

CHM 2045 Final Exam Review

Fall 2024

- Polonium crystallizes in a simple cubic unit cell. It has a density of 9.142g/cm^3 , calculate the approximate atomic radius.
 - S
 - G
- A certain metal has a density of 14.20g/cm^3 . It crystallizes in a body-centered unit cell with an edge length of 3.18\AA . Calculate the radius of the atom.
 - Gr
 - G
- Using the following phase diagram for S, what phase change happens at 1atm when sulfur is heated from 90C to 450C .
 - Regea
 - Abdf
 - Bd
 - Af
- The partial pressure of CO_2 gas above champagne at 20C is 5.5atm . What is the solubility of CO_2 in champagne? Assume Henry's law constant is $3.7 \times 10^{-2}\text{mol/Latm}$ (13.49)
 - Fds
 - Sf
 - Dh
 - Sdhf
- What is the molality of a solution with 44.0mL of benzene (C_6H_6) in 167mL of hexane. Density of benzene is 0.877g/mL and density of hexane is 0.660g/mL .
 - Rg
 - Sdb
 - Ab
 - A
- Which of the following solutions will have the highest freezing point.
 - 2.00m MgBr_2
 - 3.00m glucose
 - 1.00m sucrose
 - 1.00m KCl
- The vapor pressure of pure water at 50degC is 68.8 mmHG . What is the vapor pressure at 50C of a mixture of 20g sucrose ($\text{C}_{12}\text{H}_{22}\text{O}_{11}$, 342.3g/mol) and $80\text{g H}_2\text{O}$?
 - Fdag
 - Ab
 - Fadb
 - Adf

8. Using the data in the table below, what is the value for k?

Experiment	[A]	[B]	[C]	Initial Rate (M/min)
1	0.0010	0.0010	0.0010	9.69×10^{-10}
2	0.0010	0.0020	0.0010	9.69×10^{-10}
3	0.0010	0.0020	0.0020	1.94×10^{-9}
4	0.0020	0.0040	0.0040	1.55×10^{-8}

9. Acetone decomposes in a first-order reaction with a rate constant of $8.7 \times 10^{-3} \text{s}^{-1}$. How long does it take for 40% of a sample of acetone to decompose?
- Sdg
 - Sg
 - Ga
 - Rag
10. When the chlorite ion is oxidized to form the chlorate ion, which of the following occurs?
- (1) The Cl-O bond order changes from 1.50 to 1.33
 - (2) The formal charge on the chlorine atom changes from 0 to +1
 - (3) The oxidation state of the chlorine atom changes from +4 to +6
 - (4) The hybridization of the chlorine atom remains as sp^3
 - (5) The geometry of the anion changes from linear to trigonal planar
11. How many sigma and pi bonds respectively are in $\text{NH}_2\text{CH}_2\text{CHCOOH}$?
- 13, 2
 - 12, 1
 - 11, 4
 - 10, 2
 - 9, 1
12. A sample of a hydrocarbon produced 3.14 grams of CO_2 and 1.28 grams of H_2O during combustion analysis. If the hydrocarbon has a molar mass between 50 and 60 g/mol, what is its molecular formula?
13. When 50.0 ml of 0.200 M AgNO_3 and 50.0 ml of 0.100 M CaCl_2 , both at 25.0°C , are reacted in a coffee-cup calorimeter, the temperature of the reacting mixture increases to 26.0°C . Calculate ΔH in kJ/mol of AgCl produced. Assume the density of the solution is 1.05 g/mol and the specific heat capacity of the solution is $4.20 \text{ J/g}^\circ\text{C}$.

14. In an experiment, 25.0 ml of a gas with a pressure of 1.00 atm is contained in a balloon at 25.00°C. The balloon's temperature is adjusted until the pressure is 0.75 atm at a volume of 31.1 ml. What is the final temperature of the gas under the new conditions?

15. According to molecular orbital theory, what are the bond order and the number of unpaired electrons in CN, respectively? The valence molecular orbital sequence for CN is: σ_{2s} , σ_{2s}^* , $\pi_{2p_x} = \pi_{2p_y}$, σ_{2p} , $\pi_{2p_x}^* = \pi_{2p_y}^*$, σ_{2p}^*

16. Starting with a 70.8 g sample of benzene (C₆H₆, 78.11 g/mol) at 48.6°C and 1.00 atm of pressure, how much energy should be removed in order to lower its temperature to -68.5°C, at constant pressure? $\Delta_{\text{vap}}H^\circ = 33.9 \text{ kJ/mol}$ $C_{p,\text{liq}} = 1.73 \text{ J/g}^\circ\text{C}$ $C_{p,\text{s}} = 1.51 \text{ J/g}^\circ\text{C}$ Normal $T_{\text{melting}} = 5.5^\circ\text{C}$ $\Delta_{\text{fus}}H^\circ = 9.8 \text{ kJ/mol}$ $C_{p,\text{gas}} = 1.06 \text{ J/g}^\circ\text{C}$ $\rho = 0.879 \text{ g/cm}^3$ Normal $T_{\text{boiling}} = 80.1^\circ\text{C}$

17. Which of the following is true about the ionic sizes of S²⁻ and Ca²⁺?

- a. They are both equal in atomic size due to the same effective nuclear charge.
- b. Ca²⁺ will have a larger ionic size because its outer electrons have a higher effective nuclear charge.
- c. Ca²⁺ will have a smaller ionic size because its outer electrons experience a higher effective nuclear charge.
- d. Ca²⁺ will have a smaller ionic size because the outer electrons experience a smaller effective nuclear charge.