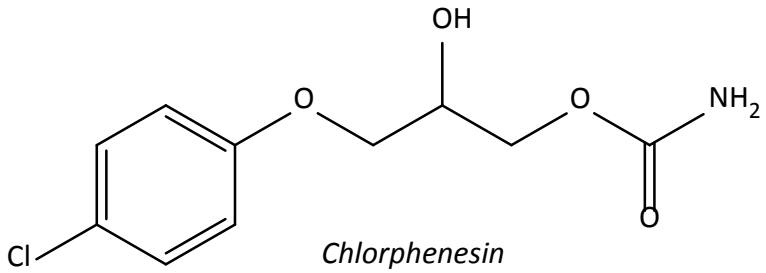
Name:_____ **Lab Section:** _____

1. Chlorphenesin is a muscle relaxant that has a chemical structure similar to guaifenesin. Propose starting materials (alkyl halide, alcohol/phenol) that could be used to prepare chlorphenesin through a Williamson ether synthesis. Draw a mechanism of the Williamson ether synthesis using the starting materials you proposed.(20 points)



Chlorphenesin

Alkyl Halide

Alcohol/Phenol

Mechanism

2. In the synthesis of guaifenesin, 15ml of a 1.33M solution of guaiacol was used. This starting material was reacted with 4ml of a 5.98M solution of 3-chloro-1,2-propanediol. Calculate the number of moles of guaiacol and the number of moles of 3-chloro-1,2-propanediol that were used in the reaction . *Show your work.* Which of these starting materials is the limiting reagent? (15 points)

Guaiacol # of moles: _____

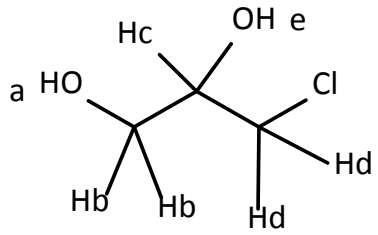
3-Chloro-1,2-propanediol # of moles: _____

The limiting reagent of this reaction is:_____

3. In this reaction, guaiacol is refluxed with NaOH for ten minutes, and then 3-chloro-1,2propanediol is added to the reaction mixture. If 3-chloro-1,2-propanediol is mixed and heated with NaOH first, then very different reaction products are formed. Specifically, 3-chloro-1,2-propanediol undergoes E_2 and SN_2 reactions. Predict the E_2 and SN_2 product(s) that would form when 3-chloro-1,2-propanediol is reacted with NaOH and draw the structures of the products in the spaces provided below. (10 points)

E_2 Product(s)	***SN_2 Product(s)***

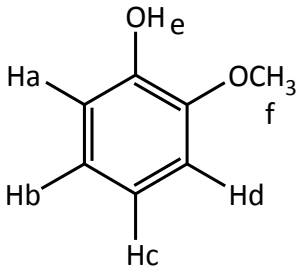
4. Fill in the predicted chemical shift range and multiplicity (singlet, doublet, etc..) for each proton type in the starting materials and product of the reaction in the designated tables below.(30 points)



3-chloro-1,2-propanediol

Proton NMR Spectrum

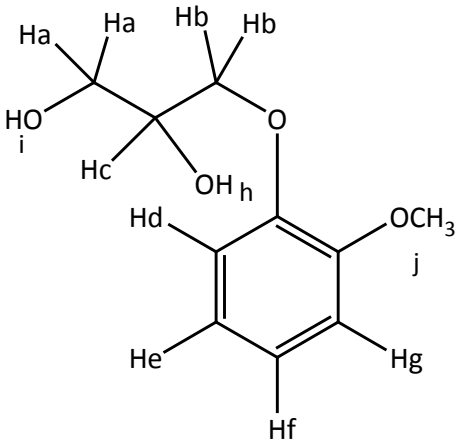
Proton(s)	Chemical Shift (ppm)	Multiplicity (n +1)
Ha		
Hb		
Hc		
Hd		
He		



guaiacol

Proton NMR Spectrum

Proton(s)	Chemical Shift (ppm)	Multiplicity (n +1)
Ha		
Hb		
Hc		
Hd		
He		
Hf		



Guaifenesin

Proton NMR Spectrum

Proton(s)	Chemical Shift (ppm)	Multiplicity (n +1)
Ha		
Hb		
Hc		
Hd		
He		
Hf		
Hg		
Hi		
Hj		