CHE 232 - Organic Chemistry
Exam 3, April 4, 2001

Name____________________    Student ID No.____________________

**Before you begin this exam:** First: You are allowed to have a simple model set at your seat. Please put away all other materials. Second: Place your student identification on your desk. A proctor will come around to check everyone’s ID. Third: Read through the entire exam. Your goal, as always, is to score as many points as possible. Do not waste time on problems that you can’t do if there are others that look easy. Fourth: It is critically important that your answers be written in a clear, unambiguous manner. Answers in which your intentions are unclear will not receive credit. Fifth: **READ THE INSTRUCTIONS FOR EACH PROBLEM.**

You have until 6:50 to complete this exam. There will be no extensions, so budget your time carefully.

<table>
<thead>
<tr>
<th>Problem Number</th>
<th>Points possible</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td></td>
</tr>
</tbody>
</table>

According to my records, you scored _______ on your first exam, _______ on the problem set, and _______ on your second exam. If these records are in error, see me immediately.
1. (8 points) Name the circled functional groups.

![Functional groups](image)

2. (4 points) How many different monochlorination products will result from the radical chlorination of 2-methylbutane? (circle the answer)

\[ \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3 \xrightarrow{\text{Cl}_2, \text{hv}} \]

a) 1  

b) 2  

c) 3  

d) 4  

e) 5

3. (30 points) Draw the products expected from the following reactions. If you believe that 2 isomers will result (like ortho and para), show both.

a) \[ \text{C}_6\text{H}_2\text{NO}_2 \xrightarrow{\text{NBS, AIBN}} \]

b) \[ \text{C}_6\text{H}_3\text{NH}_2 \xrightarrow{1. \text{NaNO}_2, \text{HCl}, 2. \text{CuI}} \]

c) \[ \text{C}_6\text{H}_3\text{C}_2\text{H}_3 \xrightarrow{1. \text{KMnO}_4, \text{KOH}, 2. \text{H}_3\text{O}^+ (\text{to neutralize})} \]
4. (20 points) Fill in the boxes (reagents or products) shown in the synthesis of 3-chlorophenol.
5. (8 points) Circle the most likely product from the reaction below

![Reaction Diagram]

6. (10 points) Explain why the E, E isomer of 2,4-hexadiene is a much better Diels-Alder diene than the Z, Z isomer. DO NOT EXCEED THE SPACE PROVIDED.
Note: Pictures often help a great deal.

![Structural Diagrams]
7. (10 points) Draw a viable mechanism for the formation of chloromethane from methane and Cl\(_2\). Be sure that you use mechanistic arrows properly in each step of this reaction. NOTE: Draw the initiation and propagation steps, and only one termination step.

\[
\text{CH}_4 + \text{Cl}_2 \xrightarrow{h\nu} \text{CH}_3\text{Cl} + \text{HCl}
\]
8. (10 points) Show how the compound below can be made from benzene and any other reagents of 4 carbons or less. Note: A retrosynthetic analysis may be very helpful.

END OF EXAM
SCRATCH PAPER