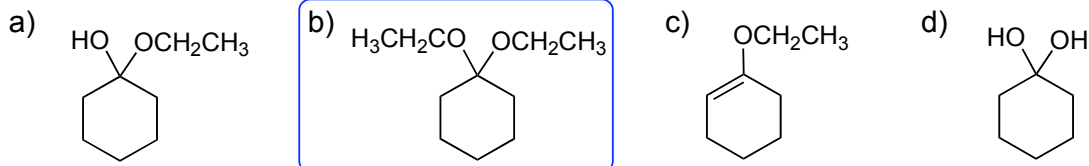
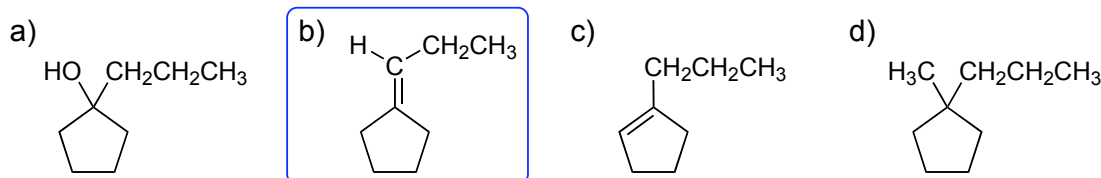
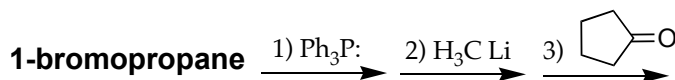


1-10. Multiple Choice. Pick the best answer for the following questions (30 pts)

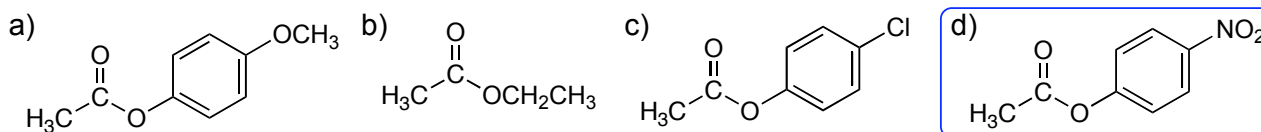
1. What is the major product from the acid-catalyzed reaction of cyclohexanone with ethanol.



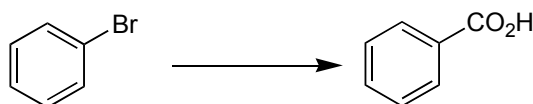
2. What is the product from the following reaction sequence?



3. Amides can be prepared by the reaction of an amine with an ester. Which of the following esters is predicted to react fastest with ammonia (NH_3) to give acetamide.

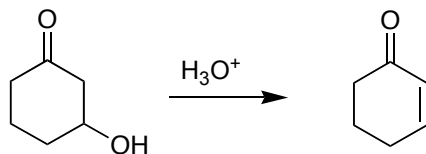


4. Which reagent(s) can be used to convert bromobenzene to benzoic acid?



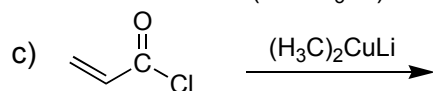
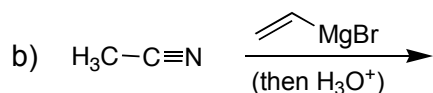
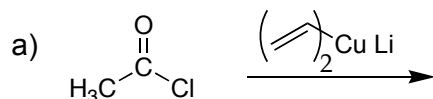
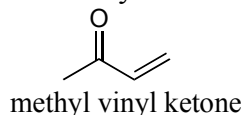
- a. 1. NaCN 2. NaOH , H_2O
 b. KMnO_4
 c. 1. Mg(0) 2. CO_2 , then H_3O^+
 d. CrO_3 , HCl

5. The carbonyl group of 3-hydroxycyclohexanone has an infrared (IR) absorbance of 1715 cm^{-1} . It readily dehydrates to cyclohexenone under mild acid conditions. What is the expected IR absorbance of the cyclohexenone?



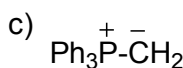
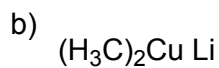
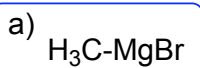
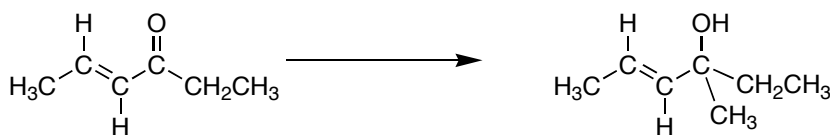
- a) 1715 cm^{-1} b) 1690 cm^{-1} c) 1740 cm^{-1} d) Cyclohexenone will not have a carbonyl absorbance in the IR

6. Which of the following is a suitable method for synthesizing methyl vinyl ketone?



d) a, b, and c are all suitable ways to synthesize methyl vinyl ketone

7. Choose the best reagent for the following reaction:



8. In general, esters are suitable precursors for . . .

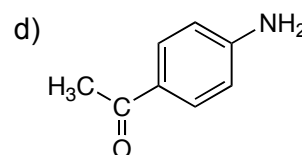
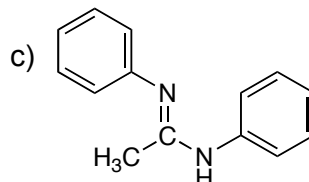
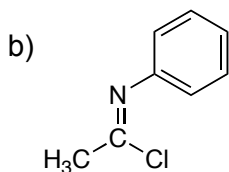
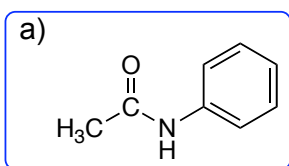
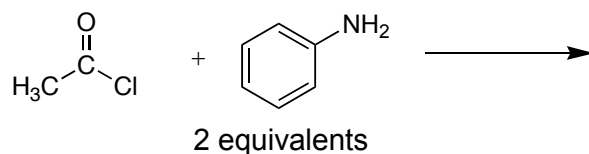
a. amides, anhydrides and acid chlorides

b. amides, but not acid chlorides, nor anhydrides.

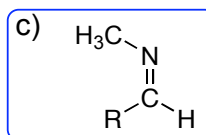
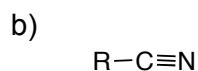
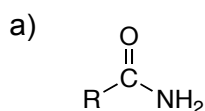
c. amides and anhydrides, but not acid chlorides

d. amides, imines and enamines, but not acid chlorides or anhydrides.

9. What is the major product from the reaction of acetyl chloride and aniline (2 equivalents)?

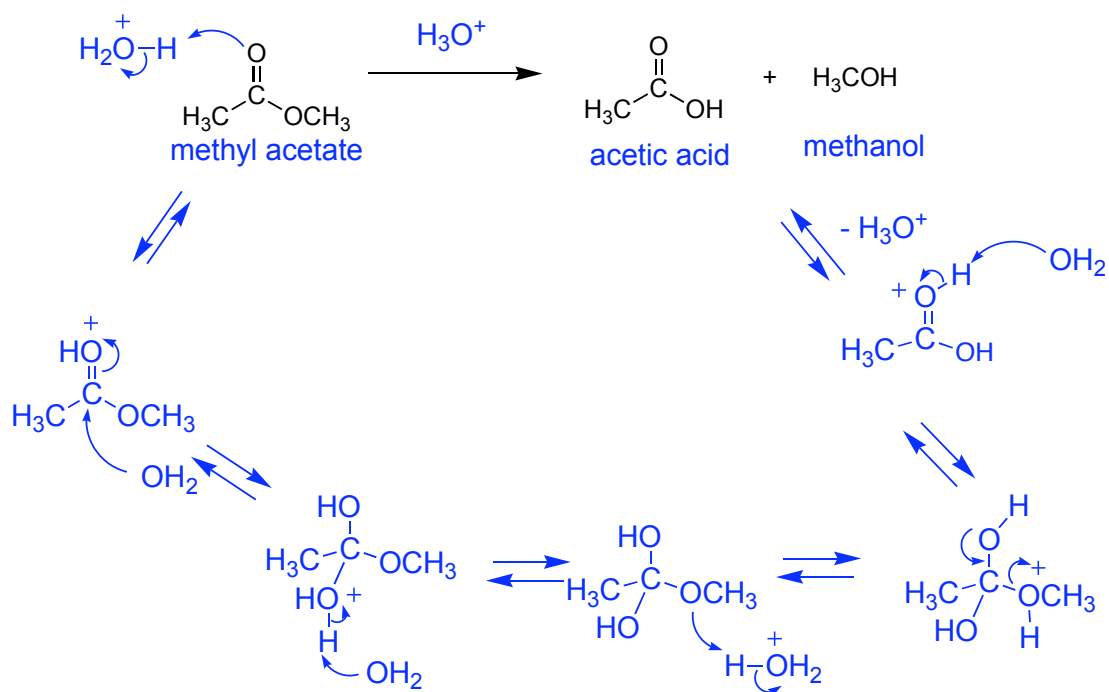


10. Which of the following does not give a carboxylic acid upon treatment with aqueous acid?

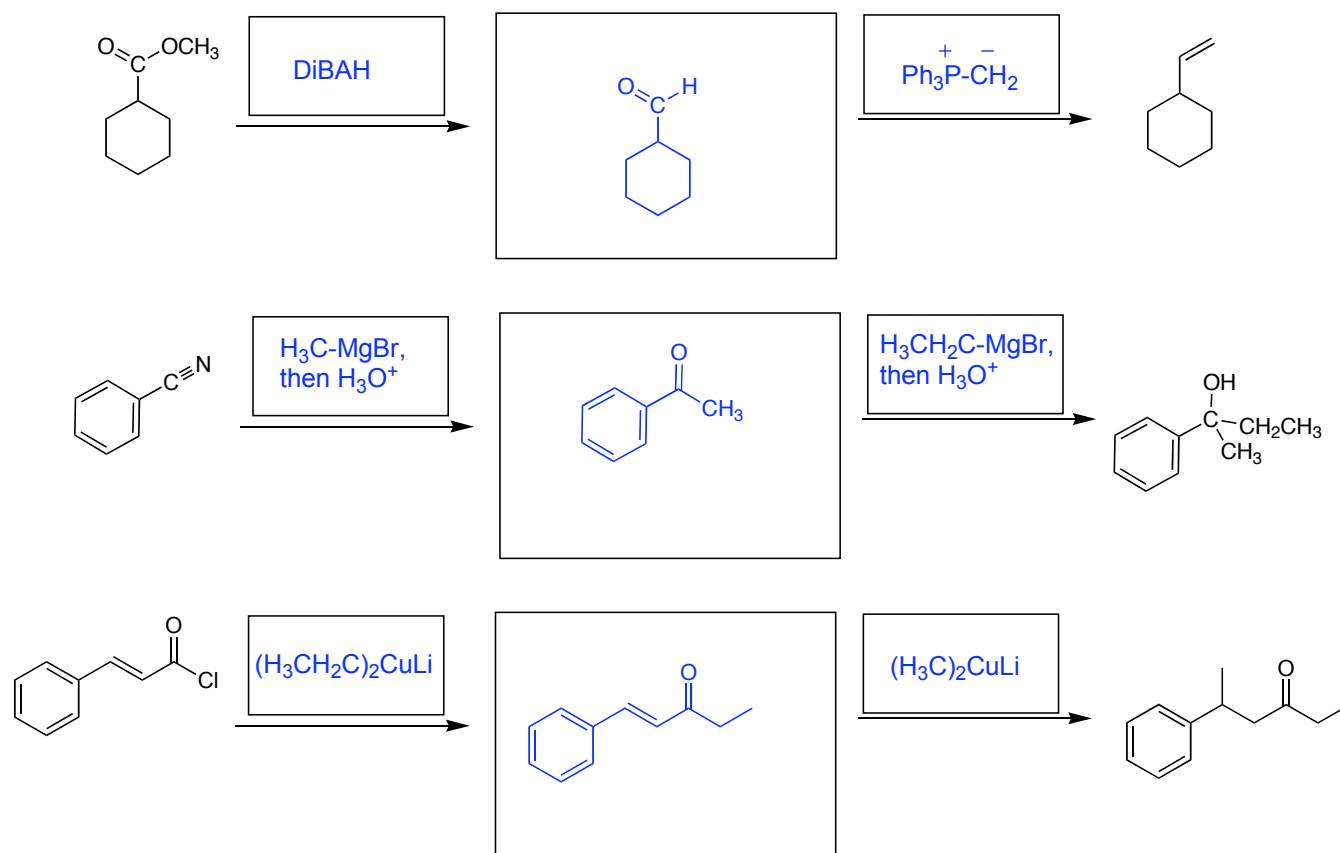


d) a, b and c are all hydrolyzed with H_3O^+ to a carboxylic acid

11. Give the mechanism for the acid catalyzed hydrolysis of methyl acetate to acetic acid and methanol. (13 pts)



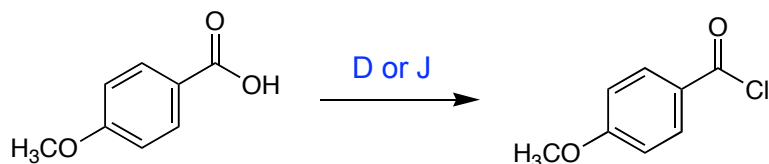
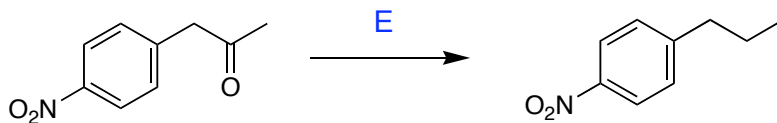
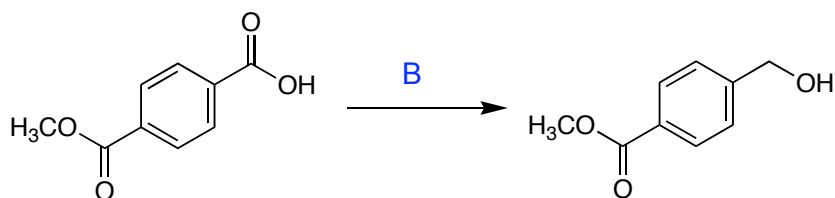
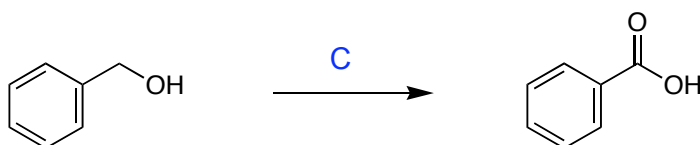
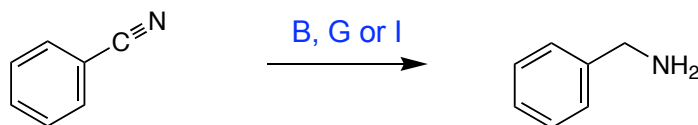
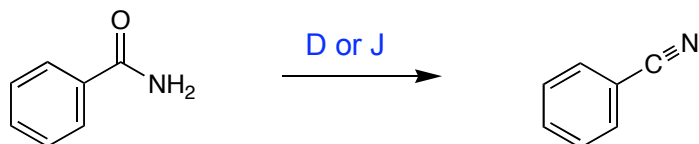
12. Provide the necessary reagents and give the intermediates for the following sequences: (27 pts)



12. Choose the best reagent for the following reactions. (18 pts)

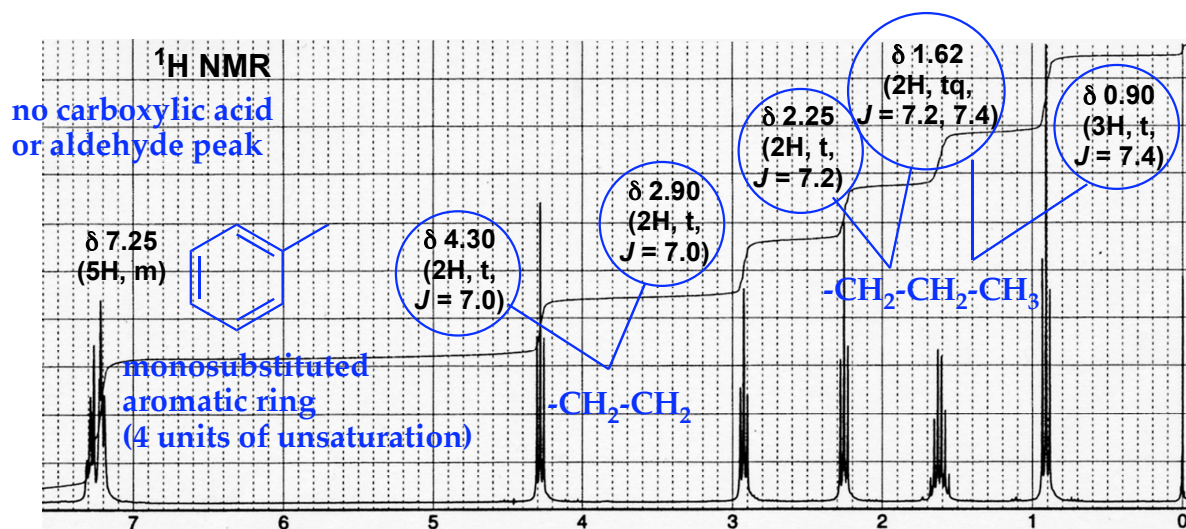
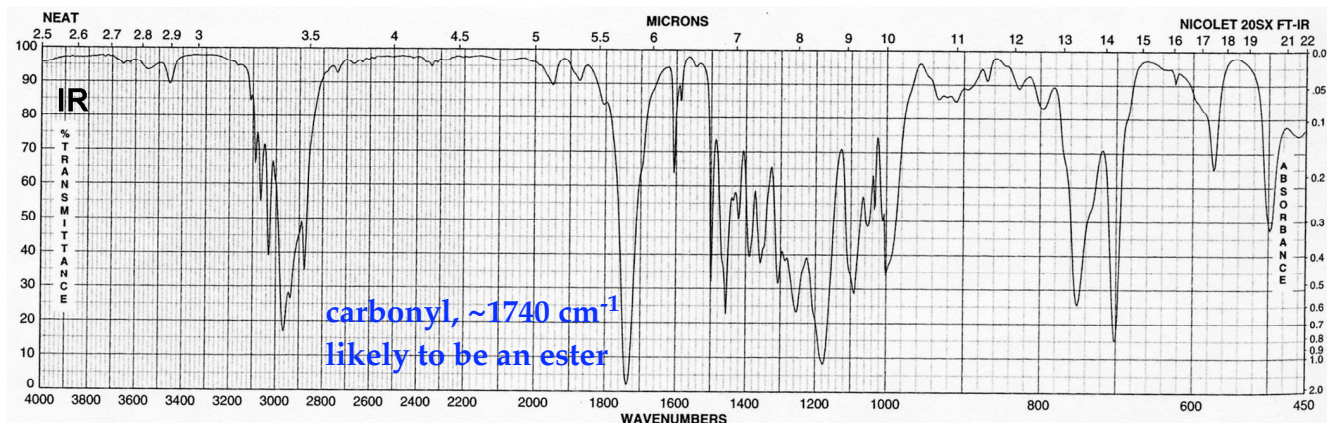
- a. NaBH_4 , ethanol
- b. BH_3 , then H_3O^+
- c. CrO_3 , HCl
- d. SOCl_2
- e. H_2NNH_2 , KOH , H_2O
- f. H_3O^+

- g. LiAlH_4 , ether
- h. DIBALH , toluene, -78°C
- i. H_2 , Pd/C
- j. POCl_3 , pyridine
- k. O_3 , then Zn(0)
- l. PCC



14. Provide a structure that is consistent with the following data. Please show your reasoning. (12 pts)

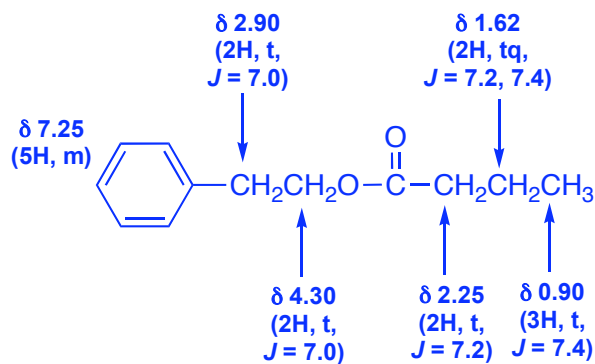
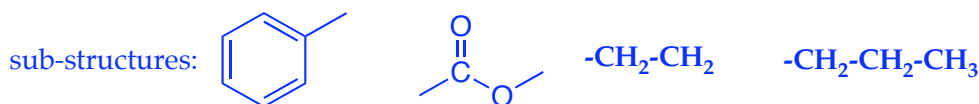
Formula: $C_{12}H_{16}O_2$ 5 units of unsaturation



^{13}C NMR: δ 173.4, 137.9, 129.0, 128.4, 126.5, 64.6, 36.2, 35.2, 18.4, 13.6

δ 173.4 = carbonyl: amide carboxylic acid or amide.

no carboxylic acid peak in NMR, no nitrogen in formula



Problem 1-10: _____ (30 pts)

11: _____ (13 pts)

12: _____ (27 pts)

13: _____ (18 pts)

14: _____ (12 pts)

Total out of 100: _____