Whittier College

Organic Chemistry: CHEM 231A

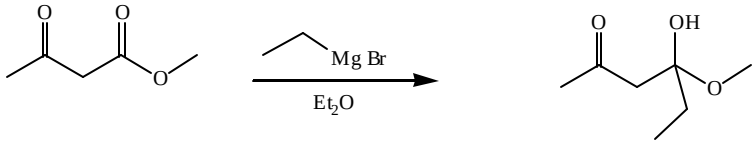
Problem Set #4

40 Points Total

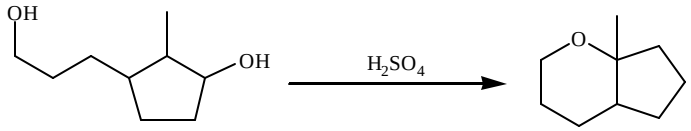
Due at 12:00am on Thursday, November 20

1. Predict whether the following reactions will occur as drawn. Propose a proper product for the reaction if it does not occur as drawn. Explain your rationale: (9 points)

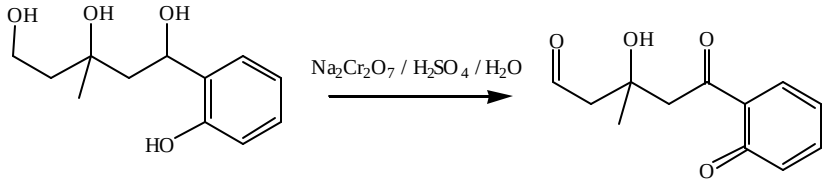
1a.



1b.

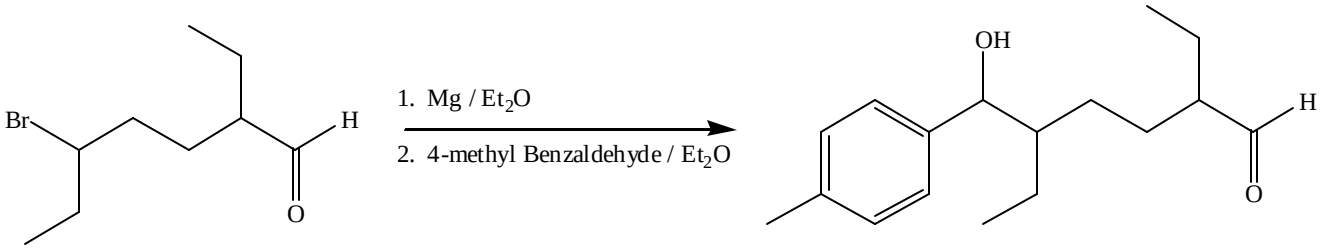


1c.



2. Perform a retrosynthetic analysis and show the best synthesis for 1-methylcyclohexene. The starting material may be any substituted cyclohexanone compound. Each synthetic pathway contains more than two steps. The retrosynthetic analysis must include at least three different synthetic pathways. (11 points = 3 pts for each retro pathway, and 2 pts for depicting the best synthetic pathway)

3. Bob wanted to conduct the following reaction: (8 points)



NMR Data of Product:

Chemical Shift:	**Integration:**	**Coupling:**
0.91 ppm	18 mm	triplet
1.22 ppm	11 mm	quintet
1.25 ppm	12 mm	doublet
1.78 ppm	6 mm	sextet
3.81 ppm	3 mm	triplet

IR Data:

Main peaks:

3545 – 3275 cm-1 (Strong, Broad)

1175 cm –1 (strong)

GC-MSD Data:

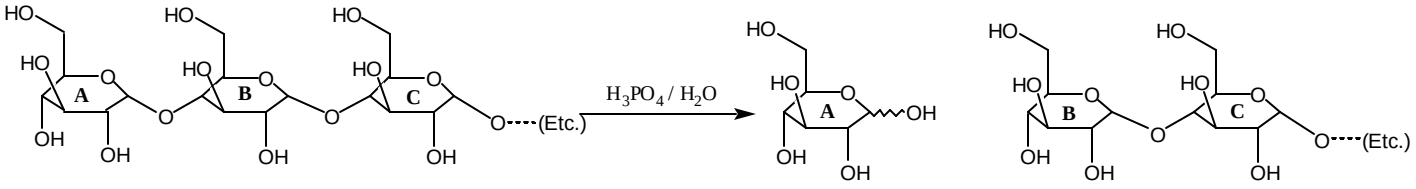
1 main peak in Chromatogram

molecular ion m/z = 142

3a. Based on the experimental data, did he succeed? If not, what product did he form? Explain briefly. (5 points).

3b. After Bob obtained his product from problem 3, he decided he wanted to recrystalize the oil he had. He decided to use dissolve his product in 6 M H_2SO_4. What do you think would happen to his product? (3 pts). Show a mechanism for your predicted product (s).

4. Our bodies use glycogen as way to store glucose, the main source of energy in our bodies. In our bodies, protein enzymes catalyze the formation and decomposition of glycogen. However, when glycogen is placed in phosphoric acid and water, glycogen will break apart to form glucose and a smaller glycogen molecule as is depicted in the reaction below. Consider and explain thoroughly the following questions about this reaction: (6 points)



Glycogen **Glucose** **Glycogen - 1 glucose unit**

4a. What kind of reaction is this? Explain. (1 points)
4b. Why is phosphoric acid required in this reaction? (1 pts)
4c. Draw the mechanism for this reaction (2 pts)
4f. Why does the molecule fragment the way that it does? (Hint: Is there an alternative way that it could fragment? Does the stereochemistry help us see which way it really did fragment? Why did it choose one fragmentation pathway over the other?) (2 points)

5. Both cis- and trans-4-methylcyclohexyl chlorides react with t-butoxide in ethyl acetate to produce 4-methylcyclohexene. However, the cis-isomer reacts more rapidly than the trans-isomer. Draw all pertinent reactions and products. Explain the observed rate data. A mechanism and an energy diagram would be appropriate as part of your answer. (6 points)