Solve the following problems in the space provided. You have a maximum of 55 minutes to complete this closed book, closed notes exam. You must turn in the exam at the completion of 55 minutes. Write down what you do know to ensure some credit. Budget your time according to the point value of the problem. It is better to do most of an exam well than all of it poorly.

1. Write IUPAC names for the following structures (18 points)

   a. 3-(1-chloropropyl)-2-(3-methylpropyl)-indole

   b. 3-bromo-3-chloro-6-oxo-7-(2-oxo-3-methyl)-7-octenoic acid

2. Which of the following statements is (are- it is possible that there is more than one correct answer) true when the outcome of a reaction is governed by thermodynamics. (8 points)

   a. The product that dominates (major product) is the one that has the lowest activation barrier to formation.
   b. There is enough energy in the system for the kinetic product to revert to starting material.
   c. The reaction is an equilibrium.
   d. Over time, the concentration of the lowest energy product increases due to the high activation barrier involved in the reverse reaction.
   e. The reaction is irreversible.
   f. The outcome of the reaction if there is enough energy and time is that the percentages of products and starting materials reflect their inherent stabilities.

   The correct answers are b, c, d, f if the reaction is truly at equilibrium.

3. Which of the following molecular orbital diagrams best represents the LUMO of 2,3-dimethyl-1,3-cyclohexadiene. (6 points)

   The correct answer was the one that was the LUMO of butadiene

   A diene is a diene, even in a ring
Write major products for six of the following seven reactions. You do not need to include mechanism here. If you do not believe a reaction is possible, write “no reaction”. Be sure to include stereochemistry where it is relevant.

Choose a reaction that is an oxidation and assign oxidation states to the carbons undergoing the transition (bonus six points)(36 points)

a. 

![Chemical structure image]

this compound is not chiral

b. 

![Chemical structure image]

assume reagents in excess

c. 

![Chemical structure image]

This molecule is not chiral

assume reagents in excess

d. 

![Chemical structure image]

e. 

![Chemical structure image]
4. Write complete mechanisms (arrow formalism), leading to reasonable products for two of the following three reactions. Be sure to include stereochemistry and intermediates where appropriate. If you do not believe a reaction is possible, write "no reaction". (48 points, 16 points each)
Products from
Second Mech

\[ \text{Br} + \text{MI} \quad \text{High energy prod} \quad \text{Br} \]

\[ \text{Thermo} \]

Which are same?

NAME them

All conjugated \( \text{w one trisub} \)
6. Outline a synthesis of each of the following molecules from the given starting materials and any other needed reagents. (24 points)

a. starting material

\[ \text{starting material} \rightarrow \text{target molecule} \]

\[ \text{starting material} + \text{Br}_2 \xrightleftharpoons{h_\nu} \text{target molecule} \]

\[ \text{starting material} + 2\text{NaOH} \rightarrow \text{target molecule} \]

b. target molecules

\[ \text{target molecules} \rightarrow \text{starting materials} \]

\[ \text{starting material} \xrightarrow{\text{NBS} \ \text{h}_\nu} \text{target molecule} \]

\[ \text{starting material} \xrightarrow{\text{Br} \ \text{h}_\nu} \text{target molecule} \]

\[ \text{starting material} \xrightarrow{2,4\text{Li} \ \text{h}_\nu} \text{target molecule} \]

\[ \text{starting material} \xrightarrow{\text{CrO}_3 \ \text{h}_\nu} \text{target molecule} \]

\[ \text{starting material} \xrightarrow{\text{NBS} \ \text{h}_\nu} \text{target molecule} \]

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\[ \text{starting material} \xrightarrow{\text{CrO}_3 \ \text{h}_\nu} \text{target molecule} \]
6. Consider the following compounds. Circle the compounds that meet the criteria for aromaticity. Box the compound that is most likely to absorb electromagnetic radiation in the visible range? (12 points)

the correct answers were.....