

First Semester Final Exam Study Guide

Unit 1

Know the structure of the atom.

- Define atom, neutron, proton, electron, atomic number, and atomic mass.
- How would you determine how many protons an atom has? Electrons? Neutrons?
- Which two sub-atomic particles make up the atomic mass of an atom?
- Where are the protons, neutrons, and electrons found in an atom?
- What do all atoms of the same element have in common? (What must never change for the same atom?)
- How many protons, neutrons, and electrons does Ni have?
- How many protons, neutrons, and electrons does Au-197 have?

Know the significant scientists, experiments, and finds for the history of the atom.

Know the scientists that contributed to the development of atomic structure and their significant contributions.

- Rutherford
- Bohr
- Schrodinger
- J.J. Thomson

Know the difference between ion and isotope.

- Define ion, anion, cation, and isotope.
- What can change between an atom and ion of the same element?
- What can change between an atom and isotope of the same element?
- Lithium will become a cation or anion? So, it will gain or lose electrons?
- How do you find the average atomic mass?
- Why is the average atomic mass different from a normal average?
- If there are three isotopes of one element that are fairly common. One has a mass of 28.965 and is found 65.5% of the time. Another has a mass of 23.96 and is found 10.1% of the time. The final isotope has a mass of 27.11 and is found 24.4% of the time. Find the average atomic mass of this element.

Know how to classify matter.

- Know key terms like: matter, atom, element, mixture, pure substance, homogeneous mixture, solution, heterogeneous mixture, compound
- Identify each as either an element or a compound. Put an E for element and a C for compound.
___ Au ___ H₂O ___ NaCl ___ He
- Describe the difference between an element and a compound.
- Identify each as either a homogeneous mixture (Ho) or heterogeneous mixture (He).
___ Chocolate Chip Cookie Dough ___ Trail Mix
___ Air ___ Salt Water (completely dissolved)
___ Granite ___ Shampoo

Know the difference between physical and chemical properties and changes.

- Define physical change and chemical change.
- What are the five indicators of a chemical change?
- Identify each of the examples as a physical (P) or chemical (C) change.
___ glass breaking ___ burning toast ___ frying an egg
___ a nail rusting ___ making salt water ___ mowing the lawn
- Identify each of the examples as a physical (P) or chemical (C) property.
___ color ___ taste ___ ability to dissolve
___ ability to rust ___ flammability ___ density

Know how to identify elements from the periodic table as metals, nonmetals, and metalloids.

- Describe the main characteristics and properties of each type of element: metal, nonmetal, metalloid/semi-metal.
- Identify each of the elements below as metals (M), nonmetals (N), or metalloid/semi-metal (S).
___ Si ___ F ___ Li ___ Ag ___ C
- If an element is shiny, good conductor of electricity it is probably a _____.

Know the organization of the periodic table.

- What are the vertical columns called? Horizontal rows?
- Where are the alkali metals? Alkaline earth metals? Halogens? Noble gases?

Know the periodic trends: atomic radius, ionic radius, ionization energy, and electronegativity

- Define atomic radius, ionic radius, ionization energy, and electronegativity.
- What is the trend for atomic radius going across the periodic table? Ionization? Electronegativity?
- What is the trend for ionization energy going down the periodic table? Ionization? Electronegativity?
- Why does the ionic radius decrease going across a period?
- Why does ionization energy increase going across a period?
- Why does electronegativity increase going across a period?
- Is a sulfur atom or sulfur ion bigger? Why?
- Is a potassium atom or potassium ion bigger? Why?

Unit 2

Know the three types of bonds.

- What types of elements are involved in ionic bonds? What happens to the electrons? What are the properties for ionic bonds?
- What types of elements are involved in covalent bonds? What happens to the electrons? What are the properties of covalent bonds?
- What types of elements are involved in metallic bonds? What happens to the electrons? What are the properties of metallic bonds?
- Why do elements bond?
- What is the octet rule? What do we use it for?
- What type of bond would magnesium and fluorine make?
- What type of bond would silicon and sulfur make?
- What type of bond would lithium and sulfur make?
- What type of bond would potassium and chlorine make?

Know how to determine valence electrons.

- What are valence electrons?
- How do we determine valence electrons?
- Why are valence electrons important?
- How many valence electrons does sulfur have? Does it become a cation or anion? Did it gain or lose electrons?
- How many valence electrons does magnesium have? Does it become a cation or anion? Did it gain or lost electrons?

Know how to name compounds and write chemical formulas.

- How do you determine if a compound is ionic or molecular?
- What do you need to keep in mind when writing chemical formulas for ionic compounds?
- What do you need to keep in mind when naming molecular compounds?
- When a polyatomic ion is involved, what type of bond is occurring?
- Write the chemical formulas for the following compounds. *You should identify if they are ionic or molecular first*

copper (I) bromide	magnesium oxide
ammonium sulfate	diphosphorous trioxide
sulfur trichloride	manganese (III) cyanide
- Write the names for the following compounds. *You should identify if they are ionic or molecular first*

AlF_3	$\text{Fe}(\text{ClO}_4)_3$
NO_3	$\text{Li}(\text{OH})$
$\text{Sr}(\text{NO}_2)_2$	Cl_5

Know how to draw Lewis dot structures for atoms, ions, ionic and covalent structures.

- What do you need to know in order to draw Lewis dot structures?
- Draw the Lewis dot structure for calcium, xenon, and silicon.
- Draw the Lewis dot structure for a calcium ion and silicon ion.
- Draw the Lewis dot structure for potassium bromide.
- Draw the Lewis dot structure for carbon tetrahydride.

Know how to determine if a covalent bond or polar molecule.

- What is happening when a bond is polar?
- How do you determine if a bond is polar?
- How do you determine if a molecule is polar?
- Draw (in a Lewis dot) CBr_4 . Include partial charges and determine if the molecule is polar or nonpolar.
- Draw (in a Lewis dot) NF_3 . Include partial charges and determine if the molecule is polar or nonpolar.

Know the difference between the three intermolecular forces.

- What is an intermolecular force?
- When would a molecular experience dipole-dipole forces? London dispersion? Hydrogen bonding?

- c) Which is the strongest IMF?
- d) Which is the weakest IMF?
- e) For a hydrogen bond to form, what three elements must be involved?

Unit 3

Know how to convert numbers from scientific notation into numbers written in ordinary notation and vice versa.

Write the following numbers into correct scientific notation:

- a) 1023 =
- b) 0.00000054 =
- c) 125.89 =
- d) 568941 =
- e) 0.000593 =
- f) $4897 \times 10^3 =$

Write the following numbers into regular/standard notation:

- a) $1.25 \times 10^3 =$
- b) $0.000034 \times 10^{-2} =$
- c) $4.53 \times 10^6 =$
- d) $165.89 \times 10^2 =$
- e) $9.573 \times 10^{-4} =$
- f) $-2.36 \times 10^{-6} =$

Solve the following scientific notation problems – remember to use the rules for multiplying and dividing scientific notation!

- a) $4.00 \times 10^4 \times 2.00 \times 10^2 =$
- b) $1.50 \times 10^6 \div 3.00 \times 10^5 =$

Know the formula for percentage error and how to use it.

- a) What is the formula for percentage error?
- b) Calculate the percent error of an experiment if you calculate the density of gold to 20.13 g/mL but the true (accepted) value is 19.32 g/mL

Know the difference between fission, fusion, and radiation.

- a) What happens during fission?
- b) What happens during fusion?
- c) Give an example where fusion is happening
- d) List the symbols for alpha particles, gamma particles, and beta particles.
- e) List the symbols from most penetrating to least penetrating.

Know how to balance nuclear equations.

- a) Complete and balance the following nuclear reactions. Label the type of radiation (alpha, beta, gamma, electron capture, positron emission)
- b) The alpha decay of iridium-174
- c) The beta decay of platinum-199
- d) ${}^{214}_{83}\text{Bi} \rightarrow {}^{0}_{-1}\beta + \underline{\hspace{2cm}}$
- e) ${}^{230}_{90}\text{Th} \rightarrow {}^4_2\alpha + \underline{\hspace{2cm}}$
- f) ${}^{239}_{92}\text{U} + {}^{0}_{-1}\beta \rightarrow \underline{\hspace{2cm}}$
- g) $\underline{\hspace{2cm}} \rightarrow {}^4_2\alpha + {}^{234}_{90}\text{Th} + 2 {}^0_0\gamma$

Know how to calculate frequency, wavelength, and energy.

- a) What is the formula for wavelength?
- b) What is the formula for energy?
- c) Can you solve for energy, if provided wavelength? Explain what you would do.
- d) A laser emits light at the frequency of $4.74 \times 10^{14} \text{ sec}^{-1}$. What is the wavelength of the light?
- e) The blue color of the sky results from the scattering of sunlight by air molecules. The blue light has a frequency of about $7.5 \times 10^{14} \text{ Hz}$. What is the wavelength?
- f) The laser used to read information from a compact disk has a wavelength of 780 nm. What is the energy associated with this radiation? ($1 \text{ nm} = 1 \times 10^{-9} \text{ m}$)
- g) How are wavelength and frequency related?
- h) How do you measure the wavelength? Frequency?

Unit 4

Know how to define, write, and solve for density.

- a) Define density and write its equation.

- b) If you have 1kg of lead and 1 kg of cotton, which takes up more space? Why?
- c) If you have 10 cm³ of lead and 10 cm³ of cotton, which one is heavier? Why?
- d) Find the density of a plastic cube that has a volume of 3 cm³ and a mass of 6.2 g.
- e) Find the volume of the ball that has a mass of 500 g and a density of 1.68 g/ml.
- f) Calculate the mass of a binder if you know its density is 2.3 g/ml and its volume is 130 cm³.

Know about the Big Bang and Stars.

- a) What did the universe look like before the big bang?
- b) What evidence do we have that supports the big bang? Explain.
- c) According to the Big Bang Theory, how long ago did the universe form?
- d) What is the single factor that determines the life cycle of a star?
- e) All stars begin with the same three stages, list and define them.
- f) Why are stars so important to understand in terms of chemistry?
- g) Main sequence stars fuse _____ to form _____.
- h) Red giants fuse _____ to form _____, and _____ fuses to form _____.
- i) Stars can fuse elements up to _____. The other elements in the universe are formed from _____.
- j) Using an H-R diagram, what color represents the hottest star? Coldest?

Know about the layers of the Sun and Solar Activity

- a) What are three inner zones?
- b) What are the three outer zones? What are the nicknames for each?
- c) What type of heat transfer is happening in the convective zone? Radiative zone?
- d) What is happening in the core of the Sun?
- e) What elements are most abundant on the Sun?
- f) Which is the hottest layer of the Sun?
- g) When can you see the Corona?
- h) Is the sun rotating? If so, is it all rotating at the same rate?
- i) What is sun spot? Solar flare? Aurora? Prominence?
- j) What happens when two sun spots merge together?
- k) Why do the pole regions see the auroras?
- l) What causes solar activity on the Sun?

After Unit 4...

Know the metric prefixes and how to convert within the metric system.

Do the following metric conversions (show your work):

- a) 53 m = ___ cm
- b) 145 kL = ___ dL
- c) 290 cm = ___ Dm
- d) 0.9 mg = ___ g
- e) 67 mm = ___ km
- f) 760, 500 mg = ___ kg

Solve unit conversions problems involving more than one conversion factor.

- a) 140 kg/L = ___ g/mL
- b) A friend tells you he measured an oceanic current's speed to be 5 m/sec. How fast is that in miles per hour? (1 mile = 1508 m)

Know the difference between accuracy and precision.

- a) What is the difference between accuracy and precision?
- b) A student retrieved data from a lab and found that mass of aluminum chloride to be 138.9 g, 140.4 g, and 152.8 g for the three trials he repeated in the lab. The true mass of aluminum chloride is 133.3 g. Is the student accurate, precise, both, or neither? Explain your answer.

Know and be able to solve for molar mass, gram to mole, and % composition.

- a) What is the molar mass of HNO₃? NaCl? KBr?
- b) What is a mole?
- c) What is mass of 1.49 mols of hydrogen gas (H₂)?
- d) How many moles are in 321 grams of dinitrogen trihydride?
- e) What is the percentage composition of nitrogen in the compound HNO₃?
- f) An 8.20 grams piece of Mg combines completely with 5.40 grams of O to form a compound. What is the percentage composition on Mg and O in this compound? **Hint: write out compound and find molar mass**
- g) 9.03 grams of Mg combines completely with 3.48 grams of N to form a compound. What is the percentage composition of Mg and N in the compound? **Hint: write out compound and find molar mass**