FORM E is EXAM II, VERSION 1 (v1)

1. DO NOT TURN THIS PAGE UNTIL DIRECTED TO DO SO.
2. These tests are machine graded; therefore, be sure to use a No. 1 or 2 pencil for marking the answer sheets.
3. Completely blacken the answer circle. If you change an answer, erase completely the previous mark.
4. You may remove your answer sheet from this booklet. If you have a pink test, test form A should be darkened (B for Blue), if it is not, notify your instructor immediately.
5. Fill in your last name, first name, and initial. Blacken the corresponding letters below.
6. Fill in your ID number. CAREFULLY, blacken the corresponding numbers below.
7. Fill in the Dept. Course No. and Section. The Dept. = CHEM, the Course No. = 101, and your section refers to your lab section.
8. READ THE TEST CAREFULLY. The time limit on this test is 50 minutes.
9. Mark your answers in this booklet as well as on the answer sheet so you can check your score with the key after the test.
10. There are 17 questions. Each of the 16 multiple choice questions in the first section counts 6 points (96), and there is one multiple choice question @ 4pts for a total of 100 points.
11. Your score will be calculated from the number of correct answers. There is no penalty for guessing.
12. Turn in your scan sheet, show your ID, and have your calculator checked by the TA listed on the overhead for your last name.
13. A key will be on the electronic class bulletin board at 11:30PM. This is accessed through the class homepage (http://chemed.tamu.edu/bb.htm). The class average will also be posted when it is confirmed.

IMPORTANT INFORMATION:

\[ F = 1.8 \, C + 32 \quad \lambda = \frac{h}{mv} \]
\[ \frac{1}{\lambda} = -R \left[ \left( \frac{1}{n_f^2} \right) - \left( \frac{1}{n_i^2} \right) \right] \quad \text{and} \quad R = 1.097 \times 10^{-7} \, m^{-1} \]
\[ E_n = \frac{-R_H}{n^2} \]
\[ \Delta E = -R_H \left[ \left( \frac{1}{n_f^2} \right) - \left( \frac{1}{n_i^2} \right) \right] \quad \text{and} \quad R_H = 2.18 \times 10^{-18} \, J \]
\[ c = 3.00 \times 10^8 \, m/s \]
\[ h = 6.63 \times 10^{-34} \, J\cdot s \]

© Vickie M. Williamson, All Rights Reserved
1. What is the % by weight (mass percent) of Cl in CH₂Cl₂?
   A. 16.5  B. 83.5  C. 41.8  D. 19.8  E. 94.1

2. How many moles are in 490 grams of H₂SO₄?
   A. 0.20 mol  B. 3.0 e26 mol  C. 5.0 mol  D. 2.0 mol  E. 0.50 mol

3. (4pts) Which one of the following polyatomic ions has the same charge as the ion formed by sulfur?
   A. hydroxide  B. phosphate  C. acetate  D. ammonium  E. carbonate

4. What is the empirical formula for a compound that is 29% by weight Na, 41% S, and 30% O?
   A. NaSO₃  B. NaSO₂  C. Na₂S₂O₃  D. Na₃S₄O₃  E. NaSO

5. How many molecules of CH₄ are in 48.2 g of this compound?
   A. 2.00 X 10²³  B. 48.2  C. 3.01  D. 1.81 x 10²⁴  E. 5.00 x 10⁻²⁴

6. What is the molecular formula of a compound with an empirical formula of NO₂ and formula weight of 92 amu?
   A. N₂O₄  B. NO  C. N₂O  D. N₃O₆  E. NO₂

7. Which is the correct formula/name combination?
   A. H₃PO₄ / phosphoric acid  B. NH₄ClO₄ / ammonium perchlorate  
   C. K₂SO₄ / potassium sulfate  D. P₂Cl₃ / phosphorus(II) chloride  
   E. Au(C₂H₃O₂)₂ / gold acetate

8. The Lewis electron-dot structure of HCN (H bonded to C)
   A. gives N 2 nonbonding (unshared) electron pairs  
   B. gives N 1 nonbonding (unshared) electron pair  
   C. gives C 2 nonbonding (unshared) electron pairs  
   D. gives H 1 nonbonding (unshared) electron pair  
   E. gives C 1 nonbonding (unshared) electron pair

9. What is the formal charge on the central N atom in the N₂O molecule?
   A. -3  B. +4  C. -1  D. 0  E. +1.
10. There are ___ $\sigma$ and ____ $\pi$ bonds, respectively, in the following molecule.

\[ \text{H} \quad \text{C} \equiv \text{C} \quad \text{C} \quad \text{H} \]

A. 6 sigma, 2 pi  
B. 5 sigma, 1 pi  
C. 6 sigma, 0 pi  
D. 5 sigma, 3 pi  
E. 6 sigma, 1 pi

11. How many resonance forms can be drawn for the SO$_3$ molecule (sulfur trioxide)?

A. 2  
B. 0  
C. 1  
D. 3  
E. 4

12. Atomic radius for the main-group elements generally increases down a group because:

A. effective nuclear charge zigzags down a group  
B. the principle energy level of the valence orbitals increases  
C. effective nuclear charge decreases down a group  
D. effective nuclear charge increases down a group  
E. both effective nuclear charge increases down a group and the principle energy level of the valence orbitals increases

13. What is the approximate O to P to Cl angle in the following molecule is:

\[ \text{O} \equiv \text{P} \quad \text{Cl} \]

A. 109°  
B. 90°  
C. 45°  
D. 180°  
E. 120°

14. The molecule ZCl$_4$ has 2 lone pairs of electrons and sp$^3$d$^2$ hybridization. What would you predict about the polarity of the bonds and of the molecule?

A. nonpolar bonds, polar molecule  
B. polar bonds, polar molecule  
C. polar bonds, nonpolar molecule  
D. nonpolar bonds, nonpolar molecule  
E. polar bonds, partially polar molecule

15. Your hot dog drips on your best shirt, so you take it to the lab and try to clean it. The spot does not come off with CCl$_4$, so what do you conclude:

A. The substance is nonpolar and should come off with water.  
B. The substance is polar and should come off with water.  
C. The substance is nonpolar and will not dissolve in water.  
D. The substance is polar and will not dissolve in water.  
E. The shirt should be burned; CCl$_4$ dissolves everything that can be dissolved.

© Vickie M. Williamson, All Rights Reserved
16. What is the shape around the carbon atom labeled 8 AND the shape around the oxygen that is between the C and H, respectively?

\[ \text{H} - N - C - C - O - H \]

A. triangular plane, linear  B. triangular plane, angular (bent)  C. triangular pyramid, angular (bent)
D. t-shaped, linear  E. triangular plane, tetrahedron

17. The respective hybridizations of bromine in BrF\(_5\) and arsenic in AsF\(_5\) are

A. sp\(^3\)d\(^2\) and sp\(^3\)d\(^2\)  B. sp\(^3\) and sp\(^3\)d  C. sp\(^3\)d and sp\(^3\)d\(^2\)
D. sp\(^3\)d and sp\(^3\)  E. sp\(^3\)d\(^2\) and sp\(^3\)d

Key

<table>
<thead>
<tr>
<th>question</th>
<th>6 pts each (unless noted)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>B (C=3pts)</td>
</tr>
<tr>
<td>2</td>
<td>C</td>
</tr>
<tr>
<td>3</td>
<td>E = 4 pts</td>
</tr>
<tr>
<td>4</td>
<td>C</td>
</tr>
<tr>
<td>5</td>
<td>D</td>
</tr>
<tr>
<td>6</td>
<td>A</td>
</tr>
<tr>
<td>7</td>
<td>B</td>
</tr>
<tr>
<td>8</td>
<td>B</td>
</tr>
<tr>
<td>9</td>
<td>E</td>
</tr>
<tr>
<td>10</td>
<td>A</td>
</tr>
<tr>
<td>11</td>
<td>D</td>
</tr>
<tr>
<td>12</td>
<td>B</td>
</tr>
<tr>
<td>13</td>
<td>E</td>
</tr>
<tr>
<td>14</td>
<td>C</td>
</tr>
<tr>
<td>15</td>
<td>B</td>
</tr>
<tr>
<td>16</td>
<td>B (A,C = 2.5 pts)</td>
</tr>
<tr>
<td>17</td>
<td>E (A,B = 3pts)</td>
</tr>
</tbody>
</table>