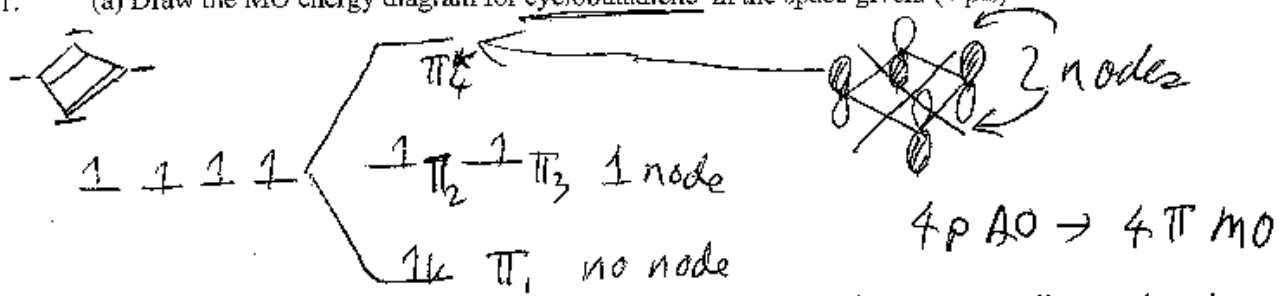
Organic II (CHEM 442) Fall 2015 Dr. Hahn MWF12pm 10/5/15M Form A Quiz III Exam # _____

Sign Name Key _____ Print Name _____

Please show work on all questions for partial credit even on questions which do not specify. (25 pts) Colored

1. (a) Draw the MO energy diagram for cyclobutadiene in the space given. (4 pts)



(b) Show the p orbital atomic orbital combination for the highest π* MO in your energy diagram above in part (a) by the MO which matches. Represent the math sign of your p orbital lobes by shading in one of the lobes in all of the p orbitals. Show the node. (3 pts)

(c) Fill your MO energy diagram [which you drew above in (a)] with the appropriate number of electrons for the cylobutadiene ([illegible]) Use up and down arrows to represent electrons. (3 pts)

(d) Show a Huckel rule explanation of the stability/instability of your cyclobutadiene. (3 pts)

$4n + 2 = \#\pi e = 4$ $4n = 2$ not aromatic

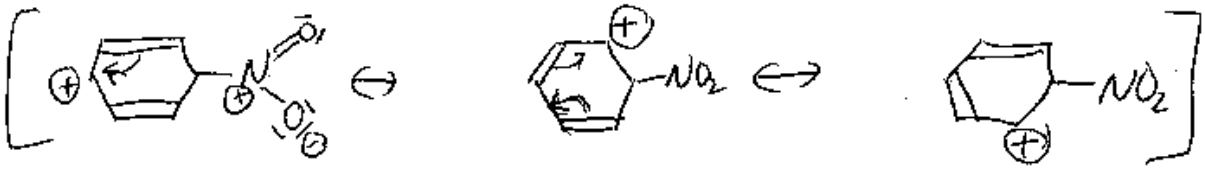
$n =$ 2/4 $4n = 4 - 2$ $n = 2/4$ unstable

(e) Label your MO diagram's individual molecular orbitals which you drew in part (a) (all of your molecular orbitals) with numbered π or π* (ie: π_1, ... π_6^*, etc) (3 pts)

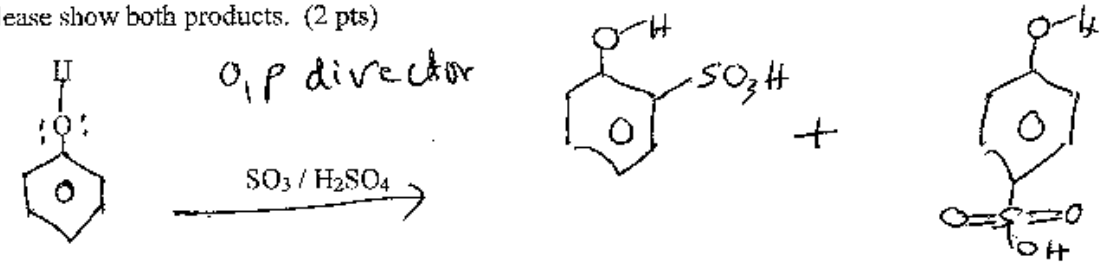
(f) Give the label of the molecular orbitals [from the label that you provided in part (e) above] which you expect will be doing the HOMO to LUMO transition that you expect for the UV-Vis transition of the molecule. Assume such a transition occurs and show your prediction. (3 pts)

(π_3 or π_2) → π_4^*

2. In an electrophilic aromatic substitution reaction for the reaction of benzene with HNO_3 /H_2SO_4 show the arenium ion intermediate with all 3 of the resonance structures with the appropriate electrophile attached to the aromatic ring. (6 pts, 2 pts per each resonance structure)



Extra Credit: complete the following reaction by giving the expected product. If 2 products are expected, please show both products. (2 pts)

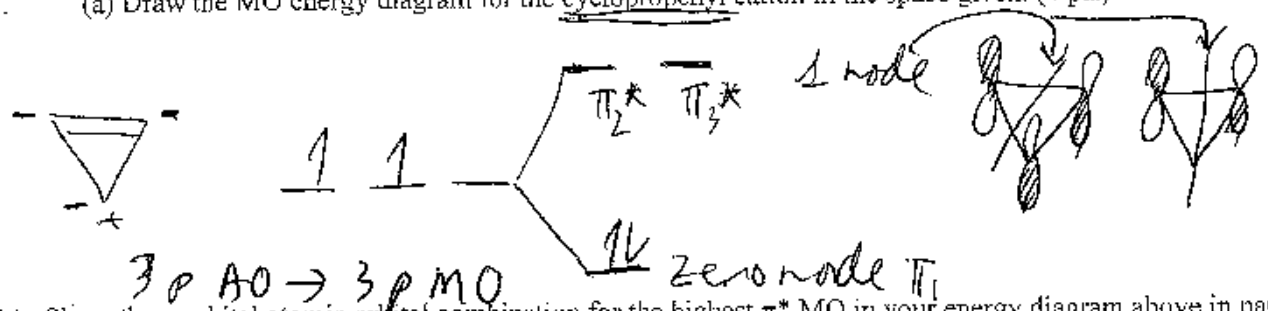


Organic II (CHEM 442) Fall 2015 Dr. Hahn MWF12pm 10/5/15M Form B Quiz III Exam # _____

Sign Name Key _____ Print Name _____

Please show work on all questions for partial credit even on questions which do not specify. (25 pts) White

1. (a) Draw the MO energy diagram for the cyclopropenyl cation in the space given. (4 pts)



(b) Show the p orbital atomic orbital combination for the highest π* MO in your energy diagram above in part (a) by the MO which matches. Represent the math sign of your p orbital lobes by shading in one of the lobes in all of the p orbitals. Show the node. (3 pts)

(c) Fill your MO energy diagram [which you drew above in (a)] with the appropriate number of electrons for the [redacted] (cyclopropenyl cation). Use up and down arrows to represent electrons. (3 pts)

(d) Show a Huckel rule explanation of the stability/instability of your cyclopropenyl cation (3 pts)

$4n+2 = \#\pi\bar{e} = 2$ aromatic Stable

$4n = 2-2$

$n =$ zero $n =$ zero

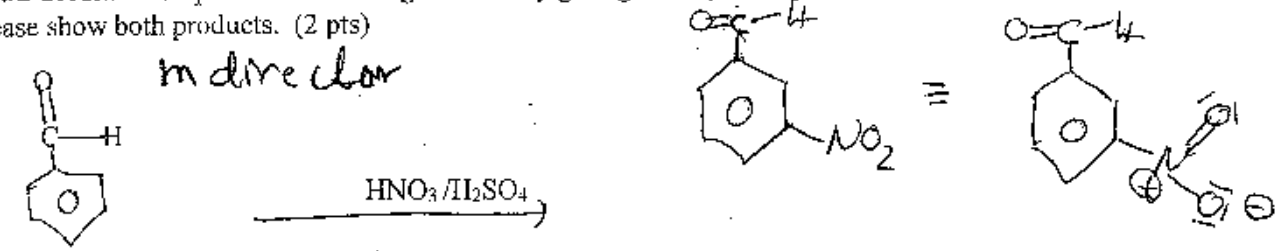
(e) Label your MO diagram's individual molecular orbitals which you drew in part (a) (all of your molecular orbitals) with numbered π or π* (ie: π_1, ... π_6^*, etc) (3 pts)

(f) Give the label of the molecular orbitals [from the label that you provided in part (e) above] which you expect will be doing the HOMO to LUMO transition that you expect for the UV-Vis transition of the molecule. Assume such a transition occurs and show your prediction. (3 pts)

$\pi_1 \rightarrow$ either π_2^* or π_3^*

2. In an electrophilic aromatic substitution reaction for the reaction of benzene with Cl_2 / $AlCl_3$, show the arenium ion intermediate with all 3 of the resonance structures with the appropriate electrophile attached to the aromatic ring. (6 pts, 2 pts per each resonance structure)

Extra Credit: complete the following reaction by giving the expected product. If 2 products are expected, please show both products. (2 pts)



Organic II (CHEM 442) Fall 2015 Dr. Hahn MWF12pm 10/5/15M Form A Quiz III Exam # 5

Sign Name _____ Print Name _____

Please show work on all questions for partial credit even on questions which do not specify. (25 pts) Colored

1. (a) Draw the MO energy diagram for cyclobutadiene in the space given. (4 pts)

(b) Show the p orbital atomic orbital combination for the highest π^* MO in your energy diagram above in part (a) by the MO which matches. Represent the math sign of your p orbital lobes by shading in one of the lobes in all of the p orbitals. Show the node. (3 pts)

(c) Fill your MO energy diagram [which you drew above in (a)] with the appropriate number of electrons for the cylobutadiene [redacted]. Use up and down arrows to represent electrons. (3 pts)

(d) Show a Huckel rule explanation of the stability/instability of your cyclobutadiene. (3 pts)

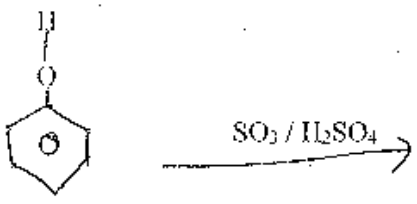
n = _____

(e) Label your MO diagram's individual molecular orbitals which you drew in part (a) (all of your molecular orbitals) with numbered π or π^* (ie: π_1, ... π_6^*, etc) (3 pts)

(f) Give the label of the molecular orbitals [from the label that you provided in part (e) above] which you expect will be doing the HOMO to LUMO transition that you expect for the UV-Vis transition of the molecule. Assume such a transition occurs and show your prediction. (3 pts)

2. In an electrophilic aromatic substitution reaction for the reaction of benzene with HNO_3/H_2SO_4 show the arenium ion intermediate with all 3 of the resonance structures with the appropriate electrophile attached to the aromatic ring. (6 pts, 2 pts per each resonance structure)

Extra Credit: complete the following reaction by giving the expected product. If 2 products are expected, please show both products. (2 pts)



Organic II (CHEM 442) Fall 2015 Dr. Hahn MWF 12pm 10/5/15M Form B Quiz III Exam # E-4

Sign Name _____ Print Name _____

Please show work on all questions for partial credit even on questions which do not specify. (25 pts) white

1. (a) Draw the MO energy diagram for the cyclopropenyl cation in the space given. (4 pts)

(b) Show the p orbital atomic orbital combination for the highest π* MO in your energy diagram above in part (a) by the MO which matches. Represent the math sign of your p orbital lobes by shading in one of the lobes in all of the p orbitals. Show the node. (3 pts)

(c) Fill your MO energy diagram [which you drew above in (a)] with the appropriate number of electrons for the [redacted] (cyclopropenyl cation). Use up and down arrows to represent electrons. (3 pts)

(d) Show a Huckel rule explanation of the stability/instability of your cyclopropenyl cation (3 pts)

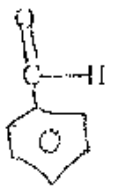
n = _____

(e) Label your MO diagram's individual molecular orbitals which you drew in part (a) (all of your molecular orbitals) with numbered π or π* (ie: π_1, ... π_6^*, etc) (3 pts)

(f) Give the label of the molecular orbitals [from the label that you provided in part (e) above] which you expect will be doing the HOMO to LUMO transition that you expect for the UV-Vis transition of the molecule. Assume such a transition occurs and show your prediction. (3 pts)

2. In an electrophilic aromatic substitution reaction for the reaction of benzene with Cl_2 / $AlCl_3$, show the arenium ion intermediate with all 3 of the resonance structures with the appropriate electrophile attached to the aromatic ring. (6 pts, 2 pts per each resonance structure)

Extra Credit: complete the following reaction by giving the expected product. If 2 products are expected, please show both products. (2 pts)



$\xrightarrow{HNO_3/H_2SO_4}$