※ 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) n-Hexane, cyclohexane
   (B) Glycine, alanine, tyrosine
   (C) PCBs, dioxins, phthalates
   (D) Benzene, toluene, ethylbenzene, xylene
   (E) Acetone, acetic acid, acetonitrile, formaldehyde, methanol

2. Describe or explain the following terms: (40%)
   (A) ppm, ppb, and ppt
   (B) Enthalpy and entropy
   (C) Acid, base, pH, and pKa
   (D) Beer's Law and Henry's Law
   (E) Amino acid, peptide, and protein
   (F) Stoichiometry and stereochemistry
   (G) Thermodynamics and chemical kinetics
   (H) Zwitterionic and amphoteric compounds
   (I) Hydrolysis, hydration, and hydrogenation
   (J) Avogadro's number and ideal gas constant

3. Calculate (20%)

   (A) The molality of a solution formed by dissolving 2.14 mol of KCl in 10.0 mol of water.

   (B) The mass percentage of Na_2SO_4 in a solution containing 12.5 g Na_2SO_4 in 380 g of water.

   (C) If 1.500 L of a 1.50 M NaCl solution is concentrated to 50 mL by an evaporator, what is the molarity of the resulting solution? What is the total weight of the resulting solution?

   (D) You generate hydrogen gas by reacting zinc with HCl to produce hydrogen gas and zinc dichloride. You collect the hydrogen gas in an evacuated container with a volume of 3.0 L. If you start with 6.0 grams of zinc and sufficient HCl to complete the reaction, what is the final pressure of the gas collected in the container if the temperature is 25 °C?

   (E) 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?

4. 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%)

5. 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? (10%)

6. 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 $5.0 \times 10^{-4} s^{-1}$. To be effective in the human body, where the reaction is catalyzed by an enzyme, the rate constant must be at least 2.0×10^{-2} 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%)