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Organic Chemistry II Drill (CHEM2220D).
Module 3. Sample Problems

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2220D – Drill test 3 – Sample problems

1. Draw an example of a cumulated diene. Will it absorb light > 200 nm? (4 pts)

   absorb > 200 nm? __________

2. Draw all significant resonance structures for the cation shown here. Circle the most important structure. (4 pts)

   ![Resonance Structures](image)

3. Arrange these radicals by stability, 1 = most stable. (4 pts)

   ![Radicals](image)

   _______   _______   _______   _______

4. Give the IUPAC names for these compounds. You do not need R/S for 4b. (6 pts)

   ![Compounds](image)

   a. ____________________________   b. ____________________________

5. Propose a mechanism for this transformation. (6 pts)

   ![Mechanism](image)
6. Complete these reactions: (12 pts)

a. 

\[ \text{\begin{align*} \text{HBr} & \rightarrow \text{Br} \text{ + enantiomer} \\ \end{align*}} \]

b. 

\[ \text{heat} \rightarrow \text{**show stereochem**} \]

c. 

\[ \text{HCl, heat (1 mole)} \]

7. Propose syntheses: (12 pts)

a. 

from cyclopentene

b. 

from

8. Which of these dienes will react fastest with 1,1-dichloroethene in a Diels-Alder rxn? (2 pts)
9. (11 points) Predict the product(s) of these reactions. Indicate stereocenters with an asterisk (*). If nothing occurs, write “no reaction”.

- \( \text{Br}_2 \) light

- \( \text{Br}_2 \) cold, dark

- NBS light

- high heat

- a pericyclic reaction

- heat

10. (4 points) Arrange conjugated systems by stability, with the most stable = 1.

11. (4 points) Arrange these dienes based on their Diels-Alder reactivity with the dienophile maleic anhydride, with the most reactive = 1.
12. (6 points) Provide the correct two starting materials (diene and dienophile) for each Diels Alder product.

\[
\begin{align*}
\text{CH}_2\text{CHO} + \text{CH}_2\text{CHO} & \rightarrow \text{product} \\
\text{H}_3\text{C} - \text{CN} + \text{CN} & \rightarrow \text{product}
\end{align*}
\]

13. (10 points total) A. Propose a mechanism for the formation of the product. You **must** show all arrows and intermediates to receive full credit.

\[
\begin{align*}
\text{H}_3\text{C} & \overset{H\text{O}^-\text{H}}{\rightarrow} \text{product} \\
\text{H}_3\text{C} & \overset{H\text{O}^-\text{H}}{\rightarrow} \text{product}
\end{align*}
\]

B. Is the reaction above most likely to occur with heat or low temperature?

14. (9 points) A. Propose a mechanism for the formation of the product. You **must** show all arrows and intermediates to receive full credit.

\[
\begin{align*}
\text{HBr} & \rightarrow \text{product} \\
\text{HBr} & \rightarrow \text{product}
\end{align*}
\]
B. Is the reaction above most likely to occur with heat or low temperature?

15. In the following series of compounds label the kinetic product of electrophilic addition of HCl to 1,3-butadiene, and a thermodynamic product (3 points)?

\[
\begin{align*}
&\text{CH}_3\text{CH}=\text{CHCH}_2\text{Cl} &\text{CH}_3\text{CH}=\text{CCH}_3 &\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl} &\text{CH}_3\text{CHCH}=\text{CH}_2 \\
&\text{Cl} & & & \\
&\text{Cl}
\end{align*}
\]

16. Draw all the resonance structures of the following anion (4 points).

\[
\text{NH}
\]

17. Name the following compound (2 points):

\[
\text{Cyclic structure}
\]

18. Draw the following structures (6 pts): a) \((2\ E, 5\ Z)\)-3,6-dimethyl-2,5-octadiene  
   b) 1,4-diethyl-9-methyl bicyclo [3.3.2] decane

19. Give the structure of the major organic product or products expected from the following reactions. “No reaction” might be an appropriate answer in some cases. Show the stereochemistry of the products if applicable. (5 points each)
20. Give a short, efficient synthesis of the target compound from the indicated starting material and any other needed reagents (7 points).

\[ \text{HO} \quad \text{from} \quad \text{pentadiene} \]

21. Which of the following will absorb the light of the lowest energy? Circle it (2 pts).

22. Provide a reasonable mechanism for the following reaction (6 points):

\[ \text{pentadiene} + \text{Cl}_2 \xrightarrow{\text{light}} \text{Cl} - \text{pentadiene} + \text{H-Cl} \]
23. Arrange these dienes by stability, 1 = most stable. Circle the one that absorbs > 200nm. (6 pts)

24. Draw all major resonance form(s). (4 pts)

25. Predict the product(s) of these reactions: (12 pts)
   a) Identify the major and minor product formed in the following reaction.

   b)  

   c)  

26. Circle the dienes that will NOT undergo Diels-Alder reaction (4 pts)
27. Draw all the products that will be formed in the following reaction (Indicate which product is major). (8 pts)

\[ \text{products} \]

28. Propose syntheses: (12 pts)
   a) 
   
   \[ \text{products} \]

   From

   \[ \text{starting chemicals} \]

   b) Propose the starting chemicals for the Diels-Alder synthesis of this compound.
29. Arrange these dienophiles based on their Diels-Alder reactivity with 1,3-cyclopentadiene, #1 = most reactive. Explain your answer. (4 pts)