

**Chemistry Fall Final Review**

- Calculate the density of a metal object with a volume of  $4.2 \text{ cm}^3$  and a mass of  $16.0 \text{ g}$  using significant figures.
- Calculate the following division problems and round off to the correct number of significant figures.
  - $342 \div 16$
  - $(23.002)(.0560)$
- Perform the following operations and express your answer in proper scientific notation with the correct number of significant figures and units.
  - $165.5 \text{ cm} + 8 \text{ cm} + 4.37 \text{ cm}$
  - $350.0 \text{ m} - 200 \text{ m}$
  - $.036 \text{ m} \times .02 \text{ m}$
  - $39 \text{ g} \div 24.2 \text{ cm}^3$
- Define a mole and Avogadro's Number?
- How many molecules are in 1 Mole of carbon?
- What is the mass that is equal to 1 Mole of Magnesium?
- Complete the following **Mass to Mole** Conversions:
  - $64 \text{ g}$  of carbon
  - $0.50$  grams of helium
  - $400$  grams of gold
- Complete the following **Mole to Mass** Conversions:
  - $0.5$  moles of oxygen
  - $11.5$  moles of argon
  - $35$  moles of potassium
- Complete the following **Molecules to Mole** Conversions:
  - $3.02 \times 10^{24}$  molecules of helium
  - $2.004 \times 10^{25}$  molecules of oxygen
- Complete the following **Moles to Molecules** Conversions:
  - $45$  moles of carbon dioxide
  - $0.685$  moles of neon
- Know which isotope is the standard for the atomic mass unit.
- Know what the difference in masses of isotopes of the same element is due to.
- Know how to calculate the number of protons, neutrons and electrons in an atom when given its isotope mass and atomic number. As an example: lead has an atomic number of  $82$ . An isotope of lead has a mass of  $206 \text{ amu}$ . Calculate the number of protons, neutrons and electrons in an atom of this isotope.
- When given the isotope symbol for an element be able to give its number of protons, electrons and neutrons. As an example give the number of each of these particles for  ${}_{30}^{70}\text{Zn}$ .
- Assume the following three isotopes of element Z exist: Z-123, Z125, and Z129. If the atomic mass of Z is  $128.66 \text{ amu}$ . which of these isotopes is most abundant?
- Use the following data table on the isotopes of element "X" to answer the questions a-c.
 

Isotope	Mass in amu	Percent abundance
X-24	23.985	78.99
X-25	24.986	10.00
X-26	25.982	11.01

  - What is the average mass of element "X"?
  - Using the periodic table what is the identity of element "X"?
  - Using the periodic table what is the atomic number of element "X"?
- Know how the relative number of protons, neutrons and electrons compare in an atom.
- Know the relative size, charge, and mass of the nucleus compared to the rest of the atom.
- Know that the three forms of natural radioactivity are alpha, beta and gamma. What are each of these? What are the penetrating powers of each of these?
- Know why radioactivity occurs.

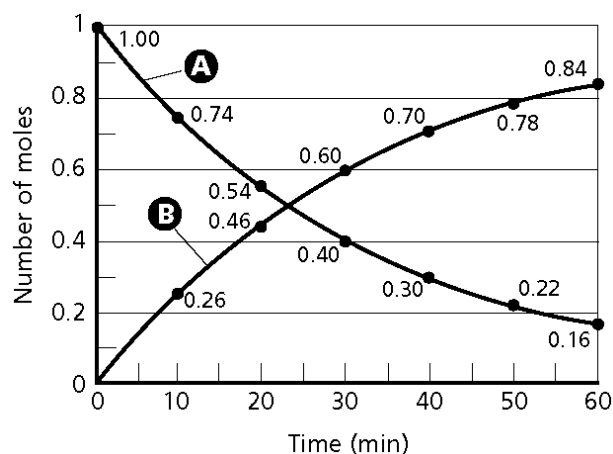
21. Know how to balance a nuclear reaction selecting the correct particle. As an example what particles would you use to balance the following nuclear reactions?
- a.  ${}_{12}^{27}\text{Mg} \rightarrow {}_{13}^{27}\text{Al} + \text{---}$  (A)  ${}_{2}^{4}\text{He}$ , (B)  ${}_{-1}^{0}\text{e}$ , (C)  ${}_{+1}^{0}\text{e}$ , (D)  ${}_{0}^{1}\text{n}$ , or (E) gamma ray
- b.  ${}_{90}^{231}\text{Th} \rightarrow {}_{88}^{227}\text{Ra} + \text{---}$  (A)  ${}_{2}^{4}\text{He}$ , (B)  ${}_{-1}^{0}\text{e}$ , (C)  ${}_{+1}^{0}\text{e}$  (D) neutron  ${}_{0}^{1}\text{n}$  or (E) gamma ray
22. Give the electron configurations for the following elements.
- A. Mg (z = 12) C. Fe (z = 26)  
B. K (z = 19) D. O (z = 8)
23. Give the orbital filling diagrams for the following elements.
- A. Mg (z = 12) C. Fe (z = 26)  
B. K (z = 19) D. O (z = 8)
24. Give the electron dot diagrams for the following elements.
- A. Mg (z = 12) C. Fe (z = 26)  
B. K (z = 19) D. O (z = 8)
25. Know the modern basis for the arrangement of the periodic table.
26. All atoms of the same element have the same number of what particle?
27. Given the following as ending configurations for unknown elements A-D, answer each of the questions below.
- A.  $3s^23p^4$**     **B.  $5s^1$**     **C.  $7s^1$**     **D.  $3s^2$**
- (1) Which of these elements belong to the same period? Identify the period.  
(2) Which belong to the same group? Identify the group.  
(3) Which are nonmetals.  
(4) Which are metals.  
(5) Which are metalloids or semimetals.  
(6) Which belong to the alkali family?  
(7) Which belong to the alkaline family?
28. Know what happens to the size of atoms as you move across a period or down a group. Know which member of the following pairs of particles is larger: Pd, Rb; Mg, Ba; Cs, Lu; Se, O.
29. Which of the following atoms would we expect to have the largest radius? Li, B, O, or F
30. Know which is larger, metal atoms or their ions. Also, know which is larger nonmetal atoms or their ions. Which member of the following pairs of particles is larger? Br, Br<sup>-</sup>; Na, Na<sup>+</sup>; F, F<sup>-</sup>; Al<sup>3+</sup>, Al
31. Know that elements in the same group or family in the periodic table have the same number of electrons in the outer energy level
32. Which of the following electron configurations would be the most stable chemically ?
- (A)  $1s^22s^22p^6$     (B)  $1s^22s^2$   
(C)  $1s^22s^22p^63s^23p^1$     (D)  $1s^22s^22p^5$
33. Know how electronegativity varies within a group and within a period on the periodic table (i.e., the trend).
34. Know what element on the periodic table has the highest electronegativity, and ionization energy, and which has the lowest.
35. Know the differences between ionic, covalent and metallic bonds.
- a. Which bond type forms molecules?  
b. In which bond type are electrons shared and in which are electrons transferred?
36. How are ions arranged in a crystal lattice structure?
37. What is the relationship between *electronegativity difference* and the type of bond between two atoms?
38. What type of bonds are found in the following compounds? NaCl, NaOH, BaSO<sub>4</sub>, LiCl, CaS, CH<sub>4</sub>, CO<sub>2</sub>, C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>

39. When given the electronegativities of several elements, be able to predict what kind of bond would form between them. As an example look up the electronegativities of the following elements and determine the type of bond that would form between them:  
C-N, K-F, H-O, Ca-F, N-Cl, Ba-Br.
40. Give the Lewis Dot Structures for  $\text{Cl}_2$ ,  $\text{SiO}_2$ ,  $\text{H}_2\text{O}$ , and  $\text{NO}_2^{-1}$
41. Give the names of the seven elements that occur as diatomic molecules.
42. Give the correct formula for a compound composed of  $\text{Ba}^{+2}$  and  $\text{OH}^{-1}$ .
43. An ion with an oxidation number of +4 can combine with how many ions with an oxidation number of -2 to form a neutral compound.
44. Give the formulas for the following compounds.
- |                       |                       |
|-----------------------|-----------------------|
| a. Cobalt III Sulfate | d. Cobalt II Sulfite  |
| b. Cobalt II Sulfate  | e. Cobalt III Sulfide |
| c. Cobalt III Sulfite | f. Cobalt II Sulfide  |
45. Give the charges on the unknown ions below indicated as "X". Use the charge on the given ion to determine the answer.
- |                                |                              |
|--------------------------------|------------------------------|
| a. XCl                         | c. $\text{XPO}_4$            |
| b. $\text{X}_2(\text{SO}_4)_3$ | d. $\text{X}(\text{NO}_3)_2$ |
46. Sodium is atomic number 11 and chlorine is atomic number 17?
- What are their electron configurations?
  - When they react what are their resulting electron configurations?
  - What is the advantage to each in the resulting electron configurations?
  - What type of bond is formed between these two elements?
  - What is the name of the resulting structure that forms. Describe its arrangement of particles.
47. Balance the following chemical reactions and then answer the questions that follow.
- $\text{C}_3\text{H}_8 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
  - $\text{Al} + \text{HCl} \rightarrow \text{AlCl}_3 + \text{H}_2$
  - $\text{Mg}(\text{GaO}_2)_2 + \text{HCl} \rightarrow \text{GaCl}_3 + \text{MgCl}_2 + \text{H}_2\text{O}$
  - $\text{CoCl}_3 + \text{Mg}(\text{OH})_2 \rightarrow \text{Co}_2\text{O}_3 + \text{HCl} + \text{MgCl}_2$
  - $\text{FeS} + \text{O}_2 \rightarrow \text{Fe}_2\text{O}_3 + \text{SO}_2$
  - When "a" is correctly balanced using the smallest whole number coefficients what is the sum of these coefficients?
  - When "c" is correctly balanced using the smallest whole number coefficients what is coefficient for HCl?
  - When "d" is correctly balanced using the smallest whole number coefficients what is the sum of these coefficients?
  - When "e" is correctly balanced using the smallest whole number coefficients what is coefficient for  $\text{O}_2$ ?
48. Know why we balance equations.
49. Know why we don't change subscripts when balancing equations
50. Predict the products for the following reactions and then balance the equation.
- $\text{Na} + \text{FeBr}_3 \rightarrow$
  - $\text{CH}_4 + \text{O}_2 \rightarrow$
  - $\text{PbSO}_4 + \text{AgNO}_3 \rightarrow$
51. Identify the type of reaction (i.e., combustion, single replacement, etc.)
- $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$
  - $\text{Al}_2(\text{SO}_4)_3 + 3\text{Ca}(\text{OH})_2 \rightarrow 2\text{Al}(\text{OH})_3 + 3\text{CaSO}_4$
  - $2\text{C}_2\text{H}_2 + 5\text{O}_2 \rightarrow 4\text{CO}_2 + 2\text{H}_2\text{O}$
  - $\text{Mg} + 2\text{AgNO}_3 \rightarrow \text{Mg}(\text{NO}_3)_2 + 2\text{Ag}$
  - $3\text{Ba}(\text{NO}_3)_2 + 2\text{H}_3\text{PO}_4 \rightarrow \text{Ba}_3(\text{PO}_4)_2 + 6\text{HNO}_3$
  - $\text{Mg}(\text{ClO}_3)_2 \rightarrow \text{MgCl}_2 + 3\text{O}_2$

52. Translate the word problems into a written chemical reaction and then balance the reaction.

- zinc and lead nitrate react to form zinc nitrate and lead
- aluminum chloride and bromine gas react to form aluminum bromide and chlorine gas
- aluminum and hydrochloric acid react to form aluminum chloride and hydrogen gas
- copper and sulfuric acid react to form copper (II) sulfate and water and sulfur dioxide

53. Using the following graph of the hypothetical reaction  $A \rightarrow B$  to answer the questions that follow.



- Identify the product and reactant
  - What happens to the number of moles of products and reactants over time?
  - At what time is the number of moles of each at a maximum and a minimum?
  - At what time is the number of moles of each the same?
54. Know what the rate of a chemical reaction can be measured by: Decrease in concentration of reactants or increase in concentration of products over time.
55. Know what factors affect the rate of a reaction: temperature, concentration of reactants and products, size of particles, presence of a catalyst.