Name __________________________ (Print last name in CAPS)

SECTION ___________(same as your lab section)

1. Read each question carefully before answering.
2. Mark the choice that best answers the question or completes the statement.
3. Use the scantron provided. Use a no. 2 pencil and clearly mark your choice. If you change an answer, completely erase your previous mark.
4. Answer each question. There is no penalty for guessing. However, multiple answers are graded as incorrect, and blank answers are graded as incorrect.
5. On the scantron, fill in your last name, first name and initial. Blacken the corresponding letters.
6. Fill in your UIN, the department=CHEM, Course no. = 101, and Section= your lab section. Blacken the corresponding letters and numbers.
7. Use the test for scratch paper.
8. Mark your answers on the test so you can check them with the key when it is posted.
9. ***Turning in a blank scantron results in a grade of zero. ***
10. You may be asked to turn in both the scantron and the exam, have your PHOTO ID and your calculator ready to be checked when you do so.
11. Work at a steady pace and you will have ample time to finish.
12. The keys will be posted on my class web page as soon as possible.

There are 22 questions for 150 points. Good Luck!
Possibly Useful Information

A periodic table is also provided on the last page of this exam.

Q.1 Below are some elements and their valence electrons. Which is incorrect?
   a) Be, 2  b) Br, 5  c) Li, 1  d) At, 3  e) C, 4
   
Q.2 Which of the following is the correct Lewis structure for carbon diselenide.
   a) \( \text{Se} = \text{C} = \text{Se} \)
   b) \( \text{Se} = \text{C} = \text{Se} \)
   c) \( \text{Se} = \text{C} = \text{Se} \)
   d) Se = C = Se
   e) Se = C = Se

Q.3 Which of the following Lewis structures is incorrect?
   a) \( \text{H} - \text{C} = \text{H} \)
   b) \( \text{H} - \text{O} - \text{H} \)
   c) \( \text{N} - \text{H} \)
   d) \( \text{O} - \text{C} - \text{O} \)
Q.4 How many lone pairs of electrons are there on the Xe atom in the XeF₄⁻ molecule?

- a) One
- b) Two
- c) Three
- d) Four
- e) Zero

\[ N = 40 \]
\[ A = 36 \]
\[ S = 4 \text{ and } B = 4 \text{ e} \]
\[ L = 28 = 14 \text{ LP} \]
\[ F^-Xe^-F^- \]
\[ (L) \]

Q.5 The valence shell is ...

- a) The highest energy level occupied by electrons.
- b) The set of orbitals used to make triple bonds.
- c) The orbitals belonging to the entire molecule.
- d) The lowest energy level occupied by electrons.
- e) The hard covering on crustaceans.

Q.6 Which of the following molecules is polar?

- a) \( \text{H}_2\text{O} \)
- b) \( \text{NH}_3 \)
- c) \( \text{CO}_2 \)
- d) \( \text{CF}_2 \)
- e) \( \text{H}_2\text{O} \)

Q.7 The hybridization associated with the central atom of a molecule in which all the bond angles are 120° is ...

- a) \( sp^3 \)
- b) \( sp^2 \)
- c) \( sp^3d \)
- d) \( sp^3d^2 \)
- e) \( sp \)
Q. 8  What is the hybridization on the boron atom in gaseous BBr₃?

a) sp
b) sp³

c) sp³ d²
d) sp³ d²

e) sp²

Q. 9  Consider CH₄ and CF₄.  Electronegativities are: C = 2.5,  H = 2.1, F = 4.0

Which statement is false?

a) Both are sp³ hybridized at the carbon.  T

b) The bond angles in CH₄ are smaller than those in CF₄.  F

c) The C-F bonds are more polar than the C-H bonds.  T

d) Both molecules are nonpolar.  F

e) The dipole moments in CF₄ are directed toward the fluorine, but those in CH₄ are directed toward the carbon.  T

Q. 10  Many simple molecules contain lone pairs of electrons which occupy hybrid orbitals of the central atom.  If the central atom utilizes sp³ hybrid orbitals in a molecule, which one of the following types of repulsions would be greater?

a) bonding-pair -- bonding pair

b) bonding-pair -- lone pair

c) lone-pair -- bonding pair

d) lone pair -- lone pair

e) repulsions between all types of pairs of electrons are the same.

Q. 11  Which of the following statements about AsF₅ is false?

a) The molecular geometry is trigonal bipyramidal.  ✓

b) Arsenic is sp³ d hybridized.  ✓

c) Arsenic has one lone pair.  X

d) The bonding angles are 120°, 90°, and 180°.  ✓

e) None of the above are true.
Q.12  Which of the following species has square planar molecular geometry?
   a) CH₄  no  
   b) SF₄  no  
   c) XeF₄  ✓  
   d) NH₄⁺  no  
   e) SO₄²⁻  no

Q.13  How many sigma and how many pi bonds does the acetylene molecule, C₂H₂, contain?
   a) 5σ/1π  
   b) 2σ/3π  
   c) 3σ/1π  
   d) 2σ/2π  
   e) 3σ/2π

Q.14  What is the molarity of 600.0 mL of a solution containing 6.72 grams of sulfurous acid, H₂SO₄?
   a) 0.114 M  
   b) 0.288 M  
   c) 0.342 M  
   d) 0.180 M  
   e) 0.360 M

Q.15  Which of the following is a soluble strong base?
   a) CsOH  ✓  
   b) Cu(OH)₂  
   c) Fe(OH)₃  
   d) Mn(OH)₂  
   e) Al(OH)₃
Q. 16 What volume of 0.50 M KOH would be required to neutralize completely 500.0 mL of 0.25 M H₃PO₄ solution?

\[
\text{H}_3\text{PO}_4 + 3\text{KOH} \rightarrow \text{K}_3\text{PO}_4 + 3\text{H}_2\text{O}
\]

\[
\begin{align*}
250 \text{ mL} & \quad \frac{0.50 \text{ mol} \text{ KOH}}{1 \text{ L}} \quad \text{ or } \quad 0.25 \text{ mol} \text{ H}_3\text{PO}_4 \\
1400 \text{ mL} & \\
83 \text{ mL} & \\
\text{Correct Answer: } 750 \text{ mL} & \\
520 \text{ mL} & \\
= 0.75 \text{ L} = 750 \text{ mL}
\end{align*}
\]

Q. 17 Balance the following redox reaction in acid. Using the smallest integer coefficients, what is the sum of the balancing coefficients?

\[
\text{H}_2\text{S} + \text{H}^+ + \text{Cr}_2\text{O}_7^{2-} \rightarrow \text{Cr}^{3+} + \text{S} + \text{H}_2\text{O}
\]

\[
\begin{align*}
a) & \quad 18 & \quad \text{H}_2\text{S} \rightarrow \text{S} + 2\text{H}^+ + 2\text{e}^- \times 3 \\
b) & \quad 20 \\
c) & \quad 22 \\
correct answer: 24 & \quad 6\text{e}^- + 14\text{H}^+ + \text{Cr}_2\text{O}_7^{2-} \rightarrow 2\text{Cr}^{3+} + 7\text{H}_2\text{O} \\
e) & \quad 26 \\
3\text{H}_2\text{S} + \left(\bigcirc\right) + 8\text{H}^+ + \text{Cr}_2\text{O}_7^{2-} \rightarrow 3\text{S} + \left(\bigcirc\right) + \left(\bigcirc\right) + 2\text{Cr}^{3+} + 7\text{H}_2\text{O} \\
3 + 8 + 1 + 3 + 2 + 7 = 24
\end{align*}
\]
Q.18 Which response includes all of the following that are strong acids, and no others?

- I. HClO₄
- II. HNO₂
- III. H₃AsO₄
- IV. H₃PO₄
- V. HCl

a) I, III, IV, V
b) I and V
c) I and IV
d) II and III
e) IV and V

Q.19 Which of the following pairs of acids and conjugate bases is incorrectly labeled or incorrectly matched?

<table>
<thead>
<tr>
<th>Conjugate Acid</th>
<th>Conjugate Base</th>
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<tbody>
<tr>
<td>a) HF</td>
<td>F⁻</td>
</tr>
<tr>
<td>b) HClO</td>
<td>Cl⁻</td>
</tr>
<tr>
<td>c) H₂O</td>
<td>OH⁻</td>
</tr>
<tr>
<td>d) NH₄⁺</td>
<td>NH₂⁻</td>
</tr>
<tr>
<td>e) H₃O⁺</td>
<td>H₂O</td>
</tr>
</tbody>
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Q.20 According to the Arrhenius theory, which of the following is an acid?

a) NH₃
b) CH₄
b) HF
b) H₂
b) NaOH

Q.21 What is the geometry of a carbon involved in a triple bond?

- a) Trigonal planar
- b) Tetrahedral
- c) Trigonal bipyramidal
- d) Octahedral
Q.22 Which, if any, of the compounds listed are not sp\(^3\) hybridized at the central atom?

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<tbody>
<tr>
<td>I.</td>
<td>CF(_4) ✓</td>
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<tr>
<td>II.</td>
<td>H(_2)O ✓</td>
</tr>
<tr>
<td>III.</td>
<td>CH(_3)Cl ✓</td>
</tr>
<tr>
<td>IV.</td>
<td>NH(_3) ✓</td>
</tr>
</tbody>
</table>

- a) III and IV
- b) I, II, and III
- c) II, III, and V
- d) III and V
- e) All are sp\(^3\) hybridized

End of Test
Magnuson 101 exam 3  KEY E  10:20 class

There are 22 questions for 150 points
Each question is 6.82 points.

<table>
<thead>
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<th>Q1</th>
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