無機化學部份，問答題共五題，每一小題 10 分，此部份總分爲 50 分。

1. Which of the following mixtures would be expected to have maximum boiling points and which to have minimum boiling points? Explain the reason.
   (a) Methyl acetate and chloroform, (b) C_6H_{12} and C_2H_5OH.

2. Which of the following complexes obey the rule of 18 (EAN rule)?
   (a) $Ni(NH_3)_6^{2+}$, $Ni(CN)_4^{2-}$, $Ni(CO)_4$ (b) $Co(NH_3)_6^{3+}$, $CoCl_4^{2-}$

3. Give the approximate pKa values for the following acids:
   (a) H_3PO_3, (b) HNO_3, (c) $HClO_4$.

4. The rate of reaction of O_2 with trans-$IrX(CO)(PPh_3)_2$ in benzene decreases in the order X= NO_2 > I > ONO_2 > Br > Cl > N_3 > F. Explain this observation.

5. Sketch π bonding orbitals that result from combination of the following orbitals on separate atoms : p_x and p_x, p_x and d_{xz}.

(背面仍有題目,請繼續作答)

分析化學部份，問答題共五題，每一小題 10 分，此部份總分爲 50 分。

6. . To prepare a solution of KHP (potassium hydrogen phthalate), you weigh out 5.103(±0.003)g and dissolve it in a volumetric flask whose volume is 250.00(±0.09) mL. Express the molarity of the resulting solution, and its uncertainty, with the correct number of significant figures

Given: K:39.0983 ± 0.0001 g/mol; O:15.9994 ± 0.0003 g/mol;
H:1.00794 ± 0.00007 g/mol; C:12.0107 ± 0.0008 g/mol;

7. An organic compound weighing 5.714 mg produced 14.414 mg of CO_2 and 2.529 mg of H_2O upon combustion. Find the weight percent of C and H in the sample.

8. Acid-base indicators are themselves acids or bases. Consider an indicator, HIn, which dissociates according to the equation

$$HIn \leftrightarrow H^+ + In^-$$

Suppose that the molar absorptivity, ε, is 2080 $M^{-1}cm^{-1}$ for HIn and is 14200 $M^{-1}cm^{-1}$ for In^-, at a wavelength of 440 nm. The cell-length is 1.00 cm.
A solution containing the indicator at a formal concentration of $1.84*10^{-4}$ M is adjusted to pH 6.23 and found to exhibit an absorbance of 0.868 at 440 nm.
Calculate pKa for this indicator.

9. Is the complex of a metal ion with EDTA affected by pH of the solution?

10. How does the pH of pure water change with increasing temperature?