

FALL 2004
2nd MIDTERM

(Total number of pages = 7)

(Total points = 50)

(Total time = 50 mins)

****Carefully remove last page which is your Periodic Table.****

YOUR DISCUSSION SECTION

YOUR TA's NAME

WRITE IN PEN (Show all your work on this paper, check units and significant figures.)

Good Luck

Constants and Formulas

Planck constant, $h = 6.63 \times 10^{-34} \text{ J} \cdot \text{s}$

Avogadro constant, $N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$

Rydberg constant, $R = 3.29 \times 10^{15} \text{ Hz}$

Gas constant, $R = 8.314 \text{ J} \cdot \text{K}^{-1} \cdot \text{mol}^{-1}$

Mass of electron, $m_e = 9.1 \times 10^{-31} \text{ kg}$

Speed of light, $c = 3.0 \times 10^8 \text{ m} \cdot \text{s}^{-1}$

$0^\circ\text{C} = 273.15 \text{ K}$

$1\text{L} = 1 \text{ dm}^3$

$1 \text{ atm} = 101.325 \text{ kPa}$

$\pi = 3.14$

$E = h \nu$

$E = pc$

$E_n = \frac{h^2 n^2}{8 m L^2}$

$p = mv$

$E_n = - \frac{h R}{n^2}$

$\lambda = \frac{h}{p}$

$c = \lambda \nu$

$\text{pH} = \text{pK}_A + \text{LOG} \frac{[\text{A}^-]_{\text{INITIAL SALT}}}{[\text{AH}]_{\text{INITIAL ACID}}}$

$E = \frac{1}{2} m v^2$

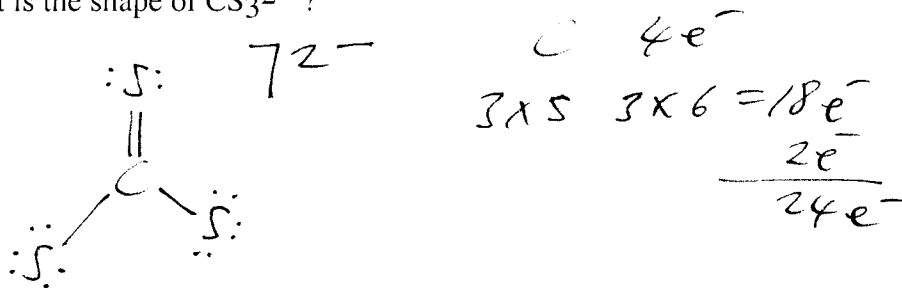
$\Delta p \times \Delta x \geq \frac{h}{4\pi}$

Solution to $AX^2 + BX + C = 0$

is $X = \frac{-B \pm \sqrt{B^2 - 4AC}}{2A}$

Q1A. What is the shape of CS_3^{2-} ?

(3pt)



Ans \Rightarrow trigonal planar

B. All of the following have an angular shape except:
Circle your one answer.

(3pt)

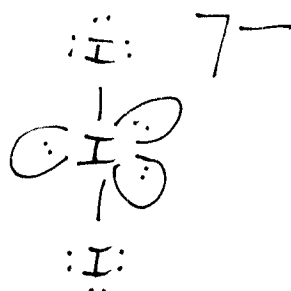
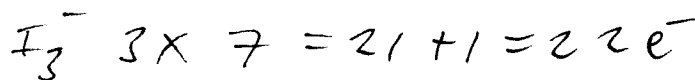
HOCl

S_3^{2-}

I_3^-

ClO_2^-

NH_2^-



Ans \Rightarrow I_3^-

C. Which of the following is polar?
Circle your one answer.

(3pt)

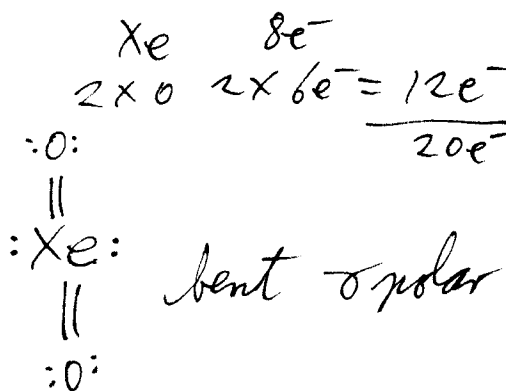
XeF_2

XeO_2

CF_4

I_3^-

Ans \Rightarrow XeO_2



Q3. Answer the following questions for the complex ion $[\text{Cr}(\text{en})(\text{ox})\text{Cl}_2]^+$

A. What is the shape of the complex? (2pt)

octahedral

B. What is the oxidation state of the Cr? (2pt)

~~6+~~ 5+

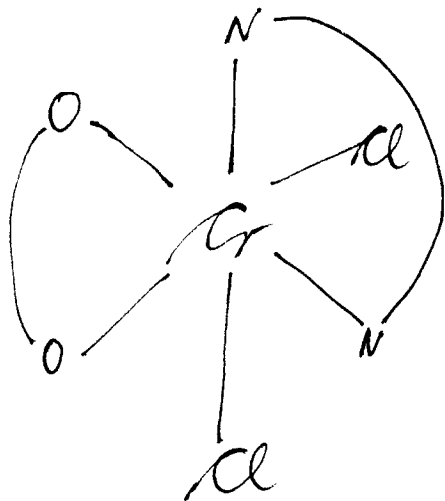
C. Write the name for this complex. (4pt)

-1 pt for incorrect order
dichloro ethylenediamine oxalato chromium(VI)

1pt 1pt 1pt 1pt

E. Draw one optical isomer. (4pt)

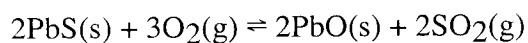
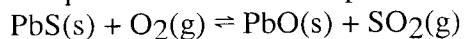
(More than one structure will be zero credit.)



cis isomer is optically active.

Q4A. Write the equilibrium constant expression for the following reaction.

(2pt)



1pt

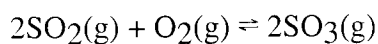
$$K = [\text{SO}_2(\text{g})]^2 / [\text{O}_2(\text{g})]^3$$

1pt

$$K = \frac{(P_{\text{SO}_2})^2}{(P_{\text{O}_2})^3}$$

B. Given: $\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons \text{SO}_3(\text{g})$

At equilibrium at a certain temperature, the concentrations of $\text{SO}_3(\text{g})$, $\text{SO}_2(\text{g})$, and $\text{O}_2(\text{g})$ are 0.12 M, 0.86 M, and 0.33 M, respectively. Calculate the value of K_c for this reaction. (3pt)



1pt

$$K_c = \frac{[\text{SO}_3]^2}{[\text{SO}_2]^2 [\text{O}_2]} = \frac{(0.12)^2}{(0.86)^2 (0.33)}$$

$$= 0.058999$$

$$= 0.059 \quad (2 \text{ sf})$$

- 1pt for sf.