有機化學　　　　　　總分：50 分

1. **(28 Points).** Write the structures of the products expected from each of the following reactions.
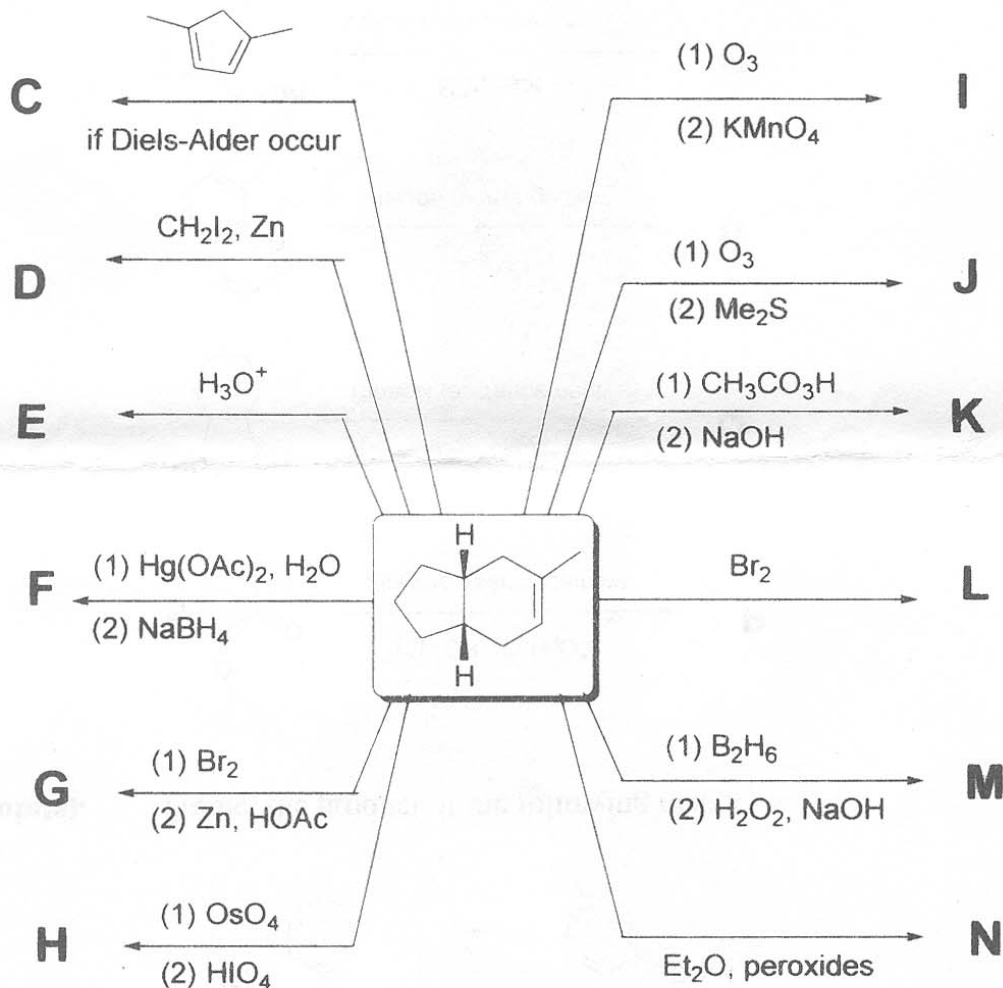
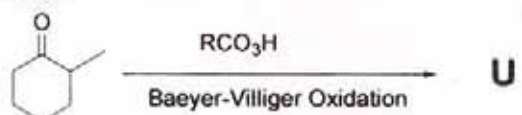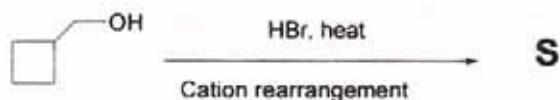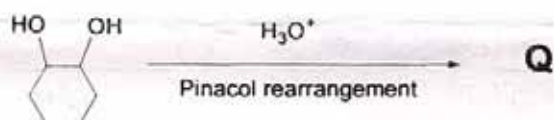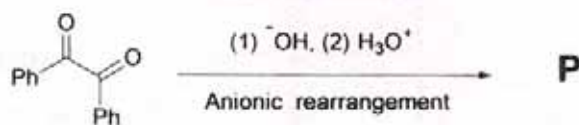2. **(10 points).** Suggest a sequence of reagents that could be used to achieve each of the following overall conversions.

(a)

(b)
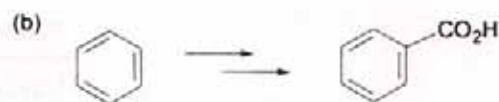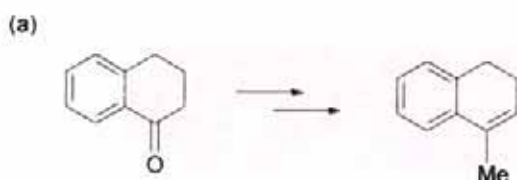
3. **(12 points).** Predict the product of the following reactions.

P

Anionic rearrangement

Q

Pinacol rearrangement

R

Claisen rearrangement

S

Cation rearrangement

T

Beckmann rearrangement

U

Baeyer-Villiger Oxidation
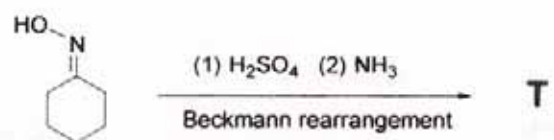
無機化學部分　（共五十分）

1. (A) Give the crystal field diagram for the square planar complex ion, $PdCl_4^{2-}$, oriented in the xy plane with chloride ligands along with the x and y axes. (3 分)

   (B) Predict the number of unpaired electrons in the following complex ions: (6 分)
   (a) $[Cr(CN)_6]^{4-}$　　　　(b) $[Cu(NH_3)_4]^{2+}$ (planar)　　　　(c) $Fe(CN)_6^{3-}$

2. (A) Use the MO energy diagram to explain why the CO ligand donates the electron pair on carbon in bonding to metals, rather than the pair on oxygen. (4 分)

   (B) Sketch all possible geometric isomers for the complexes $Co_2(CO)_8$ and $Mo(CO)_3(py)_3$, and assign an appropriate point group for each isomer. (8 分)

   (C) What are the products of PH_3 mixed with NH_4^+? What are the products of $P(CH_3)_3$ mixed with NH_4^+ ? (4 分)

   (D) Determine the order of Lewis acid strength for BF_3, BCl_3, and BBr_3. What effect (inductive, steric, or resonance effect) can be applied to explain this ordering? (4 分)

3. (A) Draw all possible isomers for the square-planar complex $[PtBrCl(NH_3)(py)]$. (3 分)

   (B) Give the *trans* effect and bond strength order for Pt-Br, Pt-Cl, Pt-NH_3 and Pt-py? (2 分)

   (C) Provide step-wise substitution procedures for the synthesis of each isomers in part (A) by using $[PtCl_4]^{2-}$ as the starting material. (6 分)

4. (A) Silver crystallizes in a cubic closest packed structure. The radius of a silver atom is 1.44 Å. Calculate the density of solid silver (the average atomic mass of Ag is 107.9 amu/atom; $\sqrt{2} = 1.414$). (4 分)

   (B) In each of the following pairs of substances, one is stable and known, the other is unstable. For each pair, choose the stable one, and explain why the other is unstable. (3 分)
   (a) NF_5 or PF_5　　　　(b) AsF_5 or AsI_5　　　　(c) NF_3 or NBr_3

   (C) Define each of the following: (3 分)
   (a) Arrhenius acid　　　　(b) Brønsted-Lowry acid　　　　(c) Lewis acid