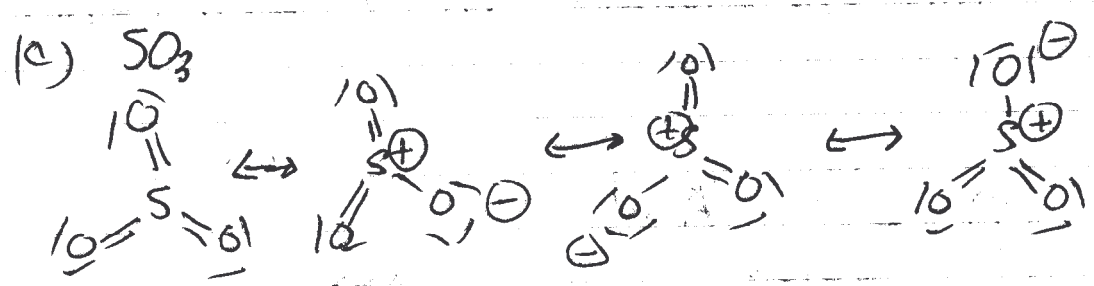
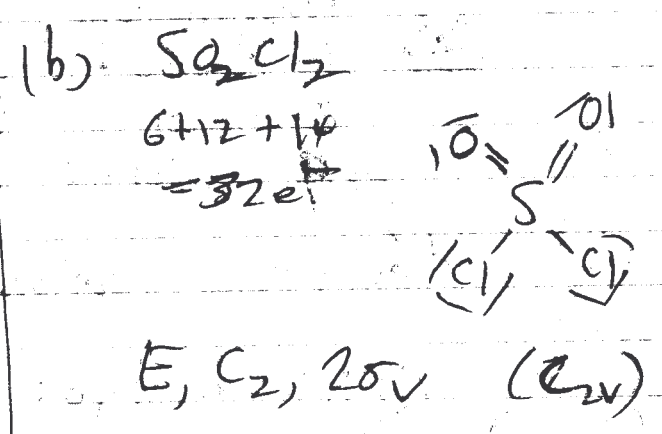
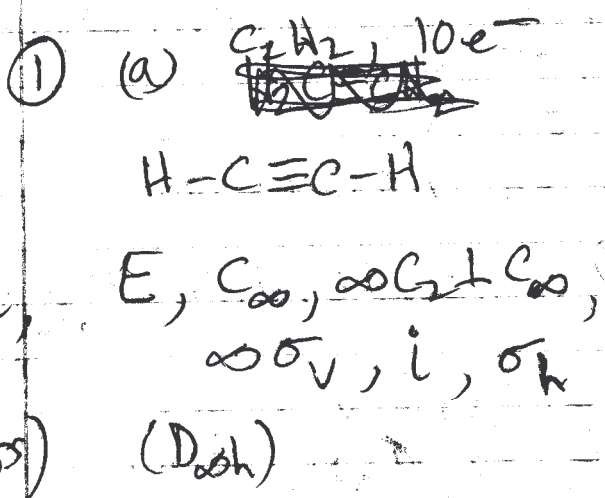


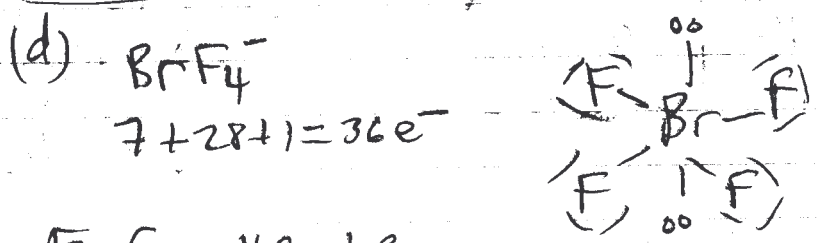
Spring 2009  
Problem Set #2

PS2-1

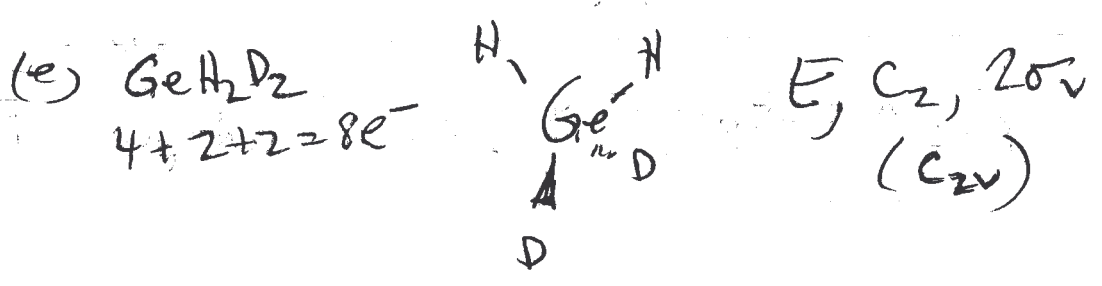
(4 pts. each;  
 2 for diagram  
 2 for symmetry elements  
 (point group not needed))



E, C<sub>3</sub>, 3C<sub>2</sub> ⊥ C<sub>3</sub>, σ<sub>h</sub>, 3σ<sub>v</sub>, S<sub>6</sub> (D<sub>3h</sub>)



E, C<sub>4</sub>, 4C<sub>2</sub> ⊥ C<sub>4</sub>,  
 σ<sub>h</sub>, i, 4σ<sub>v</sub> (D<sub>4h</sub>)



- ② Naphthalene:  $E, C_2, 2C_2 \perp C_2, \sigma_h, 2\sigma_v, i (C_{2v})$   
~~1~~ 1-chloro:  $E, \sigma (C_s)$   
 2-chloro:  $E, \sigma (C_s)$   
 $\rightarrow$  9-chloro:  $E, C_2, 2\sigma_v (C_{2v})$

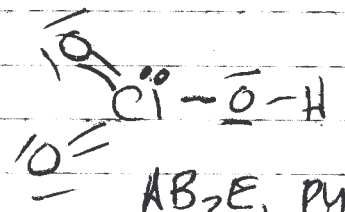
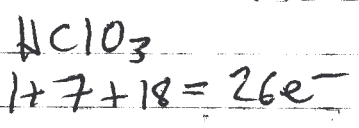
(point group not needed; 3 points each, 4 for naphthalene)

doesn't exist; optional to include; distribute points to others if not included

- (i) 1, 8-dichloro:  $E, C_2, 2\sigma_v (C_{2v})$   
 (ii) 1, 5-dichloro:  $E, C_2, \sigma_h, i (C_{2h})$   
 (iii) 1, 2-dichloro:  $E, \sigma (C_s)$   
 (iv) 2, 3-dichloro:  $E, C_2, 2\sigma_v (C_{2v})$

③ Chloric Acid

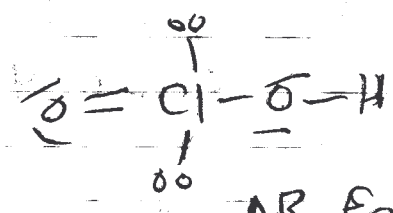
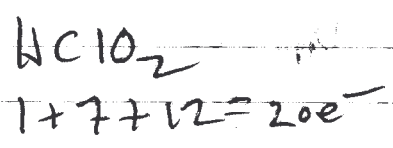
(5 points each; 3 for structure, 2 for pKa)



$pK_a \approx 8 - 5p = 8 - 5(2) = -2$

$AB_3E$ , pyramidal  
 (not required in answer; just structure)

Chlorous Acid



$pK_a \approx 8 - 5p = 8 - 5(1) = 3$

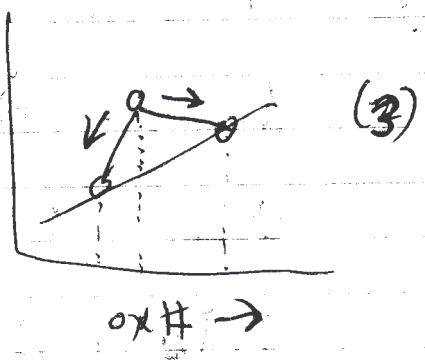
$AB_2E_2$   
 Angular/Bent

④ Disproportionation (2)

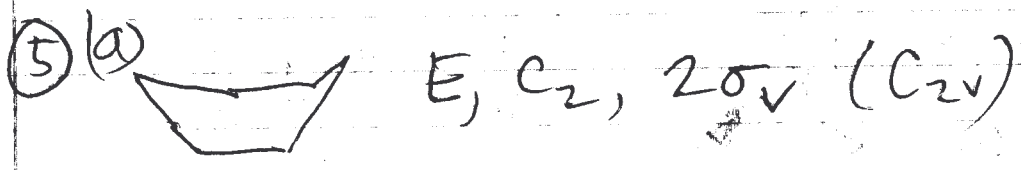
(Distribute as shown)

lowers average energy (3)

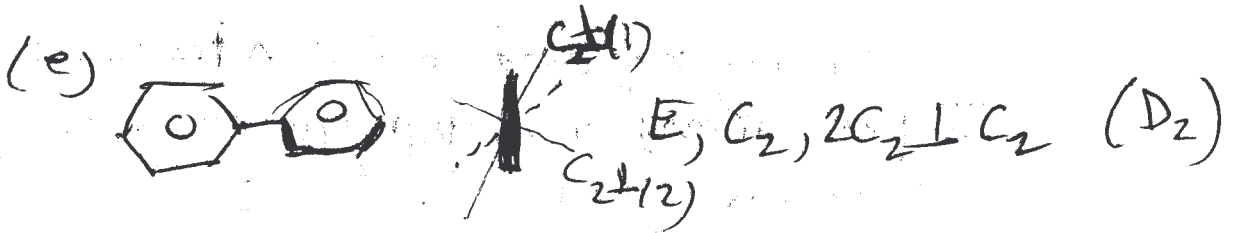
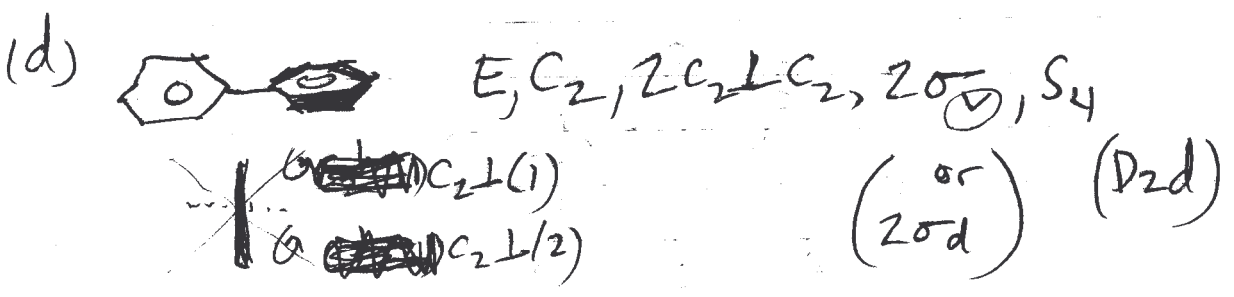
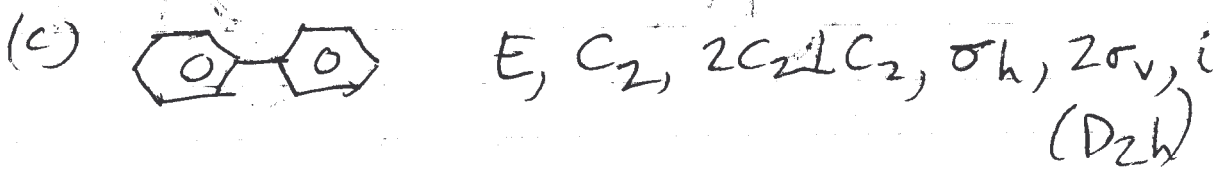
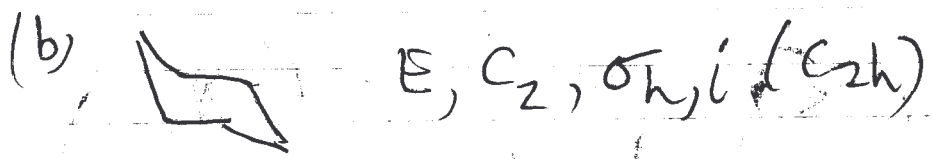
$nFE^\circ$

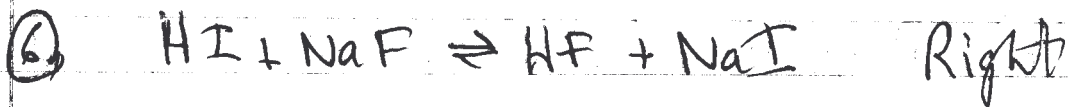


$E^\circ > 0$  ;  $\Delta G^\circ < 0$   
 (1) (1)

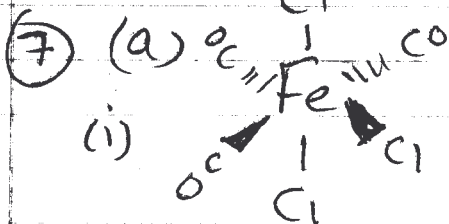


(3 marks each; point group not needed)

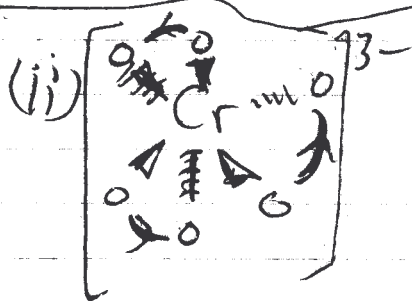




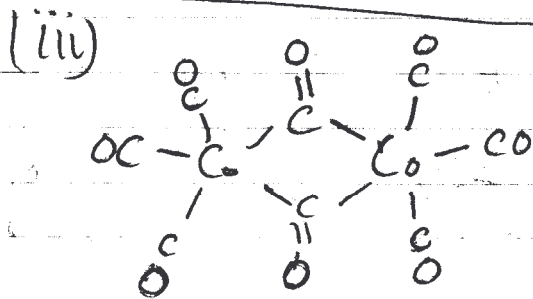
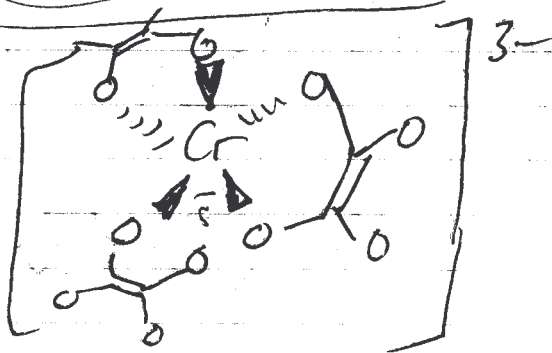
(2 points each)



Drawings can be oriented any way



or,



- (b) (i) chlorobis(ethylenediamine) nitrocobalt (III)
- (ii) pentacarbonyltriphenylphosphine tungsten (0)
- (iii) trisoxalatoaluminate (III)