1. Show all fundamental steps for the mechanism of the following reaction.



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1. Show the reaction coordinate energy diagram for the following reaction with structures for all intermediates and transition states. On the same diagram use arrows up and down to indicate how the diagram would change when the meta product is formed instead. Explain the basis for the changes.

 versus 

1. Unlike methoxybenzene, acetoxybenzene does not readily undergo multiple substitutions. Show the product(s) and explain what factors determine which halogen transfers and the regiochemistry of substitution. Why aren’t there multiple substitutions on the same ester?



1. Show the reaction coordinate energy diagram for the first reaction with structures for all intermediates and transition states. On the same diagram use arrows up and down to indicate how the reaction coordinate diagram (with structures) changes for the second reaction: bromination occurs for nitrobenezene. Explain the basis for the changes.

 versus 

1. (a) Predict favored mono-substitution product(s) for biphenyl. Explain your answer using structures as needed.



(b) A single product is formed in the following reaction. Show the product and Explain.



1. Explain the solvent effect for bromination of phenol.



1. Show the mechanism and product for the following reaction



1. Show the mechanism for the following reaction.



1. Show the mechanism for the following reaction.



1. Show the mechanism of the rearrangement of the following carbon 13 labeled compound.



1. At low temperature only A is formed, but at high temperature both A and B are formed in about equal amounts. (a) Write the mechanism for the formation of both products. Hint: HCl is a product of the first reaction. (b) Explain why A rearranges to B?



1. Ortho/para attack to NO is preferred for bromination of nitrosobenzene. Explain with structures of intermediates.



1. There are three potential chlorine nucleophilic substitution products for the reaction of 3,4-dichloronitrobenzene. One disubstituted and two mono substituted. Only one product is formed. Show the mechanism and explain.
2. Toluene react 605 times faster than benzene with bromine in acetic acid and form 32.9% ortho, 0.3% meta and 66.8% para products. Calculate the partial rate factors.
3. The partial rate factors for chlorination of toluene are 620 (ortho), 5.0 (meta) and 820 (para). Calculate the percent distribution of chlorinated products.
4. The partial rate factors for chlorination of chlorobenzene are 0.1 (ortho), 0.002 (meta) and 0.41 (para). Calculate the percent isomer distribution for chlorination of chlorobenzene.
5. Provide mechanisms for the following. Explain why rearrangement occurs in some cases and not others.









1. Write a mechanism for the following



1. Explain the difference in product distribution for 2-bromotoluene and 2-bromoanisole. Show the mechanisms.

