

國立成功大學
110學年度碩士班招生考試試題

編 號：293

系 所：環境醫學研究所

科 目：普通化學

日 期：0203

節 次：第 2 節

備 註：不可使用計算機

※ 考生請注意：本試題不可使用計算機。請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Draw the following chemical structures (10%)
 - (A) Formaldehyde, glycine, tyrosine, toluene, xylene
 - (B) Acrylamide, pentachlorobenzene, di(2-ethylhexyl)phthalate, polychlorinated biphenyl, polychlorinated dibenzodioxin
2. Calculate (20%)
 - (A) The pH of a solution that is 5.0×10^{-7} M HA and 5.0×10^{-7} M NaA while considering a weak acid HA with a K_a value of 1.6×10^{-7} .
 - (B) A compound containing carbon, nitrogen, and hydrogen is combusted completely with excess oxygen to produce 138 g of NO_2 , 28.0 g of CO_2 , and 90.0 g of H_2O . What is the empirical formula of the compound?
3. Describe or explain the following terms: (30%)
 - (A) Beer's Law and Henry's Law
 - (B) Stoichiometry and stereochemistry
 - (C) Zwitterionic and amphoteric compounds
 - (D) Entropy and the second law of thermodynamics
 - (E) Electronic, vibrational, rotational, and NMR spectroscopy
4. Balance the following redox reaction using your knowledge in stoichiometry, (10%)
$$\text{Cr}_2\text{O}_7^{2-}(\text{aq}) + \text{Fe}^{2+}(\text{aq}) \rightarrow \text{Cr}^{3+}(\text{aq}) + \text{Fe}^{3+}(\text{aq})$$
5. Describe the factors that affect the solubility, vapor pressure, boiling-point, freezing-point, and osmotic pressure of an aqueous NaCl solution. (10%)
6. How does a catalyst change the rate of a reaction? Does it change the rate of the reverse reaction? How does the catalyst affect the equilibrium? (10%)
7. A physiologically important first order reaction has an activation energy that is equal to 45.0 kJ/mole at normal body temperature, 37°C. Without a catalyst, the rate constant for the reaction is $5.0 \times 10^{-4} \text{s}^{-1}$. To be effective in the human body, where the reaction is catalyzed by an enzyme, the rate constant must be at least $2.0 \times 10^{-2} \text{s}^{-1}$. If the activation energy is the only factor affected by the presence of the enzyme, by how much must the enzyme lower the activation energy of the reaction to achieve the desired rate? (10%)