Name: ___________________________  ID#: ___________________________

Signature: ________________________

- Write your name on every page.
- The exam is 5 pages long (not including this one). Please make sure you have all of the pages.
- Write complete but succinct answers. Good Luck!

Question 1 (20 pts): ___________

Question 2 (20 pts): ___________

Question 3 (20 pts): ___________

Question 4 (20 pts): ___________

Question 5 (20 pts): ___________

Total (100 pts): ___________
1. (10 pts) Consider the following molecules. Put a circle around those you would expect to have significant aromatic character, and a big X through those that you would expect to have significant antiaromatic character. Underline any that you would expect to be simply non-aromatic.

![Molecules](image)

b. (10 pts) Would you expect the illustrated compound to display the properties of an aromatic, antiaromatic, or non-aromatic molecule? Explain briefly and concisely using clear drawings where appropriate. Remember! Orientation matters....
2. Predict the major product, if any, of the following reactions:

a. (7 pts)
\[
\begin{array}{c}
\text{1. SO}_3\cdot\text{H}_2\text{SO}_4 \\
\text{2. Br}_2, \text{FeBr}_3 \\
\text{3. H}_3\text{O}^+ \\
\end{array}
\]

b. (7 pts)
\[
\begin{array}{c}
\text{H}^+ \\
\end{array}
\]

c. (6 pts)
\[
\begin{array}{c}
\text{SbCl}_5 \\
\text{(Abstracts Cl}^-\text{)} \\
\end{array}
\]
3. Provide detailed mechanisms for the following transformations:

a. (10 pts)

\[
\begin{align*}
\text{Cl} & \quad \text{AlCl}_3 \\
& \quad \rightarrow
\end{align*}
\]

b. (10 pts) For this one, you must also explain with clear drawings why the \textit{para} isomer is the major product.

\[
\begin{align*}
& \quad \text{E}^+ \\
& \quad \rightarrow
\end{align*}
\]
4. a. (10 pts) Predict the major product of the following reaction. Would you expect the BMe₂ group to be an activator or a deactivator? A meta director, or an ortho/para director? Justify your answer with clear drawings.

\[ \text{BMe}_2 \text{Me} \xrightarrow{E^+} \]

b. (10 pts) It is well-known that anthracene can act as a diene in Diels-Alder reactions. Your task is to decide where on the anthracene the reaction takes place. Show the product of this Diels-Alder reaction, and explain why the reaction takes place at that position of the anthracene.

\[ \text{Anthracene} + \text{CC}_2\text{Me} \xrightarrow{\Delta} \]

**Resonance Energy**

<table>
<thead>
<tr>
<th>Compound</th>
<th>Energy (kcal/mol)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene</td>
<td>36</td>
</tr>
<tr>
<td>Naphthalene</td>
<td>61</td>
</tr>
<tr>
<td>Anthracene</td>
<td>84</td>
</tr>
</tbody>
</table>
5. Propose syntheses of the following compounds from benzene and any other reagents you need.

a. (10 pts)

\[
\begin{array}{c}
 \text{Me} \\
\text{Me} \\
\end{array}
\]

\[
\begin{array}{c}
 \text{NH}_2 \\
\end{array}
\]

b. (10 pts)

\[
\begin{array}{c}
 \text{Br} \\
\text{Br} \\
\text{Me} \\
\end{array}
\]

\[
\begin{array}{c}
 \text{Br} \\
\text{Br} \\
\text{Br} \\
\end{array}
\]

\[
\begin{array}{c}
 \text{NH}_2 \\
\end{array}
\]