Chemistry 1201 spring 2012 Final Exam

Form 1

Instructions:

On SIDE TWO of the answer sheet (scantron):

(i) Print your name LAST NAME then First and “bubble it in”
(ii) Print and bubble in your LSU ID number
(iii) Bubble 1 under Grade or Education on the scantron sheet

On SIDE ONE:

(iv) Answers to the test questions should be “bubbled in” on side one.
There is one best answer for each question and DON’T leave a
question blank. On a numerical problem, choose the response closest
to the correct answer

Useful Constants

Avogadro’s constant: \( 1 \text{ mol} = 6.0211 \times 10^{23} \)
Speed of light: \( c = 2.9979 \times 10^8 \text{ m/s} \); \( c = \lambda \nu \)
Planck’s constant: \( h = 6.625 \times 10^{-34} \text{ Js} \)

1 atm = 101.325 kPa = 760 torr = 760 mmHg

\( R = 0.008201 \text{ L atm mol}^{-1} \text{K}^{-1} = 8.314 \text{ J mol}^{-1} \text{ K}^{-1} \)

<table>
<thead>
<tr>
<th>Periodic Chart of the Elements</th>
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<tr>
<td>IA</td>
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<td>H</td>
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<td>Li</td>
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<td>Cu</td>
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**Numbers in parentheses represent number of most stable isotope.**

**Isotopes noted in number of most stable isotope of the**

**Commission on Isotopic Nomenclature.**

**The group designations noted here are the former Chemical**

**Abstract System numbers.**

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**La-Actinium Series**

[Further details about the periodic table and its elements are omitted for brevity.]
1. Pure copper has a density of 8.933 g/cm³. What is the volume a 5.0-g block of copper? Report your answer to two significant figures.

A. 45 cm³  
B. 0.56 cm³  
C. 1.8 cm³  
D. 0.6 cm³  
E. 3.9 cm³

2. The two common isotopes of chlorine are $^{35}$Cl and $^{37}$Cl. How many protons, neutrons and electrons are present in $^{37}$Cl isotope?

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<thead>
<tr>
<th>Protons</th>
<th>Neutrons</th>
<th>Electrons</th>
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<tbody>
<tr>
<td>A. 17</td>
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<td>B. 17</td>
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<td>C. 37</td>
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<td>D. 20</td>
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<td>E. 35</td>
<td>18</td>
<td>35</td>
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</tbody>
</table>

3. Which of the following compounds is a molecular compound?

A. CaBr₂  
B. C₆H₁₂O₈  
C. CuSO₄  
D. Ba₃N₂  
E. NaI

4. Which of the following names is correct for the compound Cl₂O₅ ?

A. Chlorine dioxide  
B. Chlorine pentoxide  
C. Dichlorine pentoxide  
D. Chlorine heptoxide  
E. Dichlorine heptoxide

5. Which of the following formula / name pairs is incorrect?  

A. AlN / aluminum nitride  
B. NaClO / sodium hypochlorite  
C. CuSO₃ / copper(ii) sulfite  
D. KH₂PO₄ / potassium hydrogen phosphate  
E. (NH₄)₂SO₄ / ammonium sulfate
6. What is the empirical formula of a compound that contains by mass 40.1 % C, 6.6 % H, and 53.3 % O?
   A. CHO
   B. CH₂O
   C. C₂H₂O
   D. C₂H₄O₂
   E. CH₄O

7. What is the formula of a compound that forms from calcium and nitrogen?
   A. CaN
   B. CaN₂
   C. Ca₂N
   D. Ca₂N₃
   E. Ca₃N₂

8. When the following equation is balanced, the coefficients for CO₂ is 
   \[ \text{C}_3\text{H}_8 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O} \]
   A. 1
   B. 2
   C. 3
   D. 4
   E. 5

9. A 15.3 gram sample of aluminum chloride contains _______ mole of aluminum chloride.
   A. 0.245
   B. 2.040
   C. 0.432
   D. 0.115
   E. 0.567

10. How many molecules of methane (CH₄) are in 80.2 g of this compound?
    A. 5.00
    B. 2.90 x 10²⁵
    C. 1.20 x 10²³
    D. 8.31 x 10⁻²⁴
    E. 3.01 x 10²⁴
11. Calcium carbide (CaC$_2$) reacts with water to produce acetylene (C$_2$H$_2$):

$$\text{CaC}_2 \text{ (s)} + 2 \text{H}_2\text{O (g)} \rightarrow \text{Ca(OH)}_2 \text{ (s)} + \text{C}_2\text{H}_2 \text{ (g)}$$

The complete reaction of 22.7 g of CaC$_2$ requires consumption of

A. 12.8 g
B. 18.0 g
C. 0.710 g
D. 64.1 g
E. 0.354 g

12. How many grams of solute are present in 57.6 mL of 0.739 M C$_6$H$_{12}$O$_6$?

A. 7.66 g
B. 42.6 g
C. 7662 g
D. 0.0425 g
e) 12.83 g

13. What volume of 3.00 M CuSO$_4$ stock solution is required to produce 250 mL of 0.950 M CuSO$_4$ solution?

A. 789 mL
B. 0.789 mL
C. 1.27 \times 10^3 \text{ mL}
D. 79.2 mL
E. 12.6 mL

14. Choose the statement from below which correctly describes the substance whose formula is given as a strong electrolyte, weak electrolyte, or nonelectrolyte.

A. Al(NO$_3$)$_3$ a weak electrolyte.
B. HClO is a nonelectrolyte.
C. MgCl$_2$ is a strong electrolyte.
D. Na$_2$S is a nonelectrolyte.
E. PbCl$_2$ is a strong electrolyte.
15. Choose the correct balanced net ionic equation which represents the metathesis reaction between sodium sulfide and aluminum chloride.
A. \(3 \text{Na}_2\text{S(aq) + 2 Al}^{3+} (\text{aq}) \rightarrow \text{Al}_3\text{S}_2(\text{s}) + 6 \text{Na}^+\)
B. \(2 \text{Al}^{3+}(\text{aq}) + 3 \text{S}^{2-}(\text{aq}) \rightarrow \text{Al}_2\text{S}_3(\text{s})\)
C. \(2 \text{AlCl}_3(\text{aq}) + 3 \text{S}^{2-}(\text{aq}) \rightarrow \text{Al}_2\text{S}_3(\text{s}) + 6 \text{Cl}^-\)
D. \(\text{Al}^{2+}(\text{aq}) + 3 \text{S}^{2-}(\text{aq}) \rightarrow \text{AlS(s)}\)
E. \(2 \text{Al}^{3+}(\text{aq}) + 3 \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{Al}_2(\text{SO}_4)_3(\text{s})\)

16. A 600-mL sample of a saturated solution of \(\text{Ba(OH)}_2\) in water was titrated with 1.95 \(M\) \(\text{HCl}\). It required 34.9 mL of the acid solution for neutralization. What was the molar concentration (molarity) of this \(\text{Ba(OH)}_2\) solution?
A. \(5.67 \times 10^{-2} \ M\)
B. \(1.93 \times 10^{-6} \ M\)
C. \(1.13 \times 10^{-1} \ M\)
D. \(2.27 \times 10^{-1} \ M\)
E. \(2.28 \times 10^{-3} \ M\)

17. When your skin cells are exposed to ultraviolet (UV) light they produce a brown pigment (melanin) to protect themselves from further exposure. If a tanning bed using UV radiation that has a wavelength of 300.0 nm, what is the energy of one photon of this radiation?
A. \(6.604 \times 10^{-19} \ J\)
B. \(1.988 \times 10^{-31} \ J\)
C. \(5.944 \times 10^{-32} \ J\)
D. \(6.604 \times 10^{-49} \ J\)
E. \(6.604 \times 10^{-28} \ J\)
18. The figure below represents the electron configuration for an atom of nitrogen. The electrons in the 2p orbital occupy separate orbitals in order to decrease electron-electron repulsion. This is an example of

\[ 1s \quad 2s \quad 2p \]

\[ \begin{array}{cccc}
1 & 1 & 1 & 1
\end{array} \]

A. probability density
B. the Pauli Exclusion principle
C. a radial probability function
D. Hund’s rule
E. electron spin

19. An electron cannot have the quantum numbers \( n = \), \( l = \), \( m_l = \).
A) 6, 1, 0  
B) 3, 2, 3  
C) 3, 2, -2  
D) 1, 0, 0  
E) 3, 2, 1

20. Choose the correct electron configuration for the element Ga.

A. \( 1s^2 \ 2s^2 \ 2p^6 \ 3s^2 \ 3p^6 \ 4s^2 \ 4d^{10} \ 4p^1 \)
B. \( 1s^2 \ 2s^2 \ 2p^6 \ 3s^2 \ 3p^6 \ 4s^2 \ 4p^2 \)
C. \( 1s^2 \ 2s^2 \ 2p^6 \ 3s^2 \ 3p^6 \ 4s^2 \ 3d^{10} \ 4p^1 \)
D. \( 1s^2 \ 2s^2 \ 2p^6 \ 3s^2 \ 3p^6 \ 4s^2 \ 4p^1 \)
E. \( 1s^2 \ 2s^2 \ 2p^6 \ 3s^2 \ 3p^6 \ 4s^2 \ 3d^{10} \ 4p^2 \)

21. The electron configuration \( 1s^2 \ 2s^2 \ 2p^6 \) does not represent which ion below?
A. \( \text{O}^{2-} \)  
B. \( \text{F}^- \)  
C. \( \text{Na}^+ \)  
D. \( \text{Mg}^+ \)  
E. \( \text{Al}^{3+} \)
22. Of the following, which gives the correct order for the atomic radius for Ca, K, Kr, Se, and Ga? "(largest atom listed first)"

A. Se > Kr > Ga > Ca > K
B. Ga > Se > Kr > K > Ca
C. K > Ca > Ga > Se > Kr
D. K > Kr > Se > Ga > Ca
E. Kr > Se > Ga > Ca > K

23. Which one of the following atoms has the largest radius?

A. Ne
B. F
C. S
D. Ar
E. O

24. Of the choices below, which gives the order for first ionization energies? (smallest ionization energy listed first)

A. C < N < O < F < Ne
B. F < O < N < C < Ne
C. Ne < F < O < N < C
D. C < Ne < F < O < N
E. O < F < N < C < Ne

25. Which of the following is an isoelectronic series?

A. S²⁻, Cl⁻, Ar, K⁺
B. Ar, Na⁺, Fe²⁺, Al³⁺
C. F⁻, Cl⁻, Br⁻, I⁻
D. K⁺, Ar, F⁻, O²⁻
E. He, Ne, Ar, Kr

26. Which of the following lists bonds between two atoms is organized in order of increasing polarity (least polar bond listed first)?

A. Si-As < Al-Se < Al-Si
B. Si-As < Al-Si < Al-Se
C. Al-Se < Al-Si < Si-As
D. Al-Se < Si-As < Al-Si
E. Al-Si < Al-Se < Si-As
27. Which of the following elements has the **highest** electronegativity?
   A. Cl
   B. O
   C. Ne
   D. He
   E. F

28. Draw a Lewis structure for \( \text{CO}_2 \). Choose the **correct** statement about your Lewis structure.

   A. The central atom in the Lewis structure has one double bond, one single bond, and one nonbonding pair of electrons attached to it.
   B. The central atom in the Lewis structure has two single bonds and two nonbonding pairs of electrons attached to it.
   C. The central atom in the Lewis structure a single bond, a triple bond and no nonbonding electrons attached to it.
   D. The central atom in the Lewis structure has two single bonds and no nonbonding electrons attached to it.
   E. The central atom in the Lewis structure has two double bonds and no nonbonding electrons attached to it.

29. Draw Lewis structures of the molecules whose formulas are given below and choose the formula of the chemical whose molecules have a central atom with an expanded octet.

   A. \( \text{SF}_2 \)
   B. \( \text{IF}_3 \)
   C. \( \text{BF}_3 \)
   D. \( \text{NF}_3 \)
   E. \( \text{CF}_4 \)
30. Draw three resonance structures for OCN\(^-\). This species has its three atoms bonded sequentially in the following fashion: O-C-N. Draw your resonance structures so that the atoms in them are bonded together in this order. Select the most important resonance structure for this species based on the formal charges on the atoms of the three resonance structures you have drawn. Now select the statement from the multiple choices which is true about this most important resonance structure.

A. The leftmost bond (between O and C) is a triple bond.
B. The rightmost bond (between C and N) is a single bond.
C. The formal charge on the leftmost (O) atom is 0.
D. The number of nonbonding pairs of electrons on the leftmost (O) atom is 3.
E. The number of nonbonding pairs of electrons on the right most (N) atom is 2.

31. What is the **electron domain geometry** around the central atom (carbon) in formaldehyde (CH\(_2\)O)?
   A. Tetrahedral
   B. trigonal planar
   C. Bent
   D. trigonal bipyramidal
   E. T-shaped

32. What is the **molecular geometry** of SnCl\(_3\)^-?
   A. trigonal pyramidal
   B. t-shaped
   C. trigonal bipyramidal
   D. bent
   E. Seesaw
33. Which of the molecules below are non-polar?

(Ⅰ) BCl₃  (Ⅱ) H₂O  (Ⅲ) SF₃Cl  (Ⅳ) BrCl

A. II only
B. I, II, III
C. II, III
D. I, III
E. I only

34. What is the hybridization at the central atom in PO₄³⁻?

A. sp
B. sp³d
C. sp⁴
D. sp³
E. sp³d²

35. Choose the answer in which the gases NH₃, Cl₂, CO₂, SO₂ and N₂ are listed in order of increasing average molecular speed if all of these gases are at the same temperature (gas with slowest molecules listed first)

A. Cl₂<CO₂<NH₃<SO₂<N₂
B. Cl₂<SO₂<CO₂<N₂<NH₃
C. NH₃<N₂<CO₂<SO₂<Cl₂
D. N₂<SO₂<NH₃<CO₂<Cl₂
E. Cl₂<SO₂<CO₂<NH₃<N₂

36. A sample of gas originally at 25 °C and 1.00 atm pressure in a 2.5 L container is allowed to expand until the pressure is 0.85 atm and the temperature is 15 °C. What is the final volume of gas?

A. 0.38 L
B. 2.1 L
C. 2.6 L
D. 2.8 L
E. 3.0 L
37. A mixture of Xe, Kr, and Ar has a total pressure of 6.70 atm. What is the mole fraction of Kr if the partial pressures of Xe and Ar are 1.60 atm and 2.80 atm, respectively.
A. 0.174
B. 0.256
C. 0.343
D. 0.481
E. 0.570

38. Determine the pressure in atm. for a 10.0 g of CO$_2$ gas sample contained in a sealed 10.00 L tank at a temperature 50 °C?
A. 0.602 atm
B. 0.0932 atm
C. 26.5 atm
D. 4.105 atm
E. 0.230 atm

39. What is the predominant intermolecular force in CCl$_4$?
A. hydrogen-bonding
B. dipole-dipole attraction
C. ionic bonding
D. London-dispersion forces
E. ion-dipole attraction

40. Which one of the following substances is more likely to dissolve in CCl$_4$?
A. HBr
B. HCl
C. NaCl
D. C$_4$H$_{10}$
E. CH$_3$OH
<table>
<thead>
<tr>
<th>Soluble Ionic Compounds</th>
<th>Important Exceptions</th>
</tr>
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<tbody>
<tr>
<td>Compounds containing</td>
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<tr>
<td>NO₃⁻</td>
<td>None</td>
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<tr>
<td>CH₃COO⁻</td>
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<tr>
<td>Cl⁻</td>
<td>Compounds of Ag⁺, Hg₂⁺, and Pb²⁺</td>
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<td>Br⁻</td>
<td>Compounds of Ag⁺, Hg₂⁺, and Pb²⁺</td>
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<td>I⁻</td>
<td>Compounds of Ag⁺, Hg₂⁺, and Pb²⁺</td>
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<td>SO₄²⁻</td>
<td>Compounds of Sr²⁺, Ba²⁺, Hg₂⁺, and Pb²⁺</td>
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<th>Insoluble Ionic Compounds</th>
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<td>Compounds containing</td>
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<tr>
<td>S⁻</td>
<td>Compounds of NH₄⁺, the alkali metal cations, Ca²⁺, Sr²⁺, and Ba²⁺</td>
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<td>CO₃²⁻</td>
<td>Compounds of NH₄⁺ and the alkali metal cations</td>
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<td>PO₄³⁻</td>
<td>Compounds of NH₄⁺ and the alkali metal cations</td>
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<td>OH⁻</td>
<td>Compounds of NH₄⁺, the alkali metal cations, Ca²⁺, Sr²⁺, and Ba²⁺</td>
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### Chem 1201 Final Exam Keys

#### Form #1

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