

# **Chemistry 2542**

## **Summer 2010; Final Exam**

**August 18, Wednesday, 8:00 to 10:10 am**

This exam has 7 problems (200 pts) on 9 pages. Make sure your copy is complete and correct.

Printed Name (**LAST**, First) \_\_\_\_\_

Your graded exams will be available today, Wednesday, August 18,  
between 2:00 and 3:00 pm in Chem 319.

Good Luck!

**Chemistry 2542**  
**Summer 2010; Final Exam**

This exam has 7 problems on 9 pages. Make sure your copy is complete and correct.

Printed Name (Last, First) \_\_\_\_\_

**Scores:**

Problem 1: \_\_\_\_\_

Problem 2: \_\_\_\_\_

Problem 3: \_\_\_\_\_

Problem 4: \_\_\_\_\_

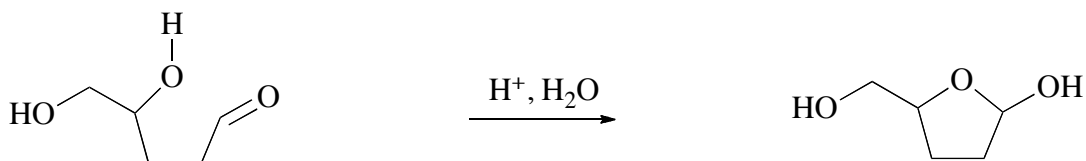
Problem 5: \_\_\_\_\_

Problem 6: \_\_\_\_\_

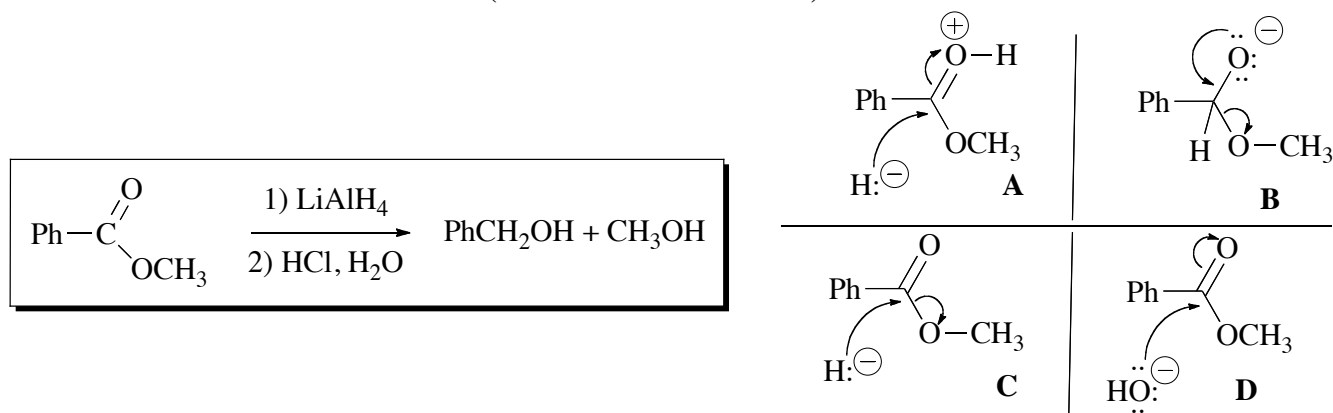
Problem 7: \_\_\_\_\_

Total: \_\_\_\_\_

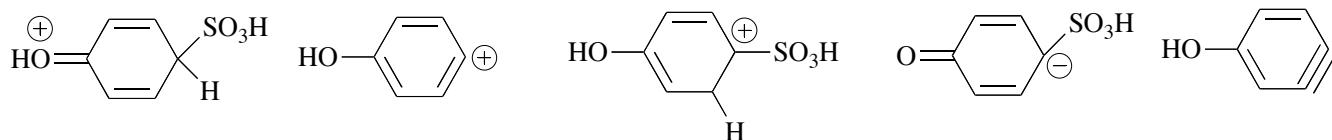
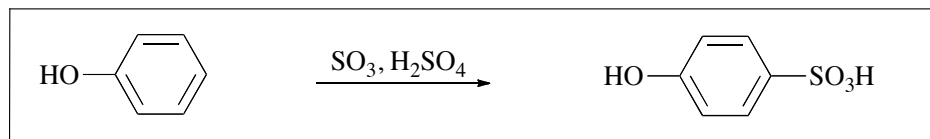
**1. 25 pts (a) (15 pts)** Using **curved arrows** and showing the structure of the **intermediates**, write the **mechanism** that accounts for the product in the following reaction:



**(b) (5 pts)** Which one of the following four schemes (**A-D**) represents an important step in the mechanism of the reaction in the box (circle the correct answer)

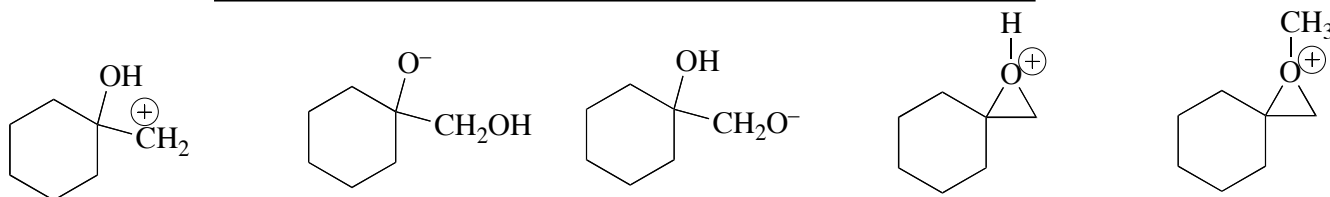
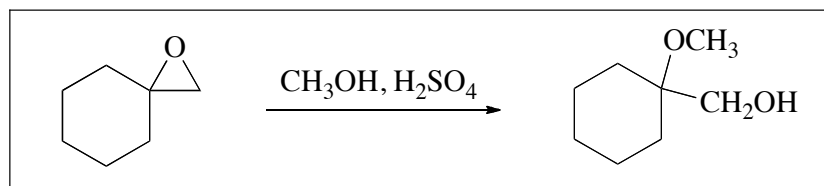


**(c) (5 pts)** Circle the structure of the **intermediate** product for the reaction in the box:

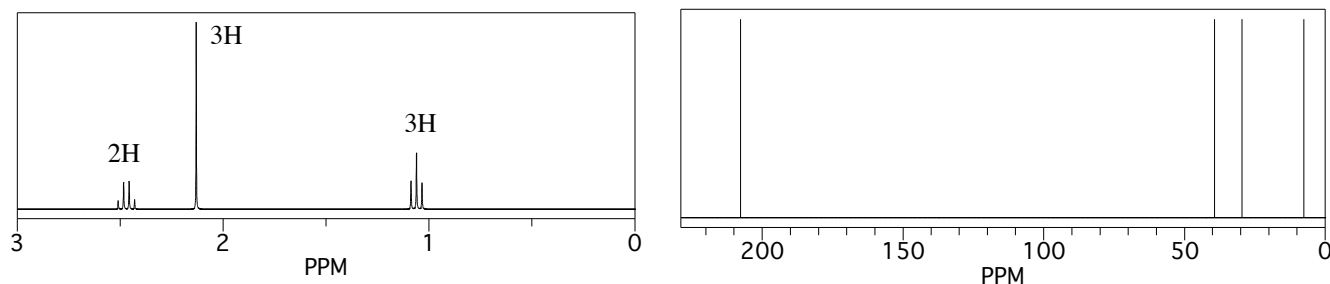


2. (25 pts) Answer the following questions:

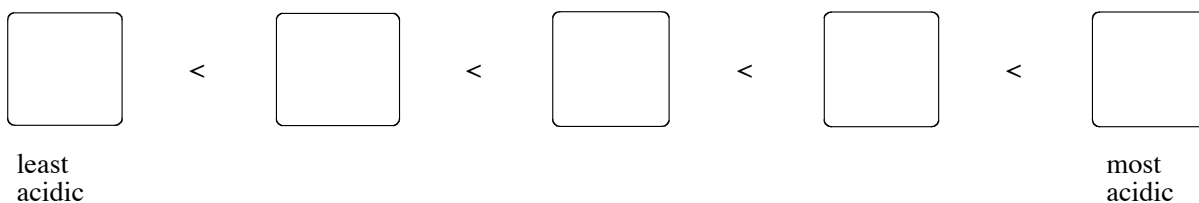
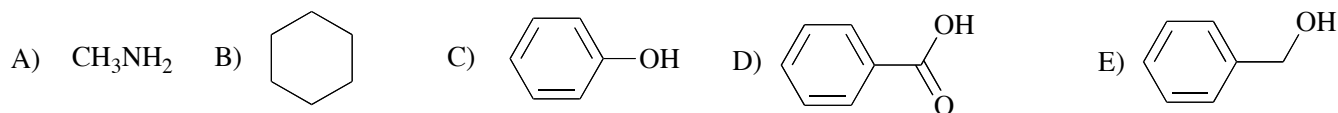
(a) (5 pts) Circle the structure of the **intermediate** product for the reaction in the box:



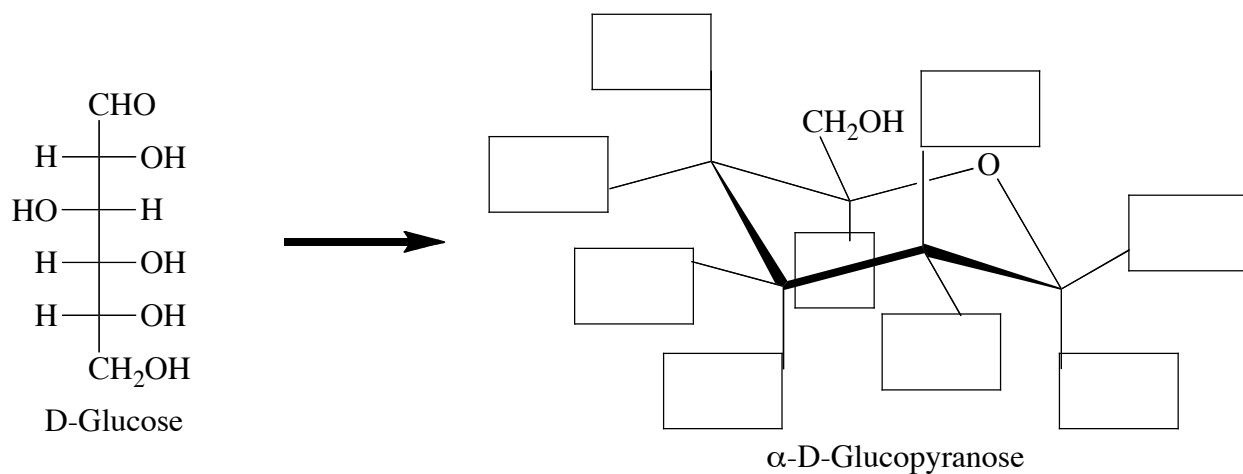
(b) (10 pts) Circle the structure of the compound that gives these  $^1\text{H}$  and  $^{13}\text{C}$  NMR spectra:



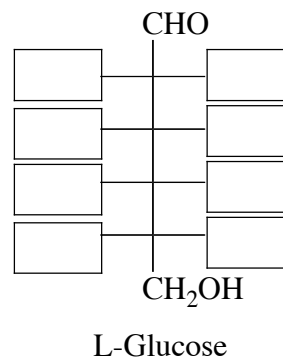
(c) (10 pts) Rank the following substances in order of increasing acidity. Put A, B, C, D, or E into the boxes (2 pts each).



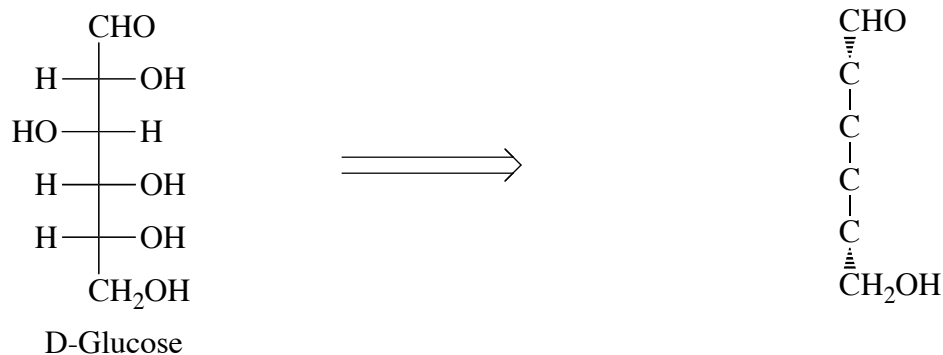
3. (25 pts) (a) Finish drawing of the cyclic structure of D-glucose in the form of  $\alpha$ -D-glucopyranose. [place missing -H and -OH substituents in each box (9 pts; 1 pt each)]



(b) Finish drawing of the Fischer projection of **L-glucose**: (8 pts; 1 pt each box)

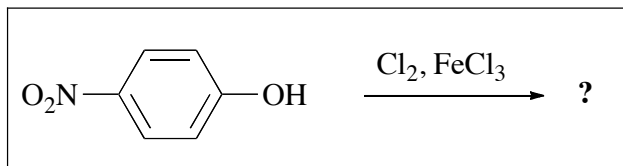


(c) Convert the Fischer projection of **D-glucose** into three-dimensional representation (finish provided drawing) and assign *R* or *S* stereochemistry to each chirality center (8 pts; 2 pt each carbon):

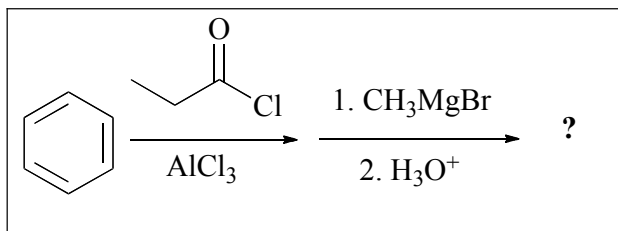


(3-dimensional structure of D-Glucose)

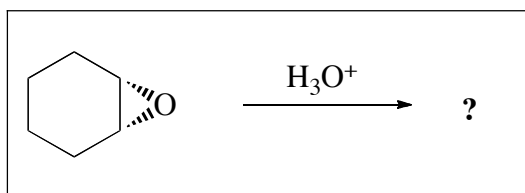
4. (30 pts) Circle the name of the **major product** for each the following reactions (5 pts each):



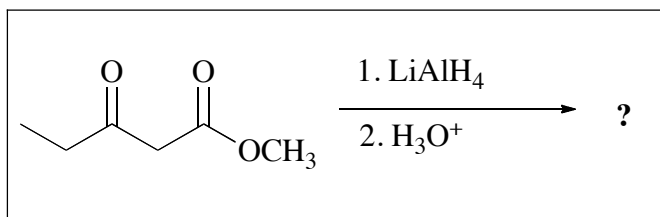
2-chloro-4-methylaniline    2-chloro-4-nitrotoluene  
 2-chloro-4-nitrophenol    *p*-chlorotoluene  
 2-chloro-4-nitro-1-hydroxyphenol



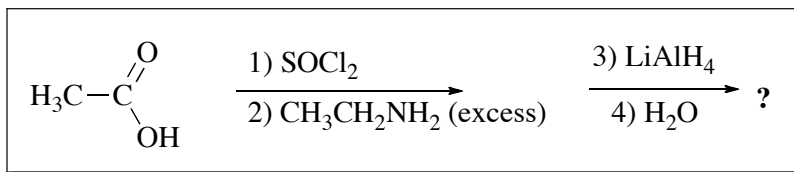
3-chloro-2-isopropylphenol    1-phenyl-2-butanol  
 2-phenyl-2-butanol    1-phenyl-1-propanone  
 1-phenyl-1-propanol    propylbenzene



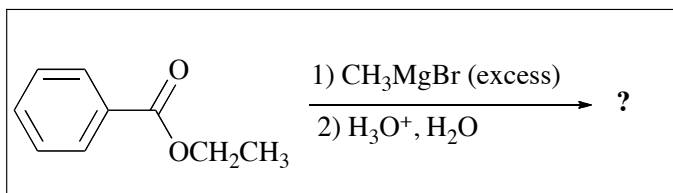
cyclohexanol    *trans*-1,2-cyclohexanediol  
 1,2-epoxycyclohexane    *cis*-1,2-cyclohexanediol  
 cyclohexanone    2-hydroxycyclohexanone



1,3-pentanediol    3-pentanone  
 1-methoxy-1,3-pentanediol  
 methyl 3-hydroxypentanoate

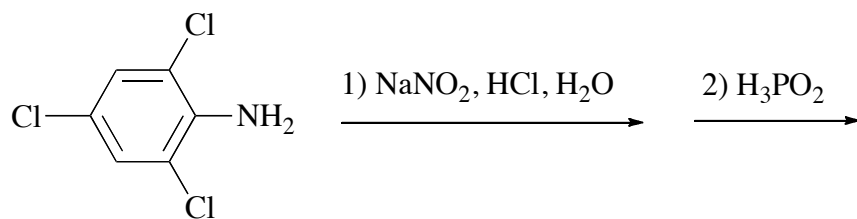
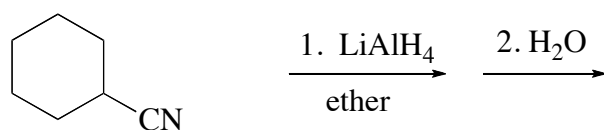
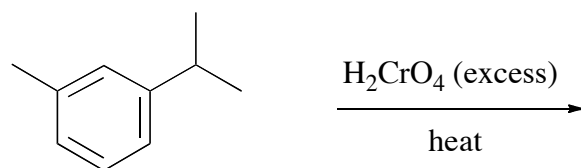
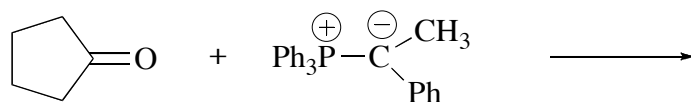
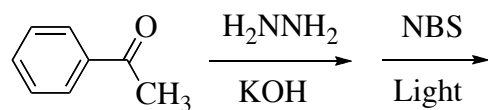
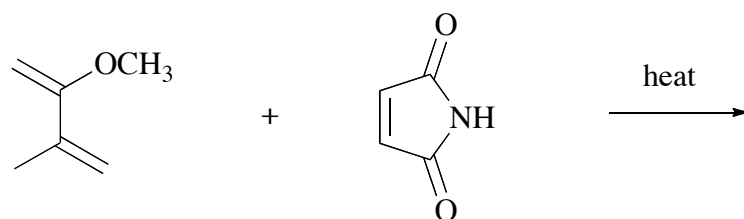
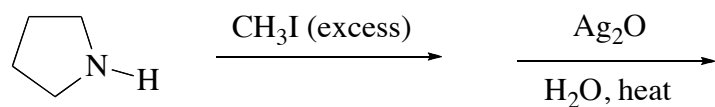
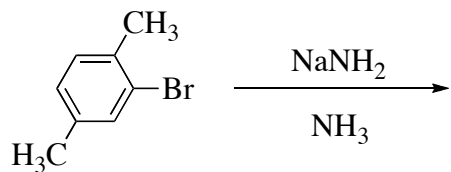


*N,N*-diethylacetamide    diethylamine  
*N*-ethylpropylamine    ethanol  
 2-(*N,N*-diethylamino)-1-ethanol

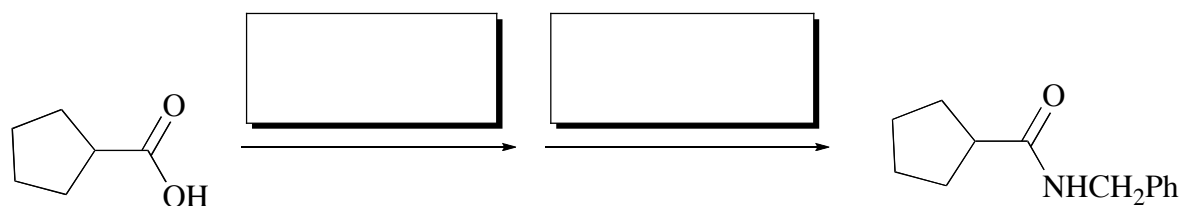
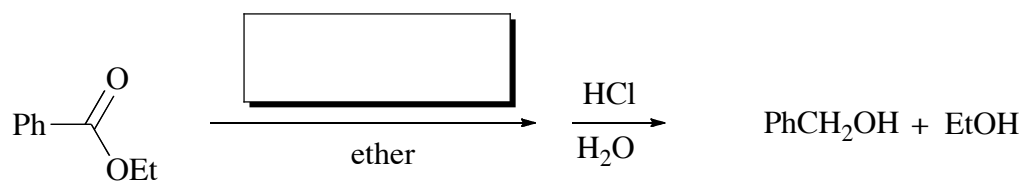
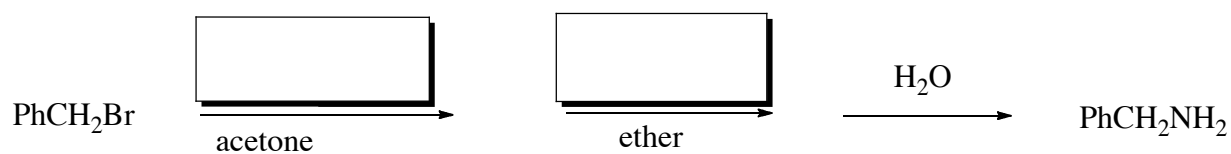
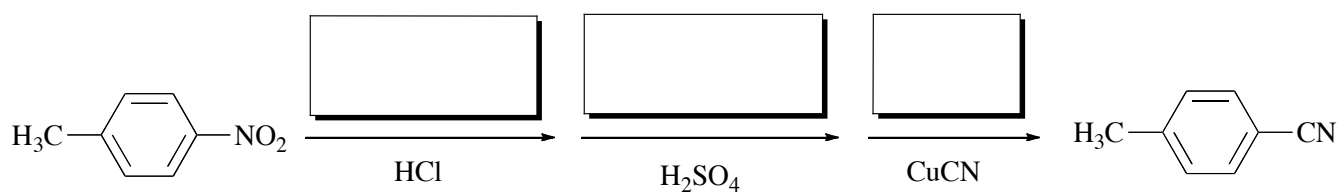
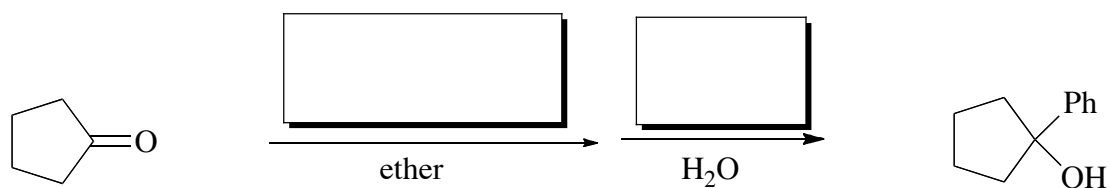


3-phenyl-3-pentanol    2-phenyl-2-propanol  
 1-ethyl-1-phenylethanol    1-benzyl-1-ethanol  
 2-phenyl-2-butanol    1-phenyl-2-butanone

5. (40 pts) Draw the structure of the main product for each the following reactions (5 pts each):



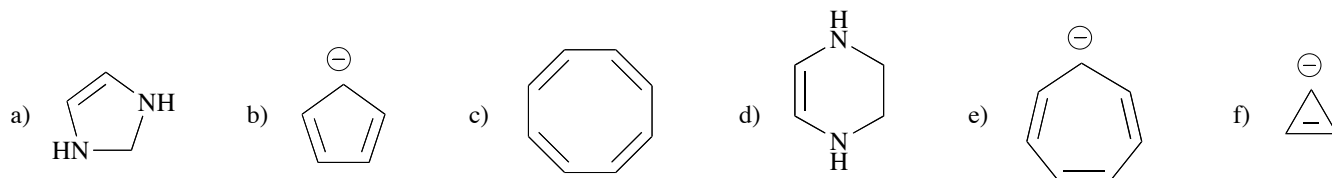
6. (30 pts) Place in each box the molecule of a reagent that is required to perform each of the following reactions (3 pts each box):





7. (25 pts) For each of the following questions **circle** the item that is the correct answer (5 pts each):

(a) Which one of the following compounds is aromatic?



(b) Which one of the following compounds is the strongest **base**?

aniline    ethane    ethanol    *o*-ethylphenol    phenol    *p*-nitroaniline    ethylamine

(c) Which one of the following compounds is more reactive than benzene towards nitration?

nitrobenzene    benzonitrile    benzoic acid    phenol    bromobenzene    benzenesulfonic acid

(d) Which one of the listed compounds is characterized by the following spectroscopic data:

IR: important absorptions at  $3298\text{ cm}^{-1}$  (medium intensity, broad) and  $1668\text{ cm}^{-1}$  (strong intensity).

$^{13}\text{C}$  NMR: two signals are observed at 163 ppm and 25 ppm.

HCOOH     $\text{CH}_3\text{COCH}_3$      $\text{HCON}(\text{CH}_3)_2$      $\text{CH}_3\text{CHO}$      $\text{HCONHCH}_3$      $\text{CH}_3\text{CN}$      $\text{CH}_3\text{CH}_2\text{OH}$

(e) How many **stereoisomers** (including enantiomers) has a molecule of *aldotetrose* in the *open chain* form?

one    two    three    four    five    six    seven    eight    nine    ten    sixteen    thirty two    sixty four