

類組：化學類 科目：無機化學(1003)

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※請在答案卷內作答

- Describe the crystal structure of wurtzite ZnS. Also give coordination numbers of cations and anions. (4%)
 - What is the driving force for the formation of ionic solids? (2%)
 - How do you confirm the composition of ionic or metal crystals? Give 2 methods. (4%)
 - As quantum dots of CdS decrease in size, how would their absorption and emission peaks shift? What is the cause of this effect? (4%)
- Draw band structure of a p-type semiconductor. (4%)
 - Would a semiconductor's electrical conductivity increase or decrease with rising temperature? (2%)
 - In a redox reaction to form Au particles from HAuCl_4 , how would you tune the cell potential to form various Au particles? Give one way. (3%)
 - Write the equation relating equilibrium constant K to ΔG° , and the equation relating ΔG° to standard cell potential. (4%)
 - Solutions of Au and Ag nanoparticles have purplish red and yellow colors, respectively. What is the origin of the color? (2%) How would the absorption band shift if Au or Ag particles become rod-shaped? (2%)
- Complete the reaction: $[\text{Co}(\text{NH}_3)_5\text{X}]^{2+} + [\text{OH}]^- \rightarrow$ If this equation is an elementary step, give its rate law. (4%)
 - An electron transfer occurring via a covalently bound bridging ligand is outer-sphere or inner-sphere mechanism? (2%)
 - What technique is used to determine organometallic complex structure? (2%)
- Discuss how a photocatalyst works. (4%)
 - How does a light-emitting diode (LED) work? (3%)
 - Give a metal or metal oxide nanoparticle-catalyzed reaction. (4%)
- Draw the Lewis structure for carbon monoxide. (2%)
 - In carbon monoxide, what are the formal charges of C and O? What are the oxidation states of C and O? Are the formal charges and oxidation states consistent? Why? (6%)
 - Construct the energy level diagram for the molecular orbitals of carbon monoxide. (6%)
 - Why the carbon monoxide usually coordinates to the transition metal through the carbon end? (2%)
- Name the following complexes in English. (6%)
 - $[\text{Co}(\text{H}_2\text{O})_6]\text{Br}_3$
 - $\text{K}_2[\text{PtCl}_4]$
 - $[\text{Fe}(\text{NH}_2\text{CH}_2\text{CH}_2\text{NH}_2)_2(\text{NO}_2)_2]\text{I}$
- Draw the Lewis structure of all isomers for following compounds and indicate their point group (10%)
 - $[\text{Ir}(\text{NH}_3)_3\text{Cl}_3]$
 - Tetraamminechloronitritocobalt(III) ion
 - μ -amido- μ -hydroxobis[tetraamminecobalt(III)] ion

注意：背面有試題

參考用

※請在答案卷內作答

8. The Nobel Prize in Chemistry was awarded to Karl Ziegler and Giulio Natta in 1963 and to Richard F. Heck, Ei-ichi Negishi and Akira Suzuki in 2010. The representative catalyst or reaction are Ziegler-Natta catalyst and Suzuki-Miyaura Cross-Coupling Reaction, respectively. Please (a) briefly describe the significance of these two discoveries. (4%) (b) write down the catalyst and other reagents as well as the chemical equations of these two reactions. (6%)
9. The complex $[\text{Ni}(\text{CN})_4]^{2-}$ is diamagnetic but $[\text{NiCl}_4]^{2-}$ is paramagnetic with two unpaired electrons. $[\text{Fe}(\text{CN})_6]^{3-}$ has only one unpaired electron but $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ has five unpaired electrons. Explain these experimental observation using simple crystal field theory. (8%)

注意：背面有試題

參考用