

Organic Chemistry

有机化学双语教学
试卷及参考答案（部分）

王 梅

大连理工大学

Name: _____
Student Number: _____
Department: _____
Chemistry
Class: _____

Dalian University of Technology

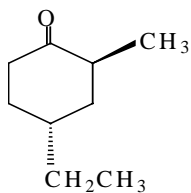
Course: Organic Chemistry (1) Band: A
School (Department): School of Chemical Engineering

Date: January 10, 2005 Total: 5 pages

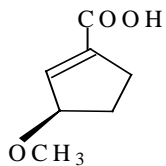
	1	2	3	4	5	6	7	8	Total
Standard points	20	12	8	20	6	20	6	8	100
Scores									

1. Give a systematic or a trivial name for each of the following formulas or write a molecular structure as required for each given name (20 points, 2 points for each name or structure).

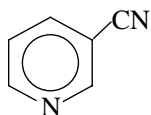
(1)



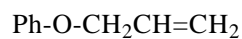
(2)



(3)



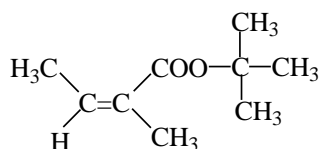
(4)



(5)



(6)



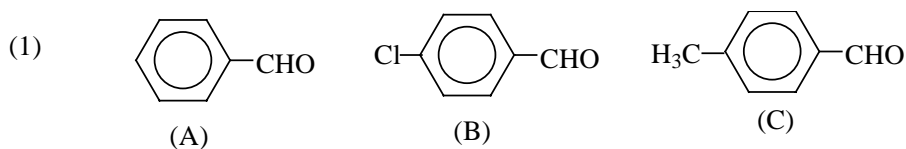
(7) 2-formylthiophene

(8) 1-pentyl amine (write the most stable Newman projection)

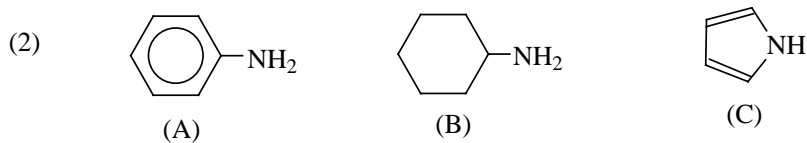
(9) (1S,2S)-1-fluoro-2-isopropylcyclohexane (write the most stable conformation)

(10) (2R,3S)-2,3-dihydroxybutanoic acid (write a Fischer projection)

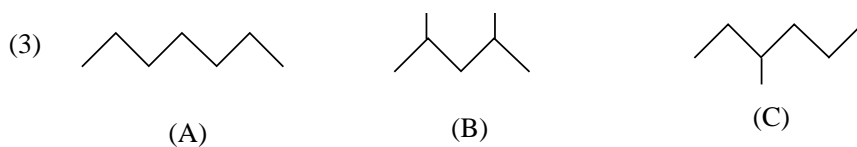
2. As required, compare physical and chemical properties for each of the following groups (12 points, 3 points for each problem).



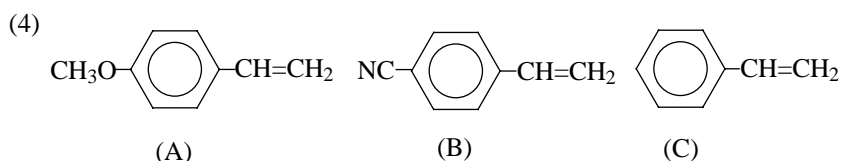
(dipole moment)



(basicity)

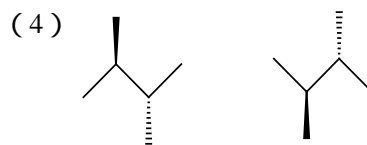
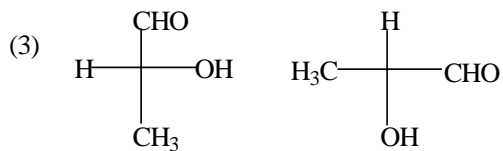
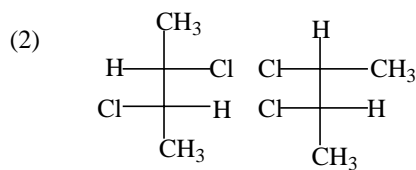
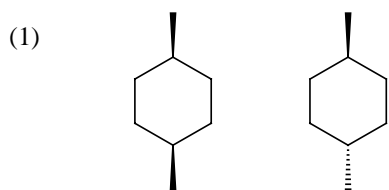


(boiling point)

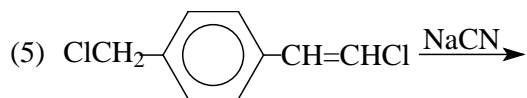
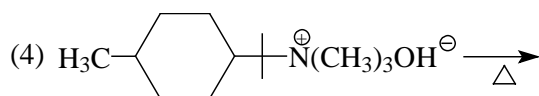
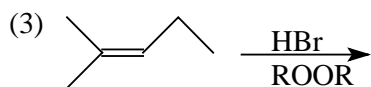
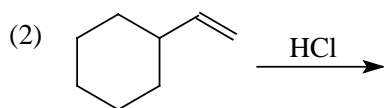
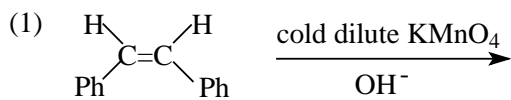


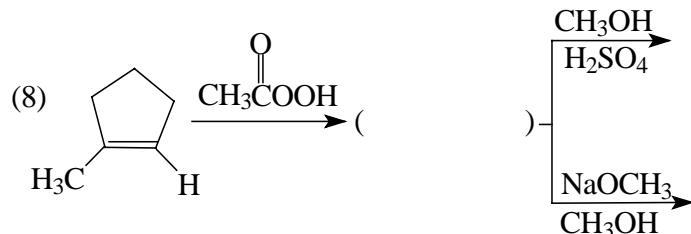
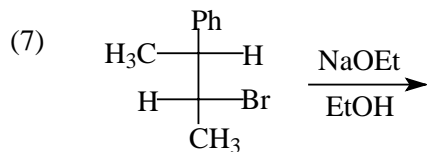
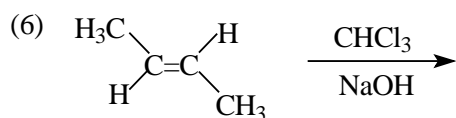
(the reaction rate of the above compounds with Br₂)

3. Identify the following pairs of compounds as identical, enantiomers or diastereomers (8 points, 2 points for each problem).

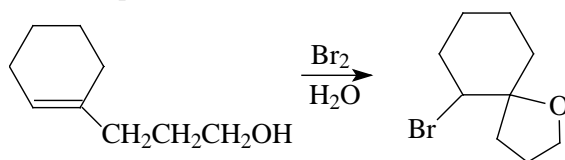


4. Give major products of the following reactions, when the reactions are stereoselective, show the stereostructures of the products by three-dimensional formula (20 points, 2 points for each product).

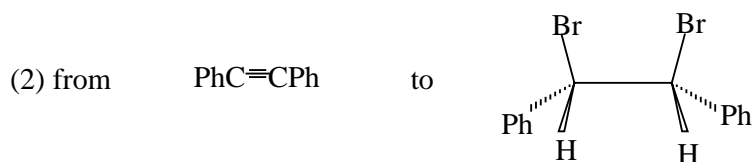


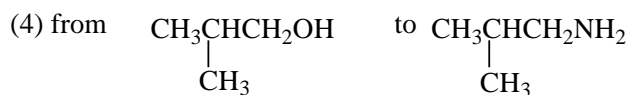


5. Show all steps in the mechanism for the formation of the product (6 points).

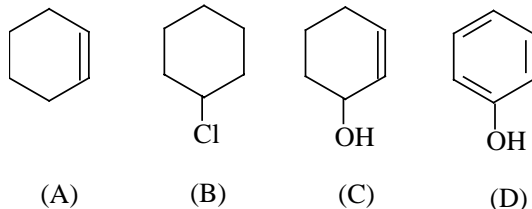


6. Design synthetic routes for the following products from the indicated starting compounds and other necessary reagents (20 points, 6 points for each product of problem (1) and (3); 4 points for each product of problem (2) and (4)).





7. There are 4 compounds (**A**, **B**, **C** and **D**) in 4 test tubes, please distinguish each compound by simple testing methods (6 points).



8. Choose correct answers for the following questions (8 points, 2 points for each problem).

(1) Valence bond theory is normally used to explain_____.

- (A) the reactivity of molecules
- (B) the spatial shape of molecules
- (C) the polarizability of molecules
- (D) the stability of molecules

(2) For a configuration retention reaction, we can confirm that during the reaction the _____ of the chiral carbon atom does not change.

- (A) relative configuration
- (B) absolute configuration
- (C) rotation direction of polarized-light
- (D) R/S designation

(3) A pair of enantiomers can be isolated by _____ .

- (A) distillation
- (B) recrystallization
- (C) sublimation
- (D) resolution

(4) The characteristics of E2 mechanism is _____.

- (A) a two step, second-order reaction
- (B) a one step, first-order reaction
- (C) a two step, first-order reaction
- (D) a one step, second-order reaction

参考答案及评分标准 (Band: A)

课程: 有机化学(上)

班级: 英强班 20021-2

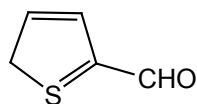
院(系): 化工学院

日期: 2005年1月10日

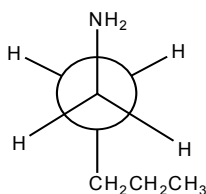
1. Give a systematic or a trivial name for each of the following formulas or write a molecular structure as required for each given name (20 points, 2 points for each name or structure).

- (1) (2S,4R)-4-ethyl-2-methylcyclohexane
- (2) (3R)-3-methoxy-1-cyclopentenecarboxylic acid
- (3) 3-cyanopyridine
- (4) allyl phenyl ether
- (5) 7-methyl-bicyclo[4.2.1]nonane
- (6) *t*-butyl (Z)-2-methyl-2-butanoate

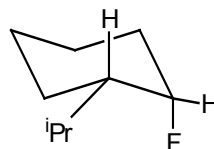
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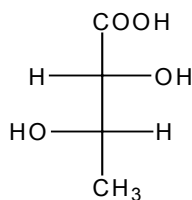
(8)



(9)



(10)



2. As required, compare physical and chemical properties for each of the following groups (12 points, 3 points for each problem).

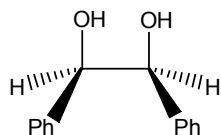
- (1) C > A > B
- (2) B > A > C
- (3) A > C > B
- (4) A > C > B

3. Identify the following pairs of compounds as identical, enantiomers or diastereomers (8 points, 2 points for each problem).

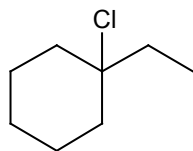
(1) diastereomers (2) identical (3) enantiomers (4) enantiomers

4. Give major products of the following reactions, when the reactions are stereoselective, show the stereostructures of the products by three-dimensional formula (20 points, 2 points for each product).

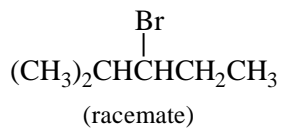
(1)



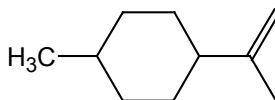
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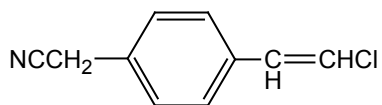
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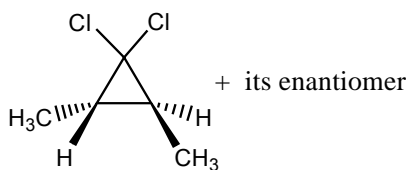
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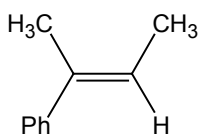
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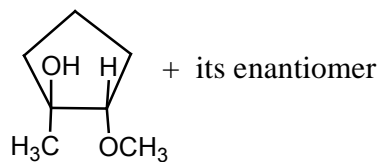
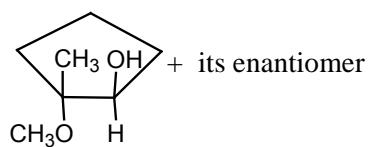
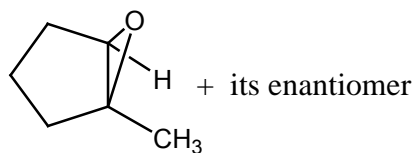
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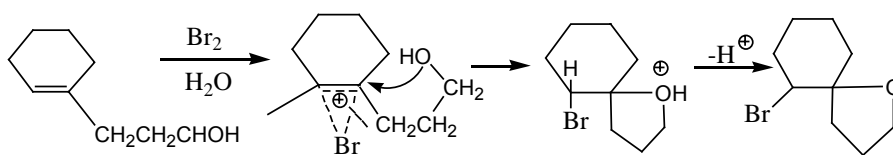
(7)



(8)

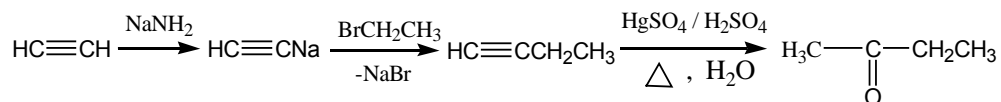


5. Show all steps in the mechanism for the formation of the product (6 points).

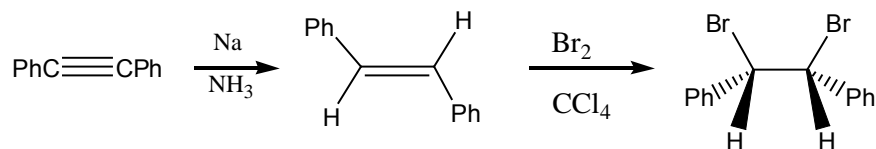


6. Design synthetic routes for the following products from the indicated starting compounds and other necessary reagents (20 points, 6 points for each product of problem (1) and (3); 4 points for each product of problem (2) and (4)).

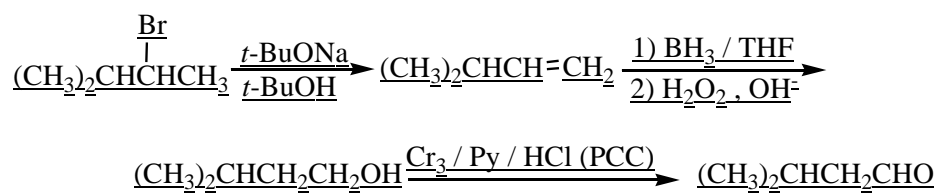
(1)



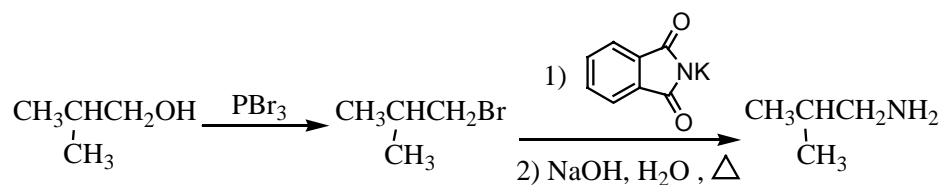
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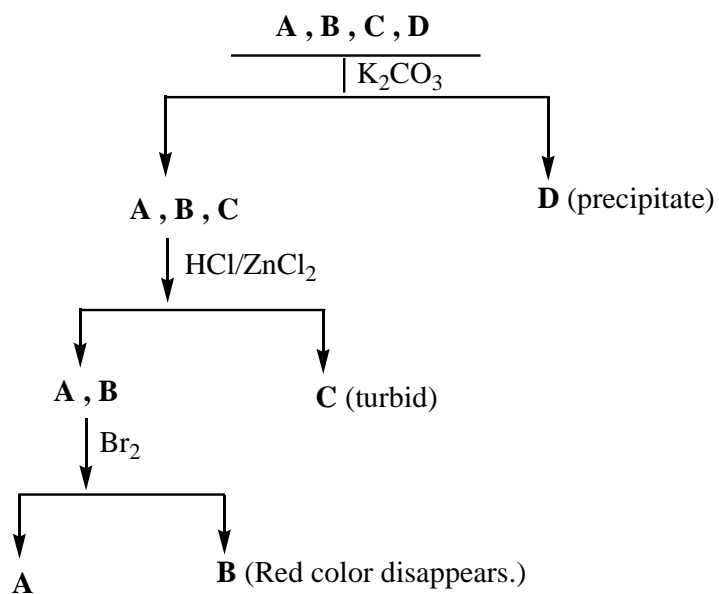
(3)



(4)



7. There are 4 compounds (**A**, **B**, **C** and **D**) in 4 test tubes, please distinguish each compound by simple testing methods (6 points).



8. Choose correct answers for the following questions (8 points, 2 points for each problem).

- (1) B (2) B (3) D (4) D

Name: _____
 Student Number: _____
 Department: _____
Chemistry
 Class: _____

Dalian University of Technology

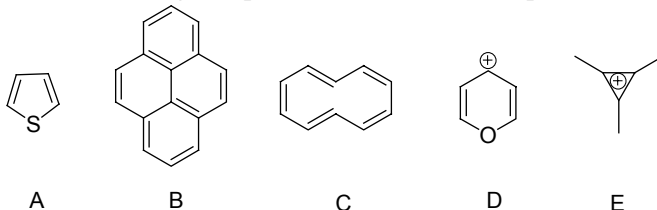
Course: Organic Chemistry (2) Band: A
 School (Department): School of Chemical Engineering

Date: July 21, 2005 Total: 5 pages

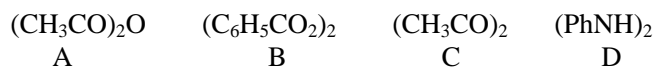
	1	2	3	4	5	6		Total
Standard points	15	22	8	20	15	20		100
Scores								

1. Give answers to each of the following questions (15 points, 5 points for (1); (2) and (3), each 2 points; (4) and (5), each 3 points).

(1) Which of the following compounds are aromatic compounds?



(2) Which of the following compounds is the initiator for a radical reaction?



(3) The nucleophilic addition of HCN to an aldehyde will form two diastereomers, which are _____.

- | | |
|--------------------|----------------|
| A. anomers (正位异构体) | C. mesomers |
| B. epimers (差向异构体) | D. enantiomers |

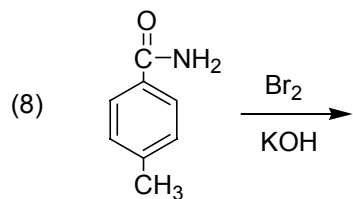
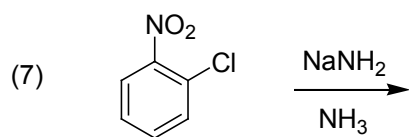
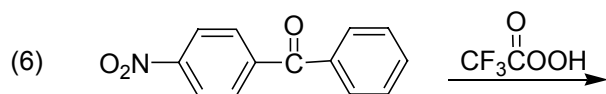
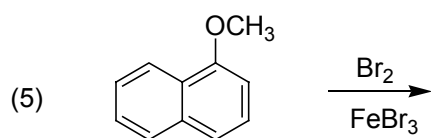
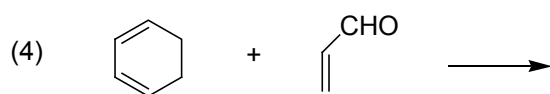
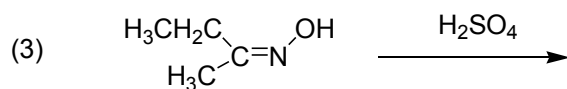
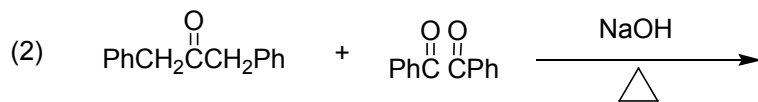
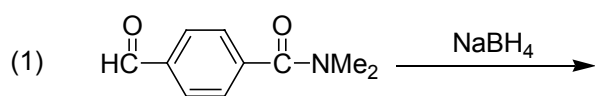
(4) Which of the following reagents can be used as a simple testing method to distinguish pentanal, 2-pentanone and 3-pentanone in 3 test-tubes?

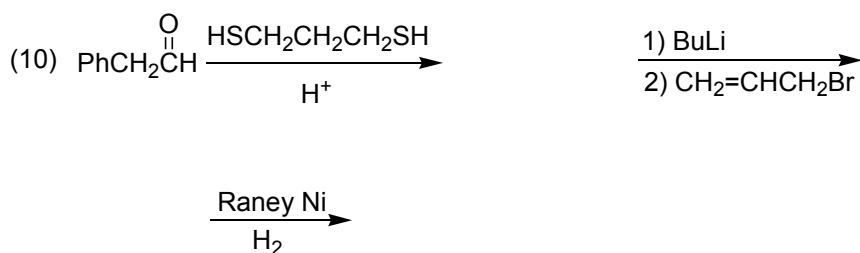
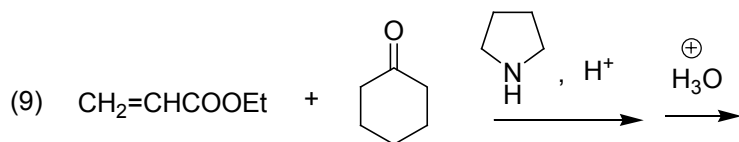
- | | |
|--|---|
| A. Tollen's reagent and KI/I_2 | C. Lucas reagent and KI/I_2 |
| B. Tollen's reagent and I_2/NaOH | D. Lucas reagent and I_2/NaOH |

(5) Which of the following reagents can be used as a simple testing method to distinguish CH_3COCH_3 (acetone), PhCOPh (diphenyl ketone) and $\text{CH}_3\text{COOCH}_3$ in 3 test-tubes?

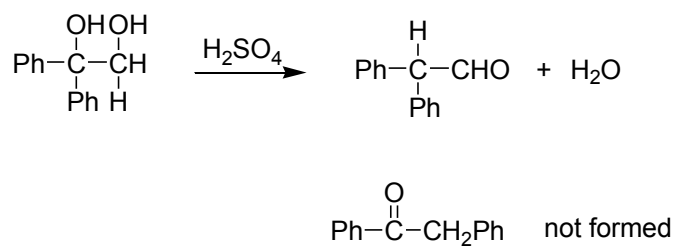
- | | |
|--|--|
| A. NaHSO_3 and NH_2OH | C. Na_2SO_3 and NH_2OH |
| B. NaHSO_3 and PhNHNHPh | D. Na_2SO_3 and PhNHNHPh |

2. Give major products of the following reactions (22 points, 2 points for each major product).

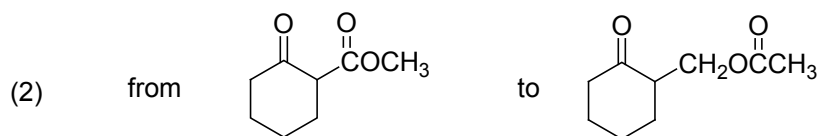
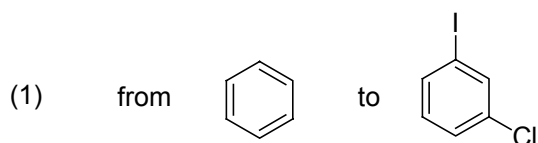


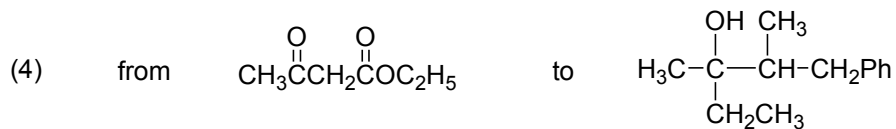
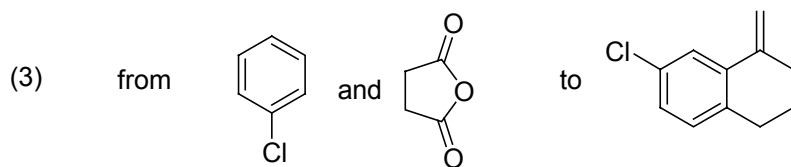


3. Show all of the steps in the mechanism for the following reaction and explain why the aldehyde is formed rather than the ketone (8 points).

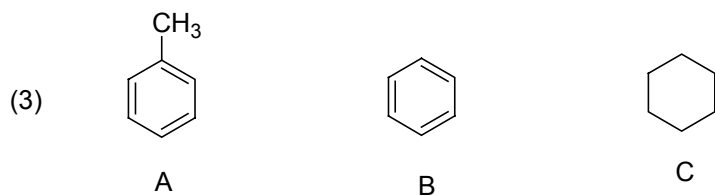
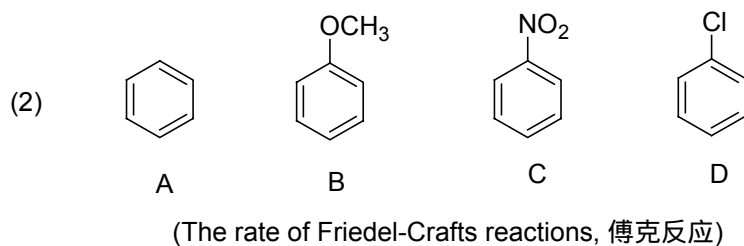
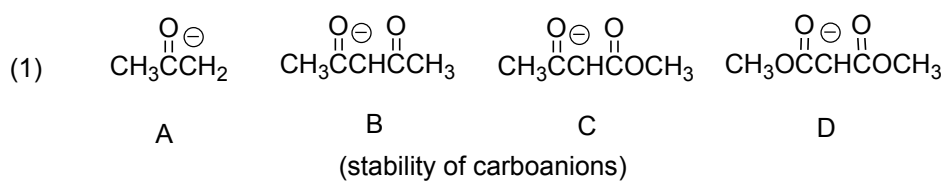


4. Prepare the following compounds using the indicated starting materials and other necessary reagents (20 points, (1) and (4), each 6 points; (2) and (3), each 4 points).





5. Compare chemical properties for each of the following groups (15 points, 3 points for each question).



(The rate of the reaction with NBS) (N-bromosuccinimide, 溴代丁二酰亚胺)

参考答案及评分标准 (Band: A)

课程: 有机化学(下)

班级: 英强班 2002-1-2

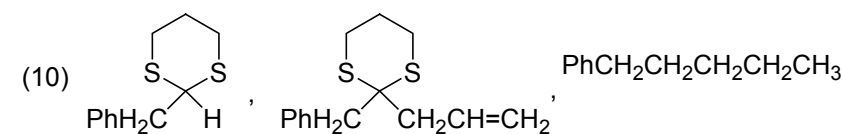
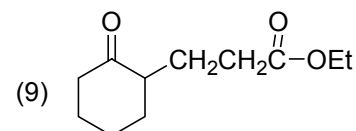
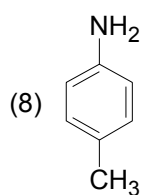
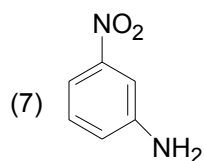
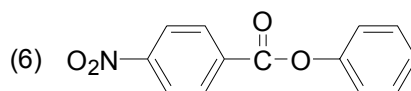
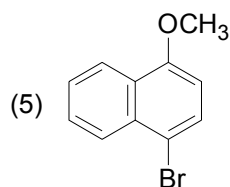
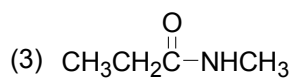
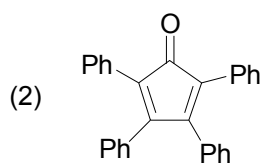
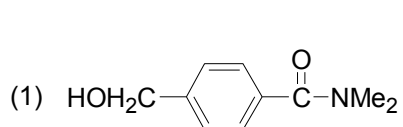
院(系): 化工学院

日期: 2005年7月21日

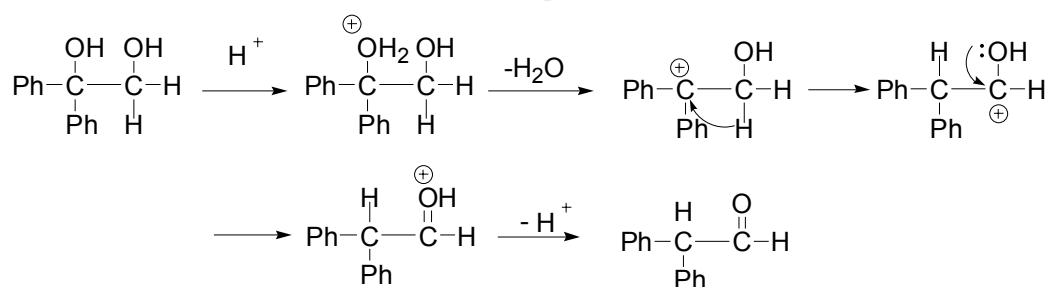
1. Give answers to each of the following questions (15 points, 5 points for (1); (2) and (3), each 2 points; (4) and (5), each 3 points).

(1) A, B, D, E (2) B (3) B (4) B (5) A

2. Give major products of the following reactions (22 points, 2 points for each major product).

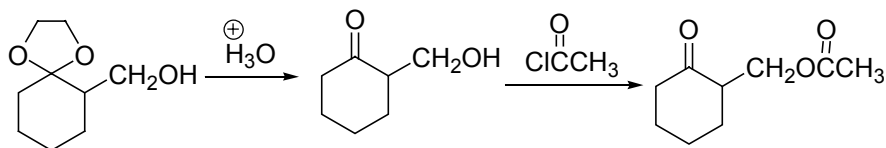
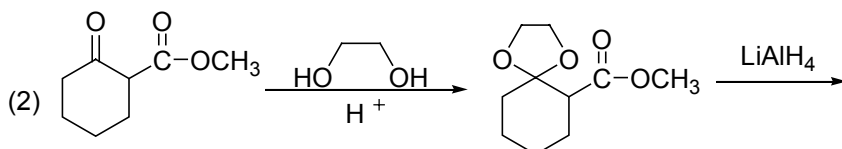
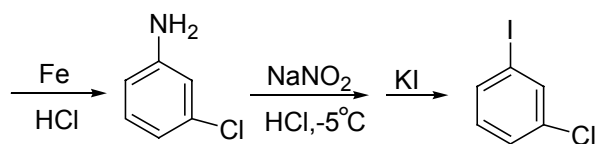
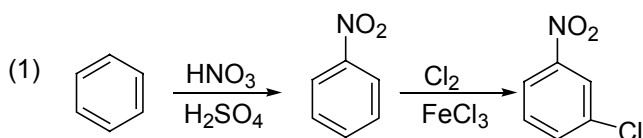


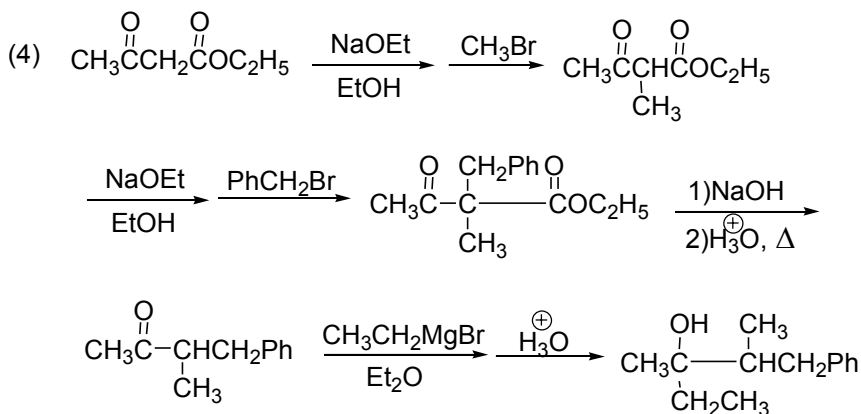
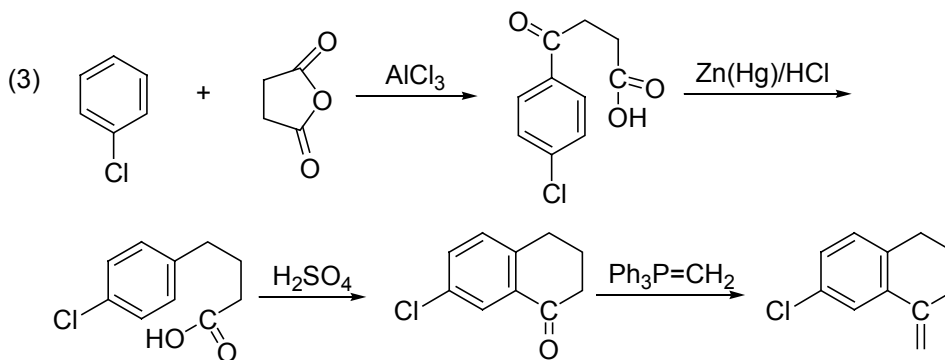
3. Show all of the steps in the mechanism for the following reaction and explain why the aldehyde is formed rather than the ketone (8 points).



Because the carbocation $\text{Ph}_2\text{C}^+-\text{CH}_2$ is less stable than $\text{Ph}_2\text{C}^+-\text{CH}_2$, the ketone $\text{Ph}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_2-\text{Ph}$ is not formed.

4. Prepare the following compounds using the indicated starting materials and other necessary reagents (20 points, (1) and (4), each 6 points; (2) and (3), each 4 points).





5. Compare chemical properties for each of the following groups (15 points, 3 points for each question).

(1) $B > C > D > A$

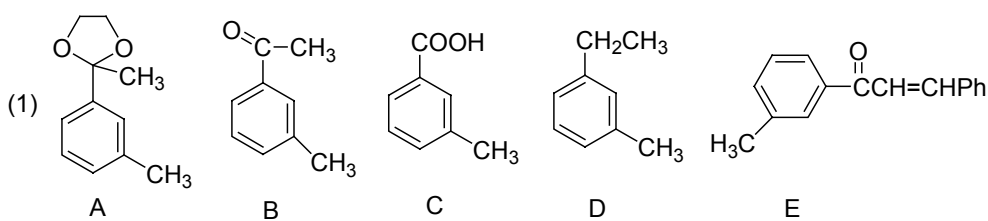
(2) $B > A > D > C$

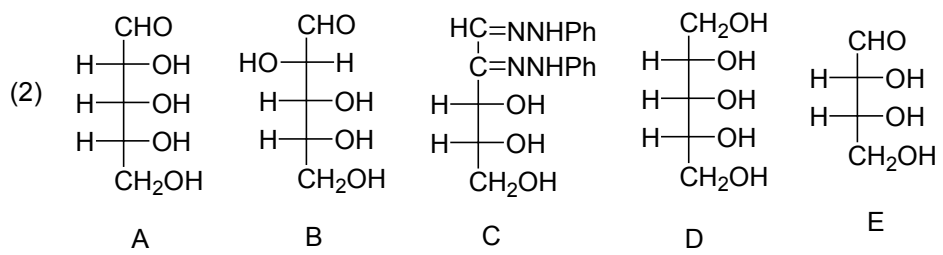
(3) $A > C > B$

(4) $C > B > A$

(5) $C > A > B$

6. Deduce the molecular structures of the following compounds according to the given reaction phenomena ((1) and (2), each 10 points; 2 points for each compound).





Name: _____
 Student Number: _____
 Department: Chemistry
 Class: _____

Dalian University of Technology

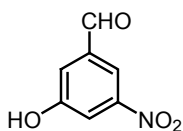
Course: Organic Chemistry (1) Band: A
 School (Department): School of Chemical Engineering

Date: January 9, 2006 Total: 5 pages

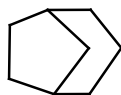
	1	2	3	4	5	6	7	Total
Standard points	14	10	26	9	5	20	16	100
Scores								

1. Give a systematic name for each of the following formulas or write a molecular formula for each given name (14 points).

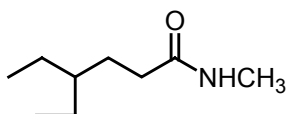
(a)



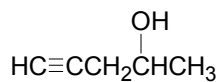
(b)



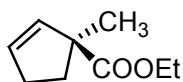
(c)



(d)



(e)

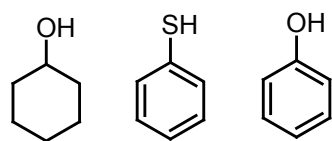


(f) 4-oxopentanenitrile

(g) (2*S*,3*R*)-3-chloro-2-butanol
(Fischer projection)

2. As required, compare physical and chemical properties for each of the following groups (10 points).

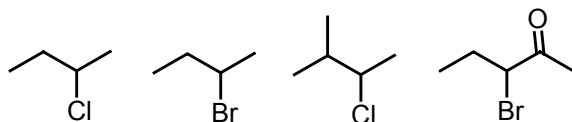
(a)



(A) (B) (C)

(acidity)

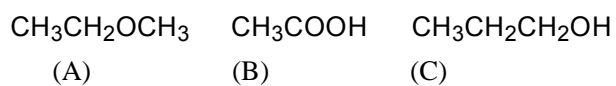
(b)



(A) (B) (C) (D)

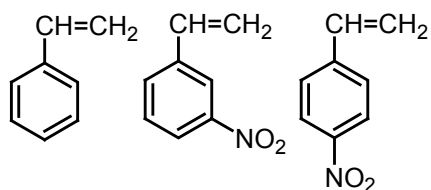
(S_N2 reaction rate)

(c)



(boiling point)

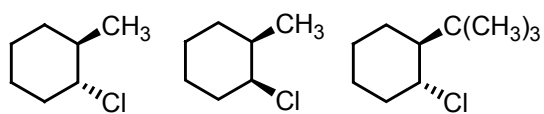
(d)



(A) (B) (C)

(the reactivity towards the addition of HCl)

(e)



(A) (B) (C)

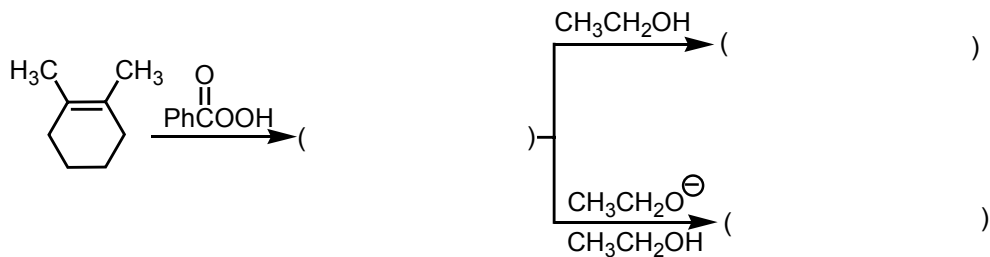
(E2 reaction rate)

3. Give major products of the following reactions, when necessary, show the stereochemistry of the products (26 points).

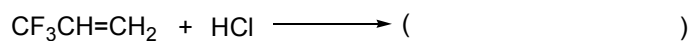
(a)



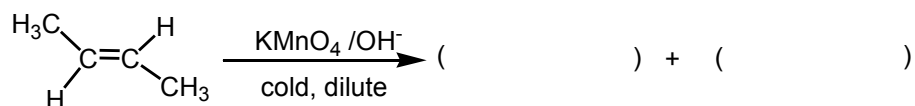
(b)



(c)



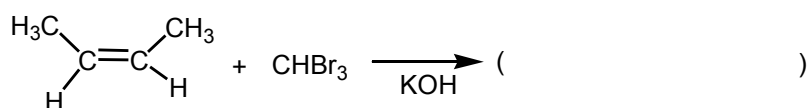
(d)



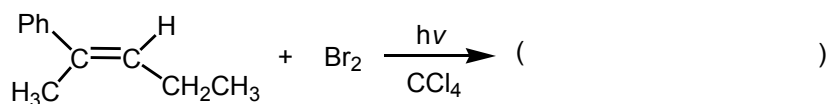
(e)



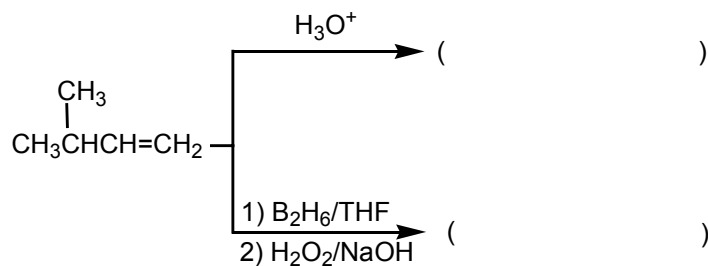
(f)



(g)

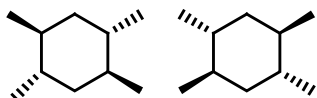


(h)

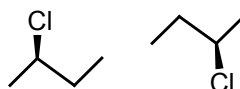


4. Determine whether the compounds in the following groups are enantiomers, diastereomers or the same compounds (9 points).

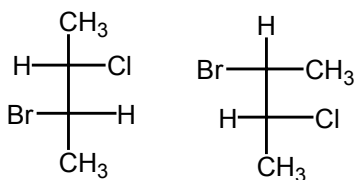
(a)



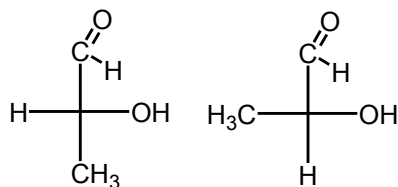
(b)



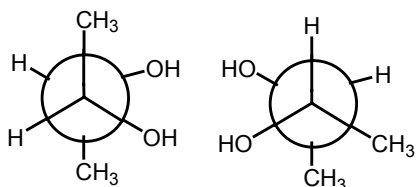
(c)



(d)



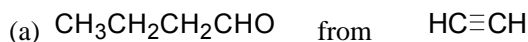
(e)



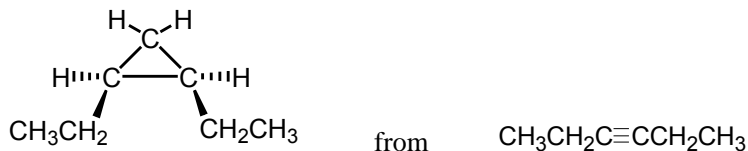
5. Determine whether each of the following statement is true or false (5 points).

- The enantiomers have the same rate of reaction with (*R*)-2-butanol.
- Hofmann eliminations are second order reactions.
- The enantiomers can be separated by distillation.
- The $\text{S}_{\text{N}}1$ reaction leads to racemization of an optically active alkyl halide.
- The rate of the $\text{E}1$ reaction increases with increasing the strength of nucleophiles.

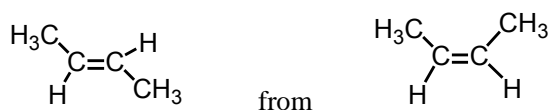
6. Synthesis of the compounds from the indicated starting materials. More than one step may be necessary (24 points).



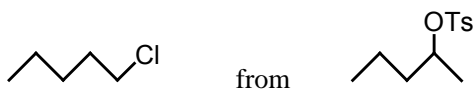
(b)



(c)

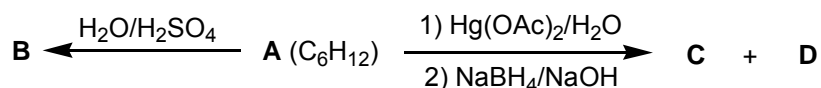


(d)



7. Deduced the molecular structures according to the given reaction phenomena (16 points).

(a) Show the structures of **A**, **B** and **C** in the following reaction scheme. What is the relationship of **C** and **D**?



optically
inactive

optically active
(*R*-enantiomer)

both optically active

(b) A cyclic compound **A** ($\text{C}_7\text{H}_{11}\text{Br}$) reacts with Br_2/CCl_4 to form a tribromo-substituted compound **B**. In water **A** changes to two alcoholic compounds **C** and **D** which are constitutional isomers. **D** is a tertiary alcohol. Compound **A** reacts with NaOH in alcohol to form a conjugate diene **E**. After **E** is oxidized by O_3 and then hydrolyzed in the presence of zinc dust, $\text{OHCCH}_2\text{CH}_2\text{COCH}_3$ and OHCCHO were obtained. Please give the structures of **A**, **B**, **C**, **D** and **E** (Don't consider stereoisomers).

参考答案及评分标准 (Band: A)

课程: 有机化学(上)

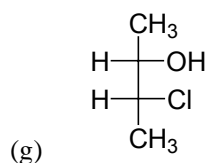
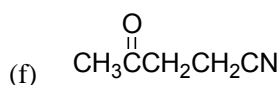
班级: 英强班 2003-1-2

院(系): 化工学院

日期: 2006年1月9日

1. Give a systematic name for each of the following formulas or write a molecular formula for each given name (14 points, 2 points for each name or structure).

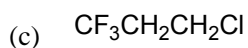
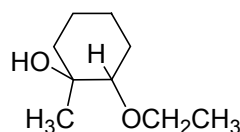
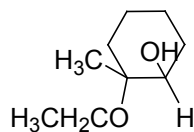
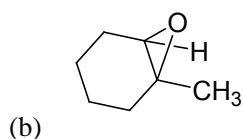
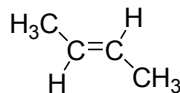
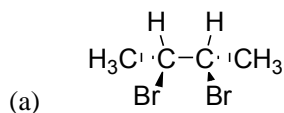
- (a) 3-hydroxy-5-nitrobenzaldehyde
- (b) bicyclo[3.2.1]octane
- (c) *N*-methyl 4-ethylhexanamide
- (d) 4-hydroxy-1-pentyne or 4-pentyn-2-ol
- (e) ethyl (*S*)-1-methyl-2-cyclopentenecarboxylate



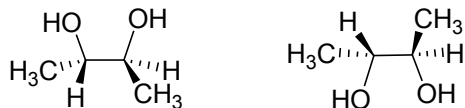
2. As required, compare physical and chemical properties for each of the following groups (10 points, 2 points for each problem).

- (a) (B) > (C) > (A)
- (b) (D) > (B) > (A) > (C)
- (c) (B) > (C) > (A)
- (d) (A) > (B) > (C)
- (e) (B) > (A) > (C)

3. Give major products of the following reactions, when necessary, show the stereochemistry of the products (26 points, 2 points for each product).

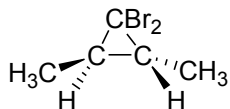


(d)

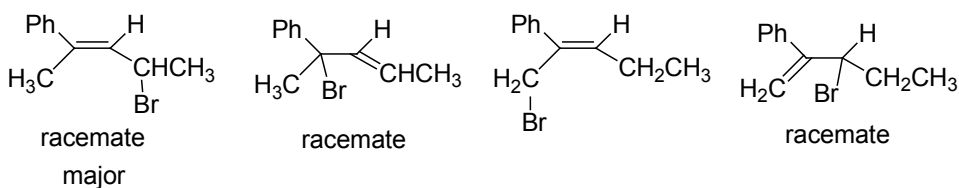


(e) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br}$

(f)



(g)



(h) $(\text{CH}_3)_2\text{COHCH}_2\text{CH}_3$

$(\text{CH}_3)_2\text{CHCH}_2\text{CH}_2\text{OH}$

4. Determine whether the compounds in the following groups are enantiomers, diastereomers or the same compounds (9 points, (a), (c), (d) and (e), each 2 points; 1 point for (b)).

(a) enantiomers (b) the same compounds (c) diastereomers

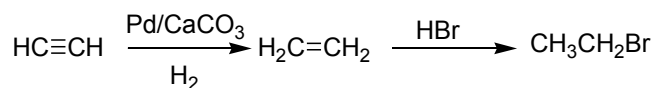
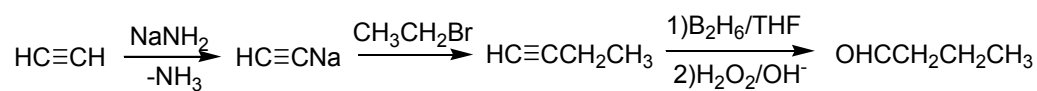
(d) enantiomers (e) diastereomers

5. Determine whether each of the following statement is true or false (5 points, each 1 point).

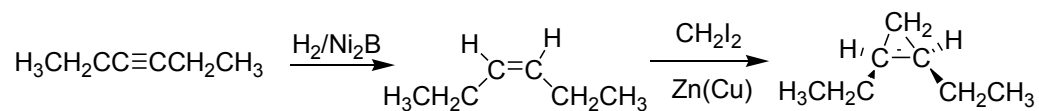
(a) F (b) T (c) F (d) T (e) F

6. Synthesis of the compounds from the indicated starting materials. More than one step may be necessary (20 points, 5 points for each product).

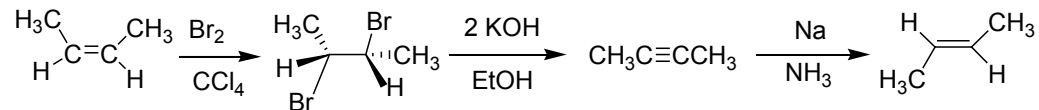
(a)



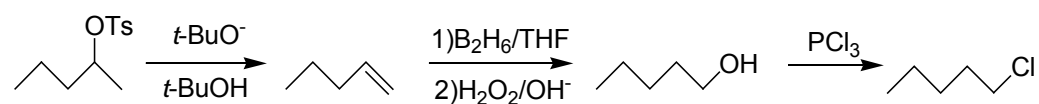
(b)



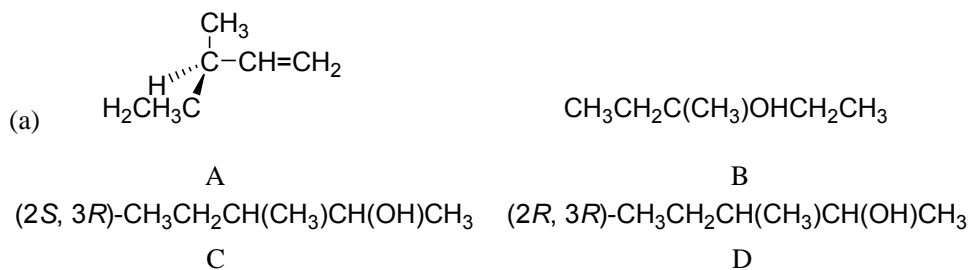
(c)



(d)

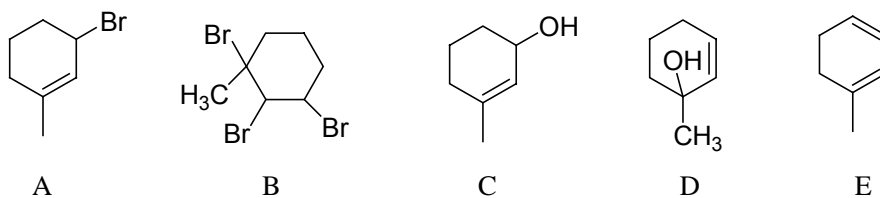


7. Deduce the molecular structures according to the given reaction phenomena (16 points, (a) 6 points, (b) 10 points, 2 points for each structure).



Compounds **C** and **D** are diastereomers.

(b)



Name: _____
 Student Number: _____
 Department: _____
 Chemistry
 Class: _____

Dalian University of Technology

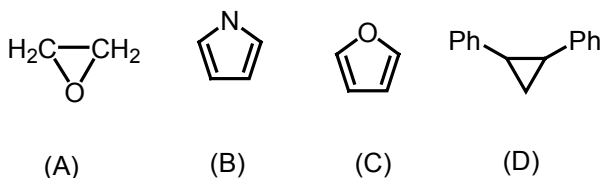
Course: Organic Chemistry (2) Band: A Exam. form: close-book
 School (Department): School of Chemical Engineering

Date: July 4, 2006 Total: 6 pages

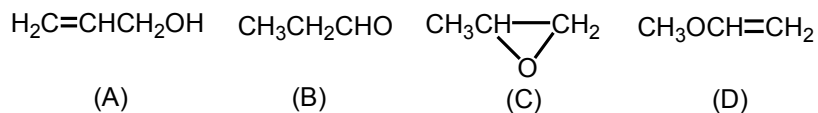
	1	2	3	4	5	6	7		Total
Standard points	8	12	20	10	25	15	10		100
Scores									

1. Give a right answer to each of the following questions (8 points).

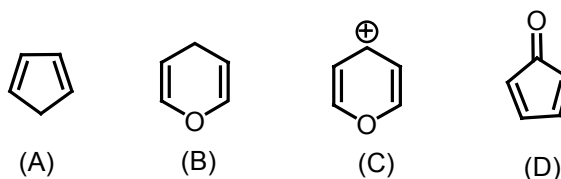
(a) In an aqueous acidic solution, which of the following compounds undergoes ring-opening reaction at a rapid rate.



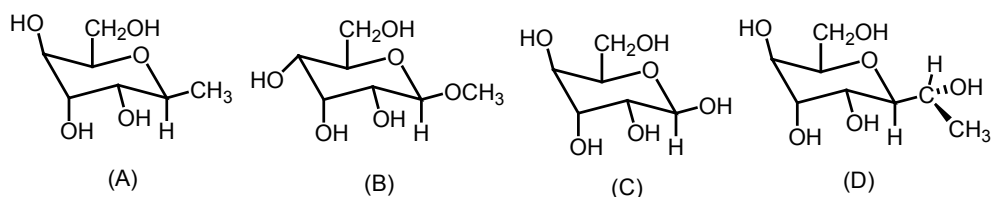
(b) Which of the following compounds is capable to reduce Tollen's reagent?



(c) Which of the following compounds is aromatic?

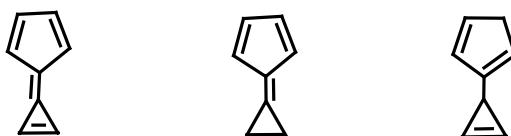


(d) Which of the following compounds displays mutarotation phenomena in basic solution?



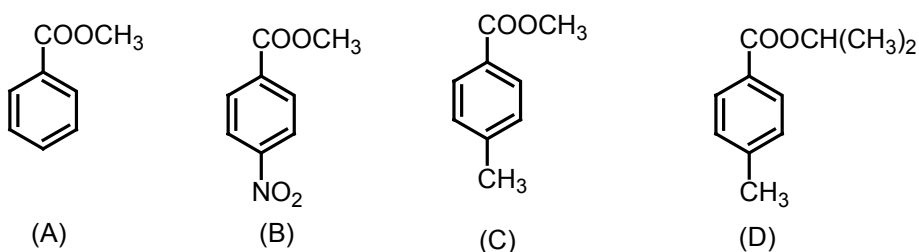
2. As required, compare physical and chemical properties for each of the following groups (12 points).

(a)



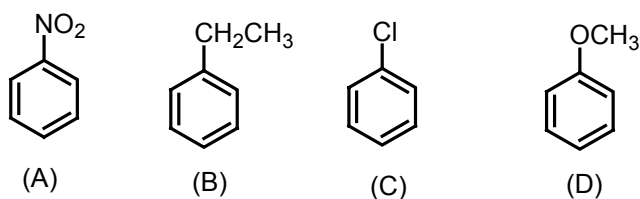
(Stability)

(b)



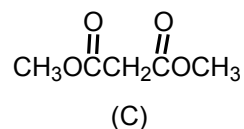
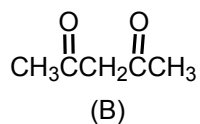
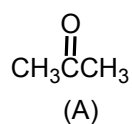
(The rate of hydrolysis in a basic aqueous solution)

(c)



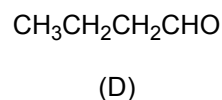
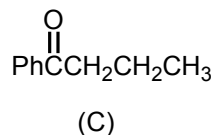
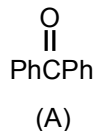
(The rate of Friedel-Crafts alkylation reaction)

(d)



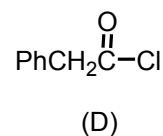
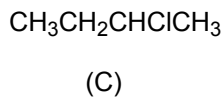
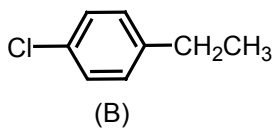
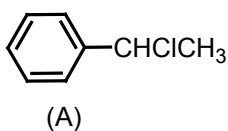
(Equilibrium constant for carbonyl - enol tautomerization)

(e)



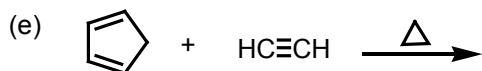
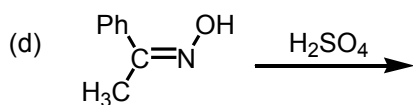
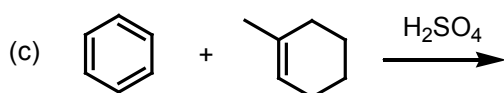
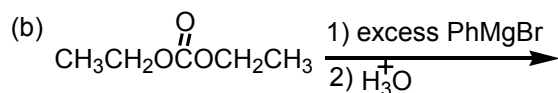
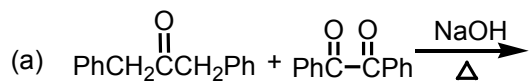
(The rate of reaction with HCN)

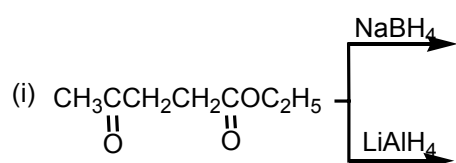
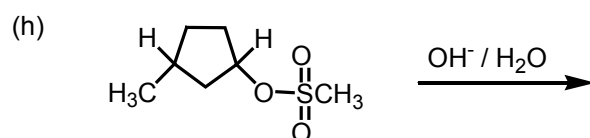
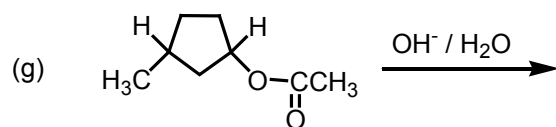
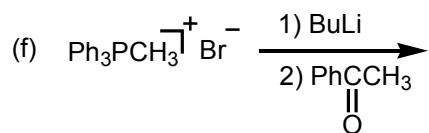
(f)



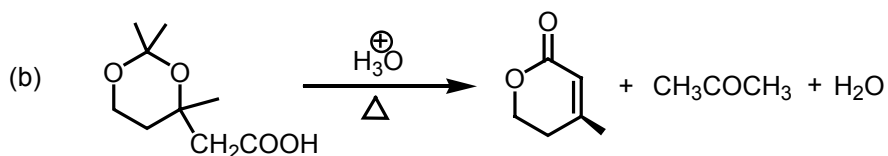
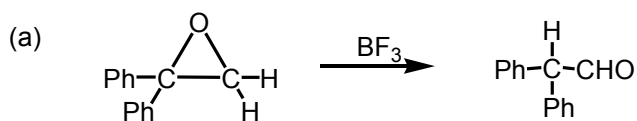
(The reactivity towards an aqueous NaOH solution)

3. Give the major products of the following reactions (20 points).

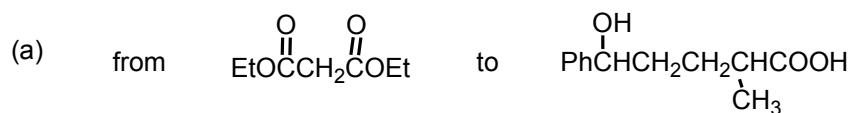


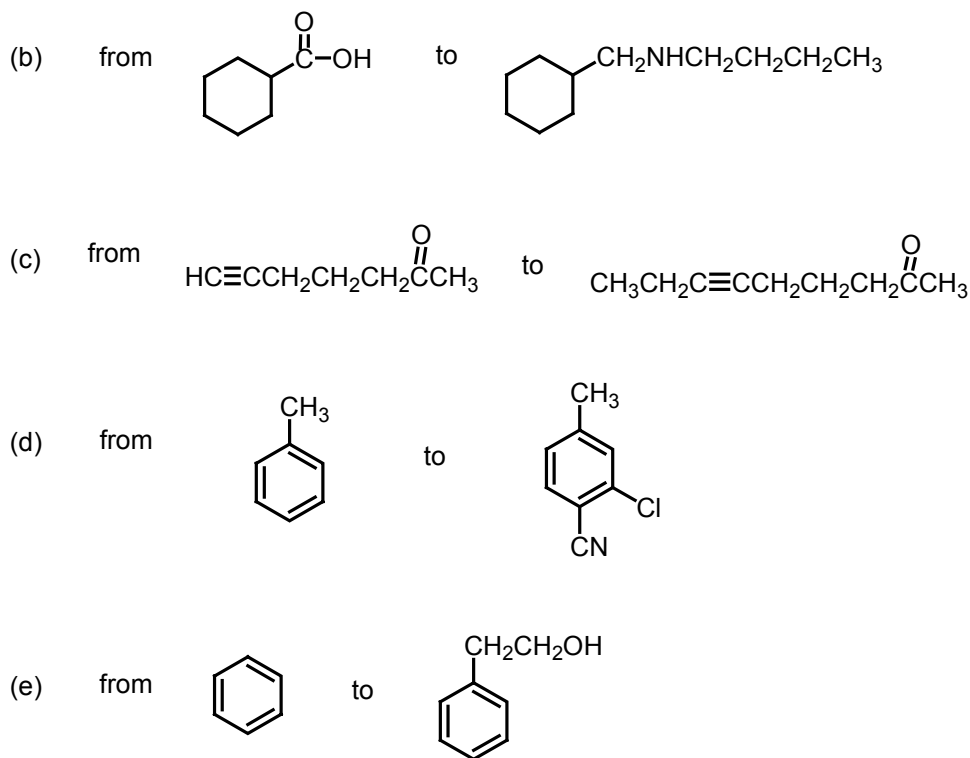


4. Show all of the steps in the mechanism for the following reactions (10 points).



5. Synthesis of the following products from the indicated starting compounds and other necessary reagents (25 points).

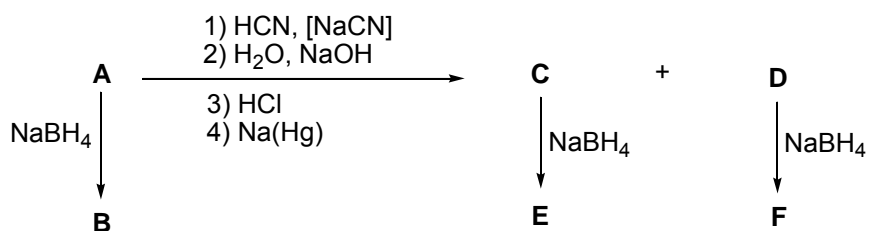




6. Deduce the molecular structures according to the given reaction phenomena (15 points).

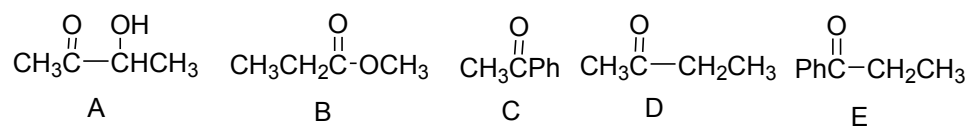
(a) Carbohydrate **A** is a D-aldotetrose. Compound **B** and **E** both rotate plane-polarized light.

Show the structures of **A**, **B**, **C**, **D** and **E** (7 points).



(b) Compound **A** ($\text{C}_{11}\text{H}_{12}\text{O}_2$) can be obtained by the reaction of an aromatic aldehyde with acetone in dilute basic solution. Hydrogenation of **A** catalyzed by Pd/C affords compound **B** ($\text{C}_{11}\text{H}_{14}\text{O}_2$). The reaction of **A** with I_2/NaOH and sequential acidification gives CHI_3 and compound **C** ($\text{C}_{10}\text{H}_{10}\text{O}_3$). Both **B** and **C** can be oxidized by $\text{KMnO}_4/\text{OH}^-$ to the same acid **D** ($\text{C}_8\text{H}_8\text{O}_3$). Treatment of **D** with HI yields another acid **E** ($\text{C}_7\text{H}_6\text{O}_3$). Intramolecular hydrogen bond is formed in compound **E**. Please give the structures of **A**, **B**, **C**, **D** and **E** (8 points).

7. There are 5 test-tubes. Each contains one of the following compounds. Please identify each of the following compounds using simple chemical testing methods and write testing reactions (10 points).



参考答案及评分标准 (Band: A)

课程: 有机化学(下)

班级: 英强班 2003-1,2

院(系): 化工学院

日期: 2006年7月4日

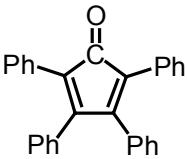
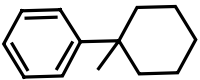
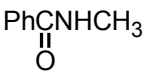

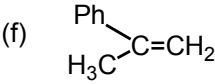
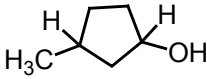
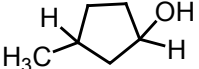
1. Give a right answer to each of the following questions (8 points, 2 points for each problem).

- (a) A (b) B (c) C (d) C

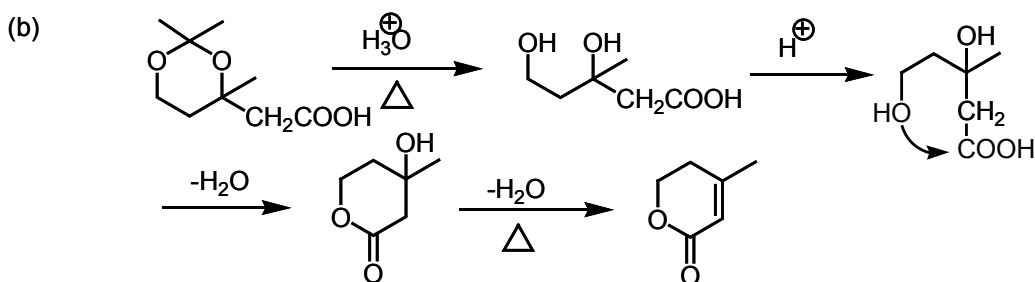
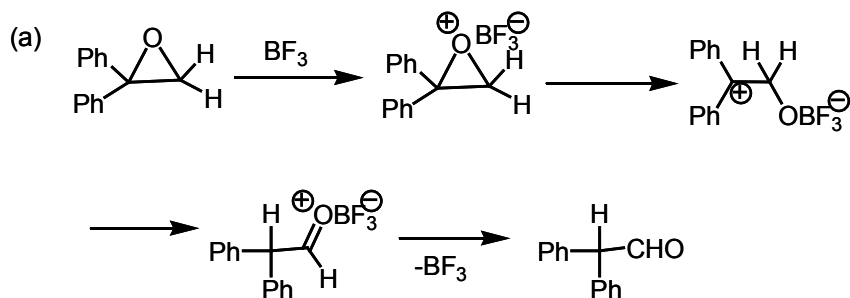
2. As required, compare physical and chemical properties for each of the following groups (12 points, 2 points for each problem).

- (a) $A > B > C$ (b) $B > A > C > D$
(c) $D > B > C > A$ (d) $B > C > A$
(e) $D > B > C > A$ (f) $D > A > C > B$

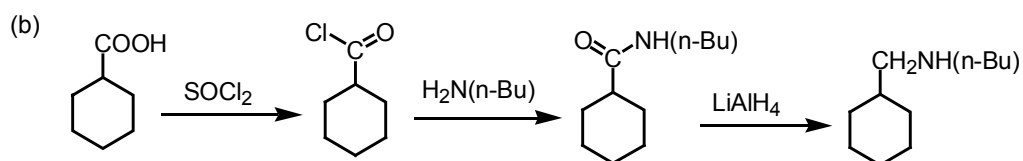
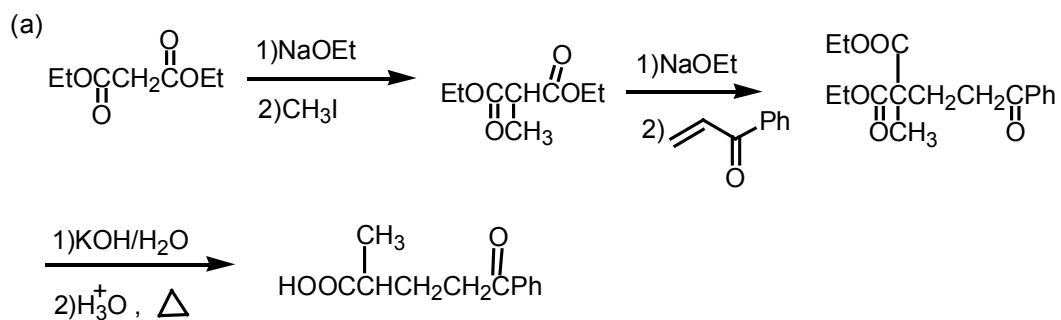
3. Give the major products of the following reactions (20 points, 2 points for each product).

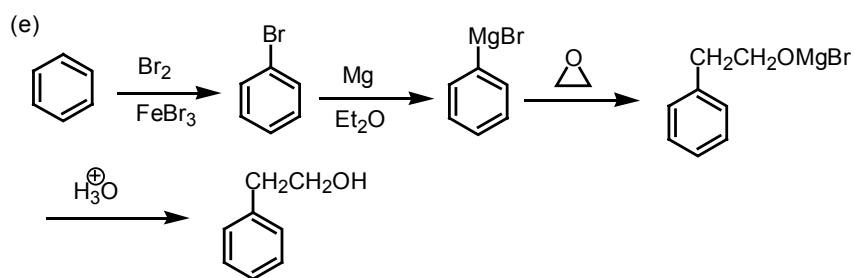
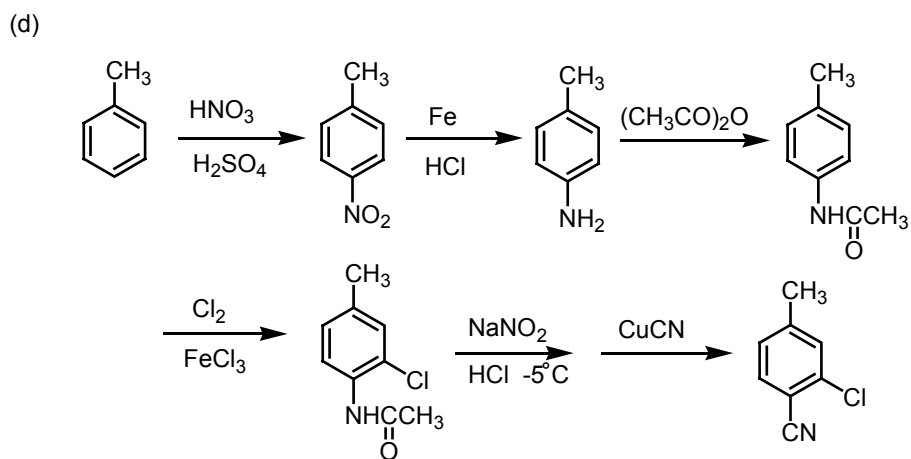
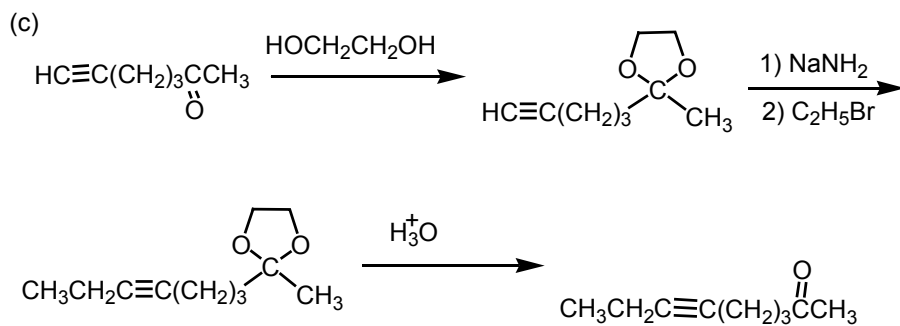
- (a)  (b) Ph_3COH (c)  (d) 
- (e)  (f)  (g) 
- (h) 
- (i) $\text{CH}_3\underset{\text{OH}}{\text{CH}}\text{CH}_2\text{CH}_2\text{COC}_2\text{H}_5$ $\text{CH}_3\underset{\text{OH}}{\text{CH}}\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$

4. Show all of the steps in the mechanism for the following reactions (10 points, 5 points for each mechanism).



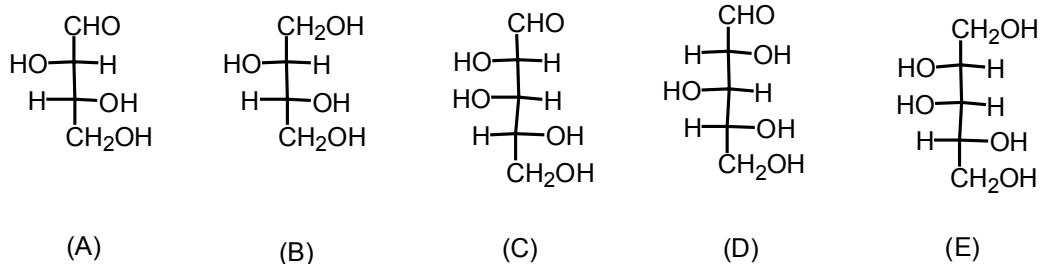
5. Synthesis of the following products from the indicated starting compounds and other necessary reagents (25 points, 5 points for each synthetic route).



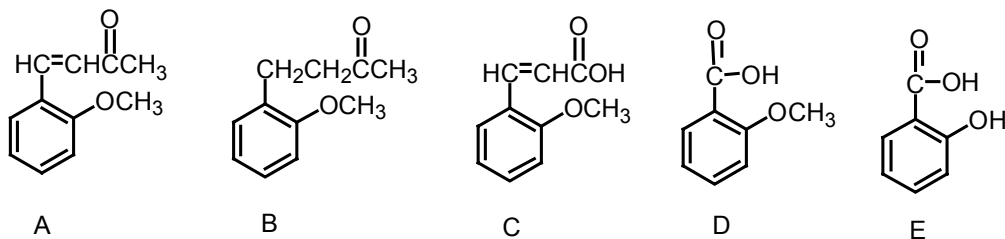


6. Deduce the molecular structures according to the given reaction phenomena (15 points).

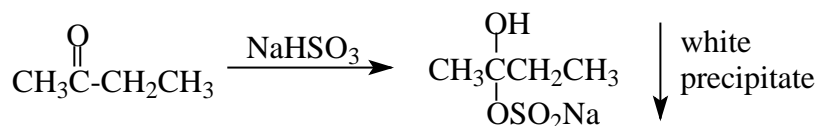
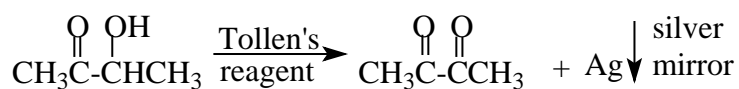
- (a) Carbohydrate **A** is a D-aldotetrose. Compound **B** and **E** both rotate plane-polarized light. Show the structure of **A**, **B**, **C**, **D** and **E** (7 points, structures **A** and **E**, each 2 points; **B**, **C** and **D**, each 1 point).

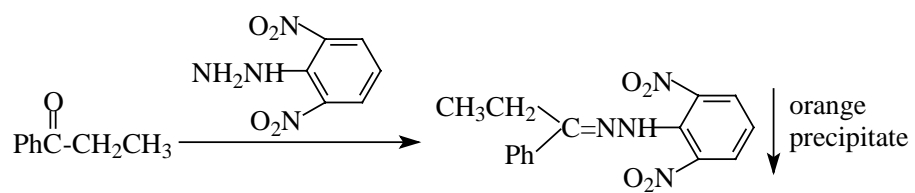


(b) Compound **A** ($C_{11}H_{12}O_2$) can be obtained by the reaction of an aromatic aldehyde with acetone in dilute basic solution. Hydrogenation of **A** catalyzed by Pd/C affords compound **B** ($C_{11}H_{14}O_2$). The reaction of **A** with $I_2/NaOH$ and sequential acidification gives CHI_3 and compound **C** ($C_{10}H_{10}O_3$). Both **B** and **C** can be oxidized by $KMnO_4/OH^-$ to the same acid **D** ($C_8H_8O_3$). Treatment of **D** with HI yields another acid **E** ($C_7H_6O_3$). Intramolecular hydrogen bond is formed in compound **E**. Please give the structures of **A**, **B**, **C**, **D** and **E** (8 points, structures **A**, **B** and **E**, each 2 points; **C** and **D**, each 1 point).



7. There are 5 test-tubes. Each contains one of the following compounds. Please identify each of the following compounds using simple chemical testing methods and write testing reactions (10 points, 2 points for each compound).





Compound $\text{CH}_3\text{CH}_2\text{COOCH}_3$ does not react with any of the above reagents.

Name: _____
 Student Number: _____
 Department: _____
 Chemistry
 Class: _____

Dalian University of Technology

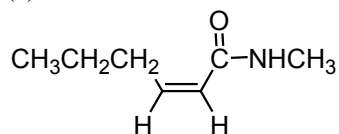
Course: Organic Chemistry (1) Band: A
 School (Department): School of Chemical Engineering

Date: January 18, 2007 Total: 6 pages

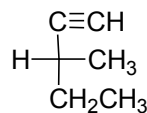
	1	2	3	4	5	6	7	8	Total
Standard points	8	6	24	15	15	14	8	10	100
Scores									

1. Give a name (either a systematic name or a trivial name) for each of the following formulas, when necessary, please designate *E/Z* and *R/S* configuration (8 points).

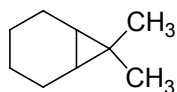
(a)



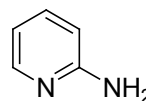
(b)



(c)



(d)



2. Write a molecular formula as required (6 points).

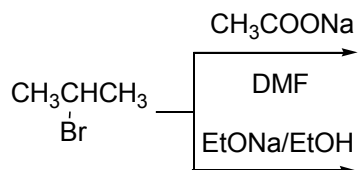
(a) (*Z*)-2-phenyl-2-butene

(b) (*2S,3S*)-2,3-pentanediol
(Fischer projection)

(c) (*1S,3S*)-3-methylcyclohexanecarboxamide
(the most stable conformation)

3. Give major products of the following reactions, when necessary, please give three-dimensional formulas or Fischer projections (24 points).

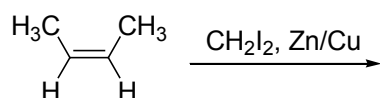
(a)



(b)



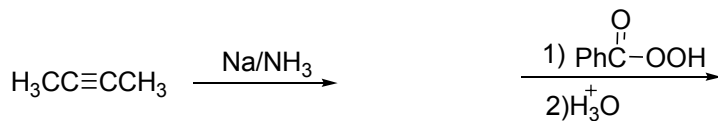
(c)



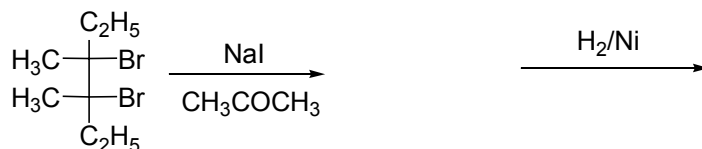
(d)



(e)



(f)

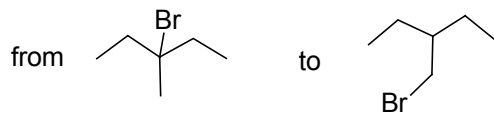


4. Synthesis of the compounds from the given starting reactants (15 points).

(a)

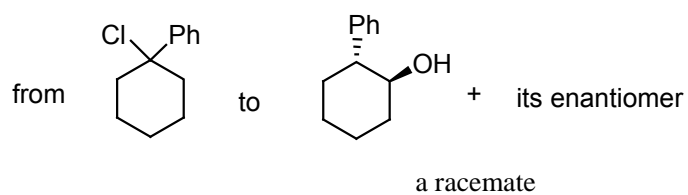
from $\text{H}_3\text{CCH}=\text{CH}_2$ to $\text{CH}_3\text{CH}_2\text{CHO}$

(b)



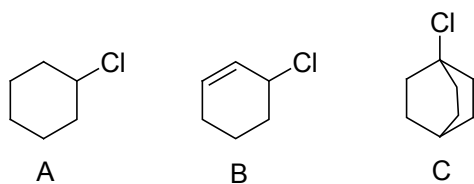
(c) from $\text{H}_2\text{C}=\text{CHCH}_2\text{OH}$ to $\text{H}_2\text{C}=\text{CHCH}_2\text{NH}_2$ (pure primary amine)

(d)



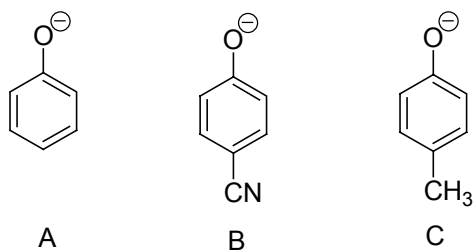
5. As required, compare physical and chemical properties for each of the following groups (15 points).

(a)



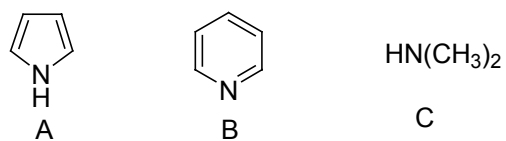
($\text{S}_{\text{N}}1$ reaction rate)

(b)



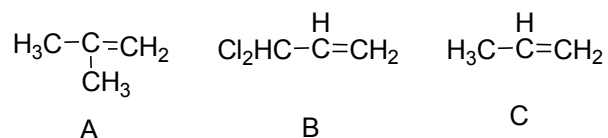
(nucleophilicity)

(c)



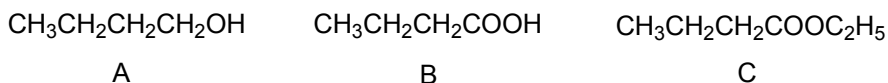
(basicity)

(d)



(the reaction rate with $\text{Cl}_2/\text{H}_2\text{O}$)

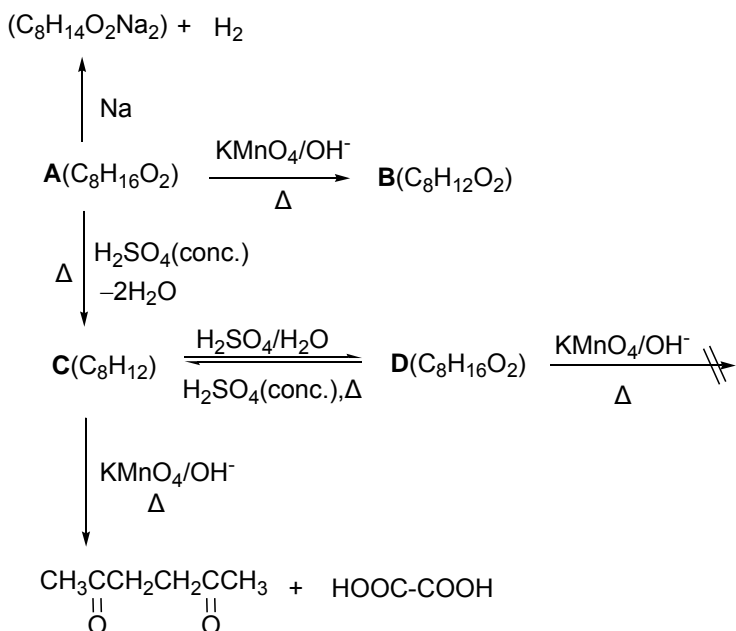
(e)



(boiling point)

6. Deduce the molecular structures according to the given reaction phenomena (14 points).

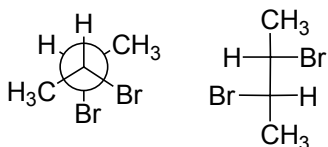
(a) Please give the full structures of **A**, **B**, **C** and **D** in the following reaction scheme.



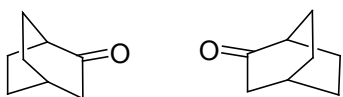
(b) When compound **A** ($\text{C}_7\text{H}_{15}\text{N}$) is treated with CH_3I , a water soluble salt **B** ($\text{C}_8\text{H}_{18}\text{NI}$) is formed. A compound **C** (C_5H_8) and trimethylamine are yielded if **B** is heated in an aqueous AgOH solution. **C** can absorb an equivalent of H_2 . When **C** is treated with O_3 and then hydrolyzed in the presence of zinc, pentanedial is obtained. Please give the structures of **A**, **B** and **C**.

7. Designate whether the following pairs are enantiomers, diastereomers or identical compounds (8 points).

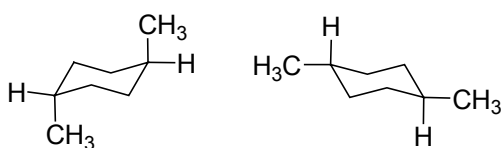
(a)



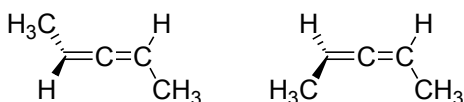
(b)



(c)



(d)



8. Choose the correct answer for each of the following questions (10 points).

(a) The E2 reaction is the _____.

- A. one step, first order reaction
- B. one step, second order reaction
- C. two step, first order reaction
- D. two step, second order reaction

(b) The enantiomers are different in _____.

- A. the magnitude of rotation of plane-polarized light
- B. the pH value
- C. the melting point
- D. the reaction rate with a chiral compound

- (c) The rate of the S_N1 reaction increase with _____.
- A. increasing the strength of nucleophiles
 - B. increasing the content of water in the solvent
 - C. increasing the number of small electron withdrawing groups on the attacked carbon atom
 - D. decreasing the steric hindrance of the alkyl halide
- (d) which of the following statement is correct?
- A. An optically active alkyl halide retains its special configuration in the S_N2 reaction.
 - B. The m.p. of the linear alcohols are higher than the m.p. of the branched alcohols with the same molecular mass.
 - C. The S_N1 reaction leads to racemization of an optically active alkyl halide.
 - D. If there is a symmetric element (a symmetric plane, a symmetric center or an n-fold alternative axis) in the molecule, the compound has no chirality.
- (a) A pair of enantiomers can be separated by _____.
- | | |
|----------------------|-----------------|
| A. recrystallization | C. sublimation |
| B. resolution | D. distillation |

参考答案及评分标准 (Band: A)

课程: 有机化学(上)

班级: 英强班

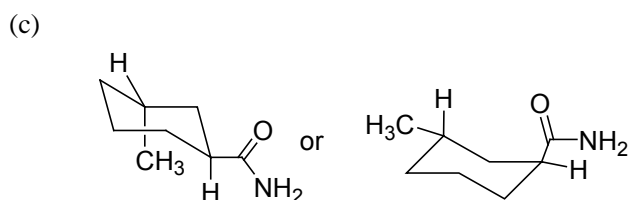
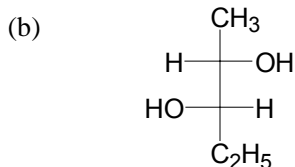
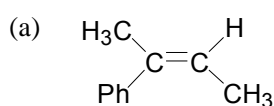
院(系): 化工学院

日期: 2007年1月18日

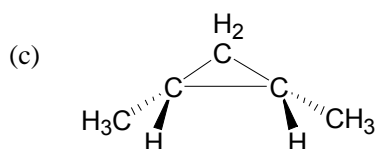
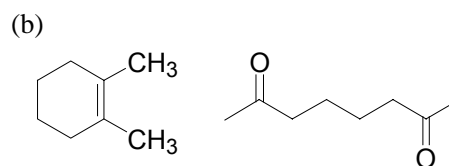
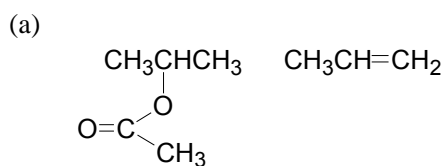
1. Give a name (either a systematic name or a trivial name) for each of the following formulas, when necessary, please designate *E/Z* and *R/S* (8 points, 2 points for each name).

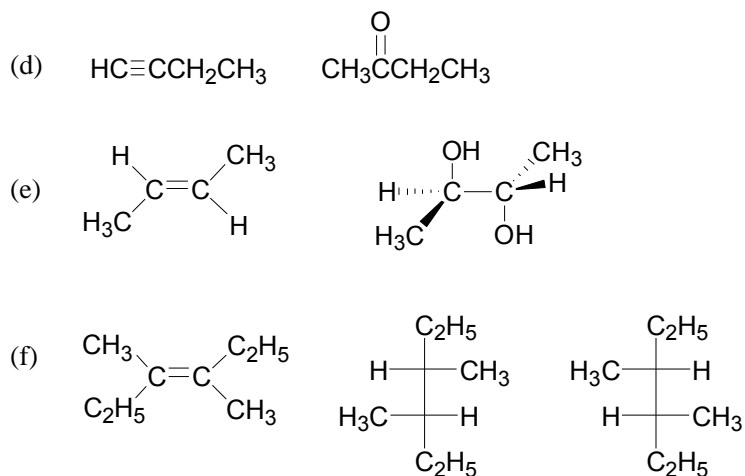
- (a) *N*-methyl (*Z*)-2-hexenamide
- (b) (*R*)-3-methyl-1-pentyne
- (c) 7,7-dimethylbicyclo[4.1.0]heptane
- (d) 2-aminopyridine

2. Write a molecular formula as required (6 points, 2 points for each structure).



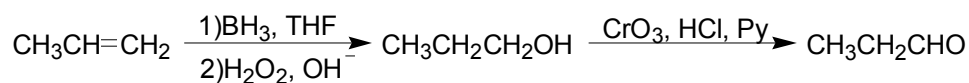
3. Give major products of the following reactions, when necessary, please give three-dimensional formulas or Fischer projections (24 points, 2 points for each product).



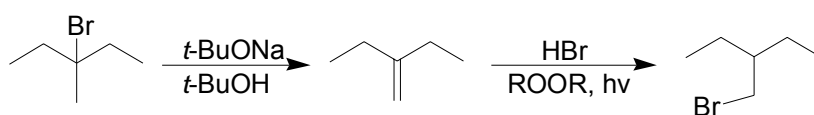


4. Synthesis of the compounds from the given starting reactants (15 points, 3 points for the first problem and 4 points for each of the other problems).

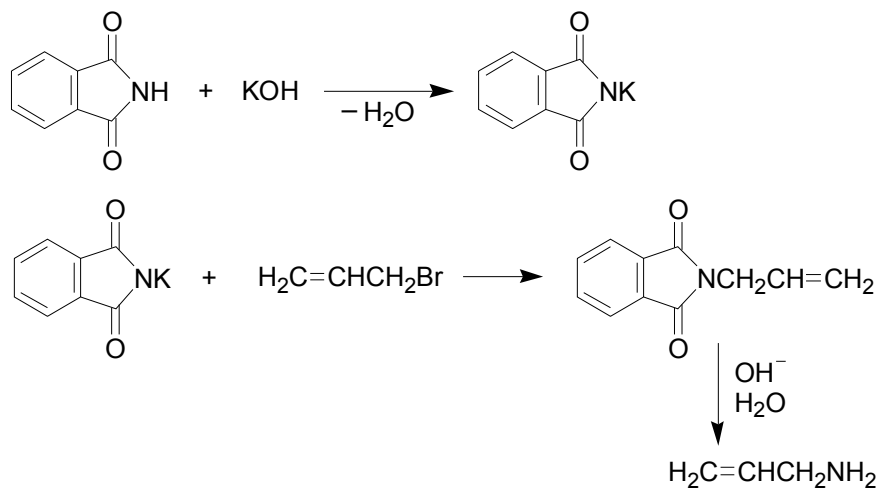
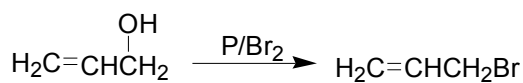
(a)



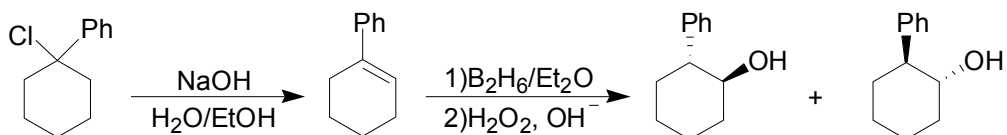
(b)



(c)



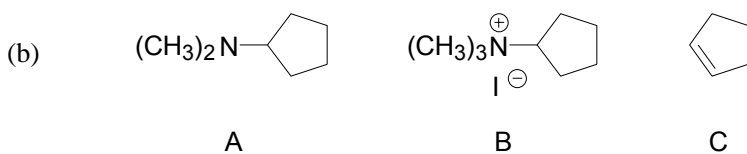
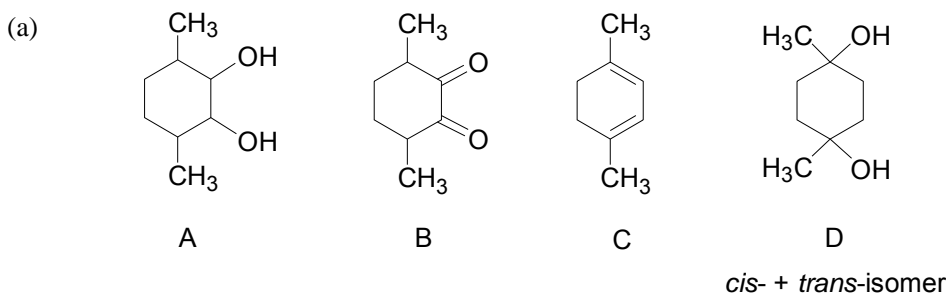
(d)



5. As required, compare physical and chemical properties for each of the following groups (15 points, 3 points for each problem).

- (a) $B > A > C$ (b) $C > A > B$
(c) $C > B > A$ (d) $A > C > B$
(f) $B > A > C$

6. Deduce the molecular structures according to the given reaction phenomena (14 points, (a): 8 points; (b): 6 points).



7. Designate whether the following pairs are enantiomers, diastereomers or identical compounds (8 points, 2 points for each problem).

- (a) enantiomers (b) identical
(c) identical (d) enantiomers

8. Choose the correct answer for each of the following questions (10 point, 2 points for each problem).

- (a) B (b) D
(c) B (d) C
(e) B

Name: _____

Dalian University of Technology

Student _____

Course: Organic Chemistry (2)

Band: A

Number: _____

School (Department): School of Chemical Engineering

Department: _____

Date: July 11, 2007

Total: 5 pages

Chemistry

Class: _____

	1	2	3	4	5	6	7	8	Total
Standard points	10	26	10	10	8	8	8	20	100
Scores									

1. Arrange the compounds of each group in order of the indicated property or reactivity (10 points).

(a) Compare the rate of protonation of the following ketones.



A

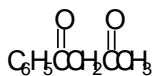


B

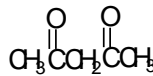


C

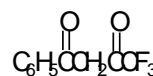
(b) Compare the content of enol form existing in basic solution.



A

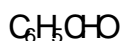


B

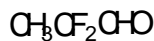


C

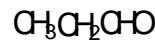
(c) Compare the reaction rate of the following compounds with HCN.



A

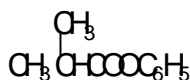


B

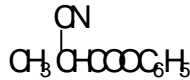


C

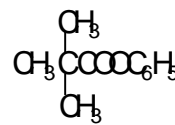
(d) Compare the rate of saponification of the following esters.



A

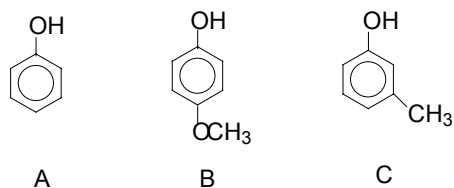


B



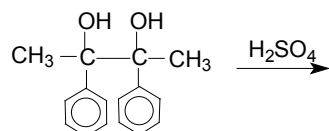
C

(e) Compare the acidity of phenol and its derivatives.

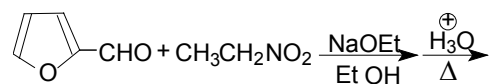


2. Give major products of the following reactions (26 points).

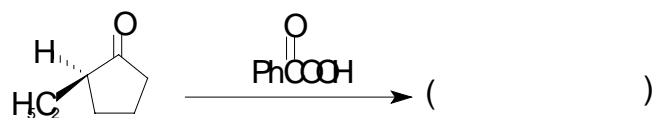
(a)



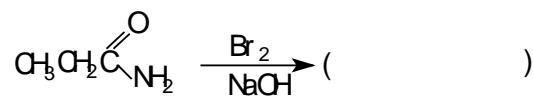
(b)



(c)



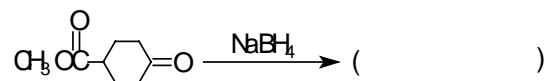
(d)



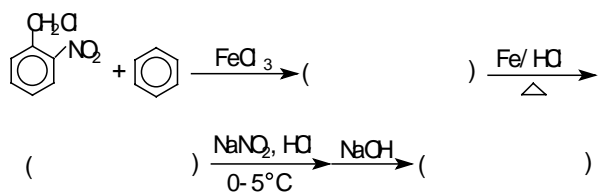
(e)



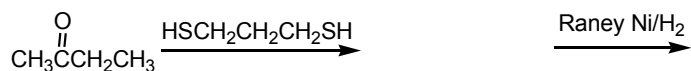
(f)



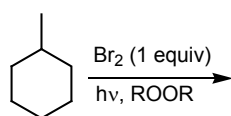
(g)



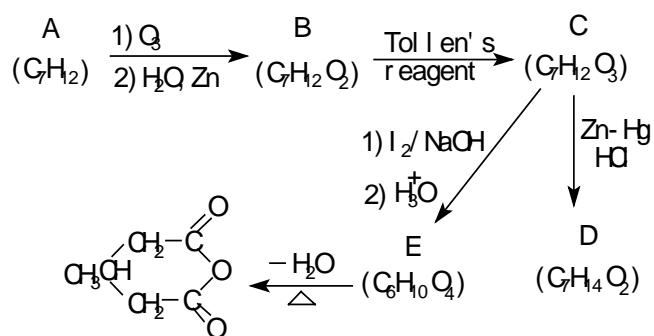
(h)



(i)



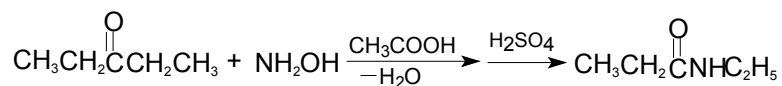
3. Show the missing structures (**A-E**) in the following reaction sequence (10 points).



4. Deduce the molecular structures of the compounds **A-E** according to the given reaction phenomena (10 points).

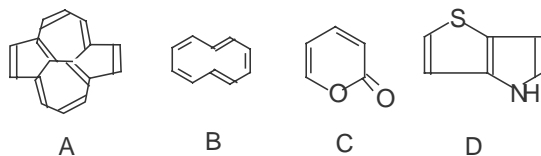
Oxidation of an L-aldohexose (**A**) by HNO_3 affords an optically active product (**B**). When (**A**) is degraded by Ruff degradation, an aldopentose (**C**) is obtained, which is also optically active. But after (**C**) is reacted with NaBH_4 , the reduced product (**D**) is optically inactive. Treatment of (**C**) by Kiliani-Fischer synthesis (the sequential reactions are: the reaction of (**C**) with HCN , followed by acidic hydrolysis, and then the reduction of the obtained carboxylic acid by Na-Hg within the range of pH value 3~5) gives L-aldohexose (**A**) and its epimer (**E**). Oxidation of (**E**) by HNO_3 forms an optically inactive dicarboxylic acid.

5. Show all steps in the mechanism for the following reaction (8 points).

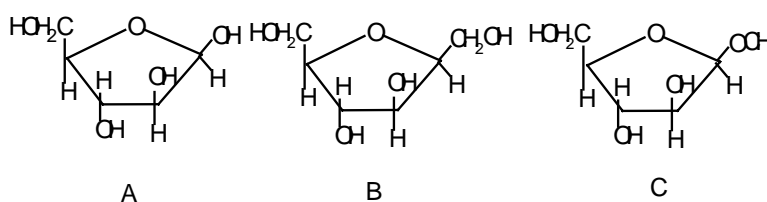


6. As required, answer the following questions (8 points)

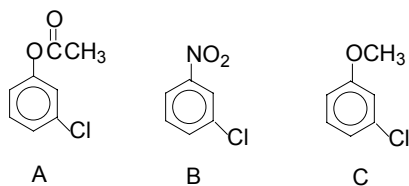
(a) Designate which of the following compounds will be aromatic.



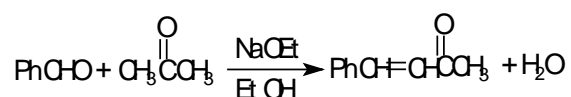
(b) Indicate which of the following compounds will react with Tollen's reagent.



(c) Indicate which of the following compounds cannot be used for synthetically application of Friedel-Crafts reaction.

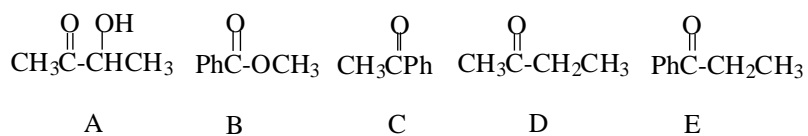


(d) Indicate which experimental procedure is proper for the following reaction.



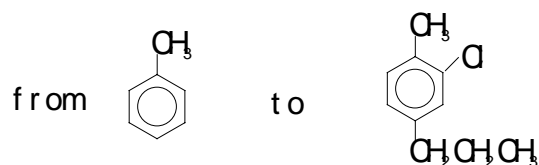
- A. To drop benzaldehyde into the basic solution of acetone.
- B. To drop acetone into the basic solution of benzaldehyde.
- C. To drop a basic solution of benzaldehyde into the EtOH solution of acetone.
- D. To drop a basic solution of acetone into the EtOH solution of benzaldehyde.

7. There are 5 test-tubes. Each contains one of the following compounds. Please identify each of the following compounds using simple chemical testing methods (8 points).

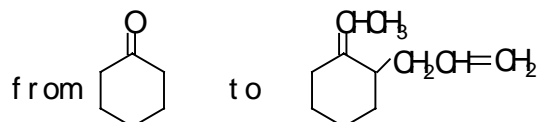


8. Show syntheses of the following compounds using the indicated starting materials and other necessary reagents (20 points).

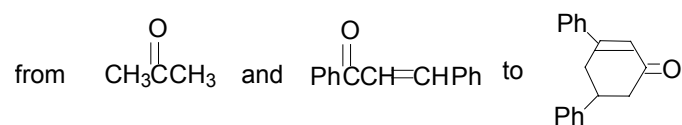
(a)



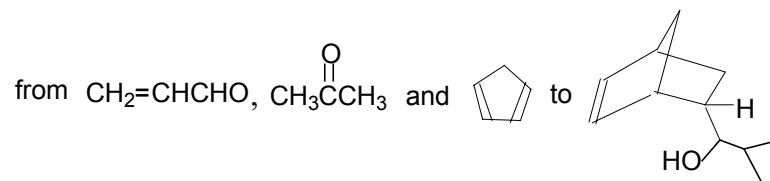
(b)



(c)



(d)



参考答案及评分标准 (Band: A)

课程: 有机化学(下)

班级: 英强班 04-1-2

院(系): 化工学院

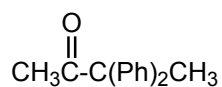
日期: 2007年7月11日

1. Arrange the compounds of each group in order of the indicated property or reactivity (10 points, 2 points for each question).

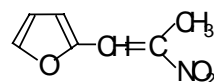
- (a) $C > A > B$ (b) $C > A > B$ (c) $B > C > A$ (d) $B > A > C$
 (e) $A > C > B$

2. Give major products of the following reactions (26 points, 2 points for each product).

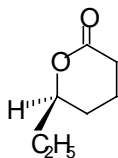
(a)



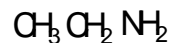
(b)



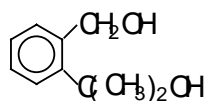
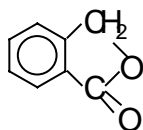
(c)



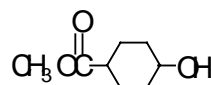
(d)



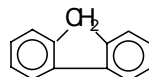
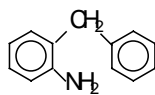
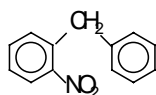
(e)



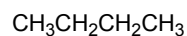
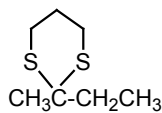
(f)



(g)



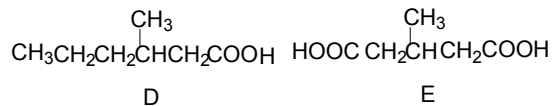
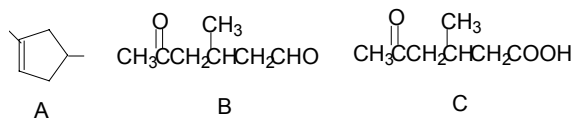
(h)



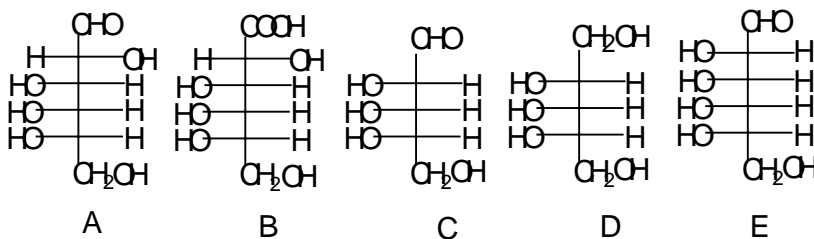
(i)



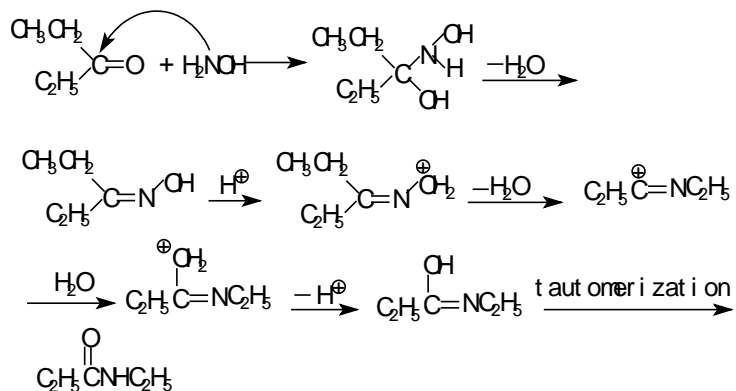
3. Show the missing structures (**A-E**) in the following reaction sequence (10 points, 2 points for each structure).



4. Deduce the molecular structures of the compounds **A-E** according to the given reaction phenomena (10 points, 2 points for each structure).



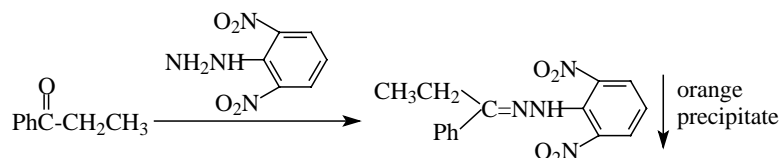
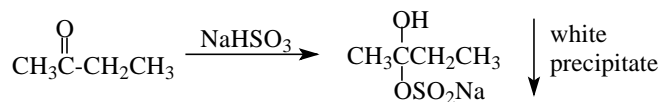
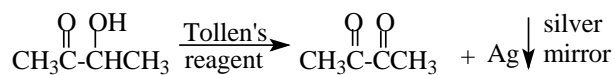
5. Show all steps in the mechanism for the following reaction (8 points).



6. As required, answer the following questions (8 points, 2 points for each question).

- (a) A, C and D (b) A (c) B (d) B

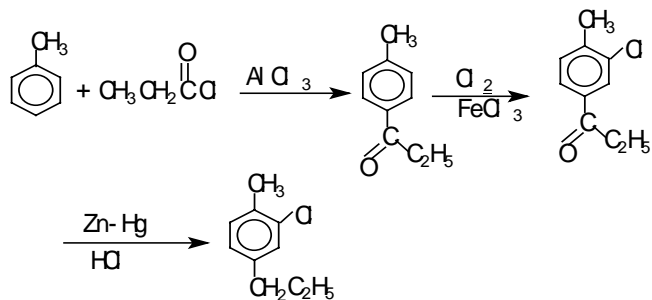
7. There are 5 test-tubes. Each contains one of the following compounds. Please identify each of the following compounds using simple chemical testing methods (8 points, 2 points for each reaction).



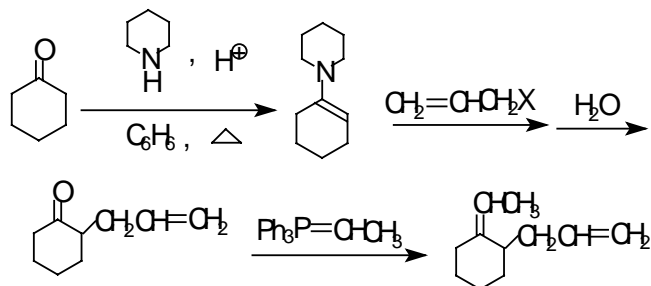
Compound PhCOOCH_3 does not react with any of the above reagents.

8. Show syntheses of the following compounds using the indicated starting materials and other necessary reagents (20 points, 5 points for each target compound).

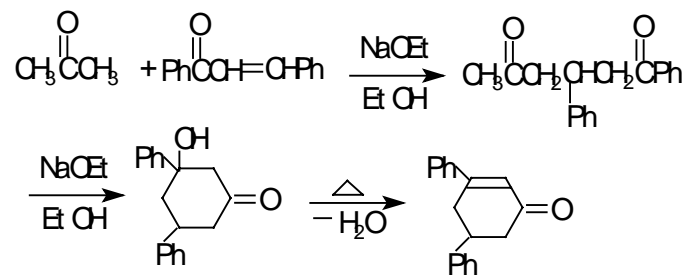
(a)



(b)



(c)



(d)

