

**Instructions:** On your scantron sheet enter your name, UF ID number (start on the first space and leave the last space blank), Discussion Section No. and Form Code (see above). This exam consists of 25 multiple choice questions each worth 10.0 points for a total maximum of 250 pts. You may retain your exam sheet (mark your answers on it and the scantron sheet). Turn in only the scantron. **Bubbling errors of any kind will count as an incorrect response or result in the loss of points.**

1. A solution of sucrose in water is 28.0% sucrose by mass and has a density of 1.118 g/mL. What mass of sucrose, in grams, is contained in 3.50 L of solution?

- 1)  $5.5 \times 10^2$  g      2)  $1.1 \times 10^3$  g      3)  $1.9 \times 10^3$  g      4)  $3.1 \times 10^3$  g      5)  $3.9 \times 10^3$  g

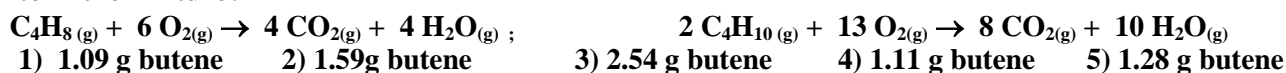
2. Silver has two naturally-occurring isotopes with masses of 106.905092 amu and 108.904756 amu. What are the percent abundances of each isotope, respectively?

- (1) 27.45 ; 72.55      (2) 50.25% ; 49.75%      (3) 62.15% ; 37.85%      (4) 15.84 ; 84.16      (5) 78.64 ; 21.36

3. What mass of oxalic acid,  $\text{H}_2\text{C}_2\text{O}_4$ , is required to make 250. mL of a 0.0500 M solution?

- 1) 1.13 g      2) 2.81 g      3) 3.15 g      4) 4.21 g      5) 0.723 g

4. A mixture of butene,  $\text{C}_4\text{H}_8$ , and butane,  $\text{C}_4\text{H}_{10}$ , is combusted in air to give carbon dioxide and water. Suppose you burn 5.72g of the mixture and obtain 17.60 g of  $\text{CO}_2$ . What is the mass of butene closest to in the mixture?



- 1) 1.09 g butene      2) 1.59g butene      3) 2.54 g butene      4) 1.11 g butene      5) 1.28 g butene

5. The vitamin C, ( $\text{C}_6\text{H}_8\text{O}_6$ ) content in a tablet is analyzed by a reaction with bromine and then titration of the hydrobromic acid with standard base:  $\text{C}_6\text{H}_8\text{O}_6 + \text{Br}_2 \rightarrow \text{C}_6\text{H}_6\text{O}_6 + 2\text{HBr}$   
 $\text{HBr} + \text{NaOH} \rightarrow \text{NaBr} + \text{H}_2\text{O}$

One tablet was dissolved in water and reacted with bromine. The solution was then titrated with 53.20mL of 0.1350 M NaOH. How much Vitamin C did the tablet contain in mg?

- 1) 323.7 mg      2) 632.5 mg      3) 513.6 mg      4) 449.2 mg      5) 488.5 mg

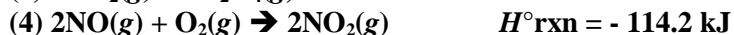
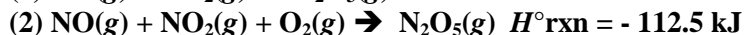
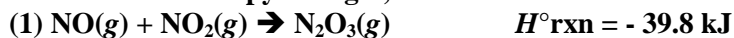
6. What volume of a 0.125 M Oxalic acid,  $\text{H}_2\text{C}_2\text{O}_4$  solution is required to titrate 53.20 mL of a 0.546 M NaOH solution?

- 1) 0.956 L      2) 0.116 L      3) 0.255 L      4) 0.323 L      5) 0.452 L

7. You are given solutions of HCl and NaOH and must determine their concentrations. You use 27.5 mL of NaOH to titrate 100.0 mL of HCl and 18.4 mL of NaOH to titrate 50.0 mL of 0.0782 M  $\text{H}_2\text{SO}_4$ . What are the concentrations of the HCl and NaOH respectively?

- 1) 0.327M HCl, 0.525 M NaOH      2) 0.237M HCl, 0.425 M NaOH      3) 0.117M HCl, 0.525 M NaOH      4) 0.117M HCl, 0.425 M NaOH      5) 0.237M HCl, 0.525 M NaOH

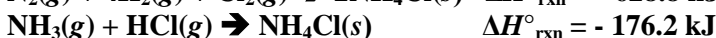
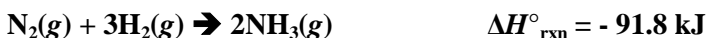
8. The chemistry of nitrogen oxides is very versatile. Choose from the following reactions and their standard enthalpy changes,



calculate the heat of reaction for  $\text{N}_2\text{O}_3(\text{g}) + \text{N}_2\text{O}_5(\text{s}) \rightarrow 2\text{N}_2\text{O}_4(\text{g})$

- 1) - 11.1 kJ      2) +35.0 kJ      3) -76.3 kJ      4) -133 kJ      5) - 22.2 kJ

9. Use the following information to find  $\Delta H^\circ_f$  of gaseous HCl:



- 1) - 87.6 kJ      2) - 92.3 kJ      3) - 184 kJ      4) - 445 kJ      5) - 574.4 kJ

10. Kerosene,  $\text{C}_{12}\text{H}_{26}$  is a common fuel. Write a balanced equation using the simplest whole number coefficients for the complete combustion of kerosene to gases. If the  $\Delta H^\circ_{\text{rxn}} = - 1.50 \times 10^4 \text{ kJ}$  for the balanced equation, what is the  $\Delta H^\circ_f$  for kerosene given:



- 1) - 266 kJ/mol      2) - 457 kJ/mol      3) - 731 kJ/mol      4) - 546 kJ/mol      5) - 366 kJ/mol

11. The  $^{81}\text{Br}$  isotope has which atomic number, neutron number, and mass number (respectively)?

- (1) 35, 46, 81      (2) 35, 81, 46      (3) 81, 46, 35      (4) 46, 81, 35      (5) 35, 81, 116

12. A 0.440 g sample of butyric acid (an organic acid consisting of C, H, and O atoms) is combusted in excess oxygen, yielding 0.882 g  $\text{CO}_2$  and 0.360 g  $\text{H}_2\text{O}$ . What is the empirical formula for butyric acid?

- (1)  $\text{C}_2\text{H}_4\text{O}$       (2)  $\text{C}_2\text{H}_4\text{O}_3$       (3)  $\text{C}_2\text{H}_4\text{O}_5$       (4)  $\text{C}_2\text{H}_4\text{O}_7$       (5)  $\text{C}_2\text{H}_4\text{O}_9$

13. How many grams of solid magnesium nitrate should be added to 5.0 g of solid sodium nitrate in a 500-mL volumetric flask in order to produce an aqueous 0.25 M solution of  $\text{NO}_3^-$  ions (once the flask is filled to the 500.-mL volume line)?  
 (1) 2.5 g                      (2) 4.9 g                      (3) 9.8 g                      (4) 14 g                      (5) 28 g
14. When iron ore containing the mineral hematite ( $\text{Fe}_2\text{O}_3$ ) is allowed to react with carbon monoxide in a blast furnace, cast iron (Fe) and carbon dioxide are produced. What is the percent of  $\text{Fe}_2\text{O}_3$  in the iron ore if  $1.64 \times 10^3$  kg of Fe are obtained from a  $2.62 \times 10^3$  kg of iron ore? (Assume the reaction goes to completion in excess carbon monoxide)  
 (1) 56.9 %                      (2) 62.6 %                      (3) 74.6 %                      (4) 89.5 %                      (5) 93.2 %
15. Consider the reaction:  $\text{MnO}_2 + 4 \text{HCl} \rightarrow \text{MnCl}_2 + \text{Cl}_2 + 2 \text{H}_2\text{O}$ . If 0.86 mol of  $\text{MnO}_2$  and 48.2 g of HCl react, how many grams of  $\text{Cl}_2$  will be produced?  
 (1) 7.00 g                      (2) 23.4 g                      (3) 61.0 g                      (4) 85.4 g                      (5) 93.6 g
16. If 1.951 g of  $\text{BaCl}_2 \cdot x \text{H}_2\text{O}$  yields 1.864 g of anhydrous  $\text{BaSO}_4$  after treatment with sulfuric acid, calculate the value of x.  
 (1) 1                      (2) 2                      (3) 3                      (4) 4                      (5) 5
17. When aqueous solutions of lead(II) nitrate and iron(III) chloride are mixed, an ionic solid composed of lead and chloride ions precipitates. Which of the following is the net ionic equation for this reaction?  
 (1)  $\text{Pb}_2\text{NO}_{3(\text{aq})} + \text{Fe}_3\text{Cl}_{(\text{aq})} \rightarrow \text{Pb}_2\text{Cl}_{(\text{s})} + \text{Fe}_3\text{NO}_{3(\text{aq})}$   
 (2)  $2\text{Pb}^+_{(\text{aq})} + 3\text{Cl}^-_{(\text{aq})} \rightarrow \text{Pb}_2\text{Cl}_{3(\text{s})}$   
 (3)  $3\text{Pb}(\text{NO}_3)_{2(\text{aq})} + 2\text{FeCl}_{3(\text{aq})} \rightarrow 3\text{PbCl}_{2(\text{s})} + 2\text{Fe}(\text{NO}_3)_{3(\text{aq})}$   
 (4)  $3\text{Pb}^{2+}_{(\text{aq})} + 6\text{Cl}^-_{(\text{aq})} \rightarrow 3\text{PbCl}_{2(\text{s})}$   
 (5)  $\text{Pb}^{2+}_{(\text{aq})} + 2\text{Cl}^-_{(\text{aq})} \rightarrow \text{PbCl}_{2(\text{s})}$
18. During the reaction  $2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2$ , the oxidation number of chlorine changes from:  
 (1) +4 to -2                      (2) -1 to -2                      (3) 0 to -1                      (4) +5 to -2                      (5) +5 to -1
19. 200. mL of aqueous 0.862 M HCl is mixed with 200. mL of aqueous 0.431 M  $\text{Ba}(\text{OH})_2$  in a constant-pressure calorimeter of negligible heat capacity. The initial temperature of both solutions is the same at 20.48°C. The neutralization reaction  $\text{H}^+_{(\text{aq})} + \text{OH}^-_{(\text{aq})} \rightarrow \text{H}_2\text{O}_{(\text{l})}$  has a  $\Delta H^\circ = -56.2$  kJ/mol. What is the final temperature of the mixed solution? (Assume all solutions have a density of 1.00 g/cm<sup>3</sup>)  
 (1) 5.98°C                      (2) 8.53°C                      (3) 23.9°C                      (4) 26.3°C                      (5) 33.8°C
20. A flask has a mass of 78.23 g when empty and 593.63 g when filled with water. When the same flask is filled with concentrated sulfuric acid,  $\text{H}_2\text{SO}_4$ , its mass is 1026.57 g. What is the density of concentrated sulfuric acid? (Assume water has a density of 1.00 g/cm<sup>3</sup> at the temperature of the measurement.)  
 (1) 1.992 g/cm<sup>3</sup>                      (2) 1.840 g/cm<sup>3</sup>                      (3) 1.729 g/cm<sup>3</sup>                      (4) 1.598 g/cm<sup>3</sup>                      (5) 0.543 g/cm<sup>3</sup>
21. Iron(III) chloride hexahydrate is used as a coagulant for sewage and industrial wastes. What is its formula?  
 (1)  $\text{Fe}(\text{Cl} \cdot 6\text{H}_2\text{O})_3$                       (2)  $\text{Fe}_3\text{Cl} \cdot 6\text{H}_2\text{O}$                       (3)  $\text{FeCl}_3(\text{H}_2\text{O})_6$                       (4)  $\text{Fe}_3\text{Cl}(\text{H}_2\text{O})_6$                       (5)  $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$
22. Calculate the number of oxygen atoms in 29.34 g of sodium sulfate,  $\text{Na}_2\text{SO}_4$ .  
 (1)  $1.244 \times 10^{23}$  O atoms                      (2)  $4.976 \times 10^{23}$  O atoms                      (3)  $2.409 \times 10^{24}$  O atoms  
 (4)  $2.915 \times 10^{24}$  O atoms                      (5)  $1.166 \times 10^{25}$  O atoms
23. Consider the following reaction:  $2\text{A} + \text{B} \rightarrow 3\text{C} + \text{D}$   
 If 3.0 mol A and 2.0 mol B react to form 4.0 mol C. What is the percent yield of this reaction?  
 (1) 100%                      (2) 67%                      (3) 89%                      (4) 50%                      (5) 75%
24. The density of cobalt is 8.90 g/cm<sup>3</sup>. Calculate the number of cobalt atoms present in a cube that has an edge of 2.50 cm.  
 (1)  $1.75 \times 10^{21}$                       (2)  $3.69 \times 10^{22}$                       (3)  $1.75 \times 10^{23}$                       (4)  $1.42 \times 10^{24}$                       (5)  $1.28 \times 10^{26}$
25. Which one of the following is a correct formation reaction?  
 1)  $\text{C}(\text{diamond}) \rightarrow \text{C}(\text{graphite})$   
 2)  $\text{H}_2(\text{g}) + \text{O}(\text{g}) \rightarrow \text{H}_2\text{O}(\text{l})$   
 3)  $\text{C}(\text{graphite}) + 4\text{H}(\text{g}) \rightarrow \text{CH}_4(\text{g})$   
 4)  $6\text{C}(\text{graphite}) + 6\text{H}_2\text{O}(\text{s}) \rightarrow \text{C}_6\text{H}_{12}\text{O}_6(\text{s})$   
 5)  $2\text{C}(\text{graphite}) + 3\text{H}_2(\text{g}) + \frac{1}{2} \text{O}_2(\text{g}) \rightarrow \text{C}_2\text{H}_5\text{OH}(\text{l})$