

Chemistry
Semester 1
Final Review

Ch. 1 Introduction to Chemistry

Chemistry; its branches, technology, scientific method, and problem solving.

1. Know the definition of matter.
2. Know the definition of chemistry
3. Know the scientific method.

Ch 2 Matter and Change

Properties of Matter

More hints:

1. Know the following words: Physical vs Chemical properties and changes.
2. Categorize Matter as either homogeneous, heterogeneous, solution, compound, or, element.
3. Know the difference between physical & chemical properties. (Intensive vs extensive)
4. Know the difference between physical & chemical changes.

Examples:

- a. Give three physical properties
- b. Give three chemical properties
- c. Classify as chemical or physical properties:
color, reactivity, flammability, stability, malleability, solubility, melting point, rusts, evaporates readily

Ch 3 Scientific Measurement

1. Know the basic units of the SI system.
2. Know the prefixes of the SI system (micro-Mega).
3. Know how to convert between units & prefixed units. i.e. km to m
4. Know how to convert between different prefixed units. i.e. dm to km
5. Know how to convert between combinations & complex forms, i.e. mL to cm³, cm³ to dm³, km/h to m/sec
6. Know how to put a number into scientific notation.
7. Know how to change scientific notation to standard notation.
8. Know how to use significant digits
9. KNOW HOW TO CONVERT USING DIMENSIONAL ANALYSIS.

Conversions: 45mg=_____g 2.05 kg=_____mg 101hm=_____mm
312L=_____ml 1.35 km/hr=_____m/s 21cm³=_____m³
75.1ml=_____cm³ 51cm²=_____km² 9dg=_____g
1.2 X 10² cm=_____mm 47mm / hr to dm / sec 835 m/sec to cm/min

Problems:

1. Find the density of an object that has a mass of 45g and a volume of 25.0 cm³.
2. Find the mass of an object that has a density of 4.5g/cm³ and a volume of 11cm³.
3. Calculate the volume of an object in cm³ that has a mass of 22kg and a density of 8.2kg/dm³.
4. The density of aluminum is 2.70 g/cm³. Calculate the mass of aluminum that occupies 75.0 cm³.

5. Convert to regular or scientific notation.

- a) 12300= _____
b) 40120= _____
c) 1120000= _____
d) 0.0000123= _____
e) 0.0120= _____

- f) 1×10^3 = _____
g) 1.110×10^4 = _____
h) 2.12×10^{-5} = _____
I) 3.20×10^{-7} = _____
j) 4.412×10^{11} = _____

6. How many sig figs?

7300 _____ 0.00125 _____ 71253 _____ 5.012 _____ 0.5100 _____

7. Answer to the correct sig figs:

- a) $85+2.3$ = _____
b) $213.213-12.3$ = _____
c) $57+11.1$ = _____
d) $1.2 \times 10^3 + 4.2 \times 10^2$ = _____

- e) $42.1/24$ = _
f) 101×2134 _____
g) $2123/3143$ = _____
h) $2.23 \times 10^5 \times 5.2 \times 10^3$ = _____

CH 4 Atomic Structure

1. Defining the Atom:

- a. Democritus to Dalton ideas about atoms
b. Know the main point of Dalton's Atomic Theory.

2. Structure of the Nuclear Atom.

- a. Identify the three subatomic particles.
b. Thompson and the electron.
c. Rutherford's Atomic Model.

3. Distinguishing Between Atoms.

- a. Isotopes vs elements
b. Atomic number, Atomic Mass, Mass Number. Know how to calculate the protons, neutrons and electrons in an atom.
c. Into to the Periodic Table

Problems:

1. How many protons neutrons, and electrons are in U-235.
2. Calculate the average atomic mass of lead containing the following isotopes: 1.4% of Lead-204, 24.1% of Lead-206, 22.1% of Lead-207, 52.4% Lead-208.

CH 5 Electrons in Atoms

1. Models of the Atoms:

- a. Bohr's Model of the atom.
b. The quantum mechanical model.
i. Principle quantum number: main energy level
ii. Angular Momentum Quantum Number: sublevels (s,p,d,f)
iii. Magnetic Quantum Number: Orientation in space.
iv. Spin quantum number: right or left spin.(two electron per house)

2. Electron arrangement in Atoms: electron configuration...

- a. Long way Germanium #32 $1s^2, 2s^2, 2p^6, 3s^2, 3p^6, 4s^2, 3d^{10}, 4p^2$ Val electrons 4.
b. Noble gas: Germanium #32 $[\text{Ar}] 4s^2, 3d^{10}, 4p^2$. Valance electrons 4.

3. Physics and Quantum Mechanical Model:
 - a. The source of electromagnetic spectrum.
 - b. Electrons jump up into higher energy levels and fall down into lower levels releasing energy in the form of light.

Problems

1. Write the electron configuration and determine the valence electrons for...
 - a. Lead, b. Strontium, c. Krypton, d. sodium, e. Aluminum, f. chlorine

CH 6 The Periodic Table

1. Organizing the Elements.
 - a. The history of the Periodic Table.
 - b. Three broad classes of elements
2. Classifying the Element
 - a. describe the information in a periodic table
 - b. Classify elements based on electron configuration and valence electrons.
 - c. Distinguish represented elements and transition metals.
3. Periodic Trends
 - a. Describe trends involving, Atomic size, ionization energy, electronegativity.
 - b. Explain how ion are formed

CH 7 Ionic and Metallic Bonding

1. Ionic bonds
 - a. Explain how the octet rule applies to ionic bonds. Metal with Nonmetal.
 - b. Determine the number of valence electrons in an atom and predict whether it will gain or lose electrons (cation or anion)
 - c. Describe three properties of Ionic compounds
 - d. Typical Ionic bonds form between active metals with active nonmetals.
2. Bonding in metals.
 - a. Describe the arrangement of atoms and valence electrons in metallic bonds.
 - b. Explain the importance of alloys.
 - c. Describe three properties of Metallic Bonds.

Problems: Show a dot structure for NaCl and CaCl₂

CH 8 Covalent Bonding

1. Nature of Covalent bonds
 - a. Sharing electrons and the octet rule
 - b. Drawing electron dot diagrams (Lewis structures)
 - c. Draw molecules showing double and triple bonds
 - d. Covalent vs Coordinate Covalent
2. Bonding Theories
 - a. VSEPR theory and molecular geometry
 - b. Hybridation involving Carbon.

3. Polar Bonds and Molecules

- Electronegativity differences determine the distribution of charge in polar molecules.
- Evaluate the strength of intermolecular attractions compared with the strength of ionic and nonpolar covalent bonds
- Understand the nature of Network Covalent Molecules and the properties associated with them.

Draw Lewis structure for the following, determine the geometry of 2,3,4,5,7.

- hydrogen gas (H_2)
- SO_2
- $(IO_3)^{-1}$
- CCl_4
- HCl
- C_2H_2
- CO_2

Of the molecules/polyatomic ions above, three show polarity, identify the three and show the relative positive and negative ends of the molecules.

CH 9 Chemical Names and Formulas

Chemical formulas, subscripts, coefficients, naming and writing compounds: traditional system and stock system and acids.

- Know the following terms: symbol, formula, subscript, and polyatomic ion.
- Know how to give the formula of a named compound.
- Know how to give the name of a compound from a formula.
- Know how to use the tables of oxidation numbers and polyatomic ions.
- Know the elements that exist as diatomic molecules. (List them) HOFBrINCl

Give the formula:

- | | |
|------------------------|-------------------------|
| a) potassium nitrate | d) manganese (II) oxide |
| b) iron (III) chloride | e) ammonium bromide |
| c) sodium carbonate | f) tin (IV) phosphate |

Name the following:

- | | |
|-------------|-------------|
| 1. $CaCO_3$ | 4. $AgBr$ |
| 2. $CuCl_2$ | 5. Sn_5 |
| 3. SnS_2 | 6. $CdSO_4$ |

Name the following molecular compounds

- | | |
|------------|-------------|
| 1. PCl_3 | 3. SiO_2 |
| 2. CCl_4 | 4. N_2O_5 |

Write chemical formula for:

1. carbon disulfide
2. dinitrogen trioxide
3. oxygen difluoride
4. nitrogen monoxide

Name the following acids

1. HNO_3
2. H_2S
3. HCl
4. $\text{HC}_2\text{H}_3\text{O}_2$
5. HNO_2
6. H_2SO_3

Write the chemical formulas for the following acids:

1. phosphoric acid
2. hydrobromic acid
3. sulfuric acid
4. hydroiodic acid
5. phosphorous acid
6. chlorous acid

Ch 10 Chemical Quantities

Calculate the Molar mass of:

1. $\text{Ca}(\text{OH})_2$
2. NaCl
3. MgCl_2
4. CO

Problems:

1. How many oxygen atoms are present in 0.500 mol of CO_2 ?
2. How many moles are present in 10.37 g of LiF ?
3. What is the empirical formula for a compound that is 43.6% phosphorous and 56.4% oxygen?
4. What is the empirical formula for a compound that is 7.9% lithium and 92.1% bromine?
5. A compounds empirical formula is C_2H_5 . If the molar mass is 58 amu, what is the molecular formula?
6. A compounds empirical formula is N_2O_5 . If the molar mass is 108 amu, what is the molecular formula?
7. Find the molar mass of the following compounds:
 - a. $(\text{NH}_4)_4\text{SiF}_6$
 - b. PbO_2
 - c. Cs_3PO_3
 - d. $\text{Ga}_2(\text{CO}_3)_3$
8. Find the percent composition of $\text{Ca}_3(\text{PO}_4)_2$
9. Calculate the Percent composition of Acetaminophen if a 10.00g sample contains 6.36g carbon, .596g hydrogen, .927g nitrogen and 2.11 g oxygen.
10. Calculate the Empirical and Molecular formula of Acetaminophen if a 10.00g sample contains 6.36g carbon, .596g hydrogen, .927g nitrogen and 2.11 g oxygen and the molar mass is 151.15 g/mole.
11. What is the difference between an empirical formula and a molecular formula?