1. (10) Define each of the following and give examples.
   a. isomers b. structural isomers c. coordination isomers d. geometric isomers e. optical isomers

2. (8) The melting and boiling points of the titanium tetrahalides are given below.

	bp (°C)	mp (°C)
TiF_4	284	
$TiCl_4$	-24	136.5
$TiBr_4$	38	233.5
TiI_4	155	377

   Rationalize these data in terms of the bonding and the intermolecular forces among these compounds.

3. (12) What are molecular orbitals ? How do they compare with atomic orbitals ? For bonding and antibonding orbitals, which are lower in energy ? Explain.

4. (8) Consider the following reaction:
   $H_2O_{(g)} + CO_{(g)} \rightarrow H_{2(g)} + CO_{2(g)}$
   Amounts of H_2O, CO, H_2, and CO_2 are put into a flask so that the composition corresponds to an equilibrium position. If the CO placed in the flask is labeled with radioactive ^{14}C, will ^{14}C be found only in CO molecules for an indifinite period of time ? Why or why not ?

5. (12) Calculate the $[H^+]$ in
   a. 1.0 M HCN ($K_a = 6.2 \times 10^{-10}$)
   b. 1.0×10^{-4} M HCN ($K_a = 6.2 \times 10^{-10}$)

6. (12) When is $\Delta H = 5/2\ RT$? When is $\Delta E = 5/2\ RT$? When is $\Delta H = 3/2\ RT$? When is $\Delta E = 3/2\ RT$? When is $\Delta H = \Delta E$? What does this say, if anything, about ΔE and ΔH as state functions ?

7. (8) Assign formal charges to the atoms in carbon monoxide. Use these to explain why CO has a much smaller dipole moment than is expected on the basis of electronegativity.

(背面仍有題目,請繼續作答)

8. (10) A first-order reaction is 38.5% complete in 480 s.

   a. Calculate the rate constant.
   b. What is the value of the half-life ?
   c. How long will it take for the reaction to go to 95% completion?

9. (10) Explain both Schottky defects and Frenkel defects in cryatalline ionic solids.

10. (10) Consider the reaction of propane with chlorine
    a. How many monochloro products can be formed ?
    b. How dichloro products can be formed ?