Name _____ Test 3 (4/17)

CHEM 0203 (Organic) Spring 2026

1. _____
2. _____
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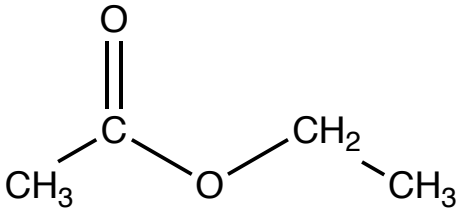
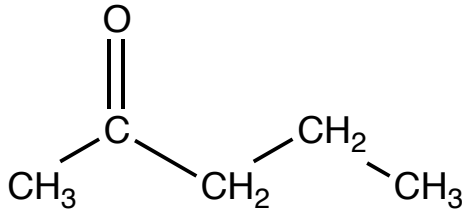
11. _____

1. (10 pts.) Explain why ketones don't undergo nucleophilic acyl substitution but esters do.

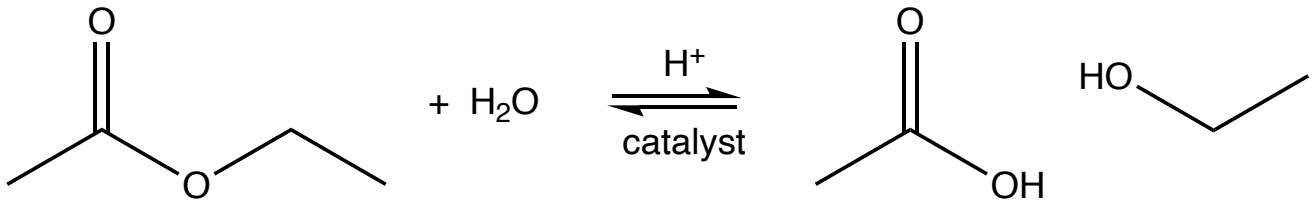


an ester



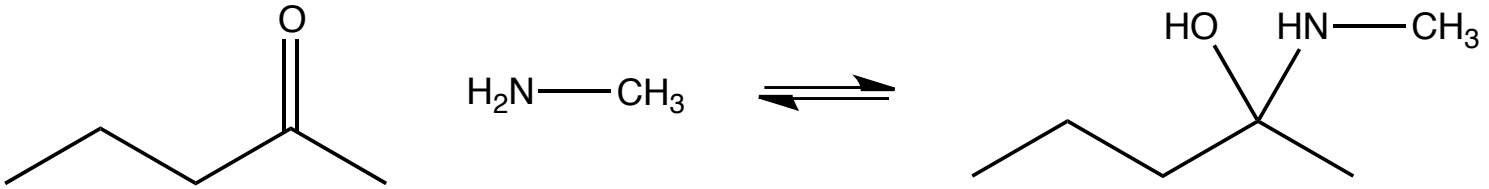
a ketone

2. The rate of hydrolysis of an ester can be increased by adding an H^+ catalyst.



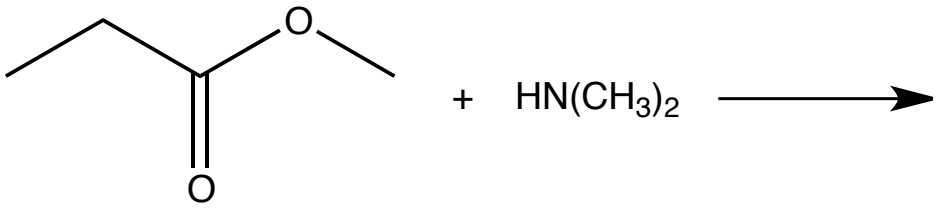
a. (6 pts.) Draw the structure of the protonated reactant that speeds up the reaction and
b. (6 pts.) briefly explain how the catalyst increases the reaction rate.

3. (10 pts.) Draw a mechanism that shows the how the product is formed. Remember to draw the intermediate(s) and electron movement arrows that show bonds breaking and forming.



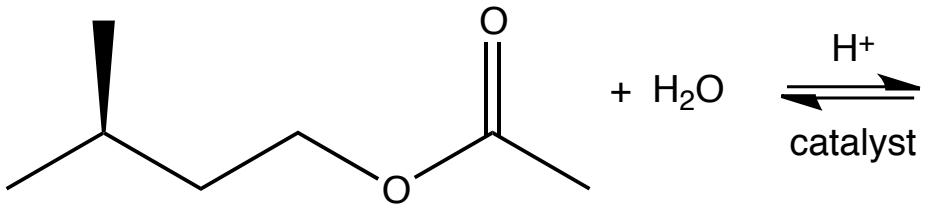
(6 pts. ea.) Predict the products for the following nucleophilic acyl substitution reactions.

4.

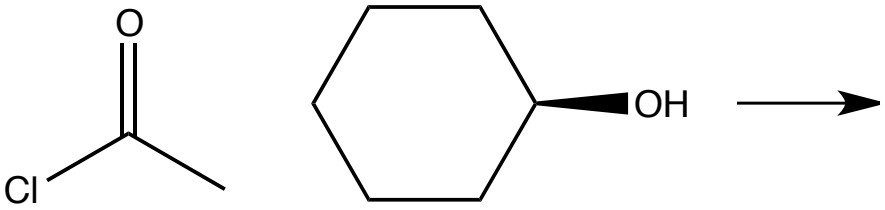


(6 pts. ea.) Predict the products for the following nucleophilic acyl substitution reactions.

5.

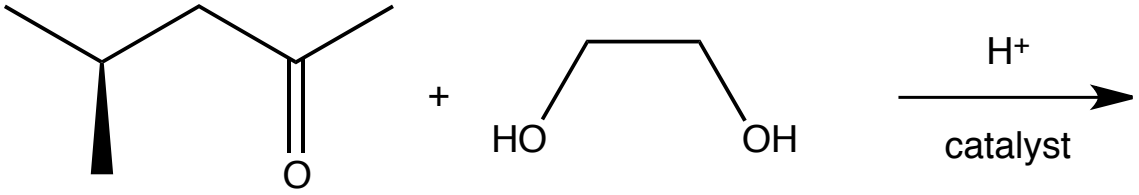


6.



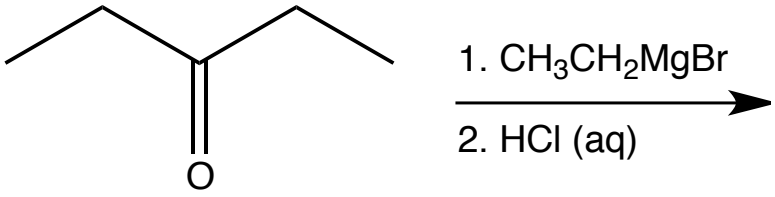
(6 pts. ea.) Predict the outcome of the following reactions.

7.

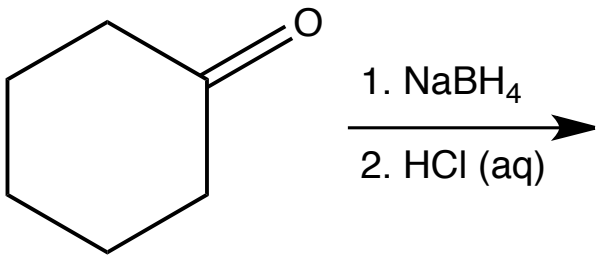


(6 pts. ea.) Predict the outcome of the following reactions.

8.

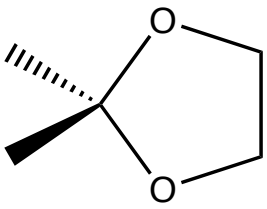


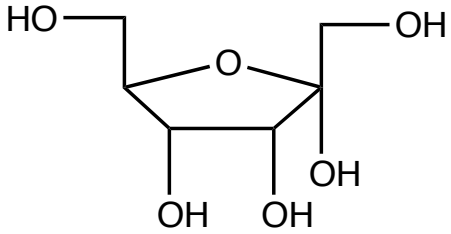
9.

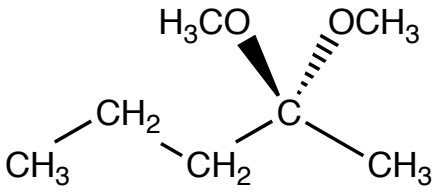


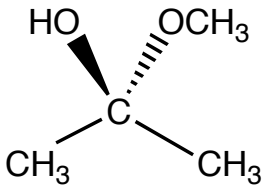
10. (10 pts.) Briefly explain why the carbon in the Grignard reagent CH_3MgBr behaves as a nucleophile.

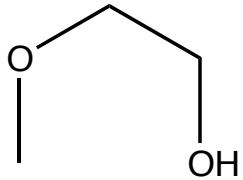
11. (10 pts.) Label the following molecules as acetals/ketals, hemiacetal/hemiketals, or none of the above.



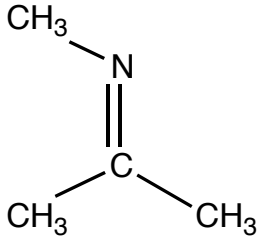




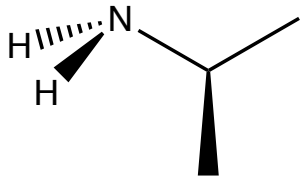


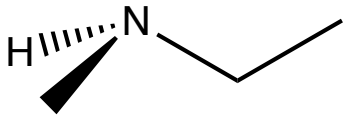


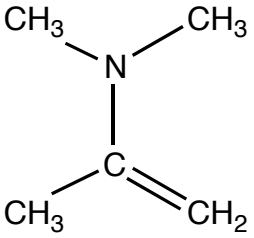
12. Two amines are drawn below. (**a. 6 pts**) Label them as 1° or 2° amines and (**b. 6 pts**) briefly explain why one forms an imine and the other forms an enamine when reacting with ketones or aldehydes. Examples of an imine and an enamine are drawn below.



imine

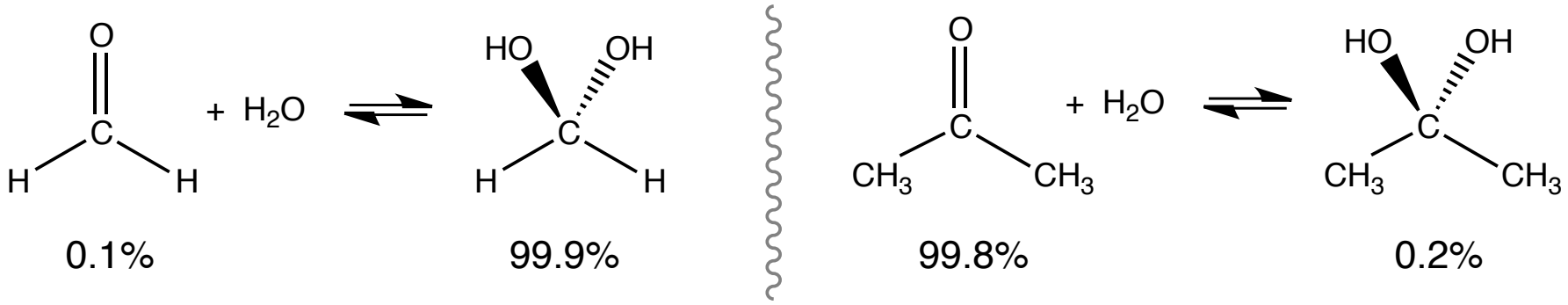






enamine

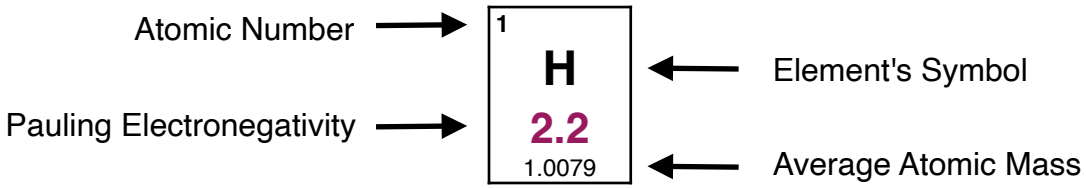
13. (10 pts.) When aldehydes and ketones are added to water they react and form geminal diols.



Explain why the equilibrium favors the carbonyl side of the reaction for the reaction of acetone, a ketone, with water, whereas in the reaction of formaldehyde, an aldehyde, with water the equilibrium favors the geminal diol side of the reaction.

Some Electronegativities of Elements of Interest to Organic Chemists[1]

1 **H** 2.2 1.0079																	2 **He** 4.0026
3 **Li** 0.98 6.941	4 **Be** 1.57 9.012											5 **B** 2.04 10.811	6 **C** 2.55 12.011	7 **N** 3.04 14.007	8 **O** 3.44 15.999	9 **F** 3.98 18.998	10 **Ne** 20.1797
11 **Na** 0.93 22.989	12 **Mg** 1.31 24.305											13 **Al** 1.61 26.981	14 **Si** 1.90 28.086	15 **P** 2.19 30.974	16 **S** 2.58 32.065	17 **Cl** 3.16 35.453	18 **Ar** 39.948
19 **K** 0.82 39.098	20 **Ca** 1.00 40.078															35 **Br** 2.96 79.904	36 **Kr** 83.798
																53 **I** 2.66 126.90	



[1] Electronegativity values obtained from https://en.wikipedia.org/wiki/Electronegativity on September 28, 2023