

# 大同大學 98 學年度轉學入學考試試題

考試科目：化學

所別：化學工程學系

第 1/1 頁

註：本次考試 不可以參考自己的書籍及筆記； 不可以使用字典； 可以使用計算器。

1. Explain the following terms: (32%)
  - (1) Octet rule?
  - (2) Gibbs free energy and spontaneous process?
  - (3) Surface tension of a liquid?
  - (4) The colligative properties of electrolyte solution?
  - (5) The Raoult's law and Ideal solution?
  - (6) Heisenberg's uncertainty principle?
  - (7) The physical meanings of the four quantum numbers ( $n$ ,  $l$ ,  $m_l$ ,  $m_s$ )?
  - (8)  $2.35 \text{ g/L} = \underline{\quad?} \mu\text{g}/(\text{mm})^3 = \underline{\quad?} \text{ kg/m}^3$
2. Assuming that the partial pressure of  $\text{CO}_2$  in the atmosphere is  $4.0 \times 10^{-4} \text{ atm}$ , and the solubility of  $\text{CO}_2$  in water at  $25^\circ\text{C}$  is  $1.28 \times 10^{-5} \text{ M}$ . How many grams of  $\text{CO}_2$  must be added in 800 mL water to prepare a sealed bottle of soft drink which has 5.0 atm  $\text{CO}_2$  gas over the liquid in the sealed bottle at  $25^\circ\text{C}$ ? (Molecular weight of  $\text{CO}_2 = 44.0 \text{ g/mole}$ ) (15%)
3. HCl is a strong acid. Its molecular weight is 36.5 g/mole. There is a concentrated  $\text{HCl}_{(\text{aq})}$  solution that has 35wt% HCl, and specific gravity of 1.20. How many milliliters (mL) of this concentrated  $\text{HCl}_{(\text{aq})}$  must be used to prepare 1 liter (L), 0.20M  $\text{HCl}_{(\text{aq})}$  solution? (15%)
4. Give the expected ground state electron configuration for the following elements :
  - (a)  ${}_{22}\text{Ti}$ ; (b)  ${}_{29}\text{Cu}$ ; (c)  ${}_{34}\text{Se}$ ; (d)  $Z=16$ ; (e)  $Z=25$ ? (Note:  $Z = \text{atomic number}$ ) (10%)
5. Draw electron-dot structures and predict the shapes of the following molecules or ions:
  - (1)  $\text{O}_3$  (2)  $\text{XeF}_2$  (3)  $\text{ICl}_4^-$  (4)  $\text{SiCl}_4$  (8%)
6. A gas sample "A" containing 1.50 mole at  $25^\circ\text{C}$  exerts a pressure of 400 torr in a container. Some gas "B" is added to the same container and mixed with the above gas A, the temperature is increased to  $50^\circ\text{C}$  and the pressure increases to 800 torr. Calculate the mole fractions of gas A and B in the container? Assume the volume of container is constant. (10%)
7. What are differences of the molecular structure between
  - (1) Graphite and diamond? (10%)
  - (2)  $\text{CO}_2$  and  $\text{SiO}_2$ ?