Chemistry 2542, Fall 2016
Midterm Exam 2

(100 points)

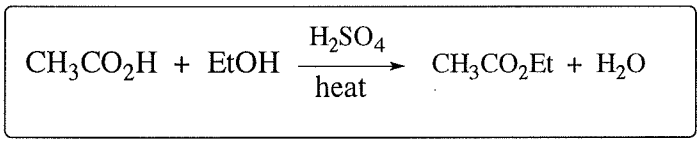
Key

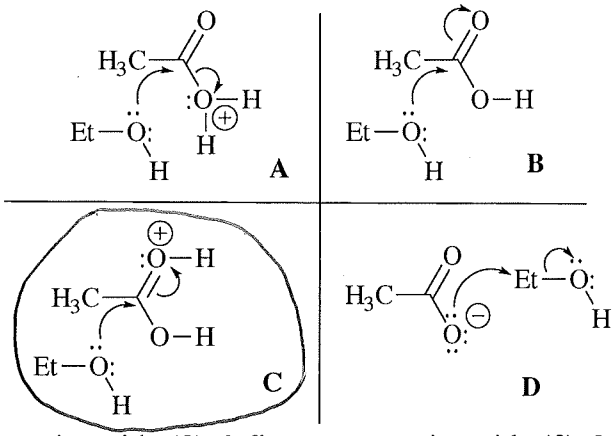
Important notes:

- Please use the provided Scantron form for your answers; you can keep the sheet with the questions and can use it as scratch paper
- Do not forget to write your name on the Scantron form
- You will not receive credit for unmarked answers or for more than one mark on answer line
- Your scores will be posted on eGradebook; graded Scantron forms will not be returned to students.

Questions 1-28 (84 pts): Please mark the appropriate box on the front of the Scantron form (3 pts each).

1. Which one of the following four schemes (**A-D**) represents a **step** in the **mechanism** of the reaction in the box?

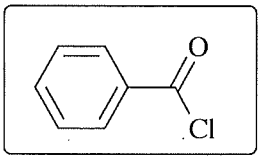




2. What is the order of **acidity** of: (*1*) 2,2-difluoropropanoic acid, (*2*) 2-fluoropropanoic acid, (*3*) 3-fluoropropanoic acid?

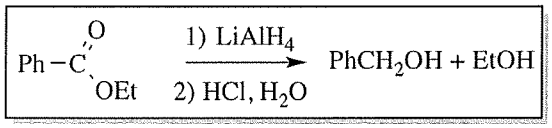
A) **1** (strongest) > **2** > **3** (weakest) B) **2** (strongest) > **3** > **1** (weakest)
C) **2** (strongest) > **1** > **3** (weakest) D) **3** (strongest) > **2** > **1** (weakest)

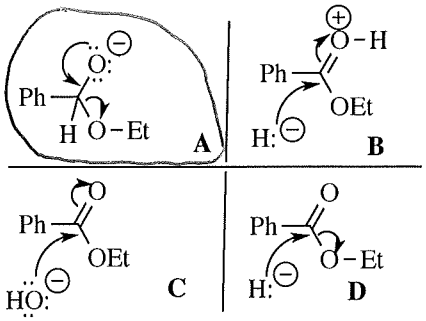
3. What is the **IUPAC name** for the compound in the box?



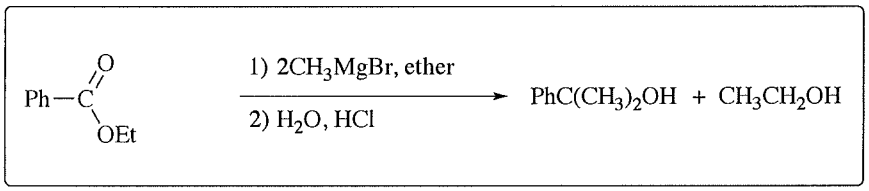
A) benzoyl chloride B) chloro benzoate
C) benzenyl chloride D) chlorobenzaldehyde

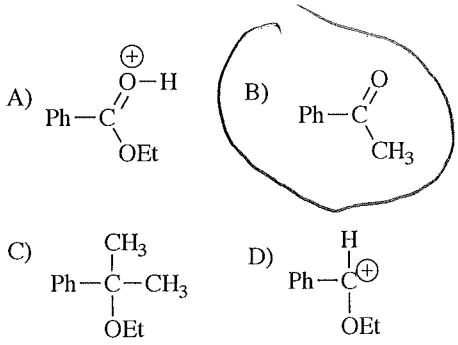
4. Which one of the following four schemes (**A-D**) represents a **step** in the **mechanism** of the reaction in the box?



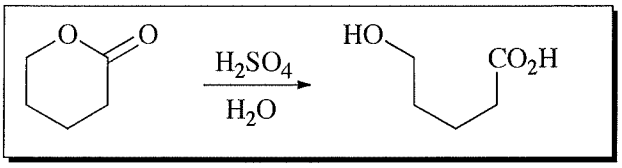


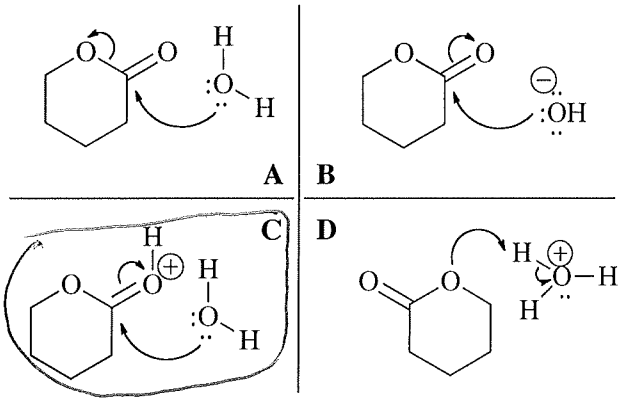
5. Which of the following is a key **intermediate** of the reaction shown in the box?



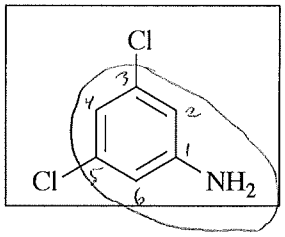


6. Which one of the following four schemes (**A-D**) represents a **step** in the **mechanism** of the reaction in the box?





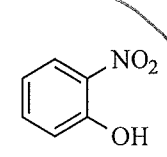
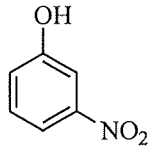
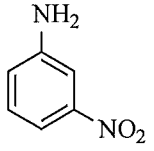
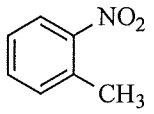
7. What is the **IUPAC name** of the compound shown in the box?



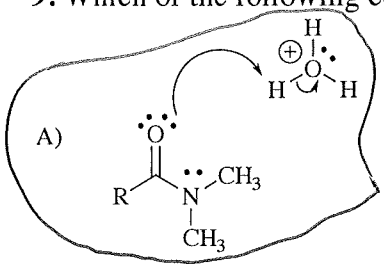
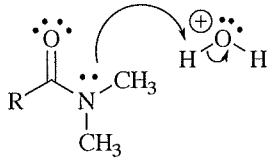
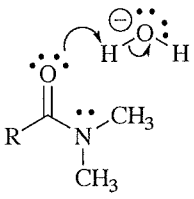
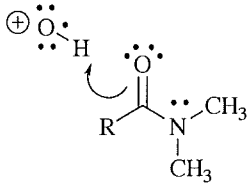
A) *m*-dichloroaniline B) 3,5-dichlorophenol

C) 1,3-dichloro-5-nitrobenzene D) 3,5-dichloroaniline

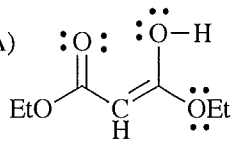
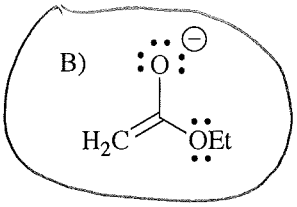
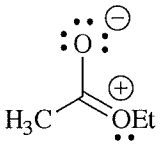
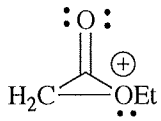
8. What is the correct structure of ***o*-nitrophenol**?

A) 
B) 
C) 
D) 

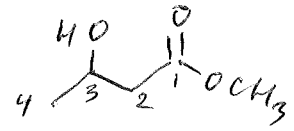
9. Which of the following correctly describes the **protonation of an amide**?

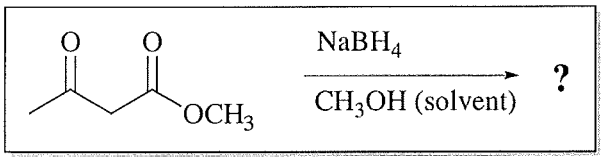
A) 
B) 
C) 
D) 

10. Which of the following represents the **enolate** of ethyl acetate (CH_3COOEt)?

A) 
B) 
C) 
D) 

11. What is the IUPAC name of the major **product** for the reaction shown in the box?

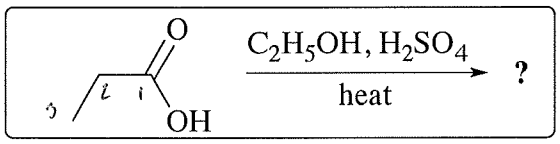




A) methyl 3-hydroxybutanoate B) 1-methoxy-1,3-butandiol

C) 3-methoxybutanoic acid D) methyl butanoate

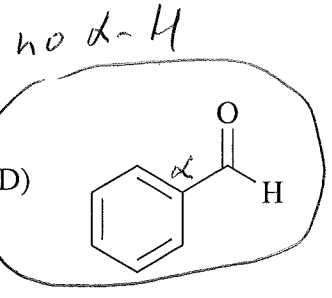
12. What is the IUPAC name of the major **product** for the reaction shown in the box?

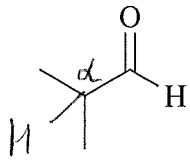
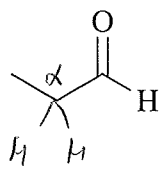
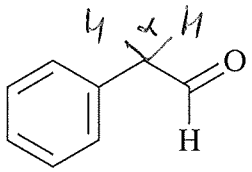


A) 2-ethylethanoic acid B) methyl pentanoate

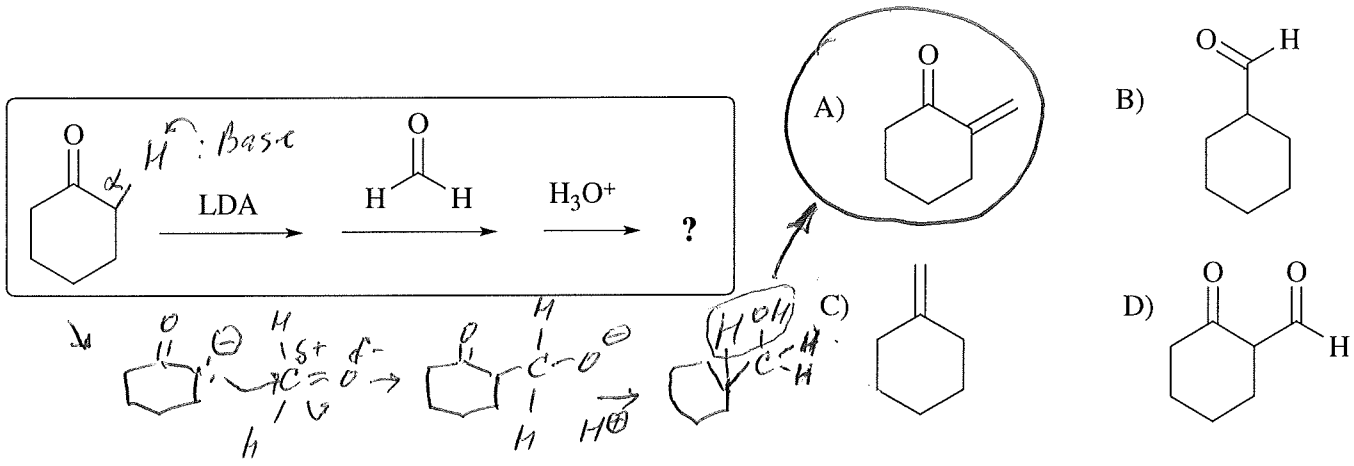
C) ethyl 2-methypropanoate D) ethyl propanoate

13. In the presence of a base which of the following compounds **WILL NOT** undergo **condensation** to give an **aldol** product?

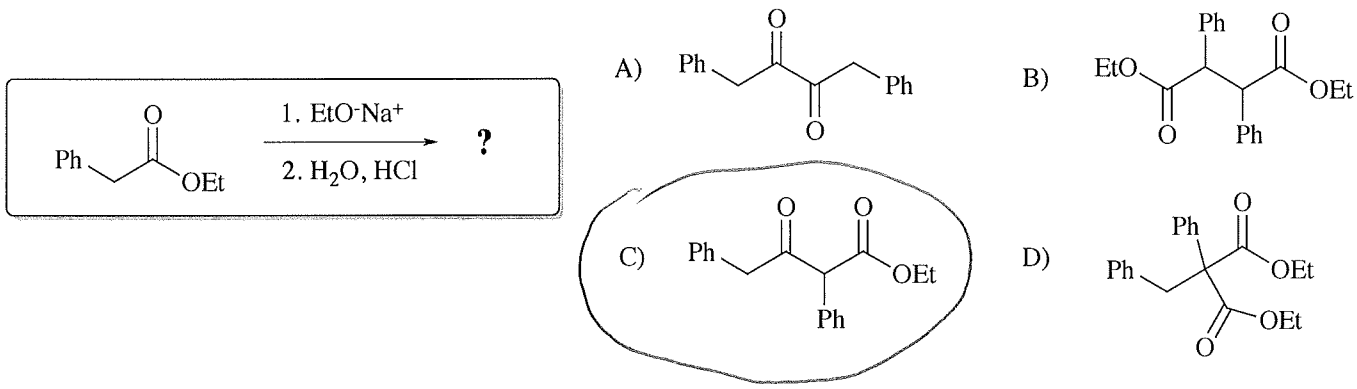


A) 
B) 
C) 
D)

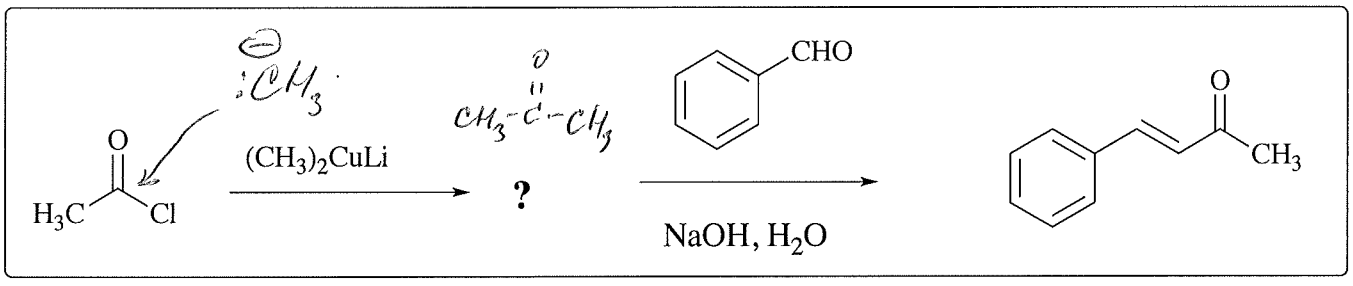
14. Which of the following is a major **product** of the reaction shown in the box? (LDA, lithium diisopropylamide, is a strong base)?

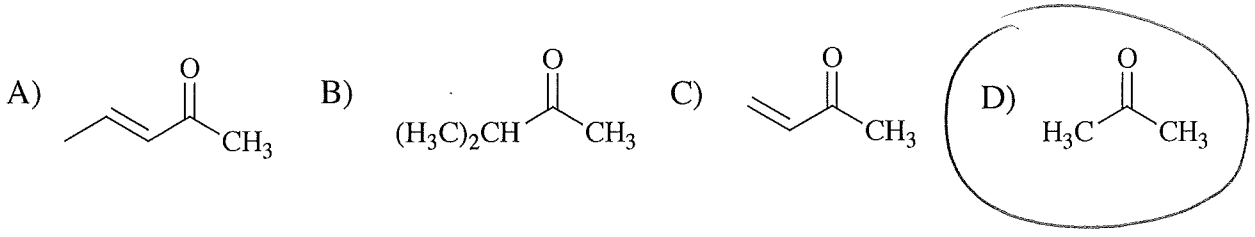


15. Which of the following is a major product of the **Claisen condensation** reaction shown in the box?

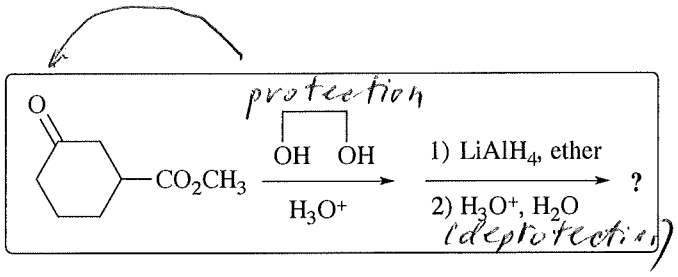


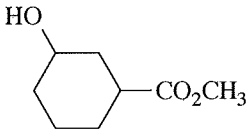
16. What is the structure of the **ketone intermediate** in the reaction sequence shown in the box?

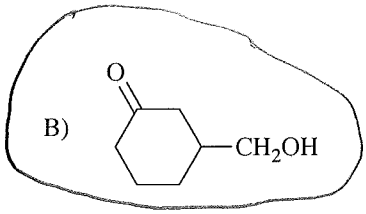


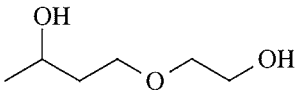


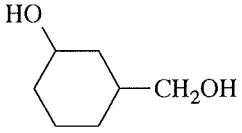
17. What is the main **product** of the reaction shown in the box?



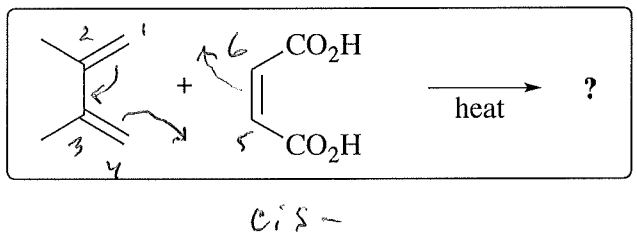
A) 

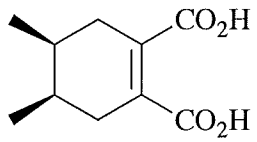
B) 

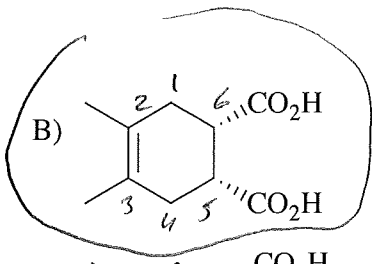
C) 

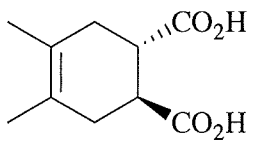
D) 

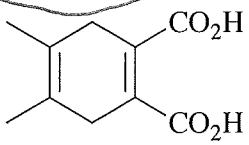
18. What is the main **product** of the reaction shown in the box?



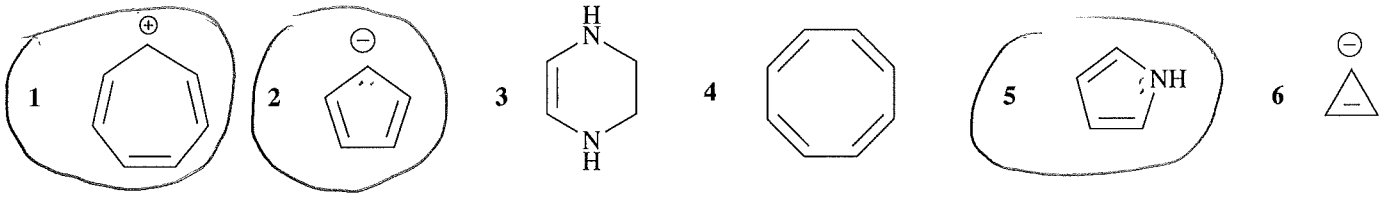
A) 

B) 

C) 

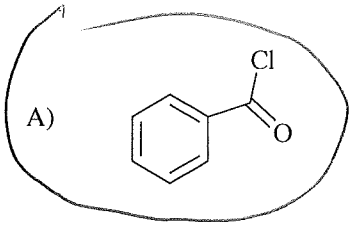
D) 

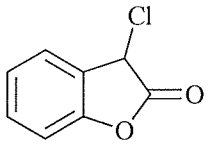
19. Which of the compounds shown in the box are **aromatic**?

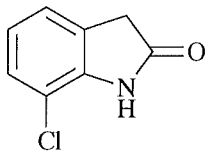


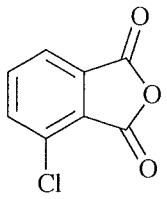
A) **1**, **2**, and **3** B) **1**, **2**, and **5** C) **3**, **5**, and **6** D) **1**, **4**, and **5**

20. Which acid derivative is the most **reactive** in nucleophilic acyl substitution reaction?

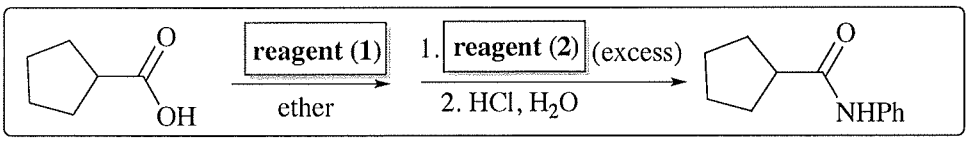
A) 

B) 

C) 

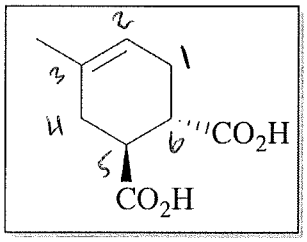
D) 

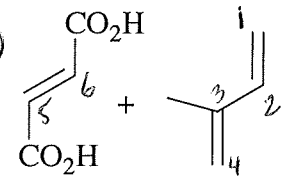
21. Which **reagents** can be used for the reaction shown in the box?

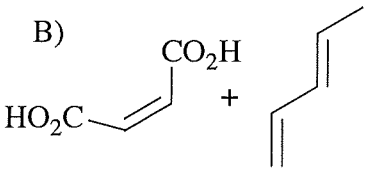


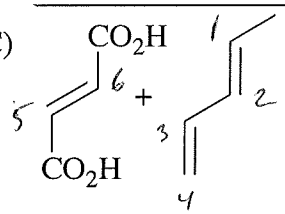
A) (1) $PhNH_2$, (2) $SOCl_2$
B) (1) $SOCl_2$, (2) $PhNH_2$
C) (1) PhLi, (2) CO_2
D) (1) $SOCl_2$, (2) $PhCH_2NH_2$

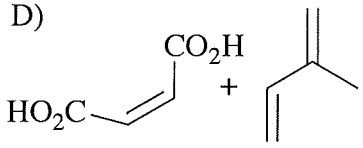
22. Which pair of **reactants** is required to synthesize the compound in the box?



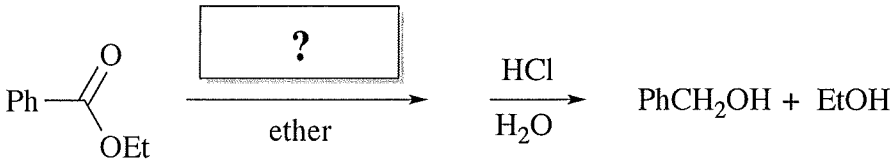
A) 

B) 

C) 

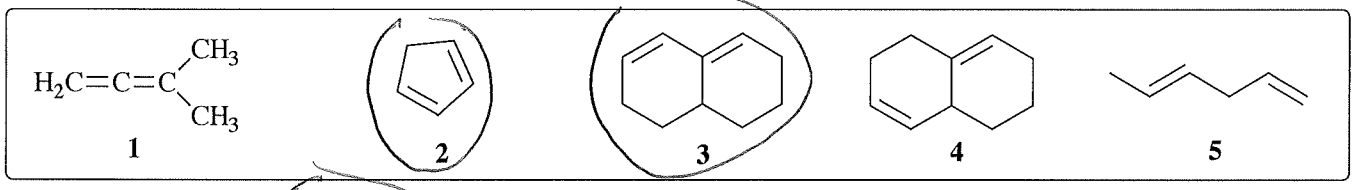
D) 

23. Which **reagent** can be used for the following reaction?



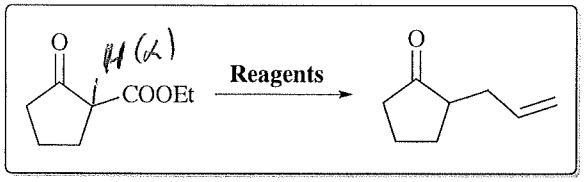
A) $NaBH_4$ B) CH_3MgBr C) Mg D) $LiAlH_4$

24. Which of these compounds are **conjugated** dienes?



A) **1** and **3** B) **2** and **3** C) **2** and **4** D) **1** and **5**

25. Which of the following schemes is expected to give the product of the reaction in the box in high yield?



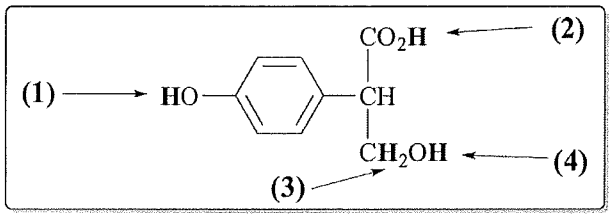
A) $NaOH, H_2O$ → $CH_2{=}CHCH_2OCH_3$ → EtO^-Na^+ → H_2O, HCl, heat

B) EtO^-Na^+ → $CH_2{=}CHCH_2Br$ → H_2O, HCl, heat (decarboxylation)

C) $CH_2{=}CHCH_2MgBr$ → H_2O, HCl → $NaOH, H_2O$, heat

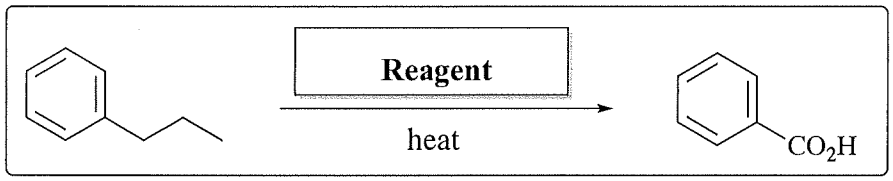
D) H_2O, HCl, heat → $CH_2{=}CHCH_2OH$

26. Which is the order of **acidity** of hydrogen atoms for compound shown in the box?



A) **1** (lowest pKa) > **2** > **4** > **3** (highest pKa)
B) **4** (lowest pKa) > **2** > **1** > **3** (highest pKa)
C) **1** (lowest pKa) > **2** > **3** > **4** (highest pKa)
D) **2** (lowest pKa) > **1** > **4** > **3** (highest pKa)

27. Which **reagent** can be used for the reaction shown in the box?



A) PCC
B) Cl_2, light
C) H_2CrO_4
D) $CO_2/AlCl_3$

28. Which one of the following compounds is the **highest acidity**?

A) phenol B) benzyl alcohol C) toluene D) *p*-nitrophenol

Question 29 (16 pts): Please write your answers into the appropriate space on the back of the Scantron form.

29. Provide formulas of **reagents** that give the indicated products in high yield (4 pts each):