CHM 2045 Exam 1(Gower, Mitchell, Ucak, Harrison) (Form Code A) corrected September 17, 2009

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) 5.5×10^2 g 2) 1.1×10^3 g 3) 1.9×10^3 g 4) 3.1×10^3 g 5) 3.9×10^3 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, $H_2C_2O_4$, 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, C_4H_8, and butane, C_4H_{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 CO_2. What is the mass of butene closest to in the mixture?
$C_4H_{8(g)} + 6\ O_{2(g)} \rightarrow 4\ CO_{2(g)} + 4\ H_2O_{(g)}$; $2\ C_4H_{10\,(g)} + 13\ O_{2(g)} \rightarrow 8\ CO_{2(g)} + 10\ H_2O_{(g)}$
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, ($C_6H_8O_6$) content in a tablet is analyzed by a reaction with bromine and then titration of the hydrobromic acid with standard base: $C_6H_8O_6 + Br_2 \rightarrow C_6H_6O_6 + 2HBr$
$HBr + NaOH \rightarrow NaBr + H_2O$
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, $H_2C_2O_4$ 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 H_2SO_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,
(1) $NO(g) + NO_2(g) \rightarrow N_2O_3(g)$ $H°rxn = -39.8$ kJ
(2) $NO(g) + NO_2(g) + O_2(g) \rightarrow N_2O_5(g)$ $H°rxn = -112.5$ kJ
(3) $2NO_2(g) \rightarrow N_2O_4(g)$ $H°rxn = -57.2$ kJ
(4) $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$ $H°rxn = -114.2$ kJ
(5) $N_2O_5(s) \rightarrow N_2O_5(g)$ $H°rxn = +54.1$ kJ
calculate the heat of reaction for $N_2O_3(g) + N_2O_5(s) \rightarrow 2N_2O_4(g)$
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 $\Delta H°_f$ of gaseous HCl:

$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ $\Delta H°_{rxn} = -91.8$ kJ
$N_2(g) + 4H_2(g) + Cl_2(g) \rightarrow 2NH_4Cl(s)$ $\Delta H°_{rxn} = -628.8$ kJ
$NH_3(g) + HCl(g) \rightarrow NH_4Cl(s)$ $\Delta H°_{rxn} = -176.2$ kJ
1) – 87.6 kJ 2) – 92.3 kJ 3) – 184 kJ 4) – 445 kJ 5) – 574.4 kJ

10. Kerosene, $C_{12}H_{26}$ is a common fuel. Write a balanced equation using the simplest whole number coefficients for the complete combustion of kerosene to gases. If the $\Delta H°_{rxn} = -1.50 \times 10^4$ kJ for the balanced equation, what is the $\Delta H°_f$ for kerosene given:
($\Delta H°_f$ for CO_2 (g) = - 393.5 kJ/mol and $\Delta H°_f$ for H_2O(g) = -241.83 kJ/mol)
1) – 266 kJ/mol 2) – 457 kJ/mol 3) – 731 kJ/mol 4) – 546 kJ/mol 5) – 366 kJ/mol

11. The ^{81}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 CO_2 and 0.360 g H_2O. What is the empirical formula for butyric acid?
(1) C_2H_4O (2) $C_2H_4O_3$ (3) $C_2H_4O_5$ (4) $C_2H_4O_7$ (5) $C_2H_4O_9$

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 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 (Fe_2O_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 Fe_2O_3 in the iron ore if 1.64 x 10^3 kg of Fe are obtained from a 2.62 x 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: $MnO_2 + 4\,HCl \rightarrow MnCl_2 + Cl_2 + 2\,H_2O$. If 0.86 mol of MnO_2 and 48.2 g of HCl react, how many grams of 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 $BaCl_2 \bullet xH_2O$ yields 1.864 g of anhydrous $BaSO_4$ 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) $Pb_2NO_{3(aq)} + Fe_3Cl_{(aq)} \rightarrow Pb_2Cl_{(s)} + Fe_3NO_{3(aq)}$
(2) $2Pb^+_{(aq)} + 3Cl^-_{(aq)} \rightarrow Pb_2Cl_{3(s)}$
(3) $3Pb(NO_3)_{2(aq)} + 2FeCl_{3(aq)} \rightarrow 3PbCl_{2(s)} + 2Fe(NO_3)_{3(aq)}$
(4) $3Pb^{2+}_{(aq)} + 6Cl^-_{(aq)} \rightarrow 3PbCl_{2(s)}$
(5) $Pb^{2+}_{(aq)} + 2Cl^-_{(aq)} \rightarrow PbCl_{2(s)}$

18. During the reaction $2KClO_3 \rightarrow 2KCl + 3O_2$, 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 $Ba(OH)_2$ 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 $H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$ has a ΔH^o = –56.2 kJ/mol. What is the final temperature of the mixed solution? (Assume all solutions have a density of 1.00 g/cm^3)

(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, H_2SO_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^3 at the temperature of the measurement.)

(1) 1.992 g/cm^3 (2) 1.840 g/cm^3 (3) 1.729 g/cm^3 (4) 1.598 g/cm^3 (5) 0.543 g/cm^3

21. Iron(III) chloride hexahydrate is used as a coagulant for sewage and industrial wastes. What is its formula?

(1) $Fe(Cl{\cdot}6H_2O)_3$ (2) $Fe_3Cl{\cdot}6H_2O$ (3) $FeCl_3(H_2O)_6$ (4) $Fe_3Cl(H_2O)_6$ (5) $FeCl_3{\cdot}6H_2O$

22. Calculate the number of oxygen atoms in 29.34 g of sodium sulfate, Na_2SO_4.

(1) 1.244 x 10^{23} O atoms (2) 4.976 x 10^{23} O atoms (3) 2.409 x 10^{24} O atoms
(4) 2.915 x 10^{24} O atoms (5) 1.166 x 10^{25} O atoms

23. Consider the following reaction: 2A + B ➔ 3C + 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^3. Calculate the number of cobalt atoms present in a cube that has an edge of 2.50 cm.

1) 1.75×10^{21} 2) 3.69×10^{22} 3) 1.75×10^{23} 4) 1.42×10^{24} 5) 1.28×10^{26}

25. Which one of the following is a correct formation reaction?

1) C(diamond) ➔ C(*g*raphite)
2) $H_2(g) + O(g) \rightarrow H_2O(l)$
3) $C(graphite) + 4H(g) \rightarrow CH_4(g)$
4) $6C(graphite) + 6H_2O(s) \rightarrow C_6H_{12}O_6(s)$
5) $2C(graphite) + 3H_2(g) + \frac{1}{2}O_2(g) \rightarrow C_2H_5OH(l)$