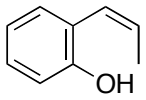
A. Nomenclature (3 points each; 9 total points)

Please provide an acceptable name for each of the following compounds, noting stereochemistry where appropriate.

1.



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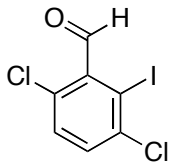
2.



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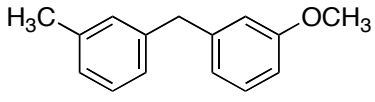
3.



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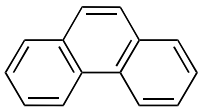
B. Facts (22 total points)

1. Label the following molecules as aromatic, non-aromatic, or anti-aromatic. (2 pts each)



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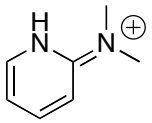

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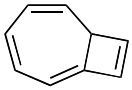

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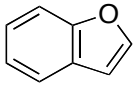

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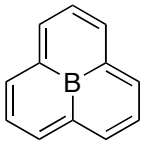

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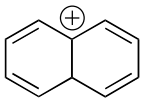

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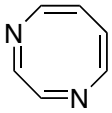

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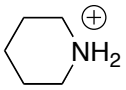
2. Provide a reasonable estimate of the pK_a of each of the following molecules. (1 pt each)



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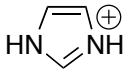

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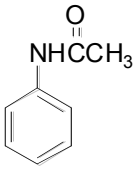
3. Rank the following from slowest (**1**) to fastest (**3**) in Friedel-Crafts Alkylation. (1 pt each)



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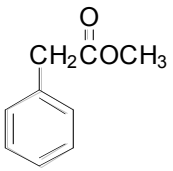

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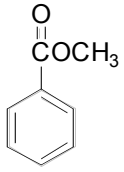

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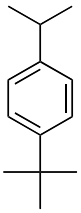
C. Reactions (7 points each; 28 total points)

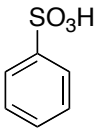
Please provide the **major** product, or **necessary reagents**, or **starting material** in the **box** provided below. Be sure your drawing indicates stereochemistry if applicable.

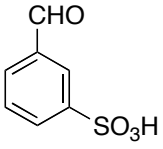
1.



1. Jones Reagent / Δ
2. $SOCl_2$
3. Benzene + $AlCl_3$
4. H_2O
5. xs Na / NH_3 (l) / CH_3OH

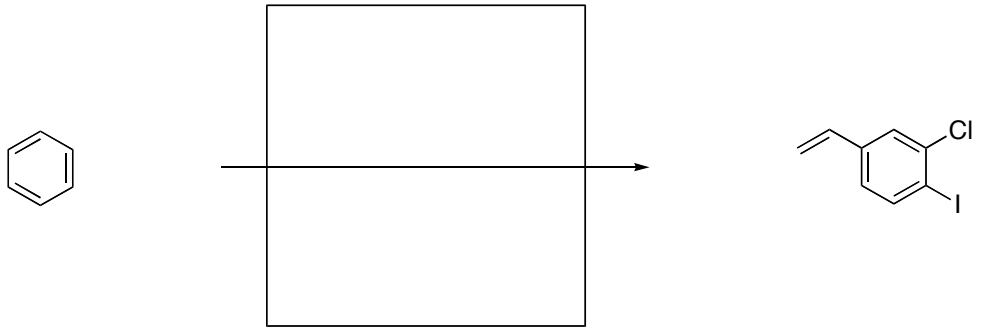
2.



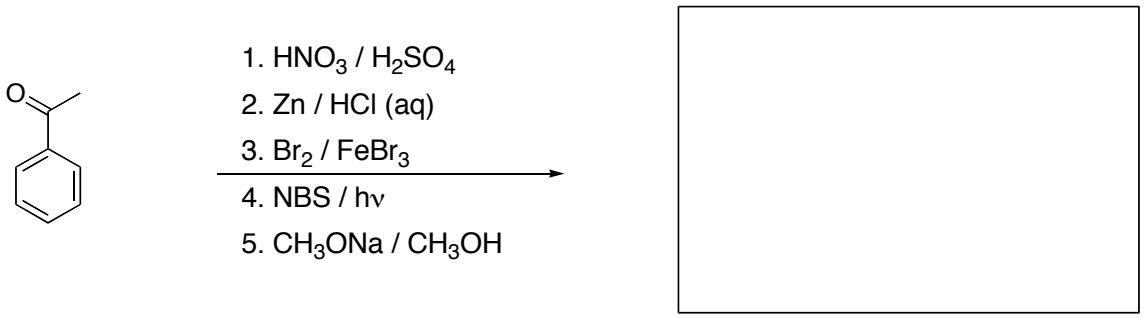


Reactions (continued)

3.

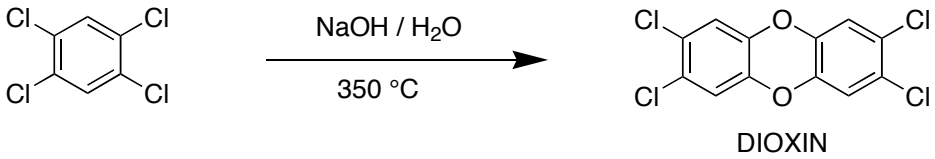


4.



D. Mechanism: (15 points)

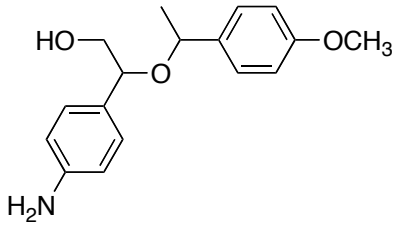
An unfortunate side reaction in the synthesis of 2,4,5-trichlorophenoxyacetic acid -- a major component of the herbicide known as "Agent Orange" -- leads to the formation of environmentally unfriendly "dioxin". Provide a reasonable mechanism for the reaction in which dioxin is formed. Use curved arrows to indicate "electron flow". **Show all intermediates and all formal charges.**



DIOXIN

E. Synthesis: 16 Points

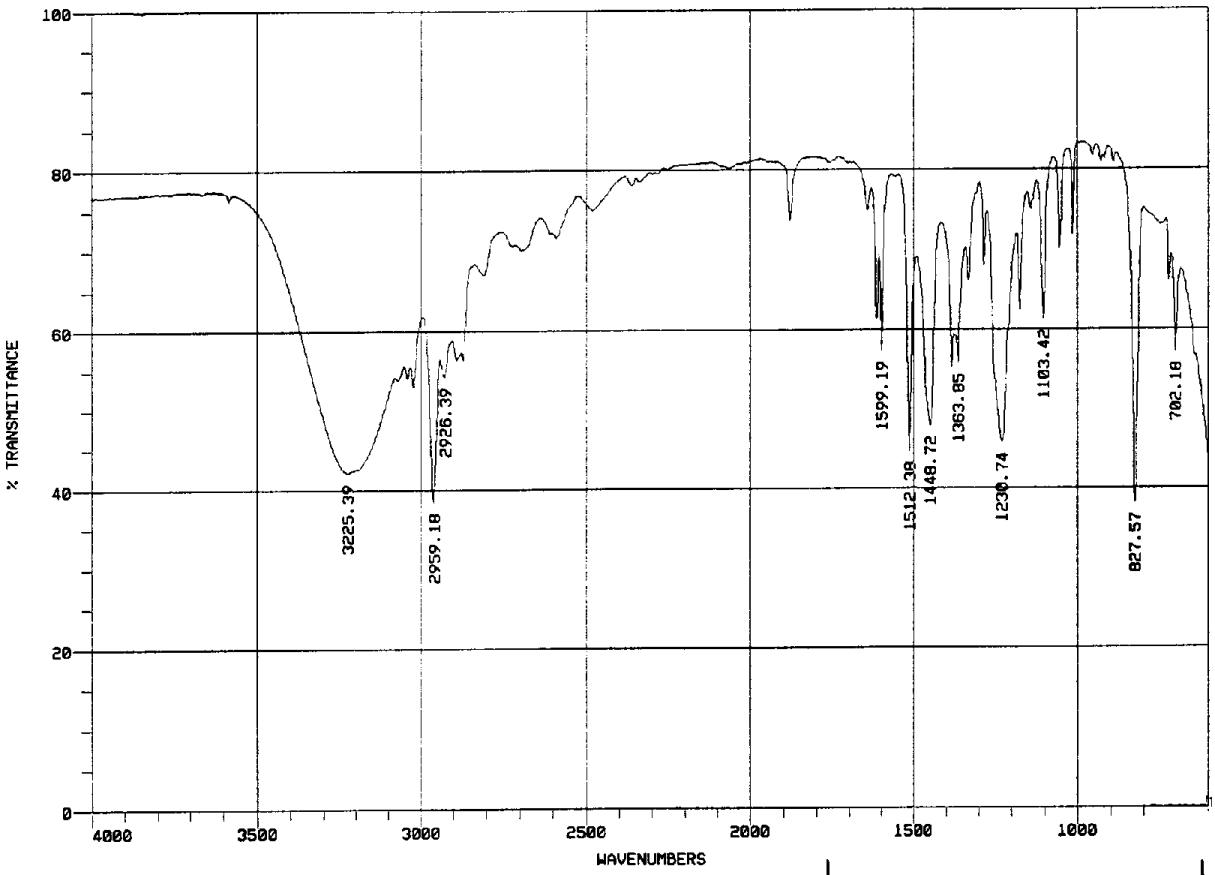
Synthesize the molecule below using any of the following reagents: alkanes, alkenes, or alkynes having **no more than <u>two</u> carbon atoms**, benzene, CO, phenol, any inorganic reagents, any oxidizing or reducing agents, and any peroxyacids.

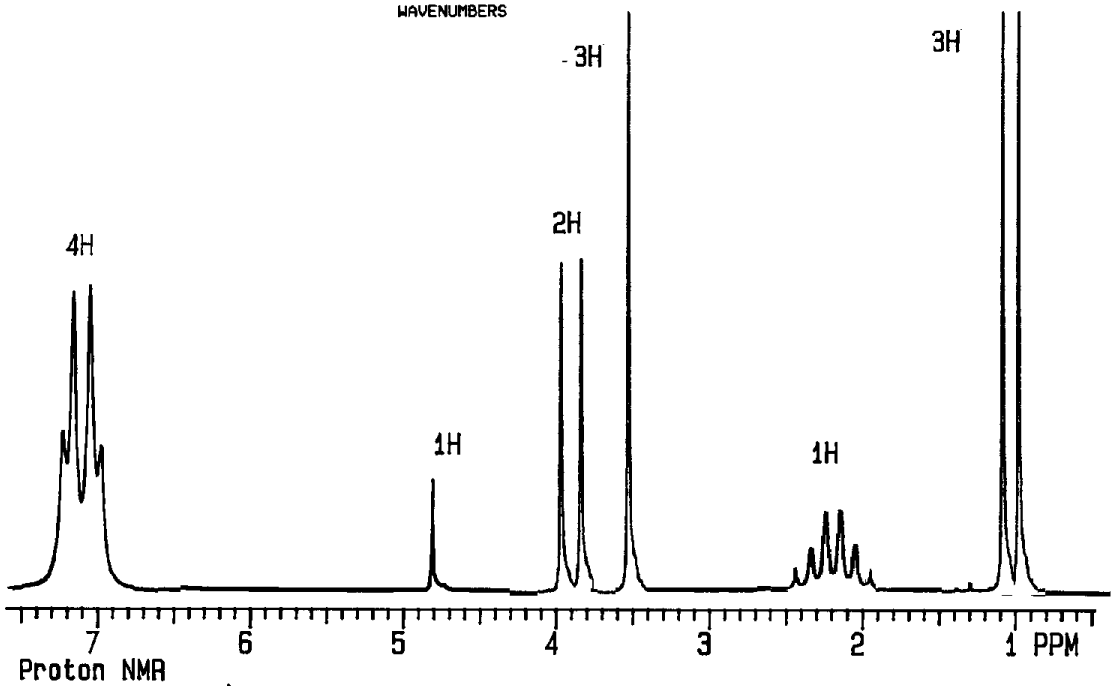


F. Spectroscopy: 10 points

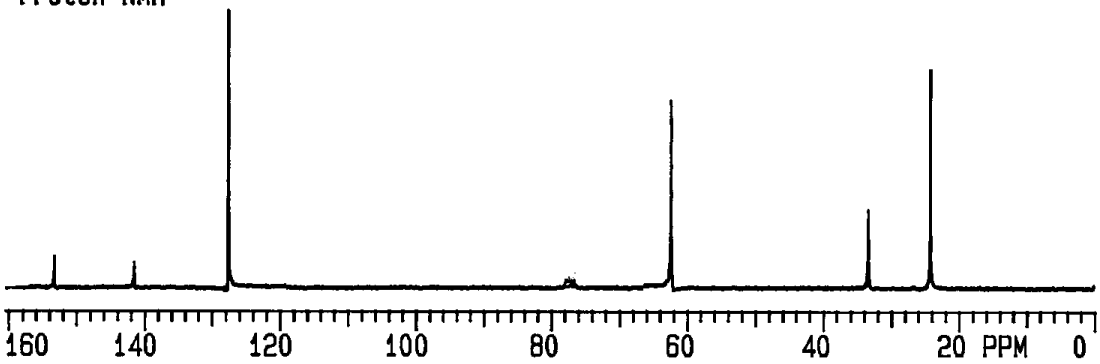
A compound with the formula $\mathbf{C_{10}H_{14}O_2}$ exhibits the IR, ^{1}H NMR, and proton-decoupled ^{13}C NMR spectra shown on the following page. Please identify this compound and draw the structure in the box provided below.

MF = $C_{10}H_{14}O_2$





Proton NMR



Carbon 13 NMR