Chemistry 115 – Exam 3 Study Guide

Study the multiple choice questions in mastering chemistry.

Know the definitions/meaning of stoichiometry, endothermic, exothermic, limiting reactant, excess reagent, percent yield, condensation, evaporation, freezing, melting, sublimation, deposition, dipole, polar, electronegativity, resonance structures, VSEPR, ionic bond, covalent bond, atmospheric pressure, gas laws, pressure, vapor pressure, Dalton’s Law of Partial Pressure

Know how to draw Lewis Electron dot structures for simple molecules. (Skeleton structures will be given.) Know how to choose the best resonance structure based on ideal numbers of bonds per atom. Know how to draw a Lewis structure for an ion. Know the orbital and molecular geometries. Be able to draw resonance structures where appropriate.

Know the definitions/meaning of ionization energy, electron affinity, isoelectronic, orbital .

Recognize the main types of intermolecular forces in substances (i.e., dipole-dipole, nonpolar-nonpolar, or hydrogen bonding). Be able to predict which types of molecules have the strongest intermolecular forces. Know how the strength of intermolecular forces helps to predict properties such as boiling point, vapor pressure, viscosity, and freezing point.

Be able to solve gas problems involving both changing conditions and static conditions. Know how to convert pressure units. Be able to do gas stoichiometry. Be able to answer questions regarding partial pressures of gases.

Know radioactivity, nuclear chemistry, radioisotope, alpha particle, beta particle, gamma ray, radioactive decay, positron, half-life, fission, fusion, chain reaction. How to write nuclear reactions and predict products of , , or  decay, how to determine half-lives and percent decay for nuclear reactions.

Below are some problems that may be similar to some of the problems on the exam.

1. Draw Lewis Electron Dot Structures for the following molecules and tell the orbital and molecular geometries for each
   1. PH3
   2. CBr4
   3. OF2
   4. SCl2
   5. CO2 (C is central)
   6. Cl2CO (C is central)
   7. C2H2
   8. C2H4
   9. C2H6
   10. N2H2
2. Draw Lewis Electron Dot Structures for the following ions. Include resonance structures as necessary.
   1. CN-
   2. NO2-
   3. SO32-
   4. CO32-
   5. NH4+
   6. ClO3-
3. Predict the orbital and molecular geometry around each of the starred atoms in the drawing below:



1. Classify each of the following molecules as polar or non-polar. What kinds of intermolecular forces would be present in each?
   1. CO
   2. F2
   3. HBr
   4. N2
2. What are intermolecular forces?
3. What is viscosity? How does it depend on intermolecular forces?
4. Acetone evaporates more quickly than water at room temperature. What can you say about the relative strength of the intermolecular forces in the two compounds? Which is more volatile?
5. Explain what happens when a liquid boils?
6. What are dispersion forces? What can you say about the strength of dispersion forces as a function of molar mass?
7. The pressure of air inside a purple balloon is 2.19 atmospheres. Calculate the pressure of the air in units of torr? In kilopascals? In PSI?
8. Why do we experience pain in our ears during changes in altitude?
9. Explain why scuba divers should not hold their breath as they ascend to the surface.
10. A snorkeler with a lung capacity of 6.3 L inhales a lungful of air at the surface, where the pressure is 1.0 atm. The snorkeler then descends to a depth of 2 m, where the pressure increases to 3.5 atm. What is the volume of the snorkeler’s lungs at this depth? (Assume constant temperature.)
11. A balloon with an initial volume of 3.2 L at a temperature of 35oC is warmed to 55oC. What is its volume at the final temperature?
12. A 0.53 mol sample of helium gas occupies a volume of 5.25 L. What is the volume of 0.31 mol of helium under the same conditions?
13. The pressure of Freon gas in an aerosol can is 6.25 atm at 25oC. What is the new pressure of the gas if the temperature is increased to 75oC?
14. A large balloon fashioned to look like a mole is designed for the Macy’s Thanksgiving Day Parade. If the volume of the balloon is 835 L after the addition of 588 moles of helium, how many more moles of helium must be added to fill the balloon to its final volume of 2953 L?
15. If a package of potato chips contains 0.132 L of air on the ground where the atmospheric pressure is 760 torr, what is the pressure in the airplane if the volume increases to 0.243 L after takeoff?
16. The balloon in problem 25 will burst if the volume exceeds 3200 L. If 2953 L of helium are put into the balloon at a temperature of 5oC, how high can the temperature go before the mole will burst?
17. A sample of a gas with an initial volume of 53.2 L at a pressure of 4.21 atm and a temperature of 52oC is compressed to a new volume of 27.4 L at a temperature of 73oC. What is the new pressure of the gas?
18. A sample of a gas with an initial volume of 84.3 L at a temperature of 96oC and a pressure of 352 torr is allowed to expand to a volume of 295 L and the pressure is increased to 420 torr. What will be the new temperature of the gas?
19. What is the volume occupies by 0.253 mol of nitrogen gas at a temperature of 37oC and a pressure of 3.54 atm?
20. What is the pressure in atmospheres of a 3.66 L sample of methane gas containing 34.2 grams of methane at a temperature of 22oC?
21. How many moles of argon gas are required to fill a 3.22 L bottle at a pressure of 382 torr and a temperature of 34oC?
22. A fuel tank is filled with 6459.3 grams of propane gas (C3H8) at a pressure of 31.5 atm. If the volume of the tank is 12.5 L, what is the temperature of the gas in oC?
23. A gas mixture contains each of the following gases at the indicated partial pressure. N2 (285 torr), O2 (539 torr), and H2(377 torr). What is the total pressure of the mixture?
24. How many electrons are there in an orbital? In an s sublevel? A p sublevel? A d sublevel?
25. What is the complete electronic configuration of carbon? Of sulfur? Of manganese?
26. What is the shorthand configuration as predicted by the periodic table of yttrium? Of zinc? Of tungsten?
27. How many valence electrons in an atom of phosphorous? Of barium? Of krypton?
28. What is the Lewis electron dot structure of carbon? Of arsenic? Of potassium?
29. Choose the element with the higher ionization energy
    1. As or Bi
    2. As or Br
    3. S or I
    4. S or Sb
30. Arrange the following elements in order of increasing ionization energy: Te, Pb, Cl, S, Sn
31. Choose the element with larger atoms from each of the following pairs
    1. Al or In
    2. Si or N
    3. P or Pb
    4. C or F
32. Arrange the following elements in order of increasing atomic size: Ca, B, S, Si, Ge, F
33. Arrange the following elements in order of increasing metallic character: Fr, Sb, In, S, Ba, Se
34. Write electron configurations for each of the following ions. What do all of the electron configurations have in common?
    1. Ca2+
    2. K+
    3. S2-
    4. Br-
35. Write balanced nuclear equations for the alpha decay of each of the following nuclides
36. Write balanced nuclear equations for the beta decay of each of the following nuclides
37. Supply the missing symbol in each of the following nuclear equations
38. The half-life of sodium-24 is 15.0 hr. How many grams of this nuclide in a 4.00 g sample will remain after 60.0 hr?
39. Determine the half-life of a nuclide if after 1024 hours 3.12% of the sample remains?
40. Technetium-99 has a half-life of 6.0 hr. What percentage of the sample will remain undecayed after 36 hours? What percentage of the sample will decay after 48 hours?
41. Contrast the abilities of alpha, beta, and gamma radiations to penetrate a thick sheet of paper.
42. Why are the radionuclides used for diagnostic procedures usually gamma emitters?
43. What are some applications of nuclear chemistry to medicine?