1 Write the systematic name of these compounds.

![化合物图示]

2 Rank in order of CIP priority (1 = highest): 1-propenyl; 2-propenyl; 1,2-propadienyl; 1,1-dimethylethyl.

3 How many stereoisomers of 5-chloro-1,3,6-octatriene are possible?

4 An alkene C\textsubscript{12}H\textsubscript{24} is treated with O\textsubscript{3} followed by H\textsubscript{2}O\textsubscript{2} to afford a single organic product (NMR: δ 1.1 (3H s), δ 2.1 (1H s); IR: 2950 cm\textsuperscript{-1}, 1710 cm\textsuperscript{-1}). Propose a reasonable structure for C\textsubscript{12}H\textsubscript{24}.

5 Rank in order of rate of hydrohalogenation (1 = fastest): trans-2-butene; cis-2-butene; 2-methyl-2-butene; ethene.
6 Propose efficient syntheses of the molecules shown below. Allowed starting materials are
- an alkene containing six or fewer carbons
- compounds containing six or fewer carbons and only one of the following functional groups: C==C, C=C, CH, Br, Cl, NH₂, CHO, C=O, CO₂Me or CN
- benzene or benzene substituted with only one of the following functional groups: CH₃, CH Br, Cl, NH₂, CHO, CO₂Me or CN
- the two carbon epoxide oxacyclopropane ((CH₂)₂O)
- any inorganic reagent

a  1, 6-hexanediol  
```
Me
D
```

b  2-(2-methoxycyclohexyl)-2-propanol

c  2-pentoxy pentane

d  2-pentoxy pentane

e  meso-2, 3-di bromobutane  

f  cis-1, 2-di methoxycyclohexane

```
D  D  Me
Me
H  Me  H
```

g  t

h  HD₂C-CH₂CO

i  CH

j  1-bromo-3-methoxybutane

7 How many products result when (R)-3-methyl-1-cyclohexene is subjected to hydroboration-oxidation ((1) BH₃, ether (2) H₂O₂, NaOH(aq))? What is the major product?

8 Present reasonable electron-pushing mechanisms.

a
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+ Br₂ → 
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+ HBr
c. When (R)-3-bromo-3-methyl cyclohexene is treated with HBr, the sole product is (1S, 2S)-1, 2-di bromo-1-methyl cyclohexane.

9. What is the stereochemical outcome of the reaction of the following reagents with cyclopentene? Is the product a single achiral compound or a racemic mixture of enantiomers? If the product is achiral, state whether it is a meso compound.

a. HCl  
b. Br₂  
c. (1) OsO₄ (2) H₂O₂  
d. (1) mCPBA (2) LiAlH₄ (3) H₂O  
e. (1) CF₃CO₂H (2) H₂O⁺

10. Each of the following molecules reacts with BH₃ followed by treatment with alkaline aqueous H₂O₂. Draw the structure of the product, clearly showing stereochemistry.
11. When (E)-3-methyl-2-pentene undergoes bromination with Br₂, the product of anti addition constitutes 100% of the product mixture:

\[
\begin{align*}
\text{anti addition product} & \quad \quad \quad \quad \quad \quad \quad 100\% \\
\end{align*}
\]

In contrast, when ((E)-1-propenyl)benzene undergoes bromination under the same conditions, the product of anti addition constitutes only 88% of the product mixture, the remaining 12% being the products of syn addition:

\[
\begin{align*}
\text{anti addition product} & \quad \quad \quad \quad \quad \quad \quad 88\% \\
\text{syn addition product} & \quad \quad \quad \quad \quad \quad \quad 12\%
\end{align*}
\]

Explain why syn addition products are observed in the latter reaction.
**Answers**

1a (3E, 7Z) - 7, 8-di chloro-2-nethyl-1, 3, 7-nonatriene
1b (3Z, 5Z) - 4-cyclooctyl-3-(1-nethyl ethyl)-1,3, 5-heptatriene
1c 1-nitro-4-((E)-1,1,3-trimethyl-2-pentenyl) benzene
1d (2S, 5E) - 6-chloro-5-hexen-2-ol
1e 3, 4, 4-trimethyl-1-cyclohexene
1f 7, 9-di nethyl-1, 5-cyclononadiene

2 1, 1-di nethyl ethyl > 1,2-propadienyl > 1-propenyl > 2-propenyl

3 eight

4 2, 2, 3, 4, 5, 5-hexamethyl-3-hexene

5 2-methyl-2-butene > cis-2-butene > trans-2-butene > ethene

6 Alternative syntheses are possible in some cases.

6a From cyclohexene: (1) O₃
(2) NaBH₄
6b From cyclohexene: (1) Br₂, MeCH (2) Mg, ether (3) CH₃COCH₃
(4) H₂O²⁻
6c From 1-nethyl cyclobutene: (1) BD₃, ether (2) H₂O₂, NaOH(aq)
(3) NaH (4) 1-bromopropane
6d From 1-pentene: (1) nCPBA (2) 1-propanol, H⁺
6e From trans-2-butene: Br₂
6f From cyclohexene: (1) OsO₄ (2) H₂O₂ (aq) (3) NaH (2 mol) (4) CH₃I (2 mol)
6g From trans-2-butene: D₂, Pd
6h From 1-nethyl cyclopentene: (1) O₃ (2) H₂O₂
6i From cyclohexene: (1) RCO₂H (2) MeMgI
(3) H₂O⁺
6j From 2-methyl-2-butene: (1) Br₂, CH₃CH (2) tert-BuOK (3) HBr, peroxides

7 Four: (1R, 3R)-3-methyl-1-cyclohexanol (major), (1S, 3R)-3-methyl-1-cyclohexanol, (1R, 2R)-2-methyl-1-cyclohexanol, (1S, 2R)-2-methyl-1-cyclohexanol

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**8a**

\[
\begin{align*}
\text{HN} \quad \text{Br} & \rightarrow \quad \text{HN} \quad \text{Br} \\
\text{H} & \rightarrow \quad \text{H} \\
\text{Br} & \rightarrow \quad \text{Br} \\
\text{Br} & \rightarrow \quad \text{Br} \\
\end{align*}
\]

**8b**

\[
\begin{align*}
\text{H} & \rightarrow \quad \text{H} \\
\text{H} & \rightarrow \quad \text{H} \\
\text{H} & \rightarrow \quad \text{H} \\
\text{H} & \rightarrow \quad \text{H} \\
\text{H} & \rightarrow \quad \text{H} \\
\end{align*}
\]

**8c**

\[
\begin{align*}
\text{Br} & \rightarrow \quad \text{Br} \\
\text{Br} & \rightarrow \quad \text{Br} \\
\text{Br} & \rightarrow \quad \text{Br} \\
\text{Br} & \rightarrow \quad \text{Br} \\
\end{align*}
\]
Problem set 5-6

8d

9a achiral (not meso) 9b racemic mixture 9c meso 9d achiral 9e racemic mixture

10a 10b

11 (E)-1-propenyl)benzene forms a resonance-stabilized carbocation intermediate that can be captured by Br⁻ from "above" or "below" (i.e., the Re or Si face); (E)-3-methyl-2-pentene cannot form a resonance-stabilized carbocation and, hence, cannot undergo syn addition.

anti addition addition from "below": anti addition from "above": syn

Problem set 5-6