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CHEM 322. Midterm 1
Spring 2011
Prof Donald Watson, Prof Mary Watson

Please write your answers clearly in the boxes provided. If your answer is illegible or outside the box, it will not be graded. You may use the back of test pages for scratch work.

You may use molecular models.

Use of calculators, cell phones, headphones, or any other electronic device during this exam is prohibited.

No notes or books may be used during this exam.

You may raise your hand to ask a question if you are not sure what is being asked of you.

There are 12 pages in this exam. Please check that your test has 12 pages before you begin. The last 2 pages are blank and may be used as scratch paper.

Please circle your lab section:

Mon 12:20–3:20 (Amber, 031)

Mon 3:35–6:35 (Tatsiana, 032)

Mon 7–10 (Craig, 033)

Tues 9:30–12:30 (Srimoyee, 020)

Tues 12:30–3:30 (Neo, 021)

Tues 3:30–6:30 (Peter, 022)

Tues 7–10 (Peter, 023)

Wed 12:20–3:20 (Tatsiana, 034)

Wed 7–10 (Tatsiana, 035)

Thurs 9:30–12:30 (Srimoyee, 024)

Thurs 12:30–3:30 (Neo, 026)

Thurs 3:35–6:35 (Srimoyee, 027)

Thurs 7–10 (Neo, 030)

Fri 9:05–12:05 (Amber, 036)

Fri 12:20–3:20 (Amber, 028)


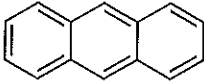

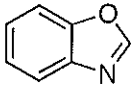
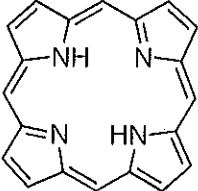
Fri 3:35–6:35 (Jesse, 025)

Fri 7–10 (Jesse, 039)

Question	Points
1	_____ /10
2	_____ /20
3	_____ /12
4	_____ /15
5	_____ /15
6	_____ /8
7	_____ /10
8	_____ /10
Total	_____ /100

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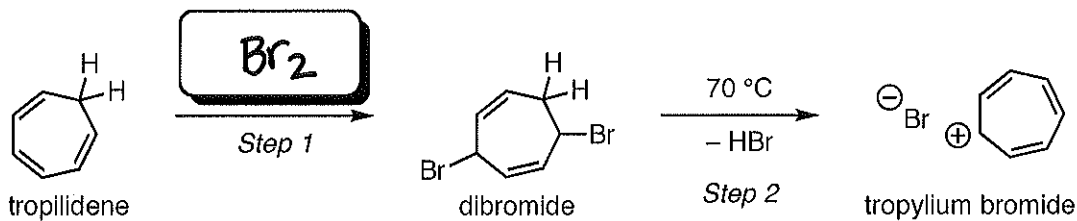
1. (10 points) Are the following molecules aromatic? Write "yes" or "no." Please also list how many electrons are in the π system. No explanation is necessary.

		Aromatic? (Yes or No)	If aromatic, how many electrons in π system?
(a)		NO	4
(b)		YES	14
(c)		NO	6 or 8
(d)		YES	10
(e)	 (Hint: This molecule is planar.)	YES	26

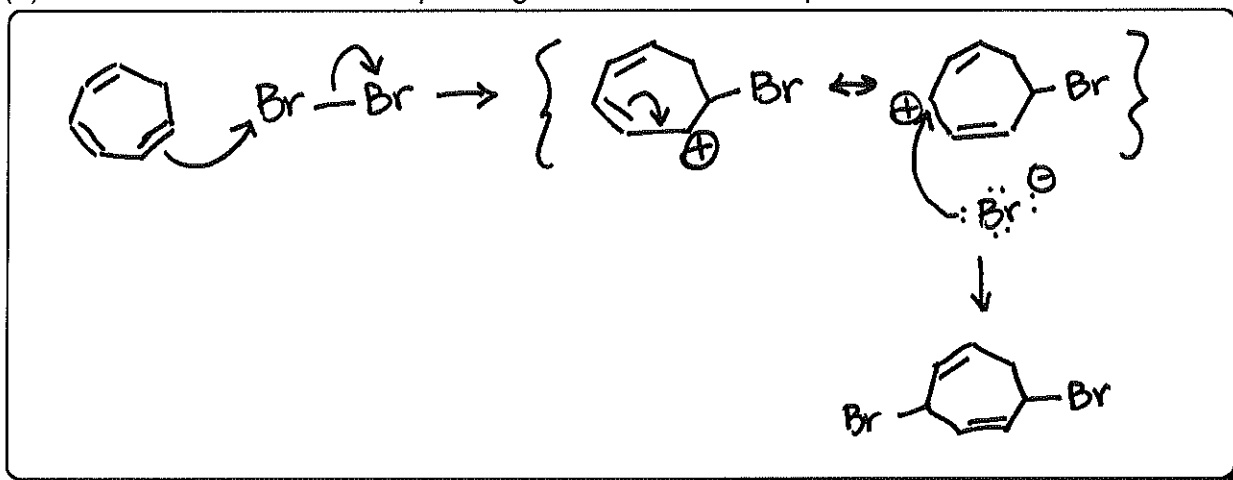
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2. (20 points) Doering and Knox reported the first synthesis of a tropylium ion in 1954 according to the following route.

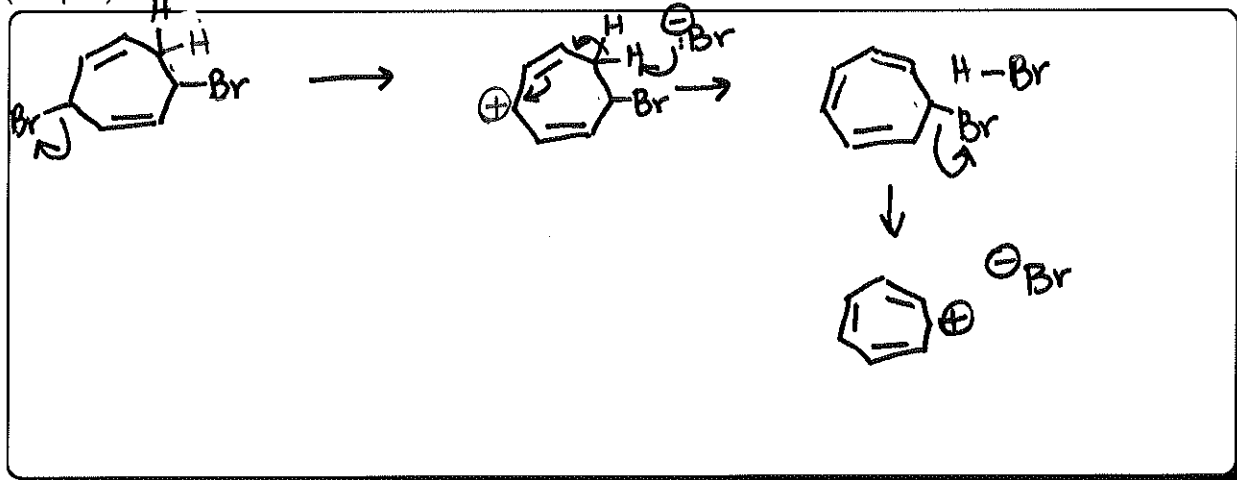
(a) What reagent(s) is needed to form the dibromide from tropilidene (step 1)? Write your answer in the box provided.



(b) Draw a reasonable arrow-pushing mechanism for Step 1.



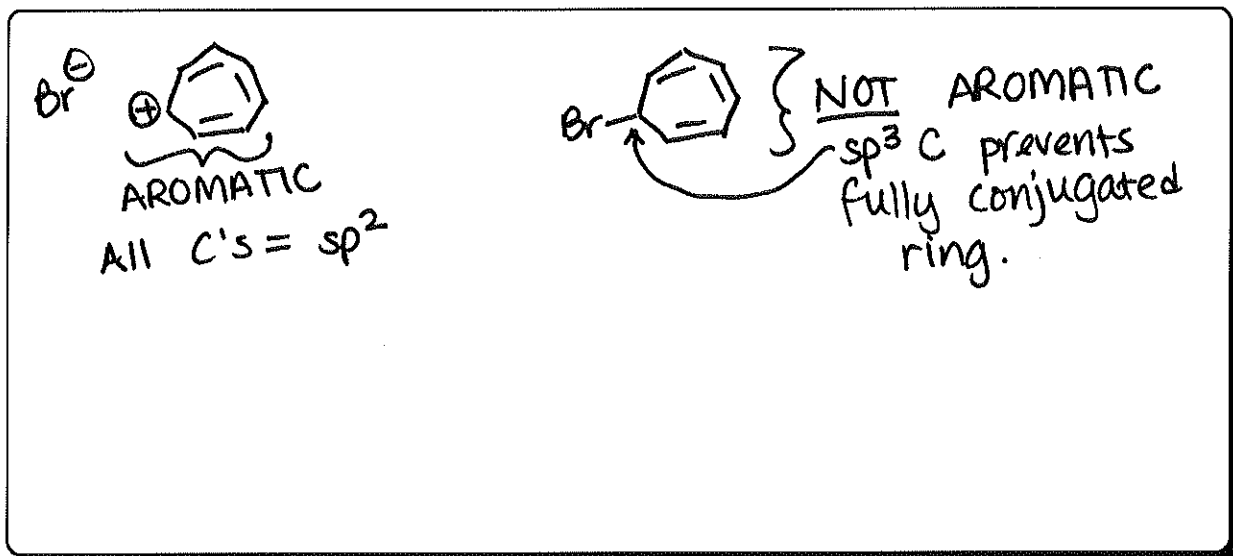
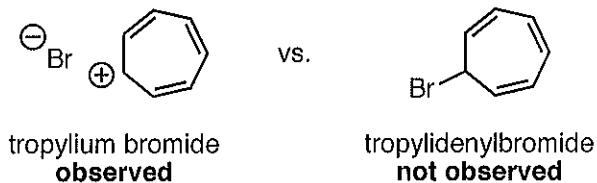
(c) When Doering and Knox tried to purify the dibromide by distillation at 70°C , the dibromide decomposed into crystals of tropylium bromide. Please draw a reasonable arrow-pushing mechanism for the transformation of the dibromide to tropylium bromide (Step 2).



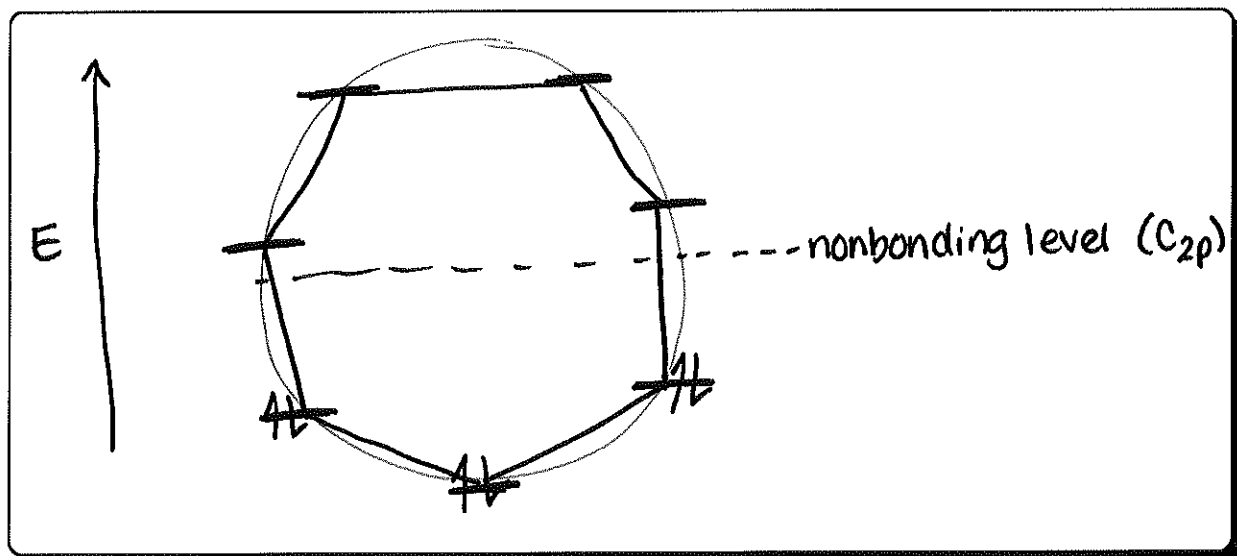
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(2 – continued)

(d) Explain why tropylium bromide, not tropylienylobromide, results when the dibromide is heated. Use pictures and less than 10 words.

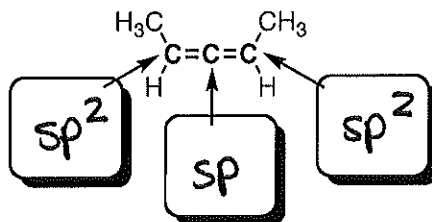


(e) Draw a molecular orbital diagram for the π system of the tropylium cation. You do not need to draw pictures of each molecular orbital.

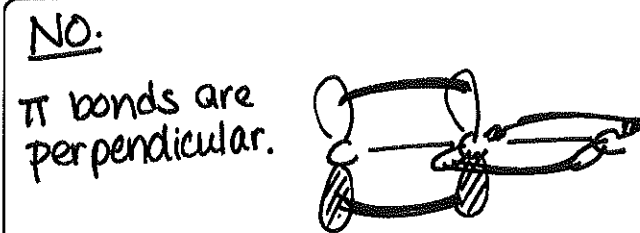


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3. (12 points) (a) Label the hybridization of the three central carbons of 1,3-dimethylallene.



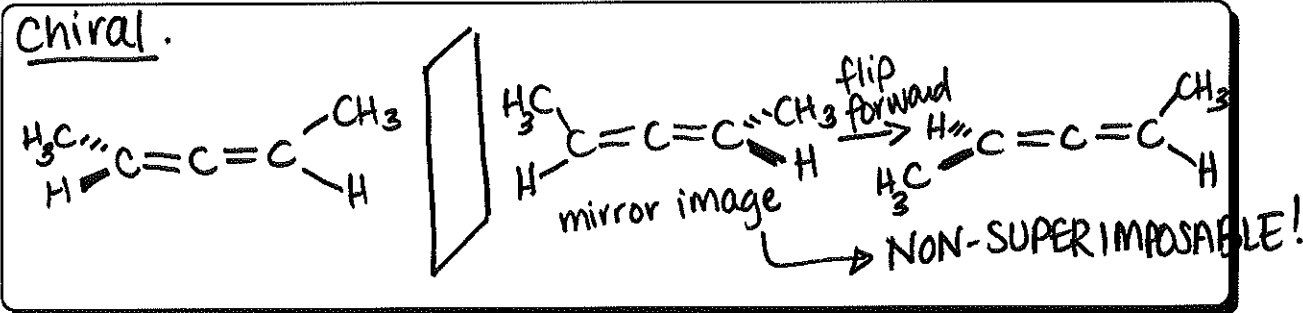
(b) Are the π bonds of allene in conjugation? Draw a picture of the π bonds to explain your answer.



(c) Draw a 3D representation of 1,3-dimethylallene that clearly shows the positions of the C-H and C-Me bonds.

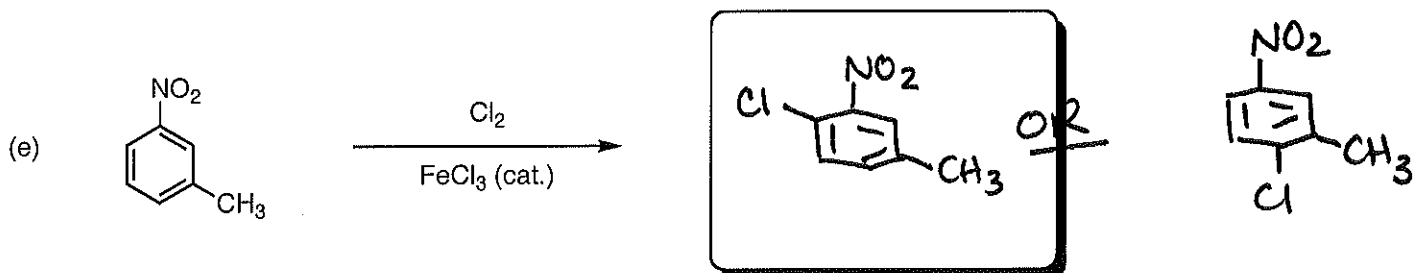
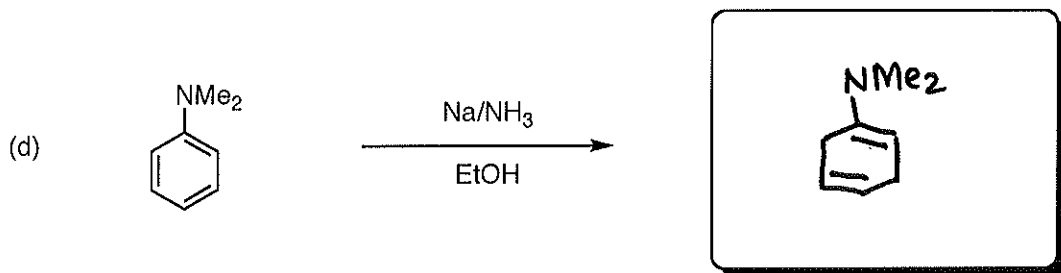
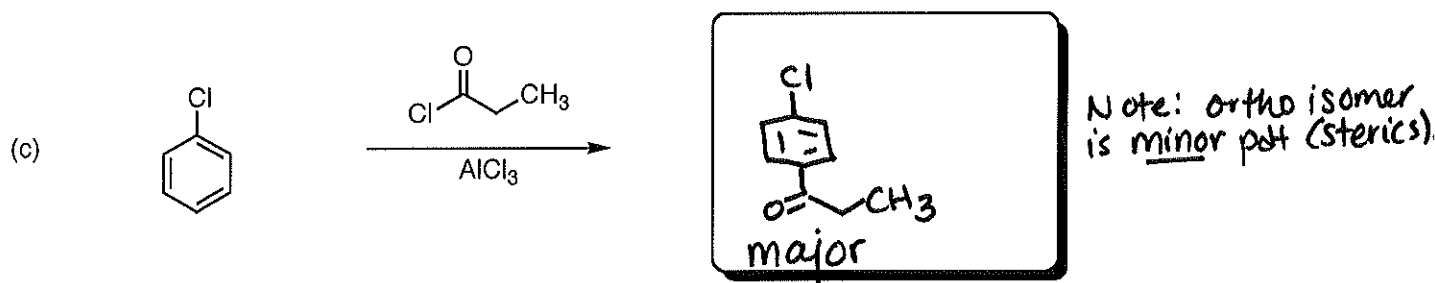
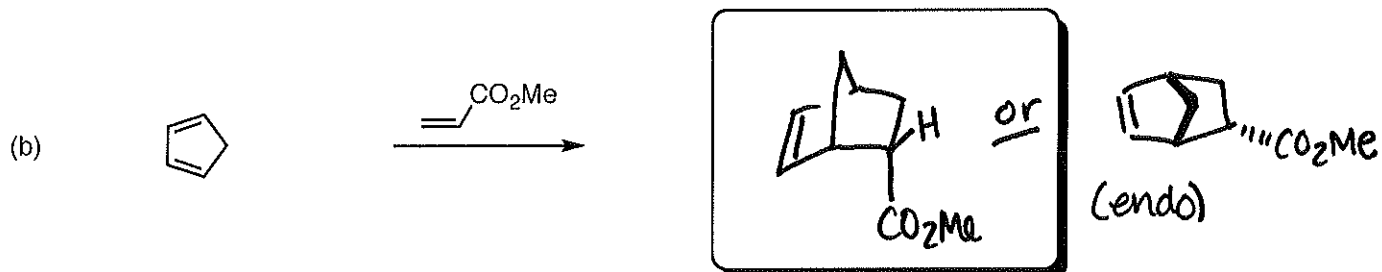
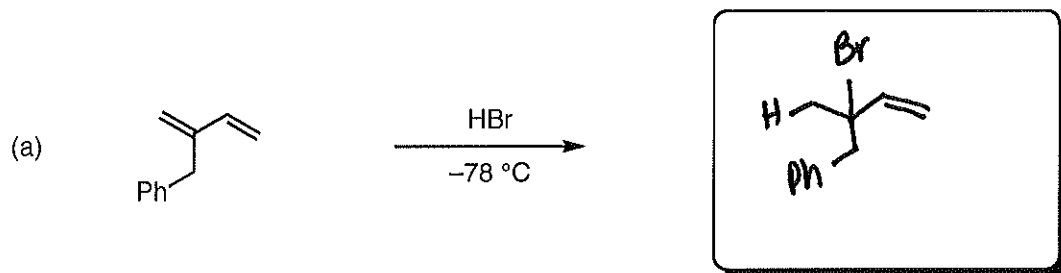


(d) Is 1,3-dimethylallene chiral or achiral? Explain in less than 10 words. You may use pictures.



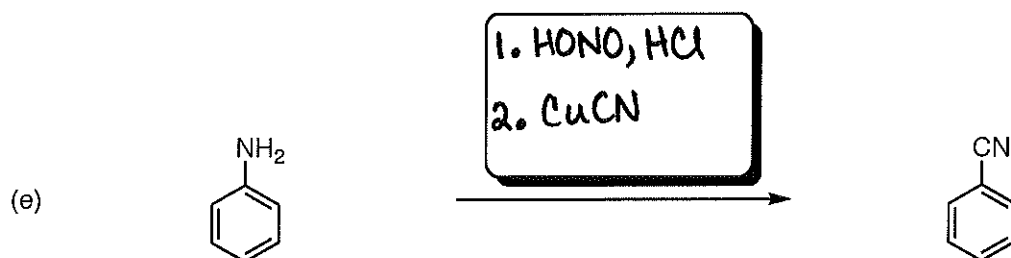
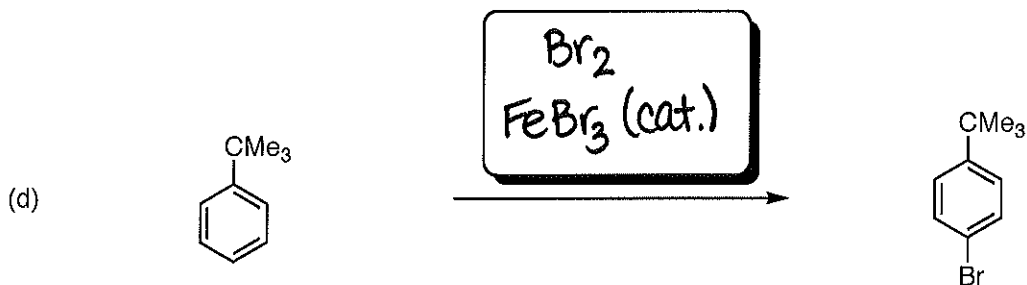
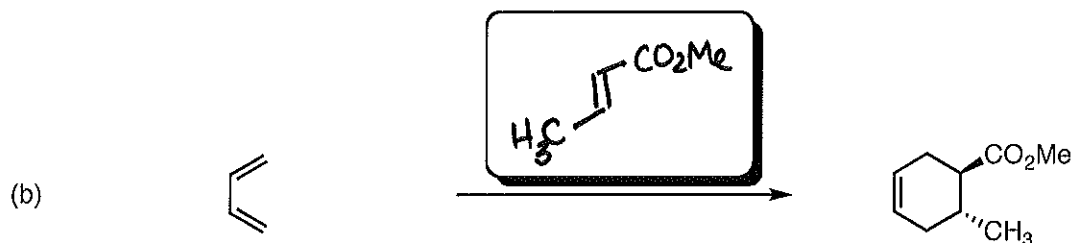
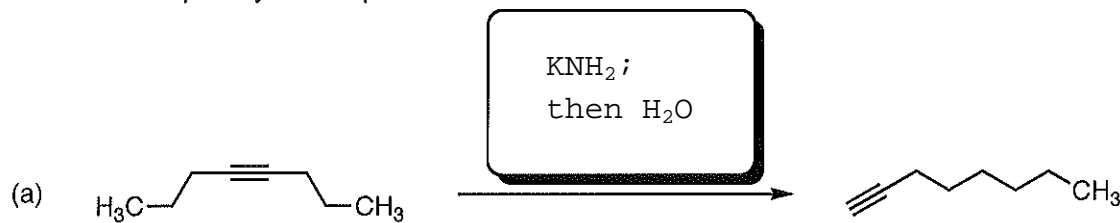
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4. (15 points) Please draw the expected major product for each of the following reactions. If no reaction is expected, write "No Reaction."



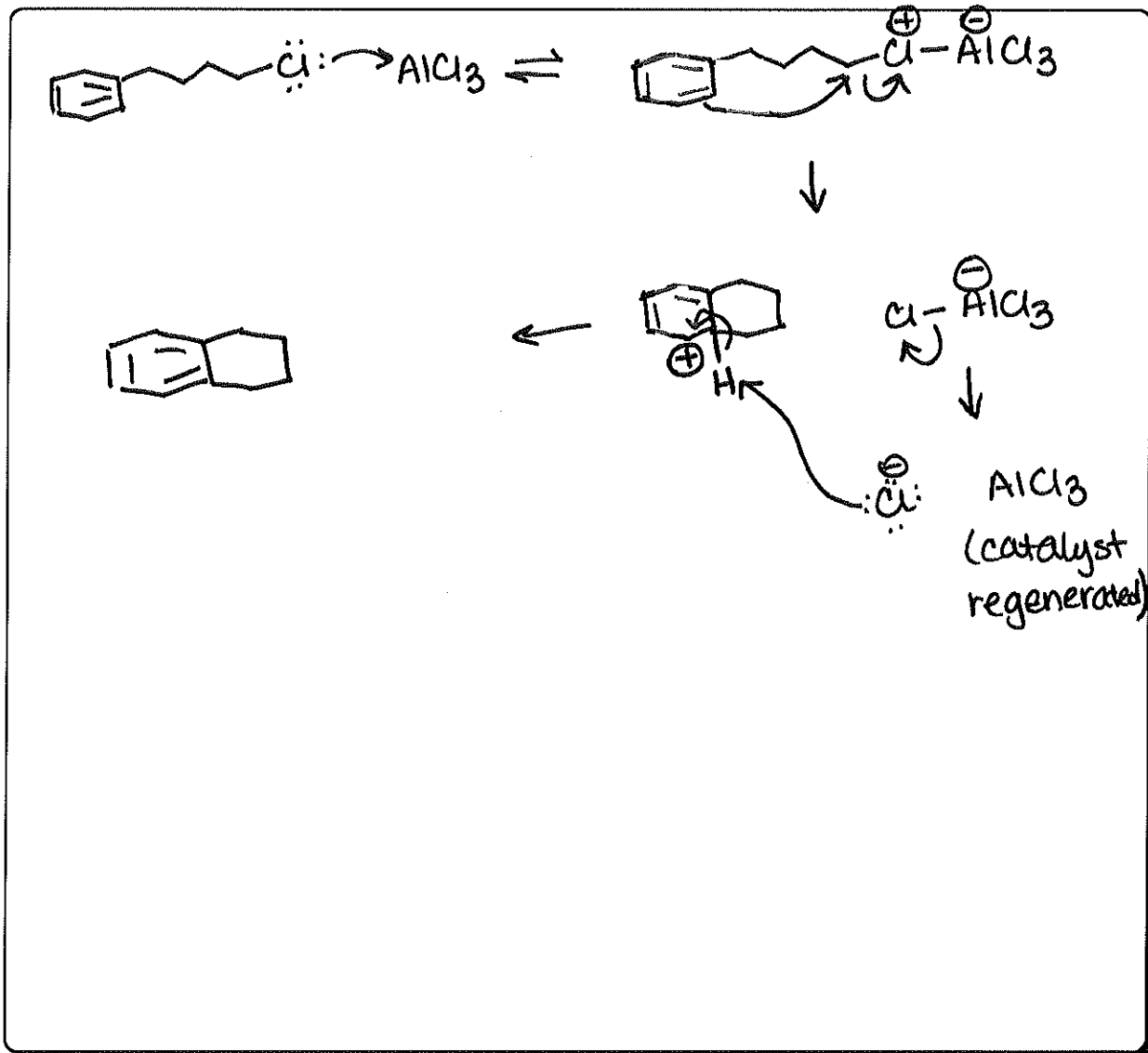
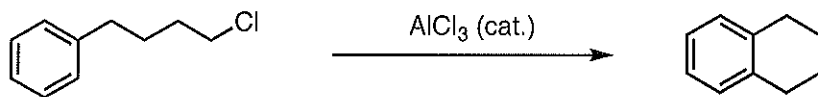
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5. (15 points) Provide reagents for the following transformations. In some cases, more than one step may be required.



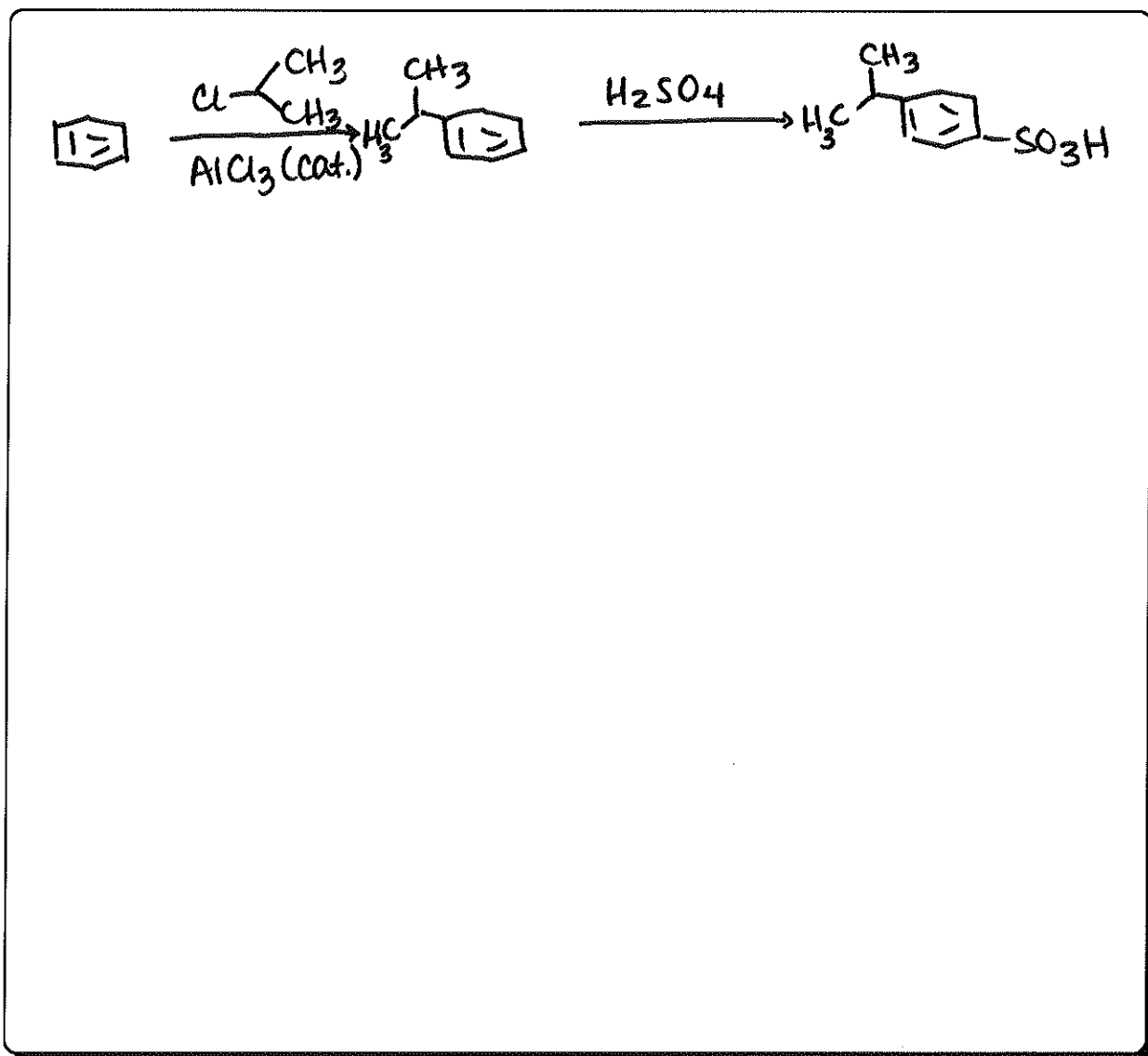
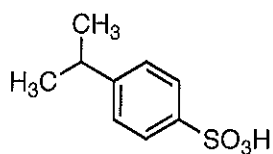
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6. (8 points) Please draw a reasonable arrow-pushing mechanism for the following reaction.



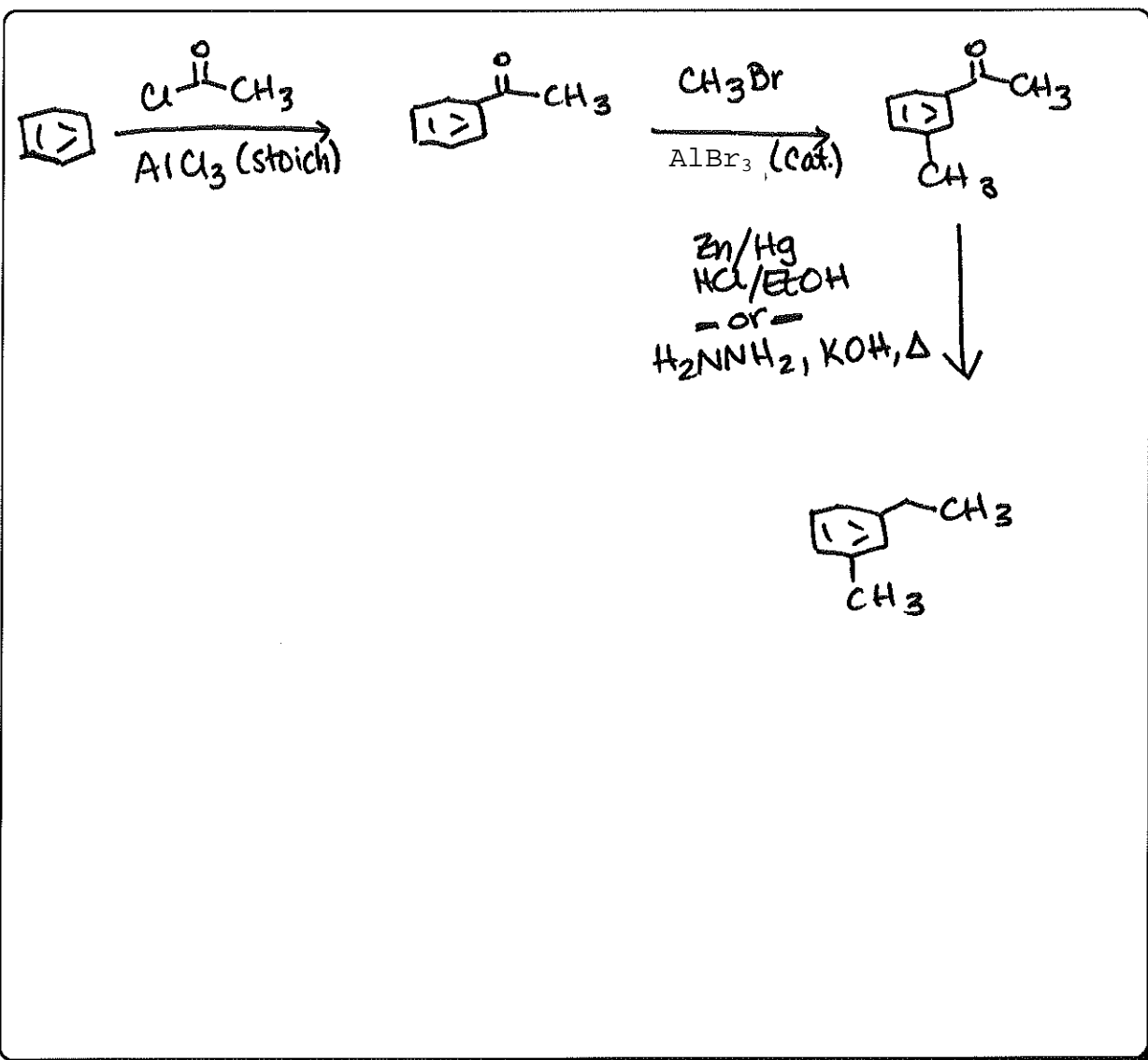
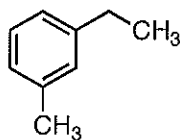
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7. (10 points) Provide a synthesis of the following molecule from benzene. You may use any inorganic reagents and any organic reagents with ~~less~~ ^{no more} than ~~8~~ ³ carbons.



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8. (10 points) Provide a synthesis of the following molecule from benzene. You may use any inorganic reagents and any organic reagents with ~~less~~ **no more** than 2 carbons.



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