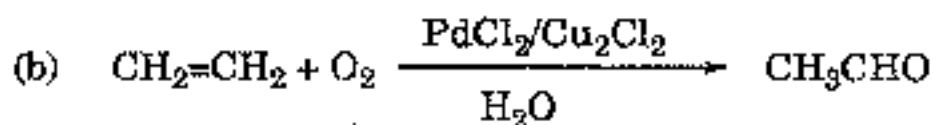
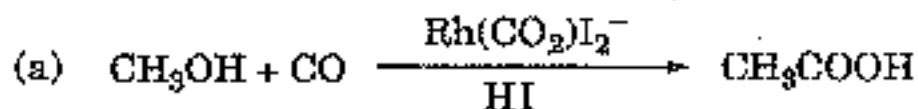


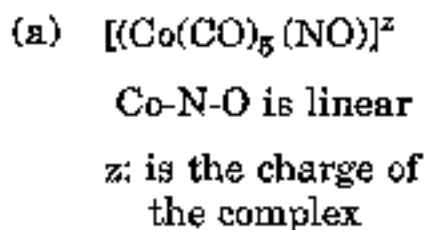
八十四學年度 化學工程研究所 乙 組碩士班研究生入學考試

科目 無機及分析化學 科號 1704 共 5 頁第 1 頁 \*請在試卷【答案卷】內作答

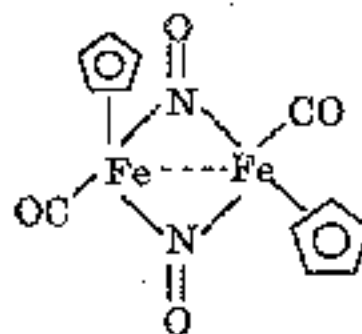
1. Write the detailed reaction mechanism of the following catalytic reactions (4% each; total 8%)



2. Explain the term n-type and p-type semiconductor. Give one example for each case. (6%)
3. If the following complexes meet 18-electron rule. Find the values of n or z (6%)

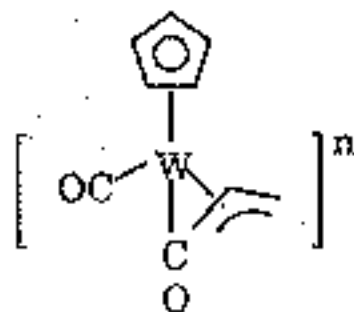


(b)



n: the metal metal bond order

(c)

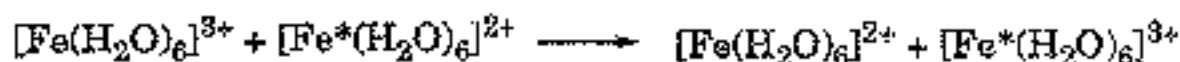


n: the charge of compound

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科目 無機及分析化學 科號 1704 共 5 頁第 2 頁 \*請在試卷【答案卷】內作答

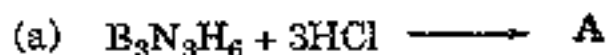
4. If  $\text{HRu}(\text{PPh}_3)_3^+$  is a 18-electron complex, suggest a reasonable structure. (4%)
5. Spinel has the  $\text{AB}_2\text{O}_4$  formula.  $\text{MgAl}_2\text{O}_4$  has a normal spinel structure in which  $\text{Mg}^{2+}$  occupies  $\frac{1}{8}$  portion of the tetrahedral holes and  $\text{Al}^{3+}$  occupies  $\frac{1}{2}$  portion of the octahedral holes. But the structure will be different for  $\text{NiFe}_2\text{O}_4$ . Give the detailed explanation on the fact that  $\text{MgAl}_2\text{O}_4$  prefers a normal spinel structure but  $\text{NiFe}_2\text{O}_4$  have an inverse spinel structure. (8%)
6. In the following electron-transfer reaction, what is the mechanism? inner sphere or outersphere?



$\text{Fe}^*$ : an isotopic element of iron

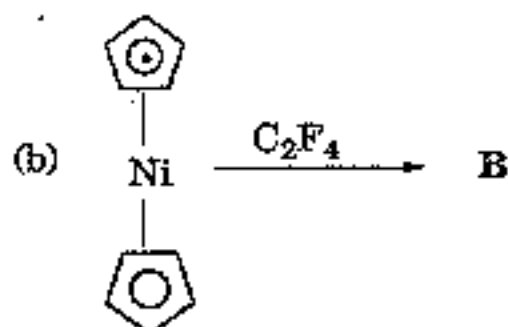
Shall the  $\Delta G^\ddagger$  value be or close to zero? Give your reason. (8%)

7. Predict the number of unpaired electrons of the following complexes. You shall give the answer together with the energy diagram. (6%)  
(a)  $\text{C}_2$  (b)  $\text{NiCl}_4^{2-}$  (c)  $\text{Cp}_2\text{V}$
8. Complete the product structures of the following two reaction. (4%)



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科目 無機及分析化學 科號 1704 共 5 頁第 3 頁 \*請在試卷【答案卷】內作答



9. What is a concentration of 1 ppm by volume of sulfur dioxide expressed in  $\mu\text{gm}^{-3}$  at  $25^\circ\text{C}$  and 750 mm Hg? And what is the concentration of  $50.0 \mu\text{gm}^{-3}$  of ozone measured at  $20^\circ\text{C}$  and 765 mmHg expressed in ppm by volume? (5%)
10. A coastal marine sediment was analyzed for its iron content. Sevent replicate measurements were made on a random sample of the marine sediment. The result were : 3.36, 3.20, 3.15, 3.12, 3.10, 3.09 and 3.06% of iron (wt/wt). (5%)
- Calculate the sample mean and the sample standard deviation.
  - Calculate the 90% confidence interval for the iron content of the marine sediment. (Student t values = 2.015, 1.943 and 1.895 for degree of freedom 5, 6 and 7 respectively)
  - Use Q-test to point out the outlying value. (the rejection quotient,  $Q_{90} = 0.51$  for seven measurements)
  - Calculate the 90% confidence interval after Q-test.
11. Describe the basic principle of the two electrochemical methods; polarography and anodic stripping voltammetry. What are the advantages of anodic stripping voltammetry over polarography in terms of sensitivity and detection limit? (5%)
12. Describe the four major parts of the spectrophotometer for a single beam and a double beam design.

八十四學年度 化學工程研究所 乙 組碩士班研究生入學考試

科目 無機及分析化學 科號 1704 共 5 頁第 4 頁 \*請在試卷【答案卷】內作答

- What are the basic principles or laws used in the spectrophotometry for qualitative and quantitative analysis. (5%)
13. Describe the following instrumentation for the metallic element analysis. (5%)
- X-ray fluorescence (XRF)
  - Graphite atomizer-Atomic Absorption
  - ICP-Atomic Emission Spectroscopy
  - ICP-Mass Spectrometry
  - Cold Vapor-Atomic Absorption Spectroscopy
14. What are the most common stationary phases and detectors in HPLC and ion chromatography?  
What is the reverse phase HPLC? (5%)
15. Calculate (5%)
- the absorptivity if a sample in a 1 cm path cell with concentration of  $0.5 \times 10^{-3}$  M shows an absorbance of 0.265 absorbance units at 595 nm ( $\lambda_{\max}$ ).
  - the partition coefficient after passing 100 ml of 0.005 M Cs<sup>+</sup> solution through an ion-exchange resin (in its H<sup>+</sup> form of 2 meq g<sup>-1</sup> capacity) the concentration of Cs<sup>+</sup> in solution was found to be 5 ppm.
16. Define and elaborate on the following terms: (5%)
- accuracy and precision
  - figures of merit
  - internal standard
  - S/N ratio
  - Standard addition