General Chemistry Semester 1 Study Guide

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Unit A, Chapters 1 &2

Chapter 1 – The Science of Chemistry

VOCABULARY WORDS:

Chemical	Chemical Reaction	Endothermic Reaction
Exothermic Reaction	Physical State	Product
Reactant	Chemical Change	Chemical Property
Density	Mass	Matter
Physical Change	Physical Property	Quantity
Unit	Volume	Weight
Allotrope	Atom	Element
Molecule	Heterogeneous Mixture	Homogeneous Mixture
Compound	Ion	Mixture
Inorganic Compound	Organic Compound	

QUESTIONS:

1. Define Chemistry.

2. Compare and contrast the phases of matter (solid, liquid, gas). How are they the same? How are they different? How do the particles in each phase behave?

3. Compare and contrast reactants and products.

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4. Compare and contrast pure substances, elements, compounds, and mixtures. What are 2 examples of each? What was the flow chart to determine what a sample of matter is?

5. What is the difference between heterogeneous and homogeneous mixture? How is a homogeneous mixture different from a pure substance. How may a mixture be separated?

6. What is the difference between an organic compound and an inorganic compound?

7. Compare and contrast <u>controlled</u> variable and variable in a laboratory. How many variables can there be in an experiment? How many should you change at once?

8. Compare and contrast physical properties and chemical properties. How are they the same? How are they different?

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9. What are examples of a chemical change versus a physical change? Give 3 specific examples of each.

9. Know how to use scientific notation. Check with your teacher on how to use the exponent key of your calculator.

Practice Examples:

Convert the following numbers to scientific notation:

a. 0.000376

b. 498,000,000

c. 0.0000000000000581

d. 9,340,000,000,000,000

Convert the following scientific notation to numbers:

a. 6.93×10^{-8}

b. 7.41×10^{5}

c. 3.98×10^{12}

d. 9.63×10^{-3}

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10. Know how to convert in the metric system. Be sure to identify the prefixes of the metric system.

Prefix	mega-	kilo-	hecto-	deca-	BASE UNIT	Deci-	centi-	milli-	micro-
Symbol	M	k	h	da	see below	d	c	m	µm
Scientific Notation	1,000,000 = 1×10^{6}	1000 = 1×10^{3}	100 = 1×10^{2}	10 = 1×10^{1}	1 = 1×10^{0}	0.1 = 1×10^{-1}	0.01 = 1×10^{-2}	0.001 = 1×10^{-3}	0.000001 = 1×10^{-6}
Conversion Factor in grams	1 Mg = 1,000,000g	1 kg = 1000g	1 hg = 100g	1 dag = 10g	Grams (g)	1 dg = 0.10 g	1 cg = 0.01g	1 mg = 0.001g	1µg = 0.000001g
Conversion Factor in liters	1 ML = 1,000,000L	1 kL = 1000L	1 hL = 100L	1 daL = 10L	Liters (L)	1 dL = 0.10 L	1 cL = 0.01L	1 mL = 0.001L	1µL = 0.000001L
Conversion Factor in meters	1 Mm = 1,000,000m	1 km = 1000m	1 hm = 100m	1 dam = 10m	Meters (m)	1 dm = 0.10 m	1 cm = 0.01m	1 mm = 0.001m	1µm = 0.000001 m

Examples:

a. Convert 582g to kg.

b. Suzy has 789mL of juice. How many liters is that?

c. Convert 39km to mm.

d. Mrs. Lemke has 4.5×10^{8}mg of vitamin C. How many kilograms is that?

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Chapter 2 – Matter and Energy

VOCABULARY WORDS:

Chemical Bond	Chemical Energy	Energy
Heat	Kinetic Energy	Law of Conservation of Energy
Potential Energy	Law of Conservation of Mass	System
Temperature	Hypothesis	Scientific Law
Theory	Accuracy	Precision

QUESTIONS:

1. What are the steps of the scientific method?

2. What is the difference between an exothermic reaction and an endothermic reaction?

3. Compare and contrast chemical, kinetic and potential energy.

4. Compare and contrast heat and temperature. How do you convert to Kelvin from Celcius?

5. Compare and contrast accuracy and precision. How are they the same, and how are they different?

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Unit B the atomic and nuclear structure of matter.

Chapter 3 – Atomic Structure and Electron Configuration

VOCABULARY WORDS:

Atomic Mass	Atomic Theory	Avogadro's Constant
Law of Definite Proportions	Law of Multiple Proportions	Mole
Electron	Neutron	Atomic Number
Isotope	Mass Number	Orbital
Nucleus	Proton	Radioisotope
Electromagnetic Spectrum	Electron Configuration	Excited State
Ground State	Hund's Rule	Line-Emission Spectrum
Aufbau Principle	Pauli Exclusion Principle	

QUESTIONS:

1. What are the parts of the atom, their charges, and their location in the atom?

What in the atom takes up the most space (volume)? Where in the atom is this? What particle(s) are involved?

What in the atom takes up the most mass? Where in the atom is this? What particle(s) are involved?

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2. List Dalton's 5 points to his atomic theory. Which are still valid? Which aren't?

3. In discovering the parts of the atom
   - Who discovered the electron, what experiment did he use?
   - Who discovered the charge and mass of the electron, what experiment did he use?
   - Who discovered the nucleus and the proton, what experiment did he use?
   - Who developed the quantum theory of the atom?

3. How do you use the periodic table to find:
   - Atomic Number
   - Atomic Mass
   - Number of Electrons
   - Number of Protons
   - Number of Neutrons

4. What are isotopes and what do they have to do with atomic mass?

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5. How do you write an atom's electron configuration? Know the orbitals (s,p,d,f) and how many electrons can go in each one. Know the order of filling the orbitals. Know abbreviated electron configuration.

Unit C: Relationships among elements and the organization of elements in the periodic table.

Chapter 4 – Periodic Table

VOCABULARY WORDS:

Actinide	Alkali Metal	Alkaline-Earth Metal
Group	Halogen	Lanthanide
Main-Group Element	Metal	Noble Gas
Nonmetal	Period	Periodic Law
Plasma	Salt	Semiconductor/Metalloid
Transition Metal	Alloy	Conduction Band
Crystal	Ionization Energy	Electron Affinity
Nuclear Reaction	Superheavy Element	Transmutation

QUESTIONS:

1. Which four people or groups contributed to the periodic table? What did each contribute?

2. What is the difference between a group and a period?

3. How can you identify the solids, liquids and gases on the periodic table? Are all the gases noble gases?

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4. Where on the periodic table are the metals found? What are the common properties of most metals?

5. Where on the periodic table are the metalloids (also known as semi-metals and semiconductors) found? What are the common properties of metalloids?

6. Where on the periodic table are the non-metals found? What are the common properties of most non-metals?

7. What are the location of each of the following groups on the periodic table and their properties?

- Alkali Metals
- Alkaline Earth Metals
- Transition Metals
- Halogens
- Noble Gases
- Actinides
- Lanthanides

8. Define and know the trend on the periodic table for the following:

- Electron Affinity
- Ionization Energy
- Atomic Radii
- Melting and Boiling Points
- Electronegativity

Unit D Avogadro's number, mass, moles and grams

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Chapter 8

Atomic Mass	Molar Mass	Avogadro's Constant
Law of Definite Proportions	Law of Multiple Proportions	Mole
Empirical Formula	Molecular Formula	

1. What is a mole? What types of things are usually counted in units of moles? Why would atoms be grouped as moles but apples would not be?

2. What is Avogadro's number? What formulae is it used in?

3. How do you calculate molar mass?

4. Determine the molar mass of these:
Carbon

Carbon-12

CO_2

$NaHCO_3$

Na_2CO_3

$Pb(CO_3)_2$

5. What are the formulae to go from grams to moles to particles? (Mole

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Island or Mole Valley)

6. What is the difference between an empirical and a molecular formula? How are they similar? Are empirical and molecular formulae ever the same?

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7. In the following table, show how many of each element are in the formula, the mass of the formula, and whether it is empirical, molecular or both

Formula	How many of each element	Mass of formula	Empirical, Molecular or both?
$Na_2(C_2O_4)$			
$Pb(C_2O_4)$			
NaCl			
$C_6H_{12}O_6$			
$C_3H_5O_2N$			

8. Convert back and forth between:
   - Moles and Grams

   Example:
   a. Mrs. Testen needs 4.5 moles of CO_2. How many grams is that?

   b. Convert 95g of C_3H_6 to moles.

   - Atoms/Molecules to Moles

   Examples:
   a. Convert 7.92×10^{56} molecules of NO_2 to moles.

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b. Mrs. Mahlberg has 9583 moles of P. How many atoms is that?

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- Atoms/Molecules to Grams

Examples:

a. Mrs. McKinney has 59,300 moles of Oxygen. How many grams does she have?

b. Mr. Albright has 42 grams of $BaCl_2$. How many molecules is that?

c. Convert 396g of Tantalum to atoms.

Unit E Electron interactions between atoms and the nature of chemical bonds.

Chapters 5, 6, 7

1. What is a chemical bond?

2. What are the three types of chemical bonds? How are they alike? How are they different? What are electrons doing in each type of bond?

3. How could you predict the type of bond by looking at the atoms in the compound?

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Chapter 5 – Ionic Bonds

VOCABULARY WORDS:

Anion	Ion	Cation
Electroneutrality	Octet Rule	Ionic Compound
Isoelectronic	Subscript	Unit Cell
Ionic Bond	Crystal Lattice	Lattice Energy
Polyatomic Ion	Hydrate	Anhydrous

Chapter 6 – Covalent Bonds and Molecular Forces

VOCABULARY WORDS:

Covalent Bond	Lewis Structure	Single Bond
Unshared Pair	Shared Pair	Valence Electron
Multiple Bond	Octet Rule	

Chapter 7 – Carbon and Organic Compounds

VOCABULARY WORDS:

Allotrope	Hydrocarbon	Functional group
Alkane	Alkene	Alkyne
Double Bond	Triple Bond	Polymer

QUESTIONS:

1. Why do atoms want to be like the noble gases? How do they become like noble gases in their electron configuration?

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2. What is the electron configuration for calcium? For the calcium ion?

What is the electron configuration for nitrogen? For the nitrogen ion?

What is the formula of the compound they form?

3. What is the Octet Rule? How does it apply in ionic compounds? How does it apply in covalent compounds?

4. Give an example of an Ion, Cation, Anion, and Polyatomic Ion.

5. What is the electron configuration for phosphorous? For oxygen? How many electrons does phosphorous need to satisfy the octet rule? Oxygen? How can each of these elements do this without becoming anion?

6. How do you write the formulas of ionic compounds? What does the Roman numeral in the name tell you? Why do the charges have to add up to zero? How does criss-crossing help with this? What do you sometimes need to do after criss-crossing?

Write the steps to find the formula of an ionic compound when you have the name of the compound:

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Write the steps to find the formula of an ionic compound when you have the ions that will combine to form it:

7. How do you write the names of ionic compounds?

When do you need to use a Roman numeral in the name? Why is it better to use the charges on the anion to figure out the charge on the cation?

Write the steps to find the name of an ionic compound when you have the formula of the compound:

Write the steps to find the name of an ionic compound when you have the ions that will combine to form it:

8. How do you write the name of a covalent compound when you are given its formula?

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9. How do you write the formula of a covalent compound when you are given its name?

10. What do you need to know to draw a Lewis Structure?

11. Draw the Lewis Structures for
CH_3I
CH_2O
CaO
C_2H_6

12. Compare and contrast organic and inorganic compounds. How are they the same? How are they different?

13. Why are there so many organic compounds? What is special about the bonds that carbon forms?

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14. What is a hydrocarbon? How are alkanes, alkenes and alkynes alike? How are they different?

15 . How do you write the name of an organic compound when you are given its formula? How do you indicate where the functional groups are in the compound?

16. How do you write the formula of an organic compound when you are given its name?

17. What are the prefixes that tell yo0u how many carbons are in the main chain of an organic compound?

18. Give the names for these organic compounds

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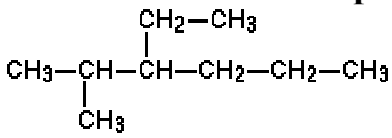

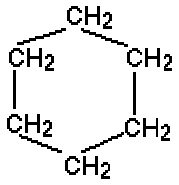

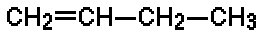

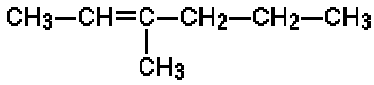

19. Draw the structure of these organic compounds
Heptane
3- butene
2-methyl pentane
2,4 dimethyl, 2 pentene
3 ethyl, 3 hexene
3-propyl, 4 methyl, 2-heptene