Instructions: You have 75 minutes to complete this 100-point exam. Indicate your exam form on the line marked “SUBJECT” on the scantron. NO CALCULATORS OF ANY KIND ALLOWED.

I. MULTIPLE CHOICE: (80 pts, 4 points each) Indicate the best answers on the scantron using a #2 pencil.

1. When the following equation is balanced, what is the number that appears before the symbol Sn\(^{2+}\)?
   a. 2
   b. 3
   c. 4
   d. 5

2. The ions present in solid silver chromate, Ag\(_2\)CrO\(_4\), are
   a. Ag\(^+\) and CrO\(_4^{2-}\)
   b. Ag\(^+\), Cr\(^{6+}\) and O\(^2-\)
   c. Ag\(^{2+}\) and CrO\(_4^{4-}\)
   d. Ag\(^+\), Cr\(^{3+}\) and O\(^2-\)

3. How many moles of Fe are needed to produce 10.0 mol of H\(_2\)?
   a. 7.50 mol
   b. 13.3 mol
   c. 13.0 mol
   d. 15.0 mol

4. What volume 0.550 M MgCl\(_2\) contains 1.1 moles of MgCl\(_2\)?
   a. 0.605 L
   b. 2.00 L
   c. 0.500 L
   d. 1.65 L

5. How many milliliters of 10.0 M HCl are required to make 100.00 mL of 0.200 M HCl?
   a. 1.00 mL
   b. 10.0 mL
   c. 5.00 \(\times\) 10\(^3\) mL
   d. 2.00 mL

6. The balanced equation for the complete combustion of cyclohexane is:
   a. \(C_6H_{12}\) + 18 O\(_2\) \(\rightarrow\) 6 CO\(_2\) + 6 H\(_2\)O
   b. \(C_6H_{12}\) + 9 O\(_2\) \(\rightarrow\) 6 CO\(_2\) + 6 H\(_2\)O
   c. \(C_6H_{12}\) + 6 O\(_2\) \(\rightarrow\) 6 CO\(_2\) + 6 H\(_2\)O
   d. 2 \(C_6H_{12}\) + 18 O\(_2\) \(\rightarrow\) 12 CO\(_2\) + 6 H\(_2\)O
7. In a balanced chemical equation, what is balanced?
   a. Atoms
   b. Moles
   c. Molecules
   d. Atoms and molecules

8. When the equation below is properly balanced, the respective coefficients are:
   a. 2, 1, 1, 6
   b. 2, 3, 1, 6
   c. 2, 5, 1, 6
   d. 2, 10, 1, 6

   \[ \_\_\_\_\_NH_3 + \_\_\_F_2 \rightarrow \_\_\_N_2F_4 + \_\_\_HF \]

9. What is the actual yield of a reaction that has a percent yield of 78.6% and a theoretical yield of 52.3 g?
   a. 66.5 g
   b. 41.1 g
   c. 1.50 x 10^3 g
   d. 26.3 g

10. Which of the following is a strong base?
    a. Fe(OH)_3
    b. Zn(OH)_2
    c. Sr(OH)_2
    d. Al(OH)_3

11. Which of the following is predicted to be insoluble in water?
    a. NaBr
    b. K_2SO_4
    c. FeS
    d. (NH_4)_2S

12. Which of these acids will dissociate 100%?
    a. C_6H_5CO_2H
    b. H_3SO_3
    c. CH_3CO_2H
    d. HF

13. The correct chemical formula of potassium sulfide is:
    a. KS
    b. K_2S
    c. KSO_4
    d. K_2SO_4

14. A solution that conducts electricity is called a (n)
    a. Electrolyte.
    b. Nonelectrolyte.
    c. Precipitate.
    d. Coefficient.
15. Given the following balanced reaction, which reactant is limiting if you have 4.0 mol Mg and 4.0 mol O₂?
   a. Mg  
   b. O₂  
   c. MgO  
   d. None  
   \[2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}\]

16. The reaction of silver nitrate and magnesium chloride produces ____________ as a precipitate.
   a. Mg(NO₃)₂  
   b. MgCl₂  
   c. AgCl  
   d. AgNO₃

17. All the following compounds are soluble in water except for:
   a. Na₃PO₄  
   b. Fe(ClO₄)₂  
   c. MnCl₂  
   d. CaSO₄

18. In an acid-base titration, the point at which the moles of base added equal the moles of acid is called the:
   a. Indicator point.  
   b. End point.  
   c. Buret point.  
   d. Acid point.

19. The net ionic equation for the neutralization of nitric acid with iron (II) hydroxide is:
   a. \[2\text{HNO}_3 + \text{Fe(OH)}_2 \rightarrow 2\text{H}_2\text{O} + \text{Fe(NO}_3)_2\]  
   b. \[\text{HNO}_3 + \text{OH}^{-} \rightarrow \text{H}_2\text{O} + \text{NO}_3^{-}\]  
   c. \[2\text{H}^{+} + \text{Fe(OH)}_2 \rightarrow 2\text{H}_2\text{O} + \text{Fe}^{2+}\]  
   d. \[\text{H}^{+} + \text{OH}^{-} \rightarrow \text{H}_2\text{O}\]

20. Acetic acid (CH₃CO₂H) is a(n):
   a. Strong acid.  
   b. Weak acid.  
   c. Nonelectrolyte.  
   d. Common indicator.
II. Balancing and Calculations (30 pts, 10 pts each): Clearly indicate your answer in the space provided. Partial credit will be given for correct work. If I cannot read the work, it will not be graded.

1. Write the complete, total ionic and net ionic equation for the reaction of sodium sulfate with barium chloride.

Complete: ________________________________________________________________

Total Ionic: ______________________________________________________________

Net Ionic: ________________________________________________________________

2. What mass of iron (III) sulfide is produced from the reaction of 11.6g of iron(III) nitrate with 0.0500 L of 0.875 M sodium sulfide? (MM of Fe(NO$_3$)$_3$ = 241.88 g/mol, MM of Fe$_2$S$_3$ = 207.88 g/mol)

\[
2 \text{ Fe(NO}_3\text{)}_3 + 3 \text{ Na}_2\text{S} \rightarrow \text{ Fe}_2\text{S}_3 (s) + 6 \text{ NaNO}_3
\]

3. If 10.0 L of 6.0 M NaOH neutralizes 15.0 L of carbonic acid, what is the molarity of the acid?

\[
2 \text{ NaOH} + \text{ H}_2\text{CO}_3 \rightarrow 2 \text{ H}_2\text{O} + \text{ Na}_2\text{CO}_3
\]