

參考
原

科目：無機化學(2003)

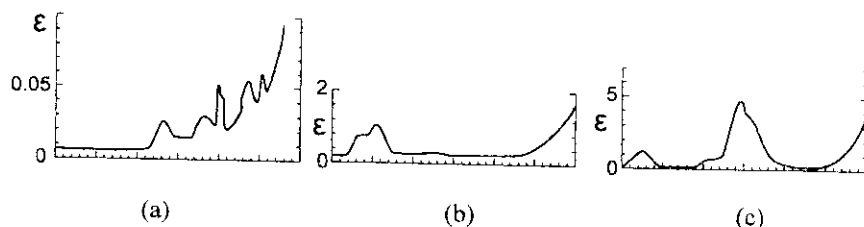
校系所組：中大化學學系 清大化學系 交大應用化學系甲組

一、 Alfred Werner (1866-1919) was named "the Father of Coordination Chemistry," who in 1893, proposed the octahedral configuration of transition metal complexes and in 1913 received the first Nobel prize in Inorganic Chemistry. One of the reasons that Werner was so successful is that he studied trivalent Cr and Co complexes, such as $M(NH_3)_3Cl_3$ ($M = Cr, Co$), instead of their corresponding divalent complexes. Explain. (5 %)

二、 Draw the structures of the following reagents. (6 %)

(a) Nickelocene (b) Vaska's complex (c) Wilkinson's catalyst

三、 The following three electronic spectra correspond to three first-row transition metal complexes $[M(OH_2)_6]^{2+}$. Which of them likely refers to complex $[Mn(OH_2)_6]^{2+}$? Explain. (8 %)



四、 Draw structures for all possible isomers of the octahedral cobalt(III) complexes formulated as $Co(NH_3)_4Cl_2(NO_2)$. (6 %)

五、 a) Calculate E° value for the following cell and balance the reaction. $MnO_4^-(aq) + I^-(aq) \leftrightarrow I_2(s) + Mn^{2+}(aq)$ Is the reaction spontaneous as written? $I_2 + 2e^- \rightarrow 2I^-$ $E^\circ = 0.54$ V $MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$ $E^\circ = 1.51$ V b) Calculate ΔG° for this cell reaction at 25 °C. $F = 96,485$ C/mol e^- c) Write the equation for the determination of equilibrium constant K of this reaction. (8 %)

六、 Draw the structure and determine the point group of *trans*- N_2F_2 . (4 %)

七、 Write the ground state electron configuration for Ga (atomic number = 31). (2%)

八、 a) Draw the *d*-orbital splitting diagrams for the octahedral complex ion of Zn^{2+} . b) Predict the magnetic property of Zn^{2+} ion. (4%)

九、 a) Draw the energy band diagram for an *n*-type semiconductor (e.g. As-doped Si). b) What technique is usually used to determine the crystal structure of an inorganic solid such as a typical semiconductor? (5%)

十、 What will happen to the energy levels for an electron trapped in a one-dimensional box as the length of the box decreases? (2%)