Final Review

The final IS cumulative so make sure to review old concepts as well. This packet will only cover Chapters 13-15.

Ch. 13 Important Concepts
- Half Headed arrows
- Understand use of peroxides in radical reactions
- Radical halogenation of alkane mechanism
  - Initiation, propagation, termination
- Reactivity of CH bonds
- Chlorination versus Bromination
- Stereochemistry of halogenation
- Radical halogenation at allylic carbon
  - Stereoselectivity and regioselectivity
  - NBS and $h\nu$ or ROOR
- Radical addition of HX to alkenes
  - Regioselectivity and stereoselectivity
- Understand radical polymerization

Ch. 14 Important Concepts
- Conjugation/delocalization
- Conjugated vs isolated diene
- Common types of resonance
  - Allyl system
  - Conjugated double bonds
  - Cations with positive charge adjacent to lone pair
  - Polarized double bond
- Contribution of resonance structures
  - Octet rule
  - Satisfy electronegativity
  - Identical structures contribute equally
  - Require p orbital overlap
- UV Absorption of conjugated alkenes
- Reactions of Conjugated Dienes
  - Electrophilic addition of HX (2 steps)
  - Diels-Alder reaction initiated by heat

Ch. 15 Important Concepts
- Aromatic, antiaromatic, non-aromatic compounds
- Properties of aromatic compounds
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- Delocalization of electron density
- ΔH° for hydrogenation
- Addition reactions of alkenes

1. What is the major monobromination reaction formed by heating each alkane with Br₂?

a. 

b. \((\text{CH}_3)_3\text{CCH}_2\text{CH(\text{CH}_3)}_2\)

c. 

2. Draw the organic products formed in each reaction.

a. 

b. 

c. 

d. 

3. Draw the products formed in each reaction and include stereochemistry around any stereogenic centers.
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4. Draw a stepwise mechanism for the following reaction.

5. Draw the structure of 4 allylic halides formed when 3-methylcyclohexene undergoes allylic halogenation with NBS + hv

6. What reagents are needed to convert 1-ethylcyclohexane into
   a) 1-bromo-2-ethylcyclohexane; b) 1-bromo-1-ethylcyclohexane;
   c) 1,2-dibromo-1-ethylcyclohexane
7. Devise a synthesis of each compound from cyclopentane and any other organic or inorganic reagents.

a. 

b. 

c. 

8. Draw additional resonance structures for each ion.

a. \[ \text{CH}_2=\text{CH}--\text{CH}--\text{CH}=\text{CH}_2 \]

b. 

c. \[ \text{CH}_3--\text{CH}--\text{Cl} \]

d. 
9. Neuroprotectin D1 (NPD1) is synthesized in the body from highly unsaturated essential fatty acids. NPD1 is a potent natural anti-inflammatory agent.

![NPD1 structure]

a. Label each double bond as conjugated or isolated
b. Label each double bond as E or Z
c. For each conjugated system, label the given conformation as s-cis or s-trans.

10. Label each pair of compounds as stereoisomers or different conformations

a. \[
\begin{array}{c}
\text{\textbf{and}} \\
\end{array}
\]

b. \[
\begin{array}{c}
\text{\textbf{and}} \\
\end{array}
\]

c. \[
\begin{array}{c}
\text{\textbf{and}} \\
\end{array}
\]

11. Treatment of alkenes A and B with HBr gives the same alkyl halide C. Draw a mechanism for each reaction, including all reasonable resonance structures for any intermediate.
12. Draw a stepwise mechanism for the following reaction.

13. The major product formed by addition of HBr to (CH₃)₂C=CH – CH=C(CH₃)₂ is the same at low and high temperature. Draw the structure of the major product and explain why the kinetic and thermodynamic products are the same in this reaction.
14. What diene and dienophile are needed to prepare each Diels–Alder product?

a. [Diagram of diene]

b. [Diagram of diene]

c. [Diagram of dienophile]

d. [Diagram of dienophile]

e. [Diagram of dienophile]

f. [Diagram of dienophile]

15. Draw the product of each Diels-Alder reaction.
16. Select the compound that is best described as:
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(a) A neutral, 4 p-electron, anti-aromatic system
(b) A 6 p-electron, aromatic system
(c) An aromatic system because $n=2$ in the Hückel $4n+2$ rule
(d) A non-aromatic, conjugated 6 p-electron system
(e) A non-conjugated hydrocarbon
(f) Non-aromatic as drawn, but if H- were removed would give an aromatic cation
(g) Non-aromatic as drawn but has an aromatic conjugate base

17. Draw additional resonance structures for each species.
18. Considering both 5-methyl-1,3-cyclopentadiene (A) and 7-methyl-1,3,5-cycloheptatriene (B), which labeled H atom is most acidic? Which labeled H atom is least acidic? Explain your choices.