系所組別： 口腔醫學研究所丙組

考試科目： 普通化學

※ 考生請注意：本試題 ☑可 ☐不可 使用計算機

1. Describe and explain (a) Standard heat of formation, (b) International system of Units (SI), (c) Galvanic cell, (d) Equilibrium constant, (e) Melting point, (f) Wavelength, (g) Triple point, (h) Third law of thermodynamic, (i) Reverse osmosis, (j) Physical adsorption. **(30%)**

2. A sample of natural gas is 80% nitrogen, N_2, and 20% oxygen, O_2, by mass. What is the density of this mixture at 25°C and 500 *mmHg*? (atomic weight: N = 14, O = 16) **(10%)**

3. Urea, $(NH_2)_2CO$, can be prepared by heating ammonium cyanate, NH_4OCN.

$$NH_4OCN \rightarrow (NH_2)_2CO$$

This reaction may occur by the following mechanism:

$$NH_4^+ + OCN^- \rightarrow NH_3 + HOCN \quad \text{(fast, equilibrium)}$$

$$NH_3 + HOCN \rightarrow (NH_2)_2CO \quad \text{(slow)}$$

What is the rate law predicted by this mechanism? **(10%)**

4. Write Lewis symbols for the following: (a) In, (b) In^{3+}, (c) P, (d) P^{3-}. (atomic number: In = 49, P = 15) **(10%)**

5. When calcium carbonate, $CaCO_3$, is heated, it decomposes to calcium oxide.

$CaCO_3\ (s) \rightarrow CaO\ (s) + CO_2\ (g)$; $\Delta H = 178.3$ kJ.

How much heat is required to decompose 10 g of calcium carbonate? (atomic weight: Ca = 40, C = 12, O = 16) **(10%)**

6. A water-soluble compound of gold and chlorine is treated with silver nitrate, $AgNO_3$, to convert the chlorine completely to silver chloride, AgCl. In an experiment, 328 mg of the compound gave 464 mg of silver chloride. Calculate the percentage of Cl in the compound. What is its empirical formula? (atomic weight: Cl = 35.5, N = 14, Ag = 108, Au = 197, O = 16). **(10%)**

7. Explain Millikan's oil-drop experiment. **(10%)**

8. Why is the heat of fusion of a substance smaller than its heat of vaporization? **(10%)**