Test Form B1

Name _____ **Chemistry 115-S**

Section _____ **FINAL EXAM** **Total Points = 210**

TA _____ Tuesday, 10:20 AM

December 11, 2007

THIS EXAM IS FOR STUDENTS WITH TUESDAY-THURSDAY 8:30 or 9:30 LECTURE. YOU SHOULD HAVE A RED COMPUTER ANSWER SHEET!

Directions:

1. Each student is responsible for following directions. Read this page carefully.

2. Write your name and other requested information on this page and on the separate answer sheet.

3. CODE your name on the answer sheet using an ordinary (#2) pencil.

4. CODE your correct ***10-digit*** identification number (PUID) on the answer sheet. **THIS IS VERY IMPORTANT!**

5. CODE your section number on the answer sheet. Please use all four digits, 0101, 0102, 0201, etc. **This is also very important!**

6. CODE the test number shown in the upper right-hand corner of this page onto the answer sheet in the block labeled "Test Form" under the Date line at the top right-hand side. **This is Test Form B1.**

7. Put all calculations on the examination pages. **DO NOT PUT ANY EXTRA MARKS ON THE COMPUTER ANSWER SHEET!**

8. This exam consists of 35 multiple-choice questions worth 6 points each. Choose the one best or correct answer for each question and write it both on your exam paper and on the computer answer sheet. **The computer answer sheet is the only one that will be graded!**

9. This exam consists of 9 pages plus a Table of Useful Information, a Periodic Table and 2 sheets of scratch paper. Please check to be sure that you have them all!

KEEP YOUR ANSWERS AND WORK COVERED TO PROTECT THE INTEGRITY OF YOUR WORK!!

_____ 1. How many mL of O_2 measured at 752 mm Hg and 23.0°C are expected from the complete decomposition of 3.00 g of H_2O_2?

$$2\ H_2O_2(\ell) \rightarrow 2\ H_2O(\ell) + O_2(g)$$

(a) 1.08 mL
(b) 128 mL
(c) 1080 mL
(d) 84.1 mL
(e) 28.1mL

_____ 2. A pair of students found that an average of 0.2991 g of sodium carbonate (105.9888 g/mol) was required to react with 25.00 mL of HCl solution. Given the balanced chemical equation below, calculate the concentration of the HCl solution.

$$Na_2CO_3(s) + 2\ HCl\,(aq) \rightarrow 2\ NaCl(aq) + CO_2\,(g) + H_2O(\ell)$$

(a) 0.1411 M
(b) 0.2258 M
(c) 0.1336 M
(d) 0.05644 M
(e) 0.1129 M

_____ 3. How many atoms of Americium-241 were in a smoke detector that contained 2.0×10^{-4} mg of Americium-241 when it was first made? [^{241}Am = 241.0047 amu]. This radionuclide decays via alpha emission and has a half life of 432.2 years.

(a) 2.5×10^{14} atoms
(b) 5.0×10^{14} atoms
(c) 5.0×10^{17} atoms
(d) 2.9×10^{22} atoms
(e) 6.02×10^{23} atoms

_____ 4. What is the half-life of an isotope if it decays to 12.5% of its radioactivity in 18 minutes?

(a) 9 minutes
(b) 18 minutes
(c) 12 minutes
(d) 6 minutes
(e) 0.17 minutes

_____ 5. P-32, a radioisotope used in leukemia therapy, has a half-life of 14.26 days. What percent of a sample remains after 35 days?

(a) 20%
(b) 82%
(c) 4.8%
(d) 18%
(e) 5.5%

_____ 6. One fission reaction of ^{235}U, produces ^{160}Sm, three neutrons and another nuclide. What is the other nuclide?

(a) $^{75}_{30}Zn$

(b) $^{72}_{30}Zn$

(c) $^{72}_{30}Co$

(d) $^{75}_{27}Co$

(e) $^{75}_{75}Re$

_____ 7. To completely burn one mole of propanol, C_3H_7OH, how many moles of O_2 are required?

(a) 0.53 mol
(b) 9.0 mol
(c) 5.0 mol
(d) 4.5 mol
(e) 7.0 mol

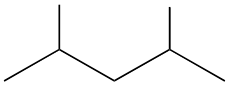
_____ 8. In the best Lewis Dot structure of $SOCl_2$, which of the following statements is true?

(a) The oxygen is the central atom.
(b) There is a double bond between the sulfur atom and the oxygen atom
(c) There is a single bond between the sulfur atom and the oxygen atom
(d) The formal charge on the oxygen is one.
(e) The bond angles are slightly less than 120^o.

_____ 9. Use VSEPR theory to predict the electron pair geometry and the molecular geometry of ClF_4^-.

	Electron pair geometry	**Molecular geometry**
(a)	Tetrahedral	Tetrahedral
(b)	Trigonal bipyramidal	Trigonal bipyramidal
(c)	Trigonal bipyramidal	See-Saw or teeter-totter
(d)	Octahedral	Square pyramidal
(e)	Octahedral	Square planar

_____ 10. What is the molecular formula for the following structure?



(a) C_5H_{12}

(b) C_7H_{14}

(c) C_7H_{16}

(d) C_3H_8

(e) C_4H_{10}

_____ 11. What is the formula of the oxide of Al?

(a) AlO
(b) AlO_2
(c) AlO_3
(d) Al_2O_2
(e) Al_2O_3

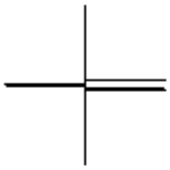
_____ 12. Cl, Br, and I, all members of group 7A, form calcium salts with the same calcium-halide ratio because Cl, Br, and I atoms:

(a) are the same size.
(b) have the same first ionization energy.
(c) have the same valence shell configuration.
(d) all form diatomic molecules.
(e) all are nonmetals.

_____ 13. Which of these molecules is ***not*** planar?

(a) $CH_2=CF_2$
(b) BF_3
(c) NO_3^-
(d) IF_4^-
(e) NCl_3

_____ 14. What is the structure for pentene?

(a) 

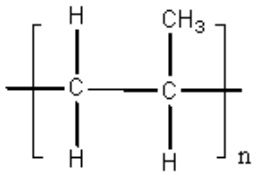
(b) 

(c) 

(d) 

(e) 

_____ 15. The addition polymer shown below came from what monomer?



(a) $H_2C{=}CH_2$

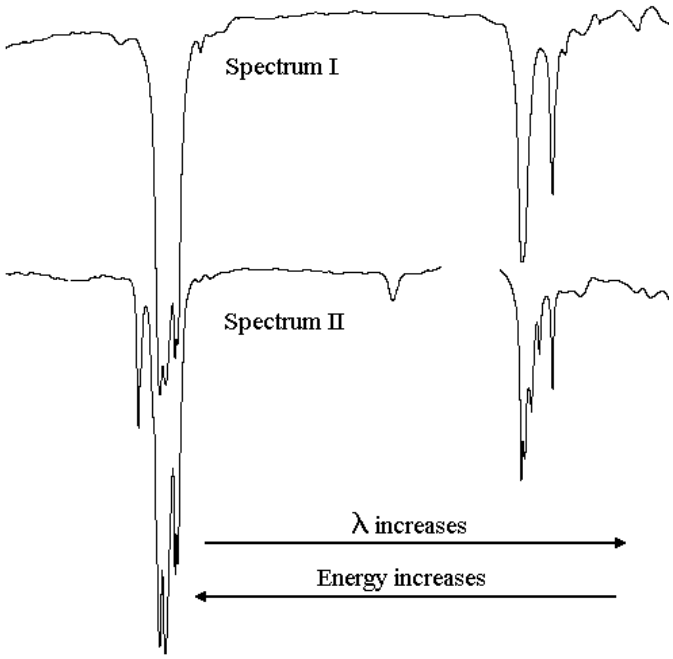
(b) $H_2C{=}CH(CH_3)$

(c) $H_3C{-}C(H)(CH_3){-}CH_3$

(d) $H_2C{=}C(CH_3)_2$

(e) None of these

_____ 16. Infrared Spectrum I is very similar to the spectrum of four of the five compounds listed below. Spectrum II is that of a fifth compound. Which compound produced Spectrum II?



(a) CH_3CH_3

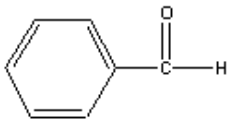
(b) $CH_3CH_2CH_3$

(c) $CH_3CH_2CH_2CH_2CH_2CH_3$

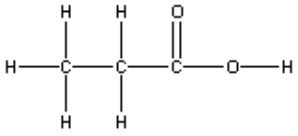
(d) $CH_3CH_2CH_2CH{=}CHCH_3$

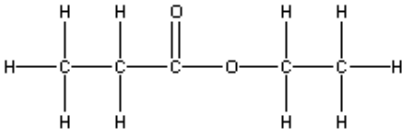
(e) $(-CH_2CH_2-)_n$

_____ 17. Hydrogen bonding would be expected to occur in which of the following **pure** substances?

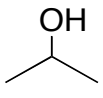
I. 

III. 

II. 

IV. 

(a) In substance III only
(b) In substances II and III
(c) In substance III and IV
(d) In substance I, II and III
(e) In all of these substances

_____ 18. Isopropyl alcohol () is sold as "rubbing alcohol" in nationwide pharmacies. What types of intermolecular forces would you predict for this molecule?

(a) Hydrogen bonding and dispersion forces.
(b) Dipole-dipole forces and dispersion forces
(c) Dispersion forces
(d) Ion-dipole forces and dispersion forces
(e) Hydrogen bonding, dipole-dipole forces, and dispersion forces

_____ 19. How many liters of ethylene glycol ($C_2H_6O_2$, also known as antifreeze) must be dissolved in 4.45 kg of water to protect a car radiator to −25.0°C? Ethylene glycol is a nonvolatile nonelectrolyte that has a density of 1.1132 g/mL. K_f for water is 1.86°C/m.

(a) 5.37 L
(b) 59.8 L
(c) 0.851 L
(d) 11.3 L
(e) 3.33 L

_____ 20. A biochemical engineer isolates a bacterial gene fragment and dissolves a 10.0 mg sample of the material in enough water to make 30.0 mL of solution. The osmotic pressure of the solution is 0.340 torr at 25.0°C. What is the molar mass of the gene fragment? [R = 0.08206 L·atm/mol·K]

(a) 1.83×10^{-5} g/mol
(b) 24.0 g/mol
(c) 2.40×10^{4} g/mol
(d) 1.82×10^{4} g/mol
(e) 1.82×10^{7} g/mol

_____ 21. A consequence of the cell membrane being composed of lipids is that the membrane is:

(a) nonpolar on the inside and outside of the cell, and polar in the middle of the membrane.
(b) polar on the inside and outside of the cell, and nonpolar in the middle of the membrane.
(c) a polymer.
(d) a nonpolar molecule.
(e) high in energy.

_____ 22. Polymorphs are:

(a) compounds with the same formulas but different molecular structures.
(b) isomers of a compound.
(c) a mixture of polymer molecules of different molecular weights.
(d) compounds that crystallize in two or more different forms.
(e) sulfanilamide drugs.

_____ 23. Gleevec was developed to inhibit the action of an enzyme (bcr-abl) that was known to cause Chronic Myeloid Leukemia. This is an example of

(a) accidental drug discovery from mold growing in a petri dish..
(b) the application of forward chemical genetics to develop an antagonist
(c) the application of forward chemical genetics to develop an angonist.
(d) the application of reverse chemical genetics to develop an antagonist.
(e) the application of reverse chemical genetics to develop an angonist.

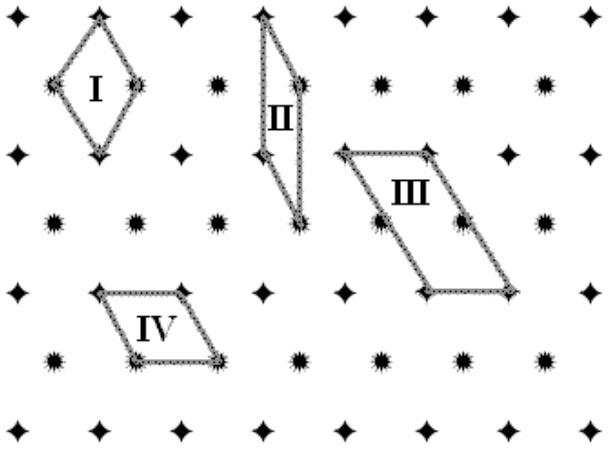
_____ 24. What is the radius of a copper atom? Copper crystallizes in a face-centered cubic unit cell with a cell edge of 360 pm.

(a) 127 pm
(b) 156 pm
(c) 180 pm
(d) 255 pm
(e) 312 pm

_____ 25. Platinum has a density of 21.5 g/cm^3 and a molar mass of 195.1 g/mole. How many platinum atoms are in a unit cell if the unit cell edge length is 391.4 pm?

(a) 1
(b) 2
(c) 3
(d) 4
(e) 5

_____ 26. Which is (are) two-dimensional unit cells in the following diagram?



(a) I
(b) II
(c) III
(d) IV
(e) all of these

_____ 27. Thallium bromide crystallizes in a cubic unit with bromide ions on the corners and a thallium ion at the center of the unit cell. What is the percent by mass of thallium in thallium bromide? (Atomic weights: Tl, 204.38; Br, 79.90.)

(a) 71.9%
(b) 56.1%
(c) 46.0%
(d) 29.9%
(e) 24.2%

_____ 28. All amorphous solids:

(a) are allotropes.
(b) have no ordered internal structure.
(c) are ceramics.
(d) are one class of crystalline materials.
(e) can be used to generate a space lattice.

_____ 29. Which is characteristic of most ceramic materials?

(a) brittle
(b) low melting
(c) formed from a melt
(d) superconducting
(e) composed of molecules

_____ 30. Which of the following is a semiconductor?

(a) gallium arsenide
(b) PVA
(c) protein
(d) lipids
(e) gold

_____ 31. What characteristic or property explains why semiconductors have different electrical properties from metals?

(a) more valence electrons
(b) fewer valence electrons
(c) band gap
(d) higher critical temperature
(e) different coordination numbers

_____ 32. The diameter of the nanoparticles you prepared in lab was about:

(a) 10 m
(b) 10 cm
(c) 10 mm
(d) 10 nm
(e) 10 pm

_____ 33. "Passive" use of solar energy involves:

(a) passing sunlight through several layers of solar cells.
(b) capturing solar energy as heat.
(c) converting solar energy to electricity in a solar cell.
(d) using solar energy to power an LED.
(e) using nanomaterials to produce electricity from solar energy.

_____ 34. Which of the following elements could be used to create a p-doped germanium semiconductor?

(a) Al
(b) As
(c) P
(d) Si
(e) Sn

_____ 35. Biodiesel is produced from:

(a) fats and oils.
(b) carbohydrates.
(c) proteins.
(d) cellulose.
(e) cornstarch.

USEFUL INFORMATION

$K = 273.15 + EC$

$PV = nRT$

$E = h\upsilon = \frac{hc}{\lambda}$

$\Delta E = \Delta mc^2$

$\frac{1}{\lambda} = R_H\left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$

$\frac{dN}{dt} = k[N]$

$\ln\left(\frac{N_0}{N_t}\right) = kt$

$k\,t_{1/2} = \ln 2$

$\pi = MRT$

$\Delta T_b = iK_bm$

$\Delta T_f = iK_fm$

$1\ ft^3 = 28.32\ L$

$R = 8.206 \times 10^{-2}\ L{\cdot}atm/(mol{\cdot}K)$

$c = 3.00 \times 10^8\ m/s$

$1\ amu = 1.661 \times 10^{-27}\ kg$

$h = 6.63 \times 10^{-34}\ J{\cdot}s$

$1\ amu = 931.5\ MeV$

$1\ MeV = 6.602 \times 10^{-13}\ J$

R_H (Rydberg constant) $= 1.096776 \times 10^7\ m^{-1}$

$1\ J = 1\ kg{\cdot}m^2/s^2$

1 atm = 760 mm Hg (exactly)

0 K = −273EC