Chemistry 2542
Fall 2012; Midterm 2 Exam

This exam has 5 problems on 7 pages. Make sure your copy is complete and correct.

Printed Name (Last, First) Key

Scores:

Problem 1: 15

Problem 2: 15

Problem 3: 28

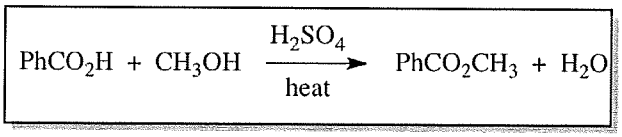
Problem 4: 24

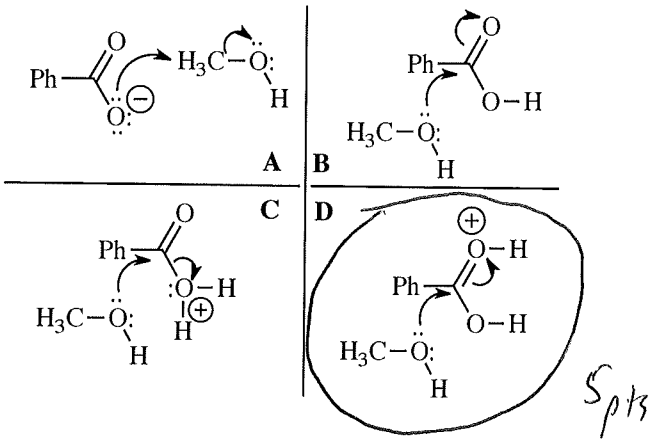
Problem 5: 18

Total: 100

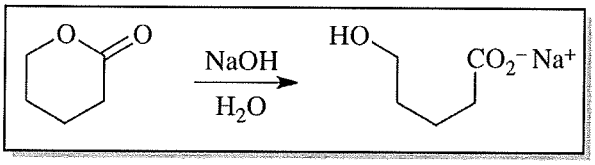
1. (15 pts) Answer the questions on mechanisms of the following reactions.

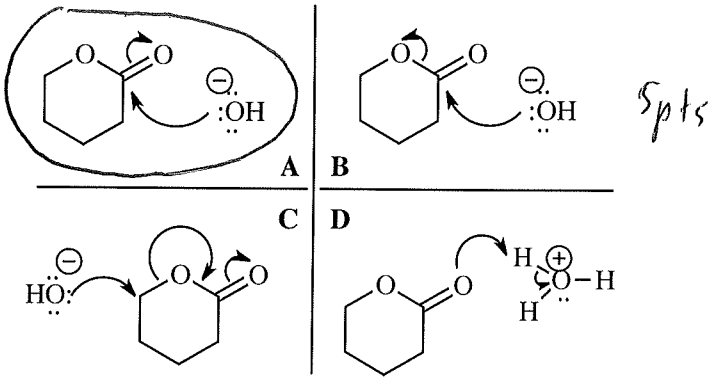
(a) Which one of the following four schemes (**A-D**) represents a step in the mechanism for the **esterification** reaction shown in the box (circle the correct answer; 5 pts)



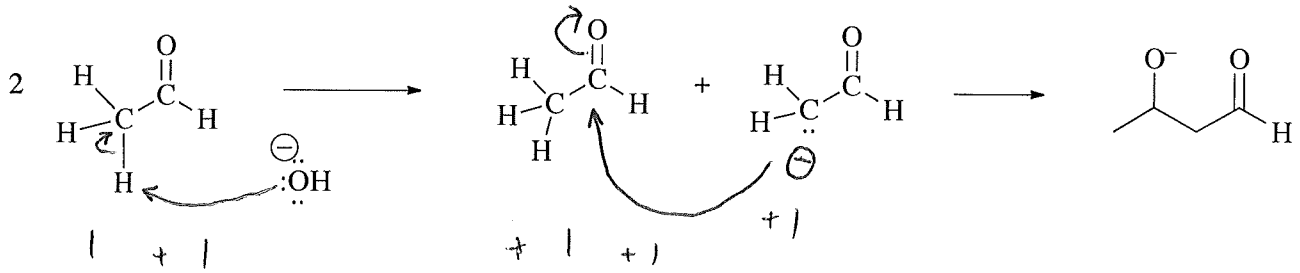


(b) Which one of the following four schemes (**A-D**) gives the best representation of a step in the mechanism of the **saponification** reaction shown in the box (circle the correct answer; 5 pts):





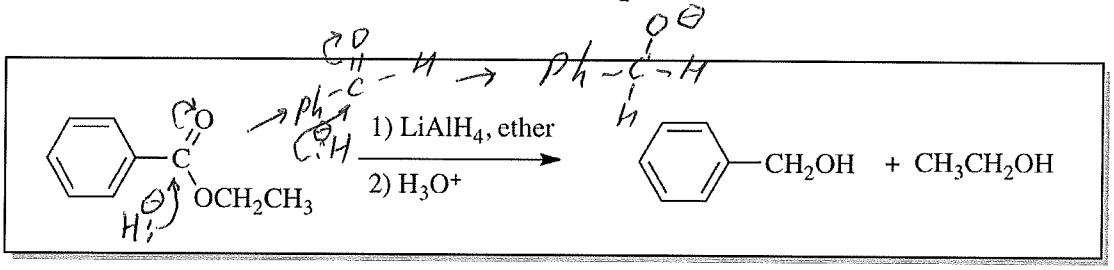
(c) Write **4** curved **arrows** and one **charge** missing in the mechanism for the **aldol condensation** (5 pts; 1 pt each):

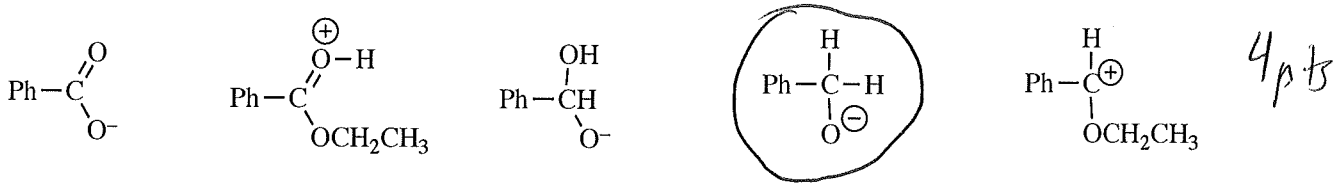


15pts

2. (15 pts) Answer the following questions.

(a) (4 pts) Circle the structure of the **intermediate product** for the reaction in the box:





4 pts

(b) (5 pts) Arrange the following compounds in order of increasing acidity (place a number ***1-5*** in the appropriate box, 1 pt each box):

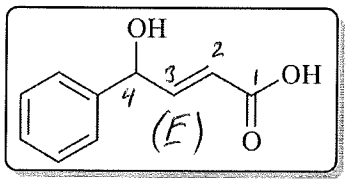
(*1*) 3-fluoropropanoic acid (*2*) 2-fluoropropanoic acid, (*3*) propanoic acid, (*4*) propane, (*5*) 1-propanol

[4] < [5] < [3] < [1] < [2]

weakest acid — strongest acid

5 pts

(c) (6 pts) Circle the correct **IUPAC name** of the compounds in the boxes (2 pts each):

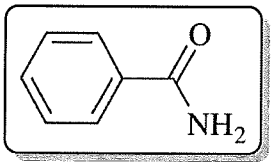


(Z)-4-hydroxy-5-phenyl-2-pentenoic acid (E)-4-hydroxy-5-phenyl-2-pentenoic acid

(Z)-4-hydroxy-4-phenyl-2-butenoic acid (E)-4-hydroxy-4-phenyl-2-butenoic acid

(Z)-4-oxo-1-phenyl-2-butenediol (E)-4-oxo-1-phenyl-2-butenediol

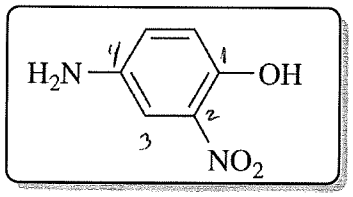
2 pts



1-amino-2-phenylethanal amidobenzene benzamide

2-phenylacetamide benzoylamine phenylformamide

2 pts



4-amino-2-nitrophenol 4-hydroxy-2-nitroaniline

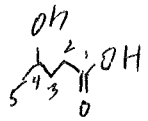
2-nitro-4-anilinophenol 2,4-diaminophenol

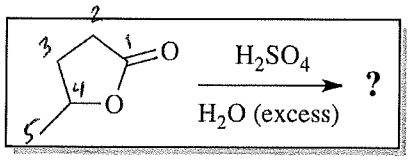
2-nitro-4-aminobenzol 3-amino-2-hydroxynitrobenzene

2 pts

15 pts

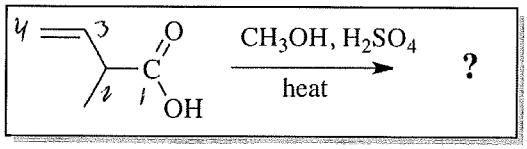
3. (28 pts) Circle the **major product** in each of the following reactions **(4 pts each)**:



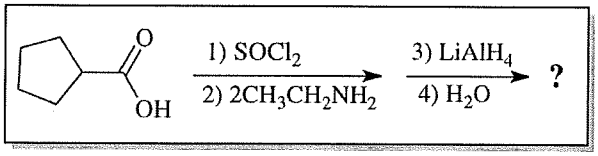


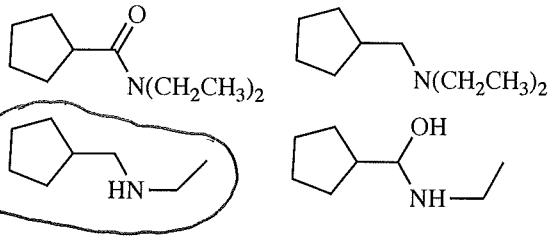
1-hydroxy-3-methylcyclopentanone
4-hydroxypentanoic acid
4-hydroxy-4-methylpentanoic acid
4-hydroxy-4-methylpentanoic acid
5-hydroxy-4-methylpentanoic acid
4-methylcyclopentanecarboxylic acid

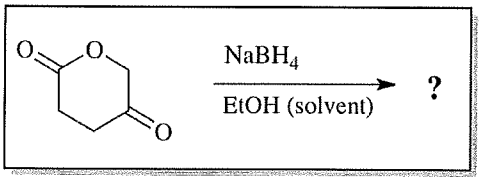
4 pts

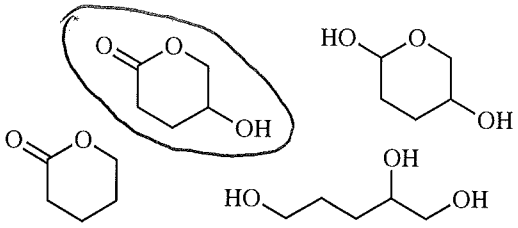


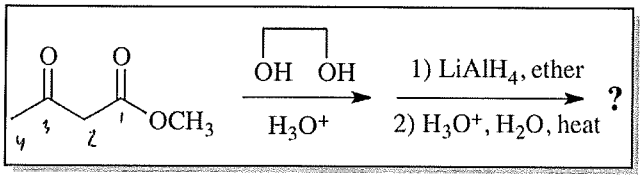
2-methyl-3-butenoic acid
2-methyl-3-buten-1-ol
2-methyl-3-buten-1-al
(Z)-2-methyl-2-propenoate
methyl 2-methyl-3-pentenoate
methyl 2-methyl-3-butenoate

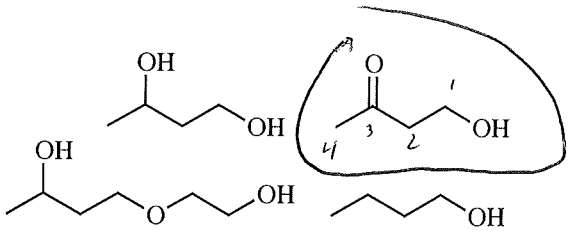


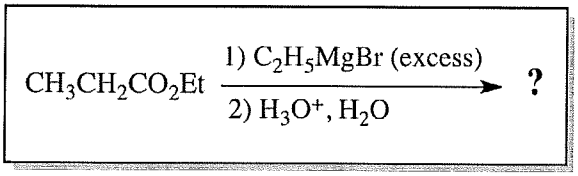


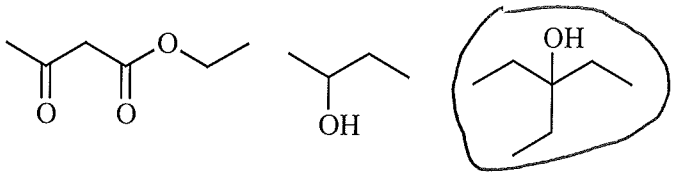




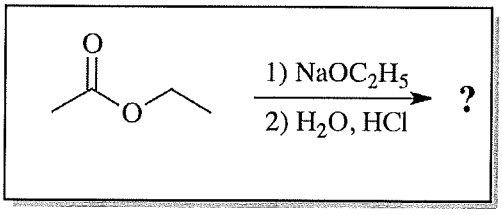


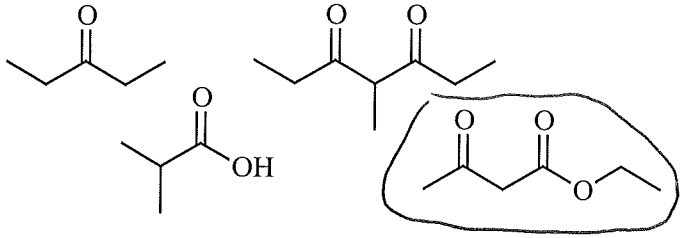






$CH_3CH(OH)C_3H_7$ $CH_3CO_2C_3H_7$ $(CH_3)_3COH$



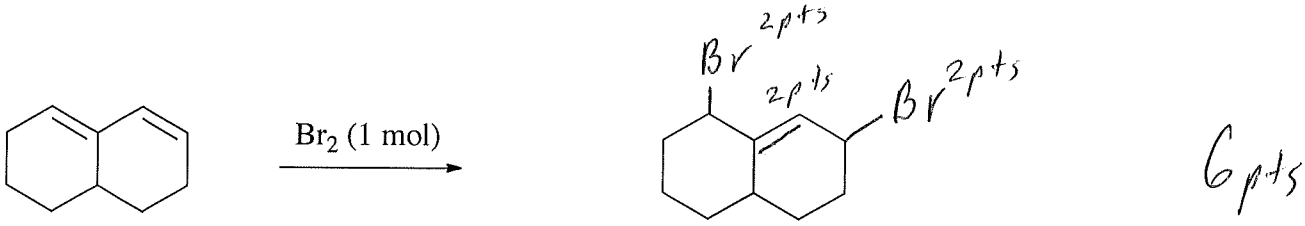


acetoacetic ester

28 pts

4. (**24 pts**) Answer the following questions:

(a) (6 pts) Finish drawing the structure of 1,4-addition product in the following reaction by showing appropriate substituents and missing bonds (2 pts each missing part):



6 pts

1,4-addition product

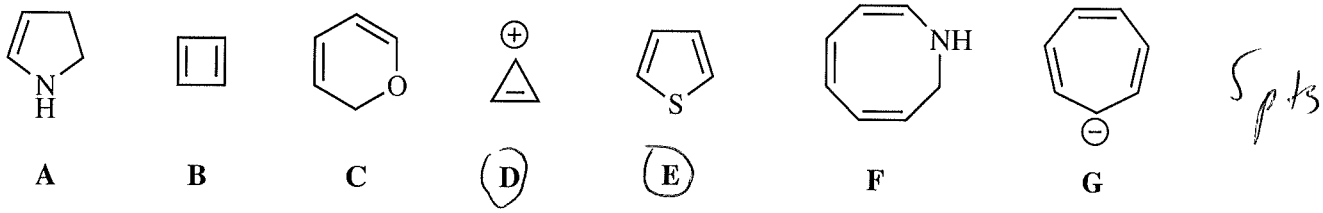
(b) (8 pts) Arrange the following **phenols** in order of **increasing acidity** (2 pts each box):

(*1*) 2,4,6-trimethylphenol, (*2*) 2,4,6-trinitrophenol, (*3*) phenol, (*4*) *o*-nitrophenol

1	<	3	<	4	<	2
weakest (2 pts)		2 pt		2 pt		strongest (2 pts)

8 pts

(c) (5 pts) Which of the compounds shown in the boxes are **aromatic**? (put all appropriate letters **A-G** in the provided box; no partial credit)

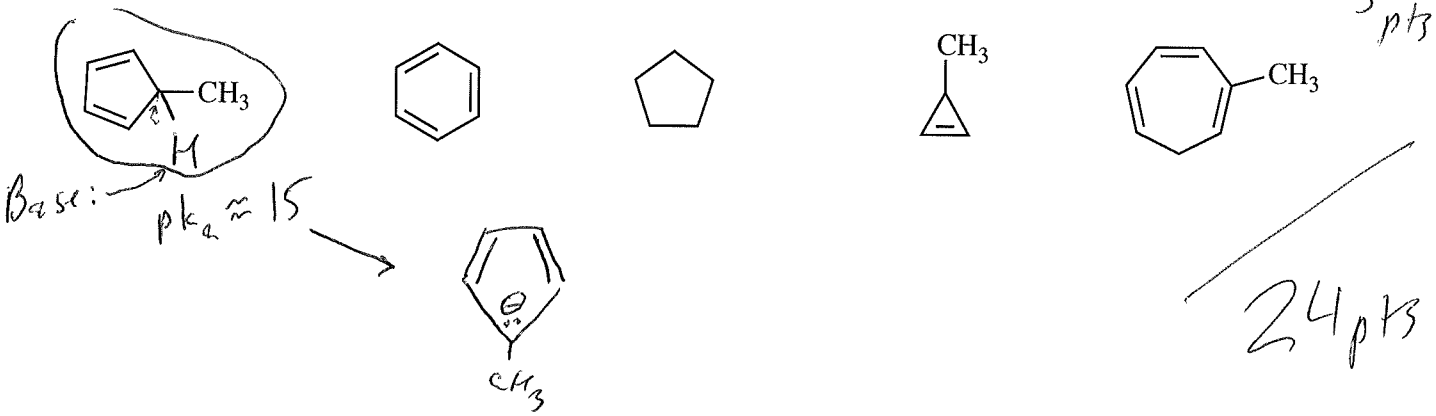


A **B** **C** **D** **E** **F** **G**

5 pts

Aromatic molecules:
(place appropriate letters A-G in the box) DE

(d) (5 pts) Which is the most **acidic** hydrocarbon (circle one molecule)?

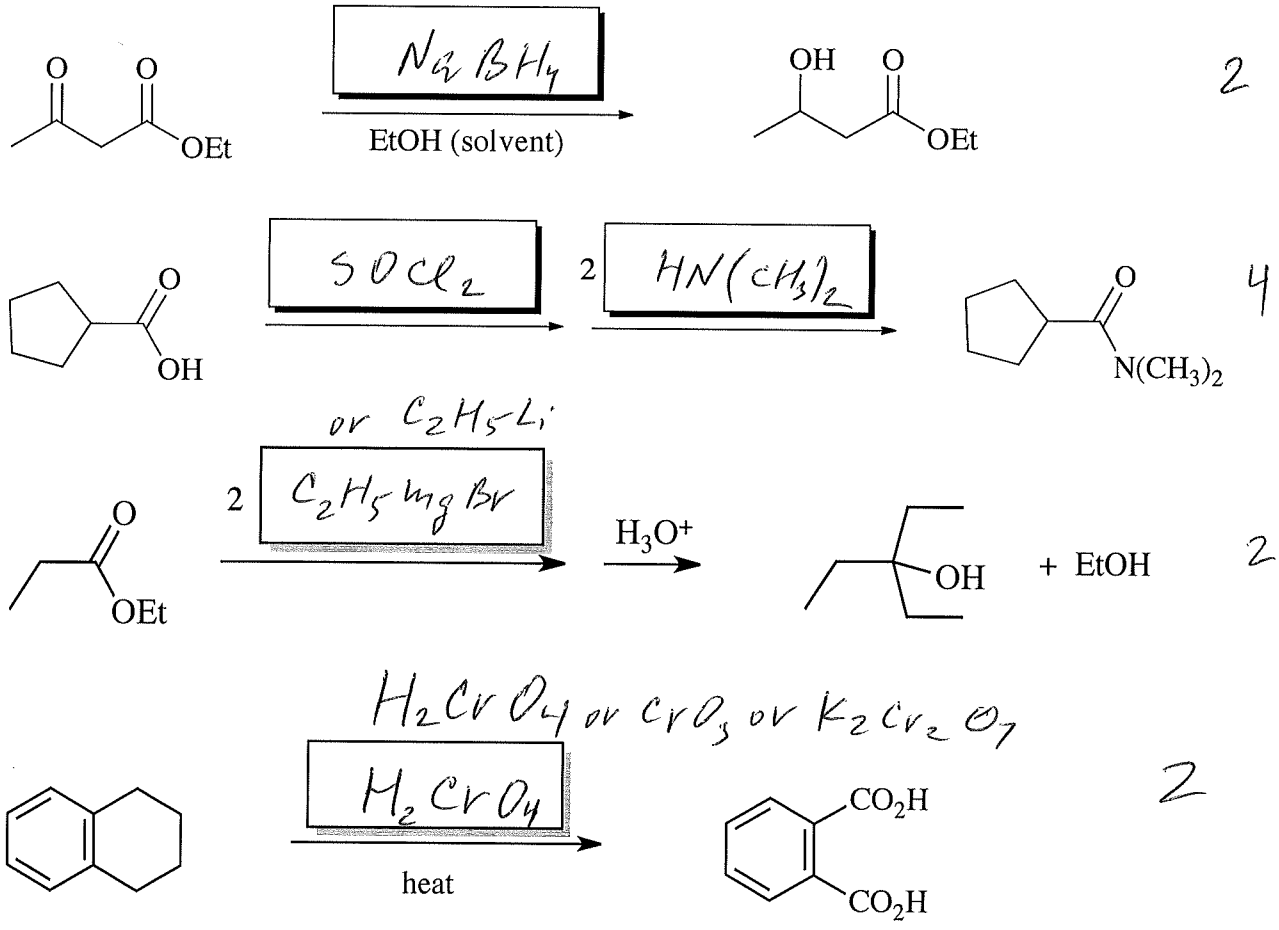


5 pts

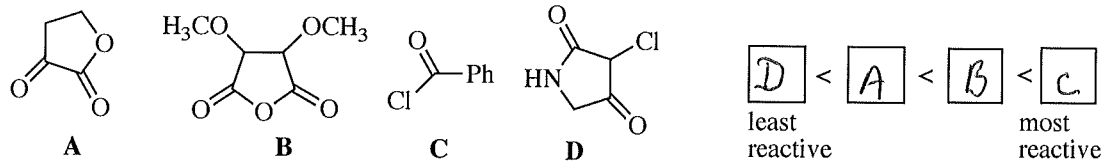
24 pts

5. (**18 pts**) Answer the following questions:

(a) (10 pts) Place in each box the molecule of a reagent that is required to perform each of the following reactions (2 pts each box):



(b) (8) Arrange the following compounds in order of reactivity for **nucleophilic acyl substitution reaction** (put letters in the box; 2 pts each box):



18 pts