1. (5 points) Provide the IUPAC name for these compounds.

   ![Compound Images]

2. (4 points) Draw the structures of these compounds:
   - ortho-bromoaniline
   - meta-nitrotoluene

3. (4 points) Circle the molecule(s) that is/are aromatic.

   ![Aromaticity Images]

4. (4 points) a. Draw the $\pi$-orbital energy diagram for this molecule. Show the ground state electronic configuration.

   ![Pi Orbital Energy Diagram]

   b. Is the ion aromatic? __________

5. (4 points total) a. Identify the reactant and product as aromatic, non-aromatic, or antiaromatic.

   ![Reaction Images]

   b. State whether the reaction is favorable, normal, or unfavorable and explain.

6. (4 points) Draw in the arrows that would show how electrons move to form the next resonance forms.

   ![Resonance Images]
7. (6 points) Draw all arrows and the first 2 resonance forms.

8. (8 points) Predict the product(s) of these reactions, including stereochemistry where appropriate. If nothing occurs, write “no reaction”.

9. (11 points) Provide the correct reagents and intermediate structure(s) to complete the reaction schemes.
10. What is the IUPAC name of these compounds? (5 pts)

2. Draw: (3 pts)

\[ \text{m-ethylstyrene} \]

(a) \[ \text{[Structure]} \]

(b) \[ \text{[Structure]} \]

11. Circle the molecule(s) that is/are aromatic. Unshared pairs are not shown. For the molecule(s) that is/are not aromatic, explain why. (6 pts)

12. Draw the \( \pi \) orbital energy diagram for this molecule. Show the ground state electronic configuration. Is the molecule aromatic? Why? (6 pts)

13. Complete these sentences for benzene: (6 pts)

a. Benzene is more likely to undergo (addition substitution) reactions compared to alkenes.

b. The length(s) of the C-C bonds in benzene are \[ \text{[Value]} \] compared to \( \text{CH}_2=\text{CH}_2 \).

c. When reduced to cyclohexane, benzene releases (more less) energy than expected.
14. Complete these reactions. (8 pts)

\[
\begin{align*}
\text{Na, CH}_3\text{OH, NH}_3 & \quad & \text{Na, CH}_3\text{OH, NH}_3 \\
\end{align*}
\]

15. Pyrrole is a weak base. Draw an equation that shows this unfavorable reaction, and explain. Be sure to describe the reactant(s) and product(s) in terms of aromaticity, non-aromaticity, and/or antiaromaticity (6 pts).

\[
\text{pyrrole}
\]

16. Propose a synthesis of benzaldehyde from ethylbenzene. (6 pts)

17. Draw a resonance structure having localized bonds for this molecule. How many pi electrons are present? (4 pts)
18. Name the following compound (6 points):

![Chemical structures]

19. Draw structures of the following compounds (6 points):
   a) 2-chloro-4-ethylaniline
   b) p-nitrobenzoic acid

20. Which of the following compounds will react with Br₂ solution and decolorize it (4 points)?

![Chemical structures]

21. Circle any structure below that is aromatic (6 points).

![Chemical structures]

22. Draw a π-orbital energy level diagram for this anion (4 points).

![Chemical structure]
23. Draw a resonance structure of the following compound that would have localized bonds. How many π-electrons does this system have? (4 points):

![Resonance structures](image)

24. Which of the following compounds is more acidic and why (7 points). Support your answer with chemical structures/equations and/or use complete sentences for your explanation, which would not make me wonder what you actually meant.

![Structures](image)

25. Which nitrogen atom in the following structure is the least nucleophilic (least basic) and why (5 points)?

![Structure](image)

26. Predict product(s) of the following reactions (8 points):

![Reactions](image)
27. Name these compounds: (9 pts)

(a) \[
\begin{array}{c}
\text{HO} \\
\end{array}
\]
(b) \[
\begin{array}{c}
\text{SO}_3\text{H} \\
\end{array}
\]
(c) \[
\begin{array}{c}
\text{NH}_2 \\
\end{array}
\]

28. Draw the structures of these compounds: (9 pts)
(a) ortho-chlorobenzaldehyde  
(b) aniline  
(c) Benzylalcohol

29. Circle the molecule(s) that is/are aromatic. All unshared pairs are shown. (4 pts)

(a) \[
\begin{array}{c}
\text{C} \\
\text{C} \\
\text{C} \\
\text{C} \\
\text{C} \\
\end{array}
\]
(b) \[
\begin{array}{c}
\text{C} \\
\end{array}
\]
(c) \[
\begin{array}{c}
\text{H} \\
\end{array}
\]

30. How many p electrons are present in the molecule and is it aromatic? (4 pts)

(a) \[
\begin{array}{c}
\text{C} \\
\text{C} \\
\text{C} \\
\text{C} \\
\text{C} \\
\end{array}
\]

31. Identify the reactant and product as: aromatic, nonaromatic, or antiaromatic. Indicate if the reaction is especially favorable, normal, or especially unfavorable. (6 pts)

(a) \[
\begin{array}{c}
\text{Cl} \\
\text{Cl} \\
\text{Cl} \\
\text{Cl} \\
\end{array}
\]
(b) \[
\begin{array}{c}
\text{C} \\
\end{array}
\]

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

KOH\text{Bu}  
heat  
\[
\begin{array}{c}
\text{C} \\
\end{array}
\]

32. Predict the product of this reaction. (9 pts)

a) \[
\begin{array}{c}
\text{K}_2\text{Cr}_2\text{O}_7
\end{array}
\]

b) \[
\begin{array}{c}
\text{NBS}
\end{array}
\]

c) \[
\begin{array}{c}
\text{Pt, 25}^\circ\text{C}
\end{array}
\]

33. Propose a synthesis for the following transformation (6 pts)

34. Draw a resonance structure having localized bonds for this molecule. How many pi electrons are present? (5 pts)