

國立交通大學 97 學年度碩士班考試入學試題

科目：普通化學(6523)

考試日期：97 年 3 月 9 日 第 4 節

系所班別：加速器光源科技與應用碩士學位學程

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【可使用計算機】*作答前請先核對試題、答案卷(試卷)與准考證之所組別與考科是否相符!!

(1) (10%) Choose the following answers below (i-iv) for each pair of compounds:

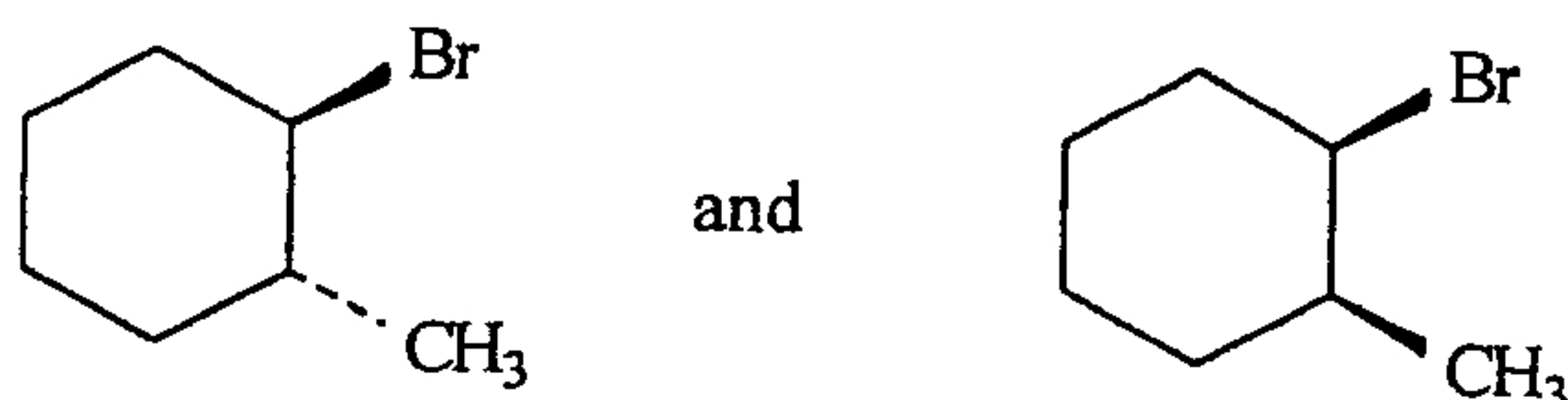
i. conformational isomers

ii. stereoisomers

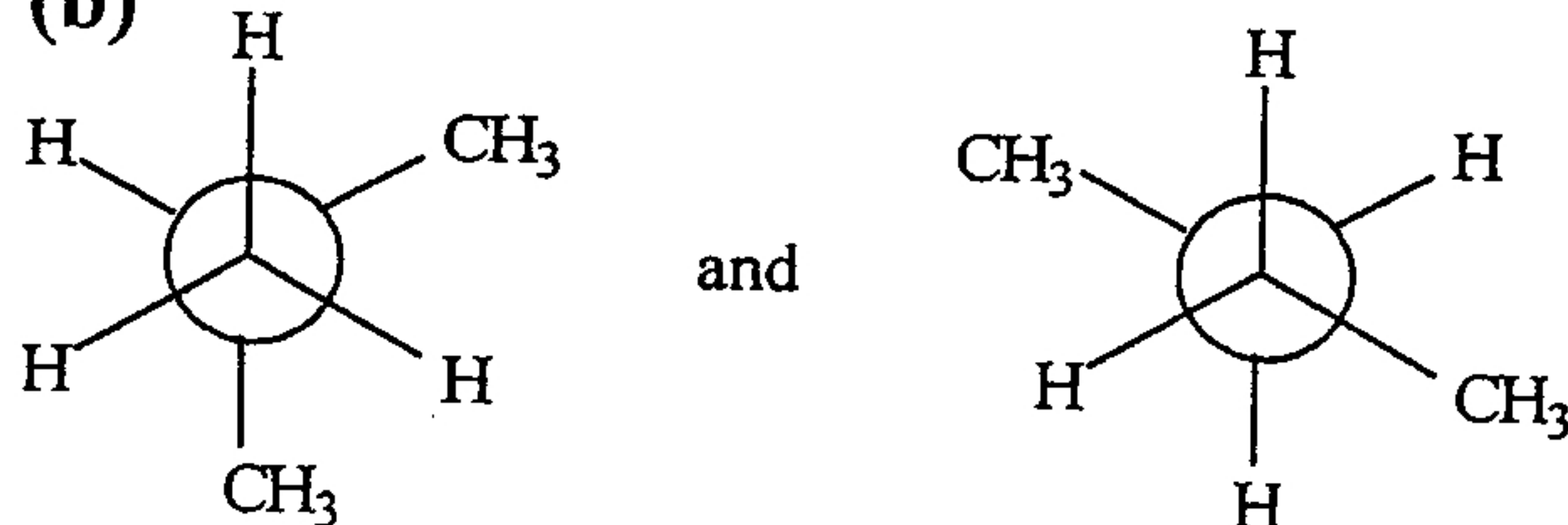
iii. constitutional isomers

iv. identical

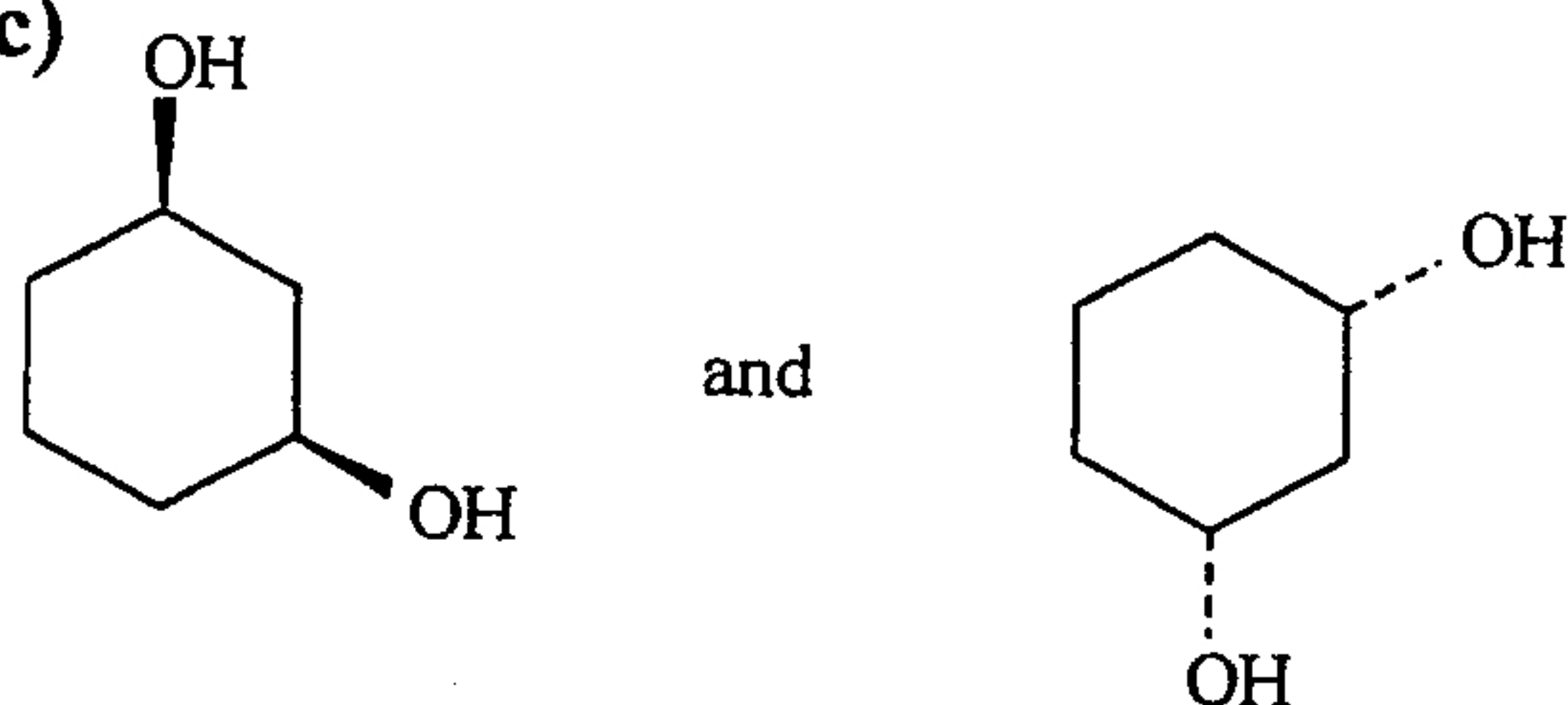
(a)



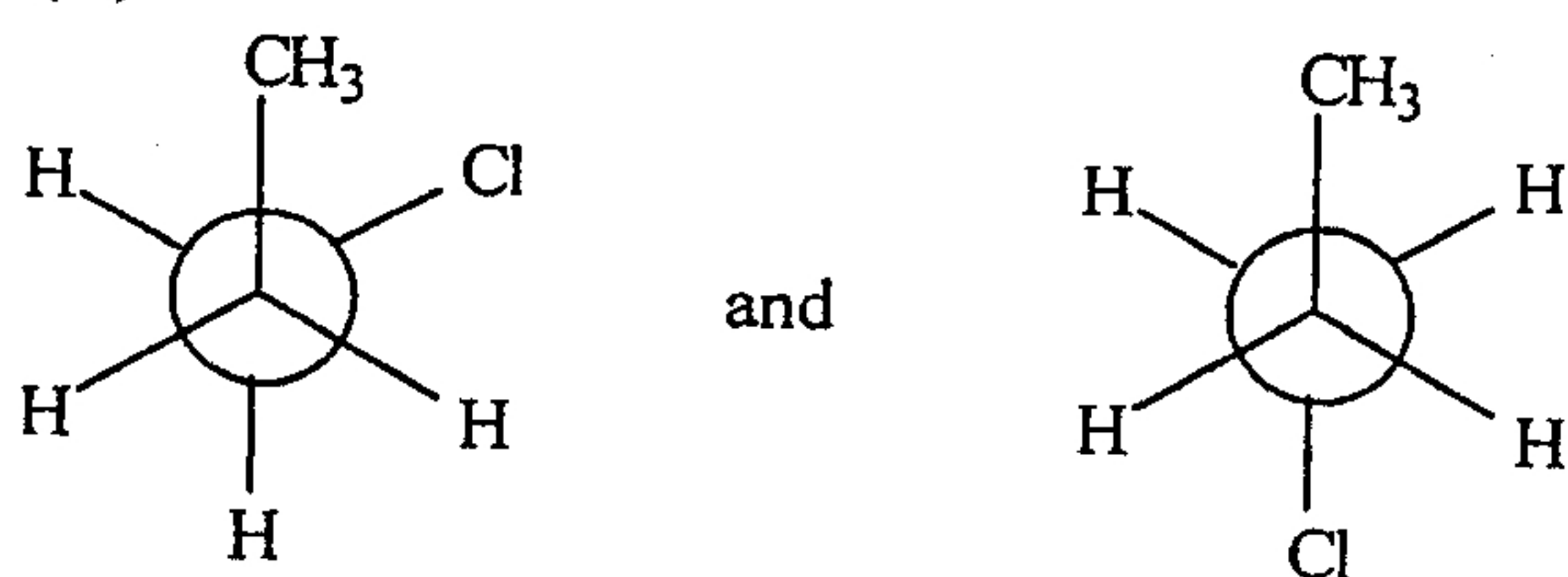
(b)



(c)



(d)



(e) For the pair of the conformational isomers in one of the previous questions, please draw its most stable structure.

(2) (15%) Draw structures corresponding to each of the following IUPAC names and give the major products of the following reactions:

(a) *p*-methoxyaniline

(b) 4-methyl-2-heptyne

(c) 1-phenyl-2-propanone

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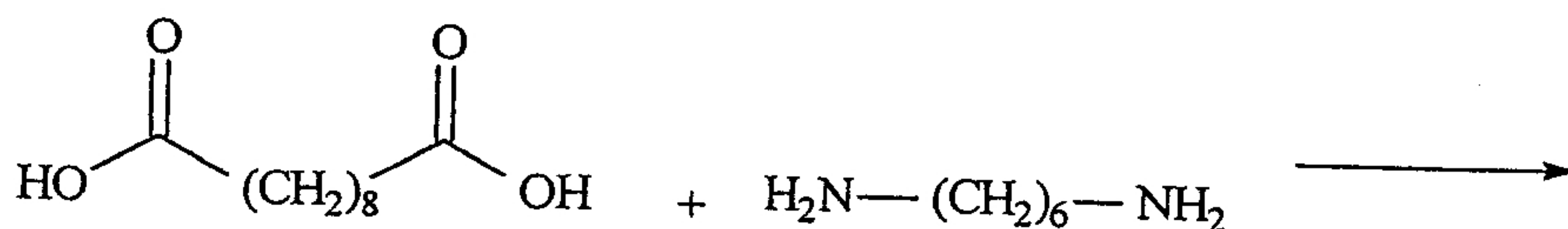
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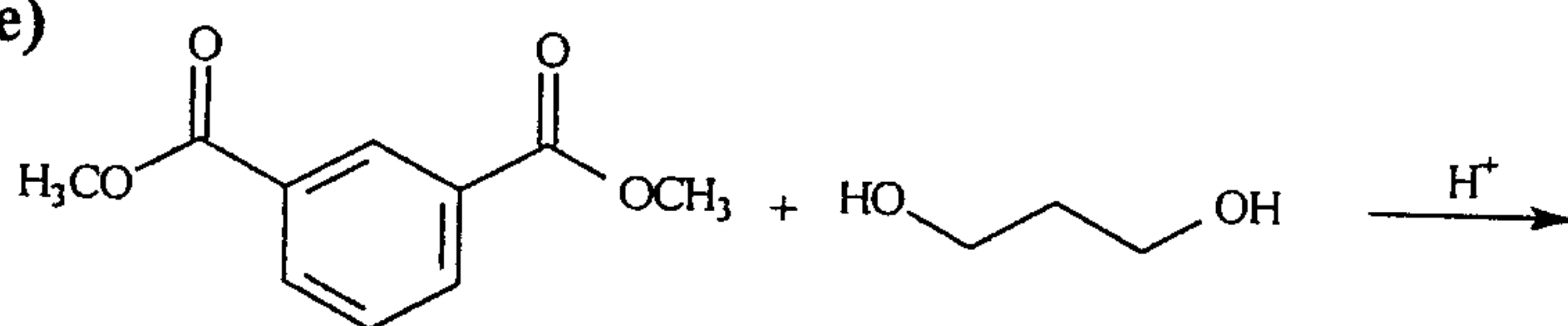
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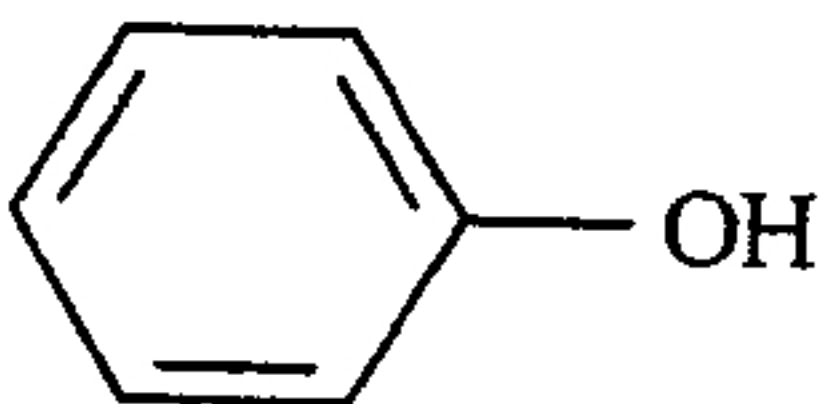
(d)



(e)



(3) (6%) Consider the acidity constants below to answer the following questions.

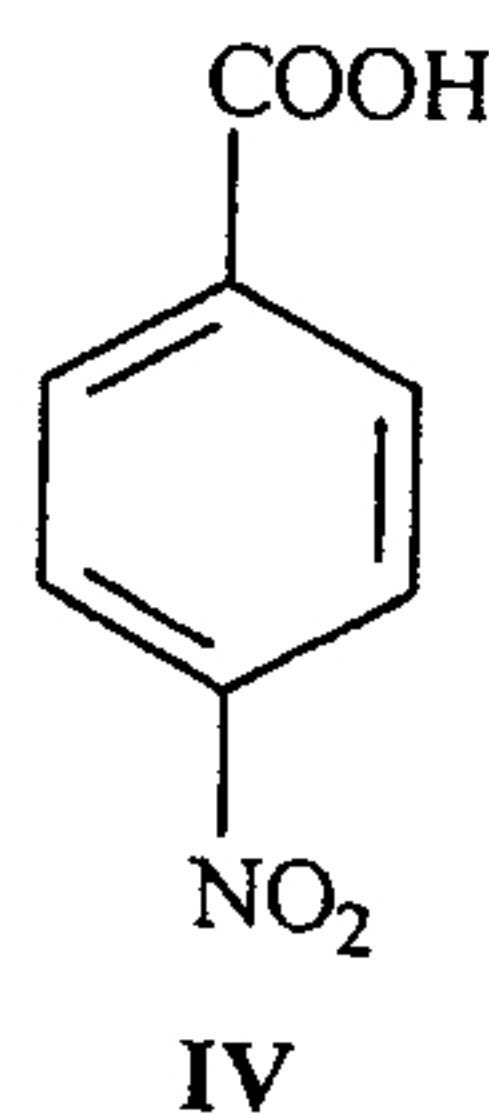
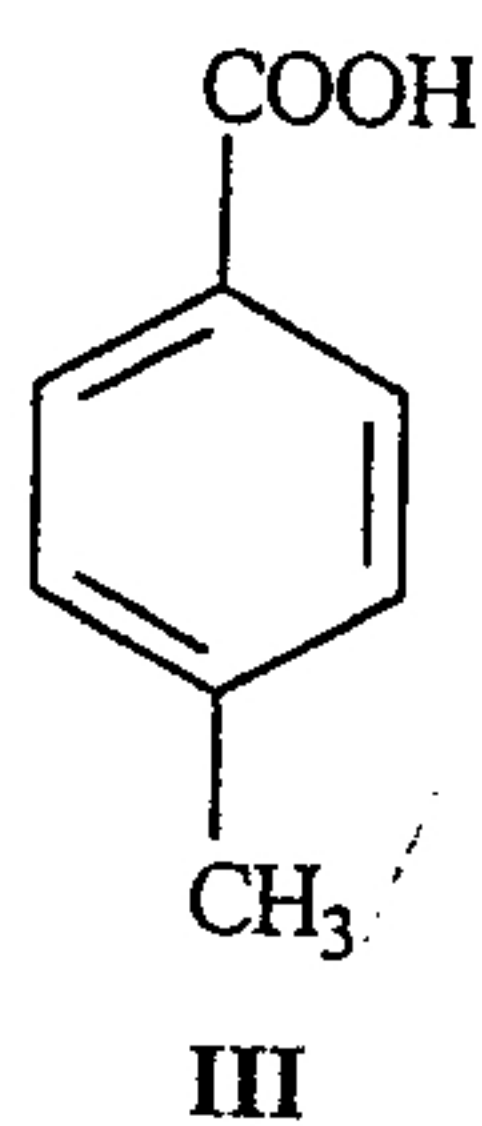
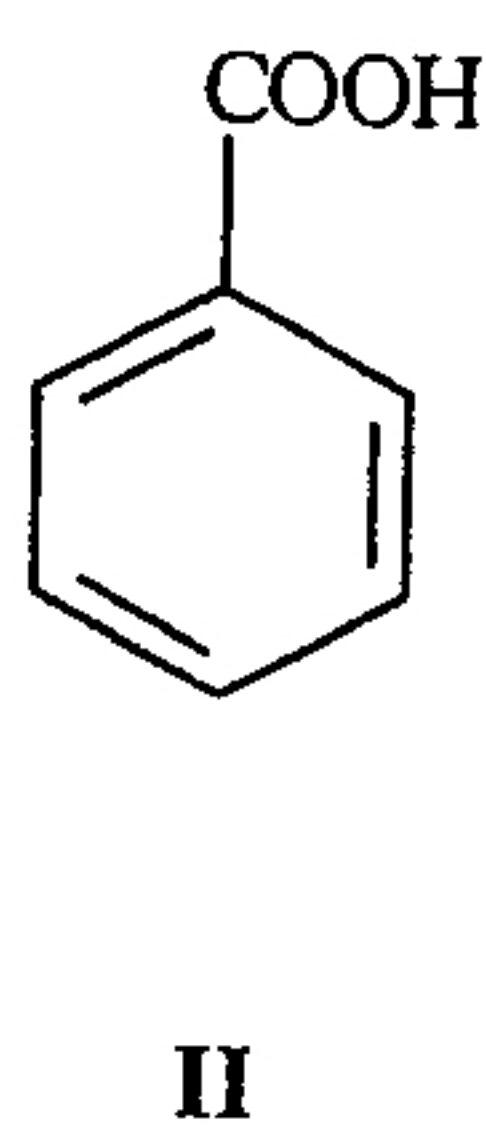
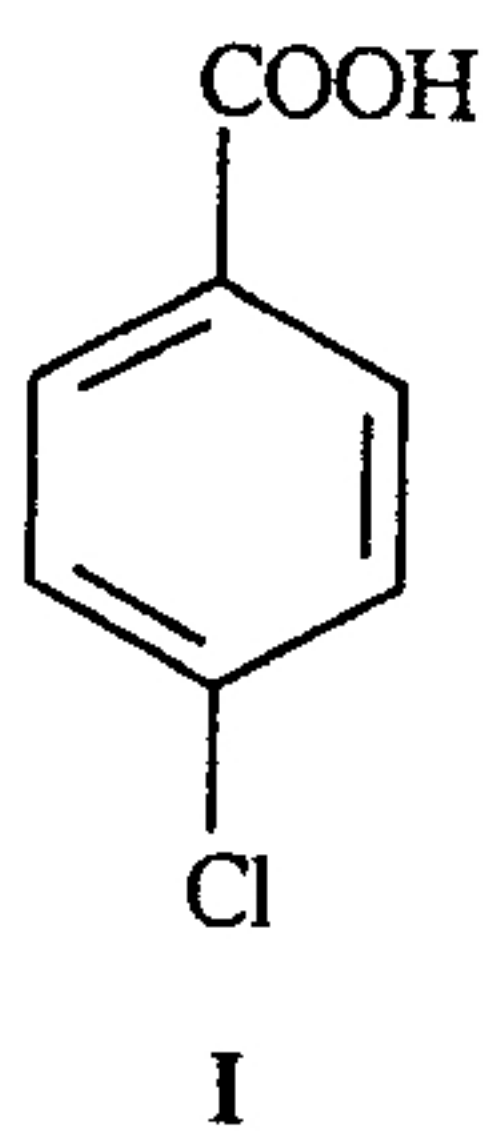
ACID	STRUCTURE	$\text{p}K_a$
phenol		10.00
ethanol	$\text{CH}_3\text{CH}_2\text{OH}$	16.00
water	HOH	15.74

(a) Which acid above (only one answer) will be almost completely deprotonated by NaOH?

(b) Which acid has the *strongest* conjugate base?

(4) (4%) What is the order of increasing acidity for the following compounds? Choose one sequence (the lowest acidity to the highest acidity) from the following answers.

- IV, I, III, II
- III, II, I, IV
- II, III, I, IV
- III, II, IV, I



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- (5) (10%) While dealing with a chemical reaction, please provide a definition or an explanation of following terms:
- (a) Reaction order
 - (b) Bronsted-Lowry Theory
 - (c) Faraday
 - (d) Activation energy
 - (e) Corrosion
- (6) (12%) State four colligative properties for solutions and write down their characteristic equations.
- (7) A chemist needs to prepare the compound PH_3BCl_3 by using the reaction $\text{PH}_3(\text{g}) + \text{BCl}_3(\text{g}) \rightarrow \text{PH}_3\text{BCl}_3(\text{s})$ for which the equilibrium constant $K = 19.2$ at 60°C .
- (a) What is the value of K_c for this reaction? (3%)
 - (b) Some solid PH_3BCl_3 was added to a closed 500 mL vessel at 60°C that already contains 0.0128 mol PH_3 . What is the equilibrium concentration of PH_3 ? (4%)
 - (c) At 70°C , $K = 26.2$. Is the reaction endothermic or exothermic? Why? (4%)
 - (d) Classify the reactants as Lewis acids and bases. (2%)
- (8) You are a smart graduate student to construct a concentration cell in which one half-cell contains 1.0M CuSO_4 solution and the other half-cell 0.001M CuSO_4 . Both electrodes are made of copper. Answer the following questions.
- (a) At which electrode would reduction spontaneously take place? (2%)
How will each of the following changes affect the cell performance? Justify your answer.
 - (b) Adding 100 mL pure water to the anode compartment. (3%)
 - (c) Adding 100 mL 1.0M ammonia to the cathode compartment. (3%)
 - (d) Increasing the size of the copper electrode in the anode compartment. (2%)
- (9) Based on the Hund's rule, draw the orbital diagram representation for the electron configuration of
- (a) oxygen (3%)
 - (b) sodium (3%)
 - (c) zinc (3%)
 - (d) carbon (3%)

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(10) Describe the nature of the corrosion that can occur if a steel washer is used in contact with a piece of magnesium. (8%)