

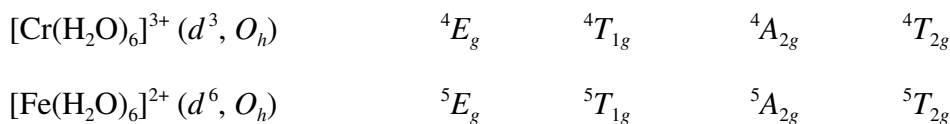
Name _____

Chem 370 - Spring, 2018
Hour Exam III - Part 1
May 7, 2018

1. (32 points; 4 points each) Fill in the blanks. In some cases, answer choices are shown in ***bold italics***.
- a. From your recall of the appropriate Orgel diagram, indicate the number of bands expected in the visible spectra of the following complexes. (Disregard any possible bands resulting from Jahn-Teller effects or spin-forbidden transitions.)



- b. Circle the ground state term for each of the following complexes:



- c. Indicate whether the following complexes in their ground states show ***strong***, ***weak***, or ***no*** Jahn-Teller distortion.



- d. $[\text{Ni}(\text{NH}_3)_6]^{2+} (d^8, O_h)$ shows visible absorption bands at $10,750 \text{ cm}^{-1}$, $17,500 \text{ cm}^{-1}$, and $28,200 \text{ cm}^{-1}$. What is the value (cm^{-1}) of Δ_o for this complex, and what is the state-to-state notation (e.g., ${}^2E_g \rightarrow {}^2T_{2g}$) for the transition that corresponds to Δ_o ?



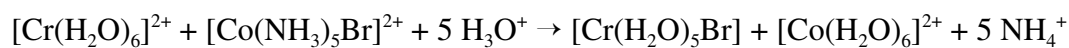
- e. The visible spectrum of $[\text{Fe}(\text{H}_2\text{O})_6]^{2+} (d^6, O_h)$ shows a broad absorption band with two distinct peaks at about $10,000 \text{ cm}^{-1}$. Give the state-to-state assignment for this band and suggest a reason why it is split into two peaks.

- f. In the reaction, $[\text{Pt}(\text{NH}_3)\text{Br}_3]^- + \text{NH}_3 \rightarrow [\text{Pt}(\text{NH}_3)_2\text{Br}_2]$, which isomer, ***cis*** or ***trans***, will be favored for the product?

Answer: _____

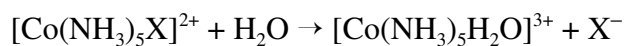
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g. Consider the redox reaction,



which occurs slowly in acidic aqueous medium. Is this redox reaction likely to be an *inner-sphere* or an *outer-sphere* mechanism? Explain briefly.

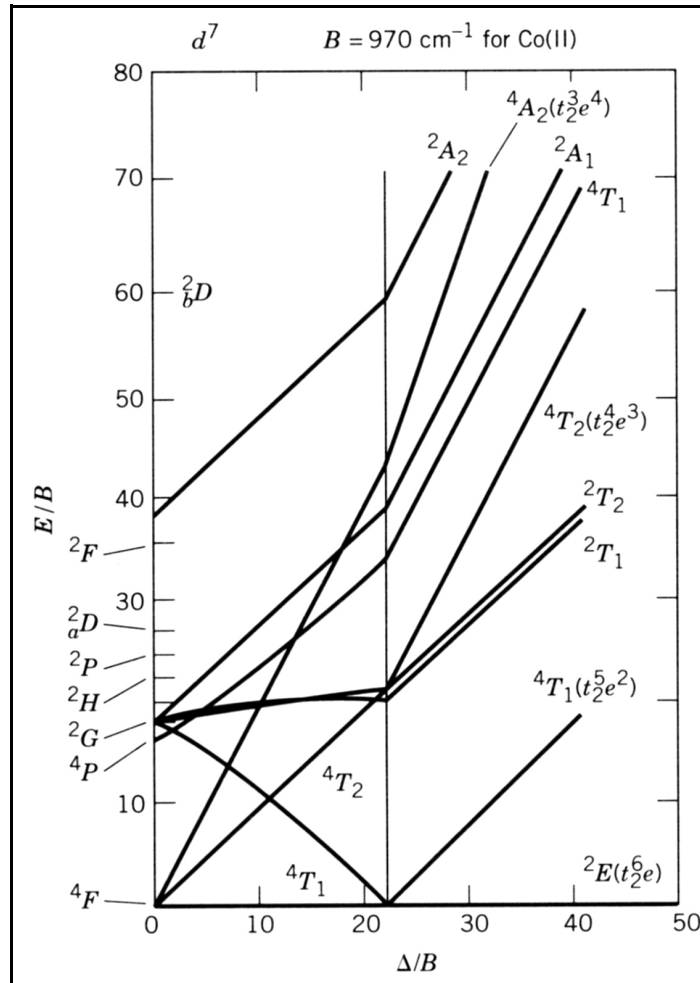
h. For the hydrolysis reactions,



where X^- is a halide, the rates of reaction are found to increase in the order $\text{F}^- < \text{Cl}^- < \text{Br}^- < \text{I}^-$. Does this suggest a mechanism that is more *associative* (S_N2 , A , I_a) or *dissociative* (S_N1 , D , I_d)? Explain briefly.

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2. (12 points) Consider the Tanabe-Sugano diagram for d^7 octahedral complexes shown below.



List the same-spin state-to-state transitions that are expected for both d^7 high-spin and d^7 low-spin ML_6 complexes, using the usual state-to-state notation (i.e., ground state \rightarrow excited state).

d^7 high-spin	d^7 low-spin

What factors might lead to fewer observed bands in the visible spectrum from the number of possible transitions you have identified for each case?