

CEM 252, Summer 2020
Midterm Exam
Monday, July 20, 2020, 6:00 PM
Online (Top Hat)

ANN SWERKY



There's no subject compared to chemistry
how it works is a total mystery
homework is for my own mastery
says my professor
but all I see is my own misery

Anonymous

A question that sometimes drives me hazy:
Am I or are the others crazy?

Albert Einstein

1-10. (40 pts.) _____

11. (20 pts.) _____

12. (20 pts.) _____

13. (20 pts.) _____

14. (5 pts. E.C) ____

TOTAL (100 pts.) _____

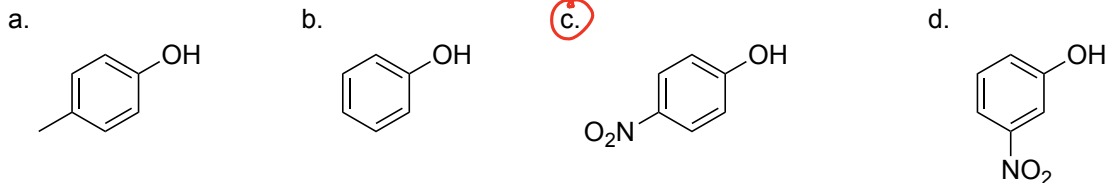
Score



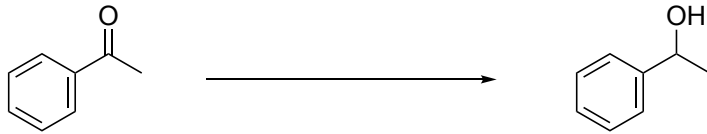
Note: You have 1.5 hours to complete this exam.

(40 pts.) Multiple choice questions (4 pts. each); choose your answer and make sure to click on the submit button for each question.

1. (4 pts.) Which of the following phenols is the strongest acid?



2. (4 pts) What reagent could perform the following transformation:



- a. NaBr
b. LiAlH₄
c. TsCl
d. H₂SO₄

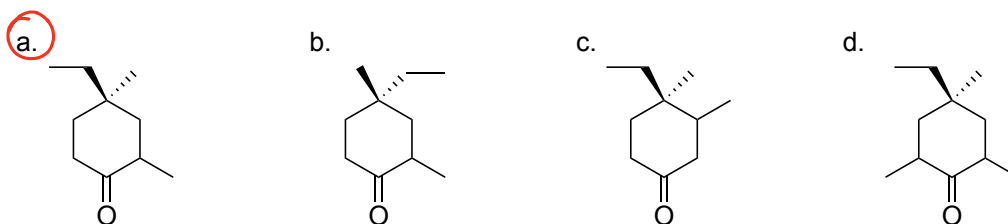
3. (4 pts) Which of the compounds below reacts with the oxidizing agent pyridinium chlorochromate (PCC) to form propanal, CH₃CH₂COH?

- a. CH₃CH₂Cl
b. HOCHCH₃CH₂OH
c. CH₃CH₂CH₂OH
d. (CH₃)₂CHOH

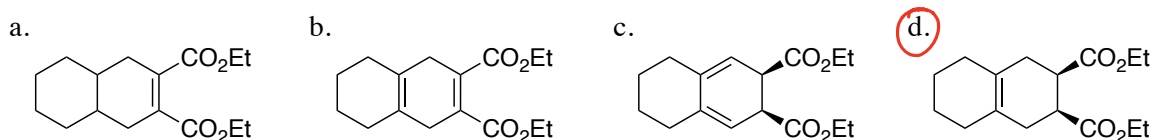
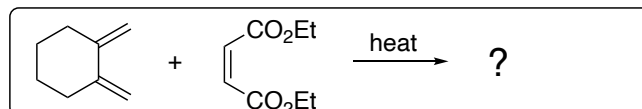
4. (4 pts) What is the chemical formula of 3-bromo-3-methylbutanal? (Hint: Draw it first, then work out the formula).

- a. C₅H₁₁BrO b. C₄H₉BrO c. C₅H₉Br d. C₅H₉BrO

5. (4 pts) Which of the structures below is (4R)-4-ethyl-2,4-dimethylcyclohexan-1-one?



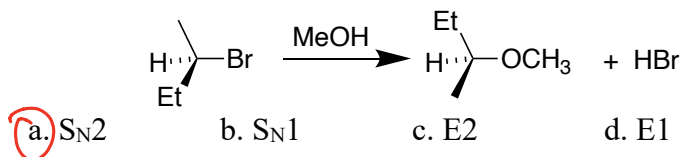
6. (4 pts) What is the major product of the following Diels-Alder addition?



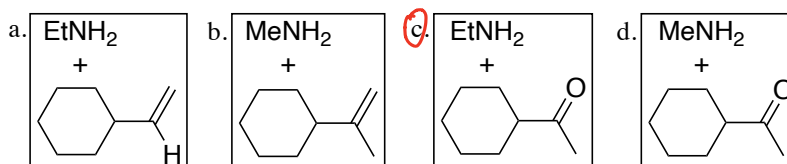
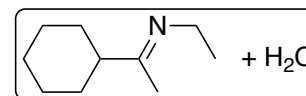
7. (4 pts) Which of the reagents below could be used to convert 2-pentanol to 2-chloropentane.



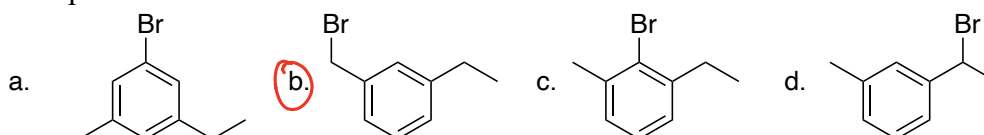
8. (3 pts) What type of reaction is shown below?



9. (4 pts) Which of the following combinations would lose water to form the imine shown at right?



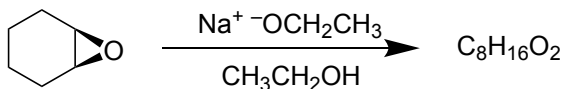
10. (4 pts) Which of the following halogenated $\text{C}_9\text{H}_{11}\text{Br}$ isomers would be the most susceptible to substitution via $\text{S}_{\text{N}}2$ reaction.



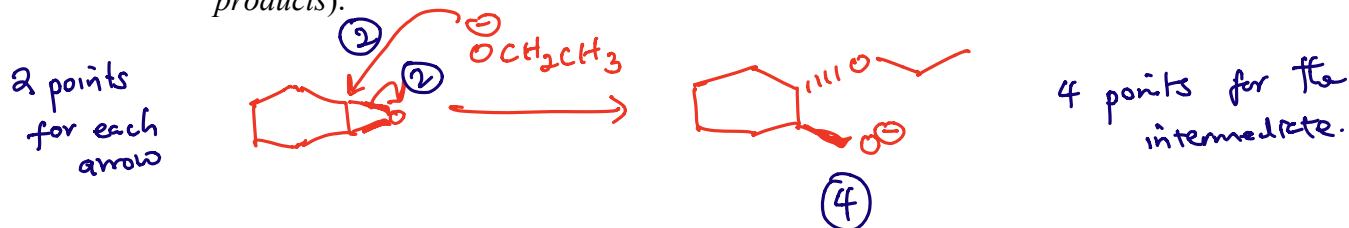
(60 pts.) There are 3 question (20 pts. each). Answer each question on a single sheet of paper and upload the image of the answer sheet directly on TopHat.

11. (20 pts.)

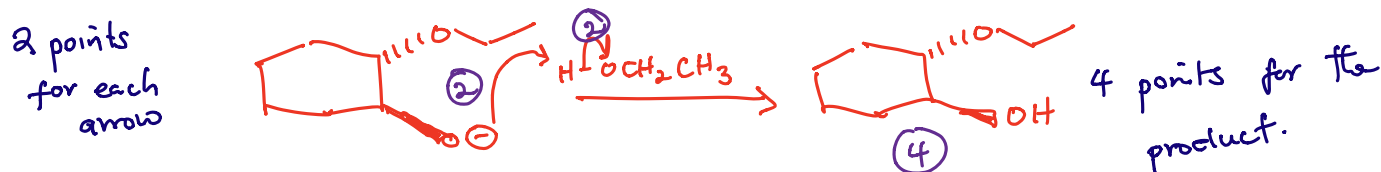
(20 pts) From the reaction below, provide arrow-pushing mechanisms to show the two steps of this process, (a) S_N2 ring opening and (b) proton transfer to the product alkoxide). If more than one stereoisomeric product is formed, draw them both:



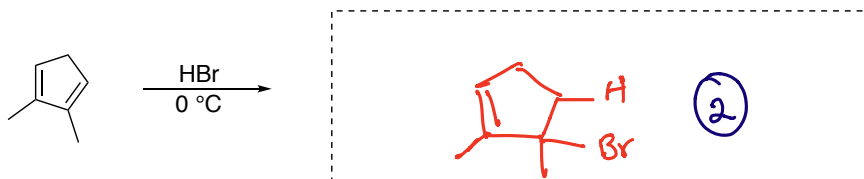
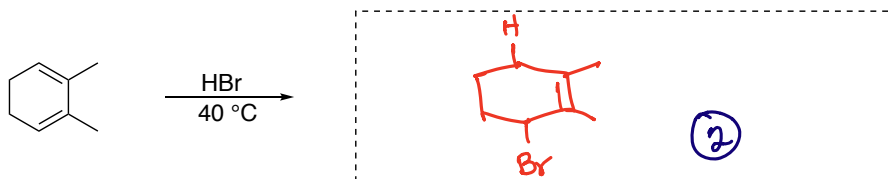
- a. (8 pts) The S_N2 step (show reactants, reaction arrows, curly arrows, and products).



- b. (8 pts) The proton transfer step (show all parts as mentioned above).

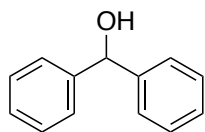


- c. (4 pts.) Predict the **Major product** for each of the following reactions:

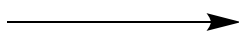


12. 20 pts.

i.



1) $\text{H}_2\text{SO}_4/\text{Na}_2\text{Cr}_2\text{O}_7$
(Jones's reagent)

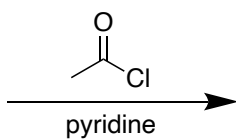
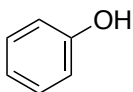


2) $\text{H}_2\text{NNH}_2, \text{NaOH}$



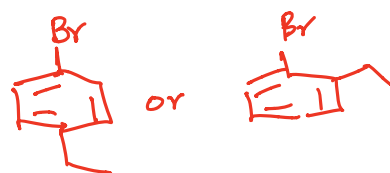
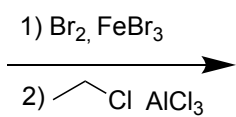
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ii.



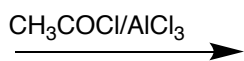
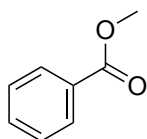
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iii.



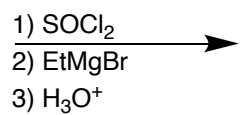
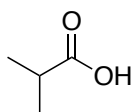
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iv.



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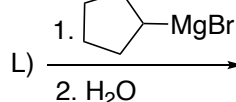
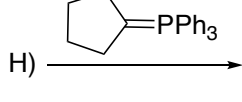
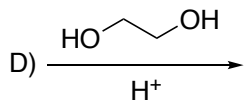
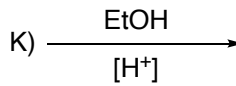
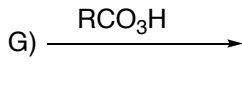
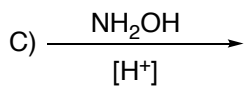
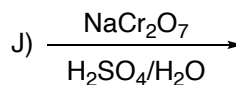
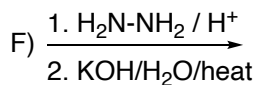
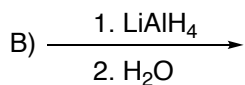
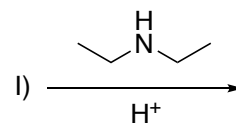
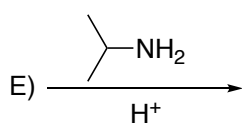
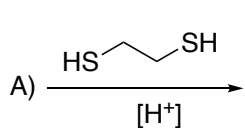
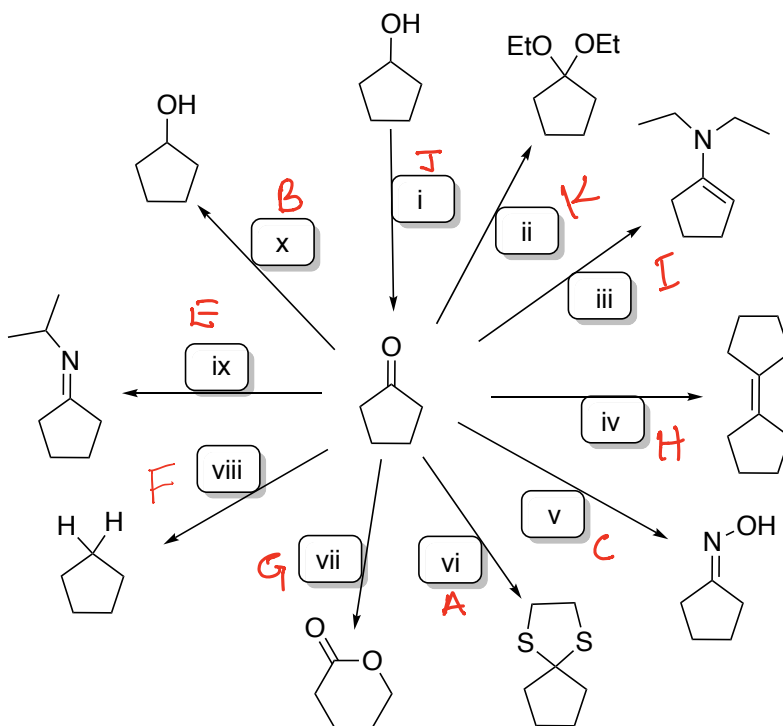
v.



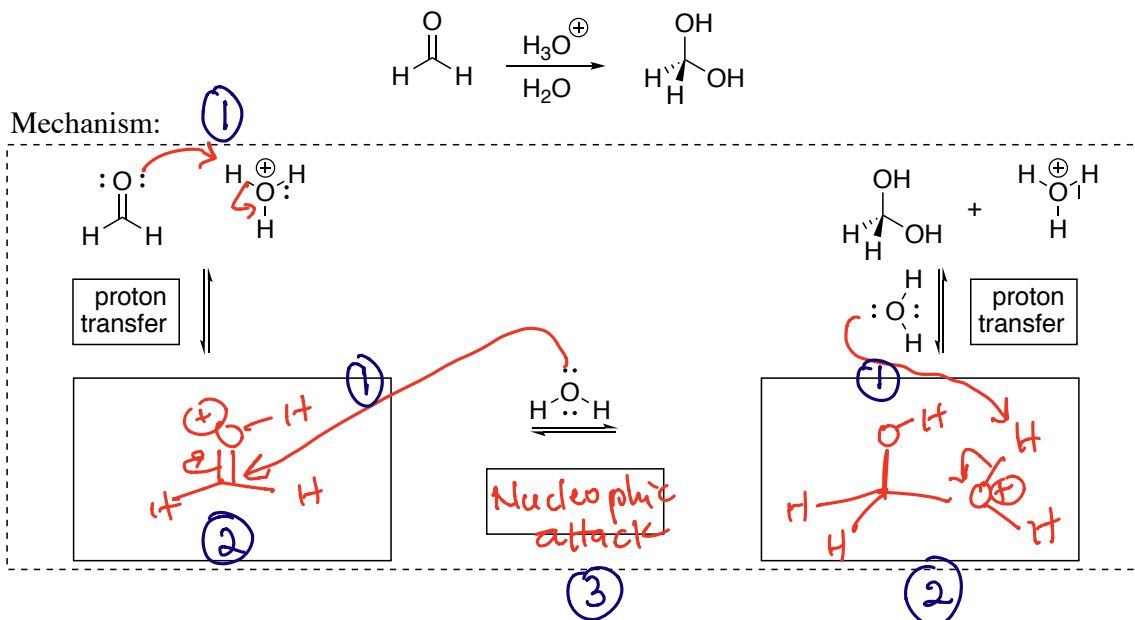
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13. (20 pts.)

- a. (10 pts, 1 pt. each) For the following transformations (i-x), choose the appropriate letter from the "reagent shelf" below. Each box only gets one letter. If needed, you may use the same reagent more than once.



- b. (10 pts) Show the mechanism for acid catalyzed hydration of formaldehyde by adding the three pairs (1 pt. each) of electron pushing arrows, filling in the two intermediate boxes (2 pts each), and the box for the transformation's name (3 pts).



14. (5 pts extra credit) Write a limerick/rhyme about something chemical that we've learned in class this summer.

You're the conjugate base to my acid,
 When I'm strong, you're stable,
 One of us may be favored, if our equilibrium is not zero,
 When my pH is low, you're favored,
 Exo- over endo- is the law the world speaks.

By Sydney T. (CEM 251, summer 2020)