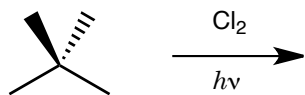


1. (12 pts.) Predict the organic product(s) for the following reactions.

1. _____

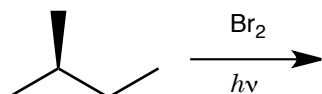
a.



2. _____

3. _____

b.



4. _____

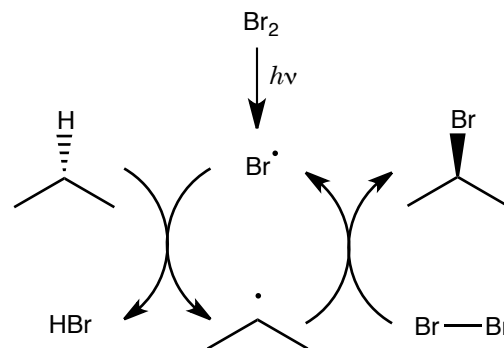
5. _____

6. _____

2. (12 pts.) Radical substitution reactions involve a chain reaction because the reaction of a radical with a non-radical always produces a radical as one of the products; thus, the chain reaction continues. Eventually, the reaction must stop. Draw two reactions that will terminate the radical chain reaction.

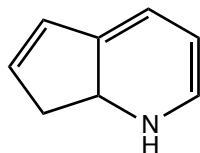
7. _____

8. _____

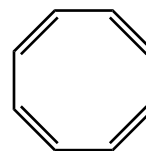


3. (12 pts.) Determine whether the following molecules are aromatic, antiaromatic, or neither.

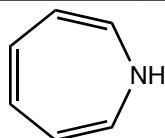
a.



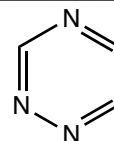
b.



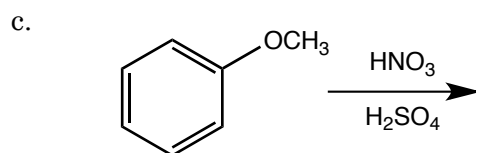
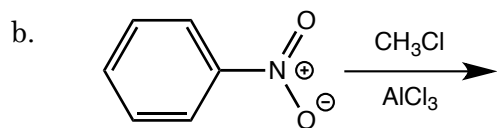
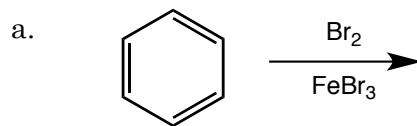
c.



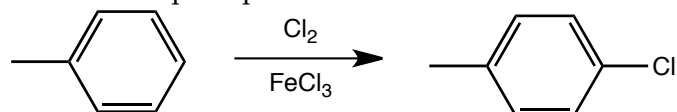
d.



4. (18 pts.) Predict the major product(s) for the following electrophilic aromatic substitution reactions.



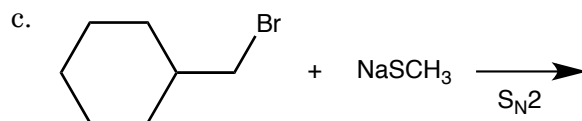
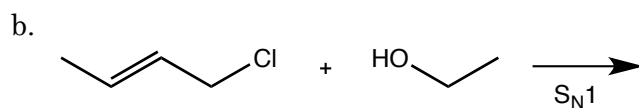
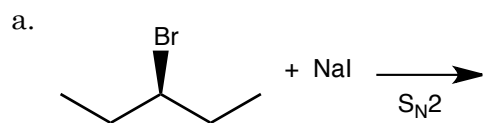
5. The presence of the CH₃ substituent on toluene causes electrophilic aromatic substitution of Cl onto toluene to occur at the ortho and para positions.



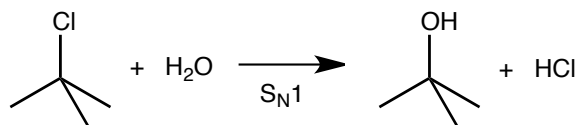
a. (4 pts.) In the drawing above, substitution has occurred at which position (ortho, para, or meta).

b. (10 pts.) Using drawings of the intermediate (and words) explain why substitution at the ortho or para position (pick one) is preferred over substitution at the meta position in this reaction.

6. (18 pts.) Predict the major product(s) for the following reactions.



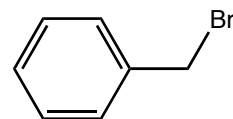
7. (10 pts.) Draw a mechanism for the following S_N1 reaction. Include electron movement arrows.



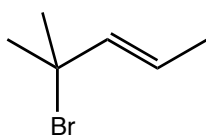
8. (12 pts.) Determine whether the following substrates can react by an S_N1 mechanism, an S_N2 mechanism, or both.



b.



c.



d.

