

Chemical Calculations I - CTEC 1205

OBJECTIVES

INTRODUCTION TO CHEMISTRY

1. Definition of Chemistry
2. History of Science and Chemistry
3. Branches of Chemistry
4. Scientific Method
 - a) collect data
 - b) analyze data
 - c) test data in regard to hypothesis
 - d) modify hypothesis
5. Hypothesis.... Theory..... Law

STANDARDS FOR MEASUREMENTS

1. Define each of the following terms and describe the distinguishing characteristic of each:
 - a. significant digit
 - b. exponent
 - c. scientific notation
 - d. matter
 - e. mass
 - f. weight
2. Given a number, express the number in scientific notation.
3. Given numbers in scientific notation, multiply, divide, add and subtract them in scientific notation.
4. Define the conversions between English and Metric measurements for volume mass and length.
5. Given a measurement in the metric system, convert it to any other related unit in the metric system.
6. Distinguish the difference between mass and weight.
7. Define energy, specific gravity and density.
8. Given a temperature measurement in one scale, convert it to one of the other scales.
9. Given the mass and volume of a substance, calculate its density.
10. Calculate the volume or mass of a substance, given the specific gravity.
11. Calculate the mass or volume of substance, given the specific gravity or density of a substance.
12. Calculate the specific heat of a substance.

PROPERTIES OF MATTER

1. Define the following terms:
 - a. matter
 - b. amorphous
 - c. gas
 - d. heterogeneous
 - e. substance
 - f. properties
 - g. chemical properties
 - h. chemical change
 - i. energy
 - j. kinetic energy
 - k. solid
 - l. liquid
 - m. homogeneous
 - n. phase
 - o. mixture
 - p. physical properties
 - q. physical change
 - r. Law of Conservation
 - s. potential energy
2. Distinguish between physical and chemical properties and physical and chemical changes.
3. Distinguish between kinetic and potential energy.
4. Define the following:
 - a. element
 - b. Law of Definite Composition
 - c. atom
 - d. chemical formula
 - e. symbol
 - f. compound
 - g. molecule
5. Write the symbols or names for common elements.
6. Differentiate between molecules and atoms
7. State the Law of Definite Composition
8. Be able to recognize a chemical formulas.
9. Differentiate between compounds and mixtures.

ATOMIC STRUCTURE and THEORY

1. Define:
 - a. Dalton's atomic theory
 - b. subatomic particles
 - c. electrons
 - d. neutrons
 - e. protons
 - f. nucleus
 - g. orbitals
 - h. energy levels of electrons
 - i. electron shells
 - j. atomic number
 - k. noble gas

1. isotopes
 - m. mass number
 - n. atomic mass unit
2. State the major provisions of Dalton's atomic theory.
3. State the names, symbols, charges and relative masses of the three principle subatomic particles.
4. Describe the atom as conceived by Niels Bohr.
5. Determine the maximum number of electrons that can exist in a given principle energy level.
6. Determine the atomic number, atomic mass, and number of neutrons, protons and electrons, given sufficient data.
7. Draw the sublevels in each principle energy level showing order and number of electrons.
8. Distinguish the differences between isotopes

PERIODIC TABLE

1. Period whether an element is a metal, nonmetal, or metalloid.
2. Determine the atomic number of an element.
3. Determine the atomic mass (atomic weight) of an element.
4. Determine the symbol or name of an element.
5. Given a known reaction, predict the reaction of other elements within the same group.

CHEMICAL BONDS and FORMULA WRITING

1. Define the following terms :
 - a. chemical bond
 - b. polyatomic ion
 - c. ionic bond
 - d. covalent bond
 - e. coordinate covalent bond
2. Describe the formation of ions by electron transfer and the nature of the chemical bond.
3. Using oxidation numbers of elements, write the chemical formulas of inorganic compounds.

NOMENCLATURE OF INORGANIC COMPOUNDS

1. Given the name or formula for binary compounds that have a metal (fixed) and a nonmetal.
2. Give the name of a binary compound with a metal (variable) and a nonmetal using the Stock system.

3. Give the name or formula for a ternary compound that has a metal and a polyatomic ion.
4. Define how to determine whether a compound is an acid or base.
5. Name salts of ternary oxy-acids and those with more than one positive ion.

BALANCING CHEMICAL EQUATIONS

1. Identify the parts of an equation.
2. Balance chemical equations by the inspection method.

WEIGHT RELATIONSHIPS

1. Determine the atomic (molecular) mass of elements and compounds.
2. Using a periodic table, write the isotopic notation for various isotopes.
3. Calculate the molar, mass, and atomic relationships of elements and compounds.
4. Calculate the percent composition of compounds.
5. Calculate the empirical and molecular formulas of compounds given elemental data.

CHEMICAL EQUATIONS and STOICHIOMETRY

1. Given the mass of one reactant or product and the equation, determine the mole-mole ratio, and the resulting masses of the other products and reactants.
2. Determine the limiting reagent in a stoichiometry problem.

SOLUTIONS

1. Define a solution and its components.
2. State the various terms used to identify concentrations.
3. Using the dilution formula, show how to prepare new solutions.
4. Calculate the molarity of a solution and determine how to prepare one.
5. Calculate the normality of a solution and determine how to prepare one.
6. Calculate the percent by volume and mass of a solution.
7. Given volumes and concentrations, perform titration calculations.

GAS LAWS

1. Convert one unit of pressure to another.
2. Determine pressures, volumes, and temperatures using the General Gas Law.
3. Using the Ideal Gas Law, determine pressures, volumes, temperatures, moles, grams, and molecular masses of gases.
4. Perform stoichiometry problems using the gas laws.
5. Calculate partial pressures using Dalton's Law of Partial Pressures (including water vapour).