Name: _____ Final Test

200 points Chemistry 121A

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SHOW ALL CALCULATIONS & USE PROPER SIGNIFICANT FIGURES AND UNITS

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

1. What is the length of a 2300 cm long block of wood in km? (4 points)

A) 2.3×10^{-6} km **B)** 2.3×10^{-2} km **C)** 2.3×10^{-1} km **D)** 2.3 km **E)** 2.3×10^{1} km

2. How many moles are 48 g of ^{16}O? (4 points)

A) 1.0 **B)** 2.0 **C)** 3.0 **D)** 36.0 **E)** 72.0

3. What is the name of the CN^- anion? (4 points)

A) cyanide **B)** carbonite **C)** carbonide **D)** chloride **E)** hypocarbonite

4. Which of the following is a strong acid? (4 points)

A) $H_2C_2O_4$ **B)** HClO **C)** $HC_2H_3O_2$ **D)** HBr **E)** HNO_2

5. How many kJ of heat is needed to raise 50.0 g of H_2O from 10.0˚ to 50.0˚ C? (4 points, the specific heat for water is C = 4.184 J / g ˚C)

A) 0.418 kJ **B)** 4.18 kJ **C)** 8.37 kJ **D)** 12.6 kJ **E)** 20.9 kJ

6. What volume of 0.3321 M NaOH is required to titrate 37.2 ml of 2.11 M HCl to a neutral endpoint? (4 points)

A) 5.86 ml **B)** 26.07 ml **C)** 33.21 ml **D)** 37.2 ml **E)** 236.4 ml

7. What is the molecular geometry of a molecule with 4 pairs of valence electrons about the central atom, of which 2 are lone pairs of electrons (*i.e.* SF_2)? (4 points)

A) trigonal **B)** square planar **C)** linear **D)** tetrahedral **E)** bent

8. How many electrons are required to fill all of the 4d orbitals for a single atom? (4 points)

A) 2 **B)** 5 **C)** 8 **D)** 10 **E)** 14

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9. Which of the following ions has the largest ionic radius? (4 points)

A) Na^+ **B)** F^- **C)** Ba^{2+} **D)** Zn^{2+} **E)** Cs^+

10. Which of the following atoms or ions has the $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^1$ electron configuration? (4 points)

A) Al **B)** Ca **C)** Ga **D)** B **E)** C^+

11. How many moles of O_2 are required to burn 2.0 moles of C_2H_4 completely to CO_2 and H_2O? (4 points)

A) 2.0 **B)** 3.0 **C)** 4.0 **D)** 6.0 **E)** 12.0

12. Which of the following is a non-metal? (4 points)

A) Np **B)** Se **C)** Ru **D)** Fe **E)** Ga

13. Write the formula or name of the following compounds and indicate the solubility. (16 points)

$Ba(NO_2)_2$	_____	_____
$(NH_4)_2CrO_4$	_____	_____
_____	silver (I) chlorite	_____
_____	sodium sulfide	_____

14. Given the following data enthalpies of reaction:

$C\ (s) + 1/2\ O_2\ (g) \longrightarrow CO_2\ (g)$ $\Delta H = -393.5$ kJ/mol

$1/2\ N_2\ (g) + 3/2\ H_2\ (g) \longrightarrow NH_3\ (g)$ $\Delta H = -46.2$ kJ/mol

$C\ (s) + N_2\ (g) + 2\ H_2\ (g) \longrightarrow NH_4CN\ (s)$ $\Delta H = 0.0$ kJ/mol

$1/2\ O_2\ (g) + H_2\ (g) \longrightarrow H_2O_2\ (g)$ $\Delta H = -136.1$ kJ/mol

Calculate the ΔH for the reaction of H_2O_2 with NH_4CN. How much heat is released when 4.0 moles of NH_4CN reacts with excess H_2O_2? (15 points)

___ $NH_4CN\ (s)$ + ___ $H_2O_2\ (g)$ —> ___ $CO_2\ (g)$ + ___ $NH_3\ (g)$

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15. Draw the Lewis dot structure and give the electron pair and molecular geometries for CF_2O. (10 points)

16. Discuss the trend in ionization energy for Na, Li and Al using electron configuration arguments. (10 points)

17. Calculate both the thickness of an object which is rectangular in shape with sides of 4.0 and 13.2 cm, has a mass of 32.134 g, and a density of 0.871 g/cm^3. (Remember proper significant figures and that the volume of a rectangular solid is length times width times height.) (6 points)

18. Balance the following two equations and write out a final net ionic equations. (12 points)

____ $CuSO_4$ *(aq)* + ____ Na_2CO_3 *(aq)* —> _____ + _____

____ NH_4ClO_3 *(aq)* + ____ $FeCl_3$ *(aq)* —> _____ + _____

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19. What is the empirical formula for an iron sulfide compound which is 56.64% Fe. (9 points)

20. Write the ground state electron configuration for V^{3+}, O^{2-} and Sn. (9 points)

21. The Rydberg equation is given below (R = 1.0966x10^{7} m^{-1}, h = 6.626x10^{-34} J s, c = 3.0x10^{8} m/s):

$$\frac{1}{\lambda} = -\frac{R}{n_i^2} + \frac{R}{n_f^2}$$

Calculate the wavelength of a photon of light emitted from the n = 6 to the n = 3 level of a hydrogen atom. How many of these photons would be needed to heat 5.0 g of water from 25˚C to 35˚C using q = m C ΔT where the heat capacity of water is C = 4.184 J g^{-1} K^{-1}. (10 points)

22. Draw a picture of a 2p orbit. Using pictures illustrate how two 2p orbits may interact to form both σ and π–type bonds, depending upon orientation. (10 points)

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23. Draw all resonance structures for O_3, indicating formal charges on each atom in each structure. What is the hybridization of each atom? (15 points)

24. Calculate the number of protons, electrons and neutrons for each of the following atoms or ions. (15 points)

	^{57}Fe	^{198}Au	$^{33}S^{2-}$	$^{137}Ba^{2+}$	^{3}H
neutrons					
protons					
electrons					

25. What is the concentration if 0.813 g of Na_2SO_4 is dissolved in 250.0 mL of distilled water. Calculate the final concentration if 23.21 mL of this solution is diluted to 1000.0 mL. (15 points)