

參考用

科目：綜合化學(2001)

校系所組：中大化學學系 清大化學系 交大應用化學系甲組

1. (3 pts) The density of an aqueous solution containing 10.0 percent of ethanol (C_2H_5OH) by mass is 0.984 g/mL. (a) calculate the molality of this solution. (b) calculate its molarity (c) what volume of the solution would contain 0.125 mole of ethanol?
2. (4 pts) Assuming the vapor pressure of pure benzene and toluene at 25°C are 95.1 and 28.4 torr, respectively, calculate the mole ratio of benzene in the vapor phase collected by fractional distillation of a mixture made of 1:1 benzene and toluene.
3. (4 pts) Predict the geometries of (a) NH_2^- (b) ICl_2^- (c) ICl_4^- (d) $CdCl_4^{2-}$.
4. (4 pts) Write balanced and complete equations for the following reactions.
 - (a) $SiO_2(s) + NaOH(aq) \rightarrow$
 - (b) $Al_2O_3(l) + NaOH(aq) + H_2O(l) \rightarrow$
5. (4 pts) (a) Why is 2s orbital lower in energy than 2p orbital for many electron atoms? (b) Draw a radial probability plot for the 2s and 2p orbitals.
6. (3 pts) How does the tendency of iron to rust depend on the pH of solution?
7. (4 pts) Nickel forms a gaseous compound of the formula $Ni(CO)_x$. What is the value of x given the fact that under the same conditions of temperature and pressure, methane effuses 3.3 times faster than $Ni(CO)_x$? (Ni 58.69)
8. (4 pts) Name the following compounds in English.
 - (a) B_2H_6 (b) N_2O_4 (c) SCN^- (d) $H_2PO_4^-$
9. (4 pts) What is the (a) Haber Process (b) Oswald Process in heterogeneous catalysis?
10. (4 pts) Apply molecular orbital theory to deduce the (a) electronic configuration (b) bond order (c) magnetic property of F_2^- .
11. (2 pts) Arrange the following substances (1 mole each) in order of increasing entropy at 25 °C: (a) Ne(g) (b) $SO_2(g)$ (c) Na(s) (d) NaCl(s) (e) $H_2(g)$
12. (3 pts) A student placed a few ice cubes in a drinking water. A few minutes later she noticed that some of the ice cubes were fused together. Explain.
13. (4 pts) Calculate the percent hydrolysis for 0.15 M sodium acetate (CH_3COONa) in water. ($K_a = 1.8 \times 10^{-5}$ for acetic acid)
14. (3 pts) If you are asked to prepare a buffer solution at pH = 8.6, using one of the following weak acids: HA ($K_a = 2.7 \times 10^{-3}$), HB ($K_a = 1.8 \times 10^{-5}$), HC ($K_a = 1.8 \times 10^{-5}$). Which acid should you choose? Why?
15. (5 pts) A sample of methane (CH_4) gas contains a small amount of helium. Calculate the volume percentage of helium if the density of the sample is 0.70902 g/L. at 0 °C and 1.0 atm.

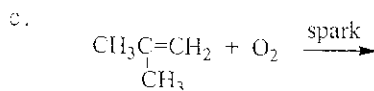
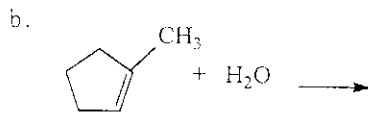
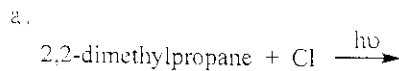
注意：背面有試題

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16. (10 pts) A sample of solid ammonium chloride was placed in an evacuated container and then heated so that it decomposed to ammonia gas and hydrogen chloride gas. After heating, the total pressure in the container was found to be 4.4 atm. (a) Write down the reaction equation (mark the phase of the reagent and products). (b) Calculated K_p at this temperature for the decomposition reaction.
17. (5 pts) When aqueous of KI is added gradually to mercury(II) nitrate, an orange precipitate forms. Continued addition of KI causes the precipitate to dissolve. Write balanced equations to explain these observations. (hint: Hg^{2+} reacts with I⁻ to form HgI_4^{2-})
18. (10 pts, 2 pts each) Identify the most important types of interparticle forces present in the solids of each of the following substances. (a) NH_4Cl . (b) Cs. (c) Teflon, $\text{CF}_3(\text{CF}_2\text{CF}_2)_n\text{CF}_3$. (d) CO. (e) Xe.
19. (5 pts) The carbonate ion, CO_3^{2-} , can act as either a monodentate or a bidentate ligand. Draw a picture of CO_3^{2-} coordinating to a metal ion as a bidentate and as a monodentate ligand.
20. (6 pts, 2 pts each) Write down the products of the following reactions:



21. (9 pts, 3 pts each) What monomer(s) must be used to produce the following polymers?

