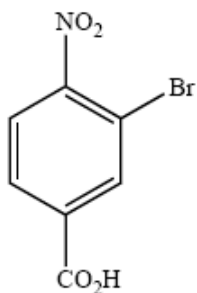
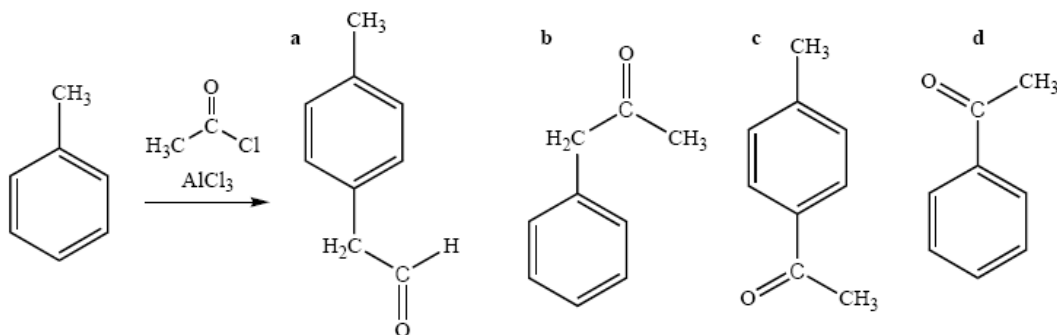


1. What is the IUPAC name of the following compound? (8.2)



2. Which of the following statements is not true about the structure of benzene? (8.4)
- the carbon-carbon bonds are all the same length
  - the structure rapidly transforms between two resonance contributors
  - the structure is an average of two resonance contributors
  - the ring of six carbon atoms is planar
3. Which of the following compounds is aromatic? (8.6)
- ethane
  - cyclobuta-1,3-diene
  - benzene
  - cycloocta-1,3,5,7-tetraene

4. What is the major organic product obtained from the following reaction? (8.9)

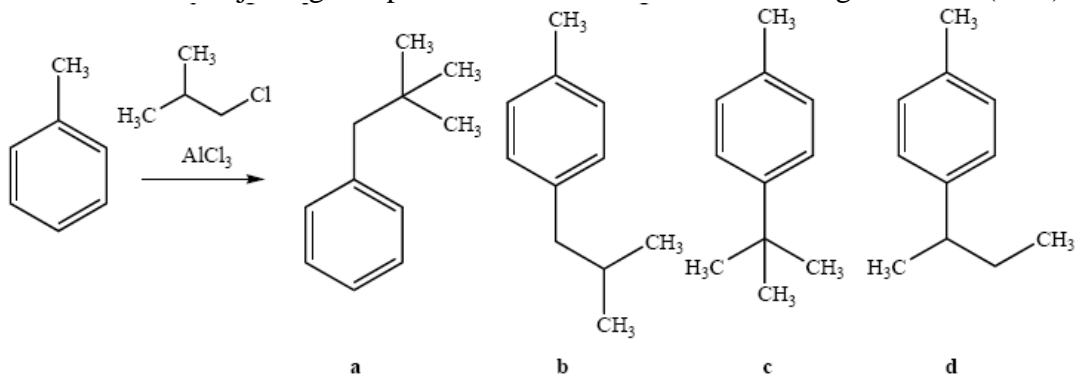


5. Which of the following undergoes the most rapid sulfonation upon treatment with fuming sulfuric acid? (8.11)
- benzene
  - benzoic acid
  - benzonitrile
  - nitrobenzene
6. Which of the following sets of substituents are all ortho/para directing in electrophilic aromatic substitution reactions? (8.13)
- Cl, CH<sub>3</sub>, CN
  - Br, OH, COCH<sub>3</sub>
  - Cl, OH, CH<sub>3</sub>
  - CN, NO<sub>2</sub>, COCH<sub>3</sub>

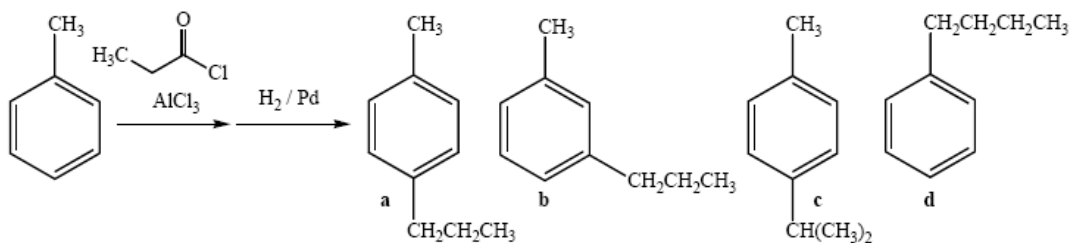
7. Which of the following sets of substituents are all deactivating groups in electrophilic aromatic substitution reactions? (8.15)

- Cl, CN, NO<sub>2</sub>
- Cl, NH<sub>2</sub>, CH<sub>3</sub>
- CH<sub>3</sub>, OCH<sub>3</sub>, COCH<sub>3</sub>
- CH<sub>3</sub>, NH<sub>2</sub>, OCH<sub>3</sub>

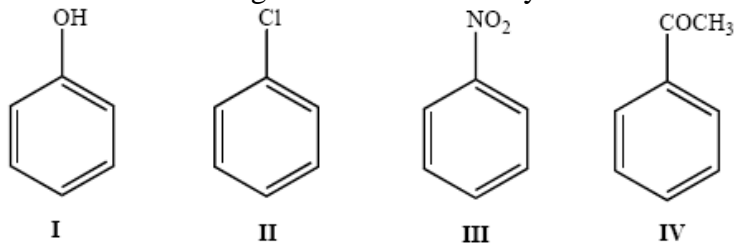
8. What is the major organic product obtained from the following reaction? (8.19)



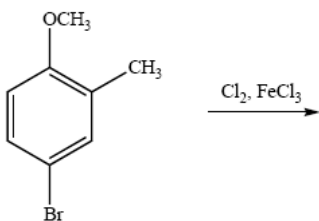
9. What is the major organic product obtained from the following sequence of reactions? (8.23)



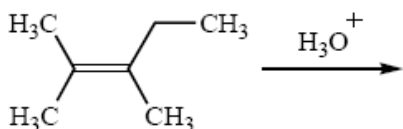
10. Place the following in order of reactivity towards electrophilic aromatic substitution. (8.28)



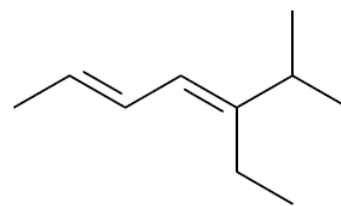
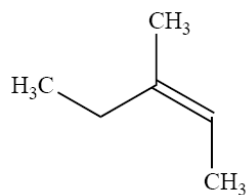
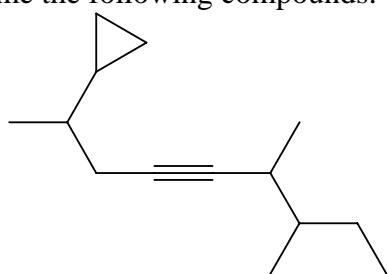
11. Predict the major product of the following reaction: (8.29)



12. Predict the two alcohol addition products obtained by reaction of the following alkene with aqueous acid.



Name the following compounds:



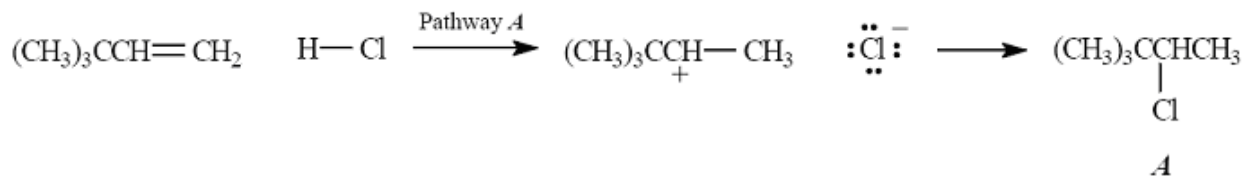
Draw structures corresponding to each name below.

13. (3*E*)-3,7-dimethylocta-1,3,6-triene

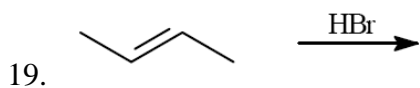
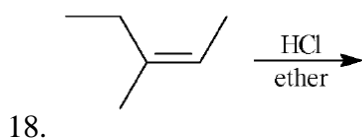
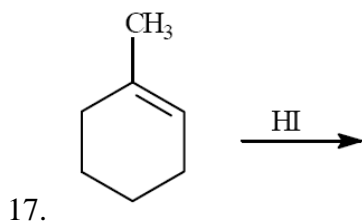
14. *Z*-hex-2-ene

15. *E*-4,4-dimethylpent-2-ene

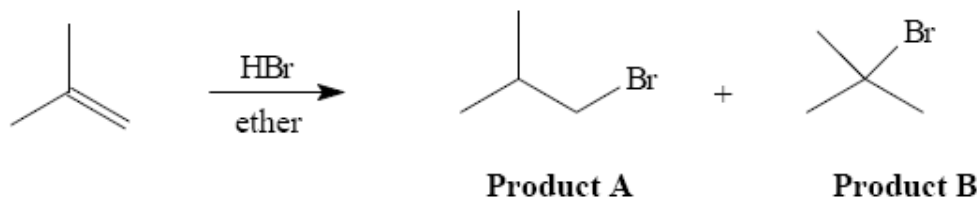
16. Below are all the chemical structures and intermediates involved in a reaction. On the structures provided, show all electron flow using the arrow formalism for the complete stepwise mechanism.



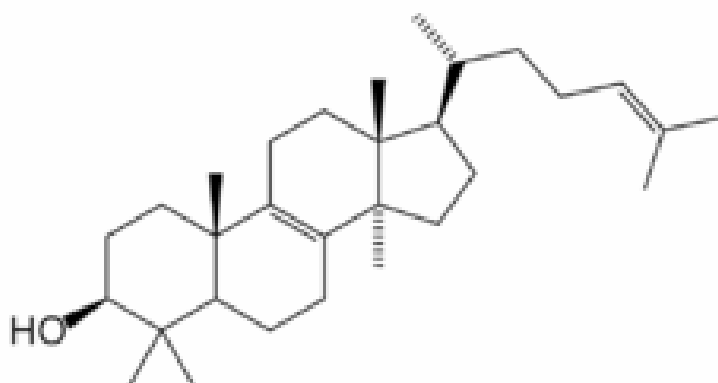
Predict the major organic product(s) in each reaction below. If more than one major organic product is expected, draw each one.



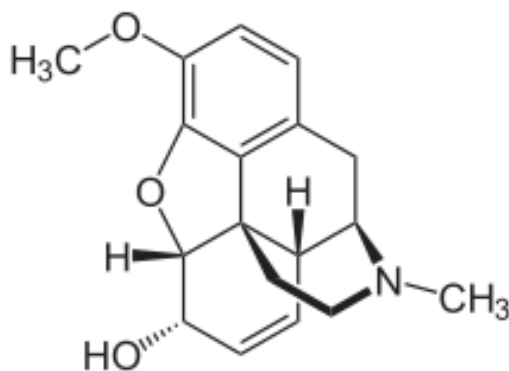
The reaction of 2-methylpropene with HBr in ether gives one of the two products below as the major product. Answer the following questions about this reaction.



20. Which product would be the major product?
21. Which product would be formed via a primary carbocation?
22. Which product would have a higher energy transition state for the formation of the intermediate leading to it?
23. Which product is the non-Markovnikov product?
24. Specify the hybridization of each carbon atom of the organic molecule below.



25. Calculate the degree of unsaturation of the following formula and two possible isomers.
  - a.  $\text{C}_8\text{H}_8$
26. The structure of codeine is given below. Circle and label all of the functional groups and indicate the hybridization of 4 carbon atoms, the nitrogen, and the three oxygens.



27. Draw a Newman projection of the anti conformation of 1-chloro-2-cyclopropylethane.
28. Draw a Newman projection of the gauche conformation of 1-chloro-2-cyclopropylethane.
29. Draw a Newman projection of the *least* stable conformation of 1-chloro-2-cyclopropylethane.

**Note: This exam may not represent all of the possible topics on the Final.**  
**Remember to Review all Previous Quizzes, Worksheets, Homework, Exams**  
**and Practice Exams and look at the topic list in the Final Review**