

Name: _____
200 points
Dr. Jay H. Baltisberger

Final Test
Chemistry 121A
December 13, 1999

SHOW ALL CALCULATIONS & USE PROPER SIGNIFICANT FIGURES AND UNITS

Avogadro's number, $N_A = 6.02 \times 10^{23}$

DeBroglie wavelength, $\lambda = h / mv$

Photon energy, $E_n = n h$

Rydberg constant, $R_H = 2.181 \times 10^{-18} \text{ J}$

Planck's constant, $h = 6.626 \times 10^{-34} \text{ J s}$

Speed of light, $c = 3.00 \times 10^8 \text{ m/s}$

Hydrogen energy, $E_n = -R_H / n^2$

Heat transfer, $q = m C \Delta T$

Multiple Choice Questions: Circle the single best answer. No penalty for guessing.

- What is the most probable oxidation number on bromine in BrF_3 ? (5 points)
A) -1 B) 0 C) +1 D) +3 E) +5
- Which anion forms soluble salts regardless of the cation present? (5 points)
A) OH^- B) SO_3^{2-} C) ClO_4^- D) NO_2^- E) NO_3^-
- What element has 12 neutrons, 10 protons and 10 electrons? (5 points)
A) ^{12}B B) ^{10}C C) ^{22}Ne D) ^{22}He E) ^{22}Ti
- Which of the following atoms or ions has the $1s^2 2s^2 2p^1$ electron configuration? (5 points)
A) C^+ B) Al C) Ga D) B^{3+} E) Si^+
- How many moles of carbon are found in 12.0 mole of butadiene (C_4H_6)? (5 points)
A) 3.00 mol B) 4.00 mol C) 24.0 mol D) 48.0 mol E) 1.20×10^2 mol
- Which of the following has the greatest number of significant digits as written? (5 points)
A) 0.10021 B) 9.10210 C) 0.210 D) 0.00210 E) 20000
- How many possible values are there for the m_l quantum number if $l = 1$? (5 points)
A) 0 B) 1 C) 2 D) 3 E) 4

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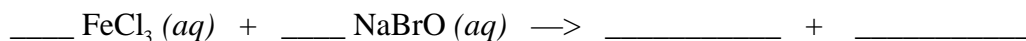
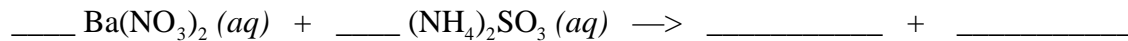
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8. Which ion has the largest radius in the first ionized state? (5 points)
A) Li^+ B) Ba^+ C) Be^+ D) Ag^+ E) Xe^+
9. Which cation forms soluble salts regardless of the anion present? (5 points)
A) Rb^{3+} B) Fe^{3+} C) Ca^{2+} D) Ag^+ E) Sr^{2+}
10. Which molecule or ion has carbon in a state of sp hybridization? (5 points)
A) CH_4 B) CO_3^{2-} C) CO D) CH_3Cl E) H_2CO
11. Which of the following compounds has the largest lattice energy (most stable lattice)? (5 points)
A) BaS B) NaF C) RbI D) CsCl E) MgO
12. How much heat is required to heat a 10.0 g block of iron from 25.0°C to 500.0°C ? (5 points, the specific heat for iron is $C = 0.480 \text{ J / g }^\circ\text{C}$)
A) 120 J B) 2280 J C) 2400 J D) 2520 J E) 9900 J
13. Write the formula or name of the following compounds (as appropriate) and circle the solubility. (16 points)
- | | | |
|-----------------|-------------------------|--------------------------|
| NaNO_2 | _____ | <u>soluble/insoluble</u> |
| CaSO_3 | _____ | <u>soluble/insoluble</u> |
| _____ | iron (III) hypochlorite | <u>soluble/insoluble</u> |
| _____ | potassium sulfide | <u>soluble/insoluble</u> |
14. Write out two additional atomic symbols which are isotopes of ^{132}Cs . (6 points)

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19. Balance the following two equations and write out the final net ionic equations for each. (12 points)



20. Explain how the atomic orbitals of C atom is involved in creating the bonds in CH₂O. Describe both the π and σ parts separately as appropriate using the valence bond model. (8 points)

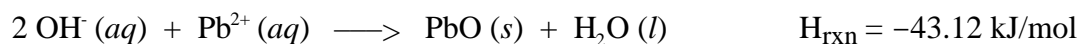
21. Calculate the De Broglie wavelength of a helium atom ($m_{\text{He}} = 6.646 \times 10^{-27}$ kg) moving at a speed of 5.2×10^4 m/s. (10 points)

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22. Draw the Lewis dot structures (showing resonance structures if appropriate) for SF_4 and NO_2^- , indicating oxidation numbers and formal charges on each atom in each structure. (14 points)

23. Given the reaction below, calculate (in kJ) the amount of heat that will be released when 1.31 L of 0.430 M NaOH reacts with 2.22 L of 0.330 M $\text{Pb}(\text{NO}_3)_2$. Assuming that the solutions have a density of 1.00 g/mL and the same heat capacity as pure water (4.184 J / g K), calculate the temperature change of the resulting solution, assuming both solutions were 300.0 K initially. (15 points)



24. Draw pictures of and describe the difference between the σ and π types of molecular orbitals formed in O_2 ? (15 points)