

※ 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 (12%)
 - (A) Benzene, Toluene, Xylene
 - (B) Glycine, Alanine, Tyrosine
 - (C) PCBs, Dioxins, Phthalates
 - (D) Epoxide, 1,3-Butadiene, Acrylamide
2. Calculate the following. Show your work. Be mindful of significant digits. (12%)
 - (A) The pH in a 0.0100 M solution of NaOH.
 - (B) Number of carbon atoms in 24.0 grams of diamond.
 - (C) The molarity of the resulting solution when 25 mL of a 0.50 M NaCl solution is diluted to 125 mL.
 - (D) The mass of NaN_3 required for yielding 11.2 L of N_2 measured at 20.0 °C and 3.00 atm. Note: $\text{NaN}_3(\text{s}) \rightarrow \text{Na}(\text{s}) + \text{N}_2(\text{g})$
3. Explain the following terms: (60%)
 - (A) Isomer and isotope
 - (B) Entropy and enthalpy
 - (C) Beer's Law and Henry's Law
 - (D) Ionic bond and covalent bond
 - (E) Hydrolysis and hydrogenation
 - (F) $\text{S}_{\text{N}}2$ reaction and Diels-Alder 1 reaction
 - (G) Activation energy and solvation energy
 - (H) Avogadro constant and dissociation constant
 - (I) The first and second laws of thermodynamics
 - (J) Zwitterionic compounds and amphoteric compound
4. Explain why a mixture of ammonium chloride and ammonia in solution has a buffering action. (5%)
5. How does a catalyst change the rate of a reaction? Does it change the rate of the reverse reaction? How does a catalyst affect the equilibrium? (5%)
6. What is alpha radiation? Beta radiation? Gamma radiation? Which type is electromagnetic in nature? Which types have particles with mass? Which types have particles with significant mass? Which types have charged particles? (6%)