

Chapter 1 & 3 Homework: Pages 94 – 97: 31, 33, 35, 36, 38, 41, 42, 43, 46, 50, 52, 54, 58, 61, 64, 67, 69, 72, 75, 76, 77, 82, 85, 89, 91, 93, 98, 99.

I. Chemistry : A Physical Science

A. The study of _____ and the _____ it undergoes.

B. Types

1. _____ **Chemistry** - the separation, identification and composition of materials
2. _____ **Chemistry** - the chemistry of carbon compounds
3. _____ **Chemistry** - chemistry of materials other than those classified as organic
4. _____ **Chemistry** - the study of the physical characteristics of materials and the mechanisms of their reactions
5. _____ - the study of materials and processes that occur in living things
6. _____ **Chemistry** - the study of subatomic particles and nuclear reactions
7. _____ **Chemistry** - the study of oil, its uses and properties
8. _____ **Chemistry** - the study of chains of molecules, i.e. plastics, nylon, polyurethane
9. **Engineering, Environmental, Chemical Oceanography, Clinical, Forensic**, and the list goes on

II. The Scientific Method

A. The _____ approach to the _____ of a problem that lends itself to _____

B. Two important questions - “What occurs?”; ”How does it occur?” come from observing a problem

C. Five General Phases

1. _____ - direct observations, search for information in many places
2. _____ - organization of data, looking for relationships
3. _____ - “educated” guess, based on assumptions and observations, must be testable, from Greek word meaning ground work
4. _____ - objectively test hypothesis using **experiments** (A sequence of observations carried out under controlled conditions)
5. _____ - a plausible explanation, based on experimentation, of an observed natural phenomenon in terms of a simple model with familiar properties, predicts future events, from Greek word meaning to look at

D. _____ and _____ - generalizations that describe behavior in nature

E. Simple Scientific Method

Step 1. Try something, if it works your done, if not, ask why it didn't work

Step 2. Try something else until you solve the problem

III. Matter

A. Anything that _____ and possesses _____ or has _____

1. _____ - resistance to change in position or motion

B. Mass vs Weight

1. _____ - the quantity of matter that a body possesses, also the measure of inertia of a body
2. _____ - the measure of the earth's attraction for a body
3. Mass is _____, weight is _____

C. Density

1. The _____ of a unit _____ of a material
2. Formula: Density = _____ of object / _____ of object (grams/mL)

D. Phases of Matter (States)

1. _____ - uniform part of a system separated from other uniform parts by boundary faces
2. _____ - definite shape, definite volume, closely packed, very low entropy
3. _____ - indefinite shape, definite volume, loosely packed, high entropy
4. _____ - indefinite shape, indefinite volume, no packing, very high entropy
5. _____ - exists at extremely high temperatures, nuclei are separated from electron clouds, exist in the sun and nuclear explosion
6. _____ - gaseous form of a solid or liquid that is normally a solid or liquid at room temperature (68°F or 20°C) (body temp = 37°C)
7. _____ - any substance that flows - liquids and gases
8. _____ - surface that needs no containment or support
 - a. Solids have _____ free surfaces
 - b. Liquids have _____ free surface
 - c. Gases have _____ free surfaces

E. Properties of Matter

1. _____ **properties** - properties that are useful in identifying and differentiating matter
2. _____ **properties** - properties that do NOT depend on the amount of matter present, i.e. - density, melting and boiling points
3. _____ **properties** - properties that DO depend on the amount of matter present, i.e. - mass, volume, length, weight
4. _____ **properties** - properties that can be determined directly without altering the identity or composition of a material, i.e. - odor, color, texture, solubility, melting, boiling
5. _____ **properties** - properties that describe the behavior of a material in processes that alter its identity, i.e. - chemical activity: active, inactive, inert
 - a. Evidence of a chemical change (reaction)
 - (1) evolution of _____ and/or _____ (change in _____)
 - (2) production of a _____
 - (3) formation of a _____ - solid formed from two solutions
 - (4) dramatic _____ change
 - (5) new _____ with new _____

F. Classification of Matter

1. _____ - matter that has parts with different properties, can usually see the different components
2. _____ - matter that is the same throughout, cannot see individual components
3. _____ – materials consisting of two or more kinds of matter each retaining its own characteristics; can be separated physically
 - a. _____ - mixtures of homogeneous matter, does not have a set of unique properties
 - b. _____ - each component displays its own unique properties but together the mixture has similar properties, called a **solution**, metal solutions are called alloys
 - c. Separation techniques
 - (1) _____ – mixture poured through filter paper, larger particles stay in filter
 - (2) _____ – solution is heated, different substances have different boiling points and will thus boil at different temperatures, vapor is captured and condensed.
 - (3) _____ / _____ – used with solid dissolved in liquid, evaporate liquid (condense and capture if needed), as solute becomes more saturated it will begin to crystallize.
 - (4) _____ – one solid goes from solid to vapor stage skipping liquid phase.
 - (5) _____ – use the components ability to travel through a stationary phase. Different sized components travel different distances, smaller travels farther.
4. _____
 - a. Homogeneous material consisting of one particular kind of matter
 - b. Has definite chemical composition
 - (1) sugar has properties that stem from itself directly relating to its particular composition
 - (2) granite, a heterogeneous mixture, has properties that stem from quartz, feldspar and mica
5. _____
 - a. Consist of two or more substances chemically combined each component loses its unique properties and forms new unique properties
 - b. Can be decomposed into two or more simpler substances by ordinary chemical means
 - (1) Heating
 - (2) Electrolysis – using electricity to separate
 - c. **Law of Definite** _____ / _____ - 1st observed by Louis Proust
 - (1) Each compound has a definite composition by mass; same elements in same proportions always. Like a recipe.
 - (2) Can be expressed as a percent by mass which is the

$$\frac{\text{mass of } \underline{\hspace{2cm}}}{\text{mass of } \underline{\hspace{2cm}}} \times 100 = \% \text{ mass}$$

- d. **Law of Multiple** – when different compounds are made of the same elements, different masses of one element combine with the same relative mass of the other element in a ratio of small whole numbers.
6.
- a. Substances that cannot be decomposed by ordinary chemical means
 - b. The known elements 118 and growing
 - (1)
 - (a) 90 elements from hydrogen to uranium
 - (b) two exceptions #43 - Technetium & #61 - Promethium
 - (2)
 - (a) those beyond uranium
 - (b) artificial/man-made elements prepared from other elements during nuclear synthesis
 - (3) classes of elements
 - (a) - left hand side of zigzag line
 - i) metallic luster -
 - ii) good reflectors of and , good of heat and electricity
 - iii) - drawn into fine wire
 - iv) - hammered, rolled into thin sheets
 - v) - resist being stretched and pulled apart, possess tensile strength
 - vi) examples - gold, silver, mercury
 - (b) - right hand side of zigzag line
 - i) poor conductors of heat and electricity
 - ii) brittle and neither ductile nor malleable
 - (c)
 - i) nonmetallic
 - ii) essentially without chemical reactivity - inert
 - iii) group 18 elements
 - (d) - border zigzag line
 - i) better conductors of electricity than nonmetals but not as good as metals
 - ii) also called semiconductors
 - iii) silicon, germanium
 - (4) chemical symbols - symbols of the elements

(a) John Dalton in 1808 developed circular symbols

Dalton's 1808AD symbols and formulae.

 <i>Hydrogen</i>	 <i>Soda</i>	 <i>Ammonia</i>
 <i>Nitrogen</i>	 <i>Pot Ash</i>	 <i>Olefiant</i>
 <i>Carbon</i>	 <i>Oxygen</i>	 <i>Carbonic Oxide</i>
 <i>Sulphur</i>	 <i>Copper</i>	 <i>Carbonic Acid</i>
 <i>Phosphorus</i>	 <i>Lead</i>	 <i>Sulphuric Acid</i>
 <i>Alumina</i>	 <i>Water</i>	

(b) J. J. _____

- i) Began using _____ letter of element as symbol, always _____ letter
- ii) Then as letters were repeated, used a second letter that _____ close to the element's name. Ca - calcium, Co - cobalt. This letter is always a printed lowercase letter.
- iii) The letter also represents _____ atom of the element

(c) Elements you should know - 1-36, 38, 47, 48, 50, 51, 53, 54, 56, 74, 78, 79, 80, 82, 83, 86, 92, 93, 94, 99.

(d) Earth's elemental composition

- i) 90 elements known in either free or combined state in the Earth's crust
- ii) Crust - mostly O₂ and Si
- iii) Water - Mostly H₂ and O₂
- iv) Atmosphere - mostly N₂ and O₂

IV. The changes that matter undergoes

A. _____

1. Those in which certain physical properties of substances change and their identifying properties remain unchanged
2. Properties that can be observed _____ altering the identity of the substance
3. Ice == Water == Steam; texture, color, odor

B. _____

1. Those in which _____ substances with _____ properties are formed
2. Properties, that when observed, _____ the identity of the substance
3. Activity, Inactivity, Inertness
4. Burning wood, iron rusting, silver tarnishing

5. Any process that absorbs energy as it proceeds is _____
(_____ meaning enter or into; therm referring to heat)
 - a. Can be chemical or physical
 - b. The products have _____ energy than the reactants
 - c. Photosynthesis (chem); ice melting (phys)
 6. Any process that releases energy as it proceeds is _____ (_____ = out)
 - a. Can be chemical or physical
 - b. The products have _____ energy than reactants
 - c. Burning wood (chem); steam condensing (phys)
 - d. This the majority of the chemical reactions
 7. Agents used to _____ chemical reactions (chemical _____)
 - a. _____ - each 10^0 C increase approximately doubles the rate of many reactions. Need to know exo or endo
 - b. _____ - photosynthesis, photography
 - c. _____ - used to decompose H_2O into H_2 and O_2 ; called electrolysis
 - d. _____ - allows free exchange of ions, water is the medium in which the reaction can occur – electrolytes conduct electricity; non-electrolytes do not. Salt water vs. sugar water.
 - e. _____ - a substance or combination of substances that increases the rate of a chemical reaction without itself being permanently changed. It accomplishes this by lowering activation energy
 8. Reaction tendencies
 - a. There is a tendency for processes in nature to occur that lead to a lower _____ state and a higher state of _____ (state of disorder)
 - b. Energy needed to start a chemical reaction is called _____ energy.
 - c. To increase rate of reactions –
 - i. _____
 - ii. _____
 - iii. _____
- C. _____ changes
1. The new substances are formed by altering the identity of the _____ themselves not a rearrangement of elemental combinations
 2. Some are spontaneous _____ \implies _____
- V. Concept of _____
- A. The capacity/ability to do work; the capacity/ability to change matter
 - B. Types of energy
 1. _____
 - a. _____ - energy of position, stored energy
 - b. _____ - energy of motion measured in joules ($kg\ m^2/s^2$)
(1) $E_k = \frac{1}{2} mv^2$
 2. _____ (_____) - energy that is transferred between two systems
 3. _____ - movement of electrons
 4. _____ - kind of stored energy, from chem rxns

5. _____ - energy from one source emitting in all directions
 - a. Radio waves, x-rays, visible light, solar
 6. _____ - energy from the atom
- C. Energy can be _____ (_____) from one type to another
1. Potential E to kinetic E - _____
 2. _____ Plant - Coal burned - heat released transferred to water, water to steam, steam drives a turbine, turbine drives generator to form electricity
 3. Only the energy _____ during transformation is _____
- D. Conservation of _____ and _____
1. _____ and _____ are interchangeable, and the total _____ and _____ in the universe is constant, _____ and _____ can neither be created nor destroyed
 2. In ordinary chemical reactions, the total _____ of the reactants is equal to the total _____ of the products
 3. Einstein's view
 - a. "Matter and energy may represent two different forms of a single, more fundamental, physical quantity."
 - b. $E = mc^2$ where E = energy, m = mass, c = speed of light (3.0×10^8 m/s)
 - c. So with a very small amount of matter enormous amounts of energy can be gained - support - nuclear power