 2

STATES OF MATTER

A GAS is composed of particles that are widely separated. A gas will expand to fill its container; it has no definite shape or volume. The particles are separated by large distances. Gases have very low densities. The volume of a gas expands and ~~contacts~~ CONTRACTS easily with a change in temperature or pressure.

A LIQUID has a definite volume but no definite shape; it assumes the shape of its container. The particles are much closer together than in the gaseous state.

A SOLID has a regular pattern of particle arrangement called the crystal lattice. The particles are very close together. It has a fixed volume and shape.

The KINETIC THEORY of matter proposes that all matter is made up of tiny particles that are in constant random motion. The speed of these particles increases with an increase in temperature

See Figure 2.1 p 18 in Dewey

CHAPTER 2

A PHYSICAL PROPERTY is anything observed about matter without destroying or changing its composition

A PHYSICAL CHANGE is a change in physical properties without a change in composition.

1. Change in state:

   Solid <———> Liquid <———> Gas

2. Dissolving - A solute dissolves in a solvent to produce a solution

A CHEMICAL CHANGE involves a change in composition

The smallest particle of an element that can combine with other elements to form compounds is an ATOM

A MOLECULE is a neutral particle composed of two or more atoms bonded together

CHAPTER 2

FORMULAS

The FORMULA for a molecular substance gives the number of atoms of each element in one molecule of the substance

CO_2 1 atom of C/ molecule of carbon dioxide
2 atoms of O/molecule of carbon dioxide

O_2 2 atoms of oxygen/molecule ofoxygen

DIATOMIC ELEMENTS

H_2, N_2, O_2. F_2, Cl_2, Br_2, I_2

makes the number 7 in the periodic table

What do the following formulas represent?

CO

NH_3

I_2

CHAPTER 2

Indicate if the following are elements or compound, atoms or molecules

I

I_2

He

H_2O

P

P_4

CO

CHEMICAL REACTIONS

REACTANTS (LEFT) PRODUCTS (RIGHT)

$$N_2 + 3H_2 = 2NH_3$$

Whole number coefficients are placed in front of the formulas to balance the equation

A process such as a chemical reaction, that releases heat to the surroundings is called an EXOTHERMIC reaction.

One that absorbs heat from the surroundings is an ENDOTHERMIC process

CHAPTER 2

IONIC AND MOLECULAR SUBSTANCES

There are two types of substances, IONIC and MOLECULAR

In MOLECULAR substances nonmetals are held together by covalent bonds

In IONIC substances a metal and a nonmetal are held together by electrostatic attraction (force of attraction of a positive ion for a negative ion)

Indicate if the following substances are molecular or ionic

NaCl

CO

CaO

H_2O

CHAPTER 2

10. PHYSICAL AND CHEMICAL PROPERTIES

1. Classify each of the following as a physical or chemical property

   a. Bromine is a red - brown liquid at room temperature.

   b. Bromine reacts with sodium to form sodium bromide

   c. Bromine has a boiling point of 59°C

2. Classify each of the following as a physical or chemical change.

   a. melting

   b. burning

   c. rusting

   d. breaking

3. Classify each of the following mixtures as heterogeneous or homogeneous

   a. a solution of sugar dissolved in water
   b. air
   c. chocalate chip cookies
   d. tap water
   e. tea
   f. sand and water

4. Pure aspirin is odorless. Upon opening a bottle of aspirin you smell the odor of vinegar (acetic acid). Has a chemical change occured?

5. From the symbol classify each of the following into the categories given

Substance	Element or Compound	Atom or Molecule
O		
O_2		
Br		
Br_2		
CO_2		
H_2O		
He		
H		
I		
SbI_3		
I_2		

12. ATOMIC SYMBOLS

Fill the following table with the symbols of the element derived from the latin name of the element.

ELEMENT SYMBOL	LATIN NAME
Gold	Aurum
Silver	Argentum
Mercury	Hydrargyrum
Iron	Ferrum
Copper	Cuprum
Tin	Stannum
Lead	Plumbum
Antimony	Stibium
Sodium	Natrium
Potassium	Kalium