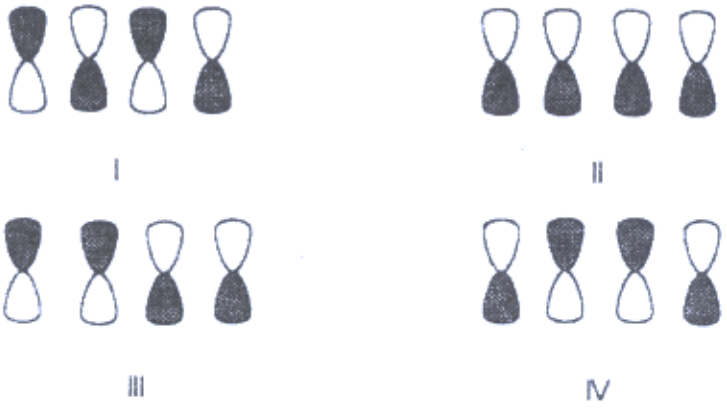
說明： 答案一律寫在答案紙並請標明題號依序作答

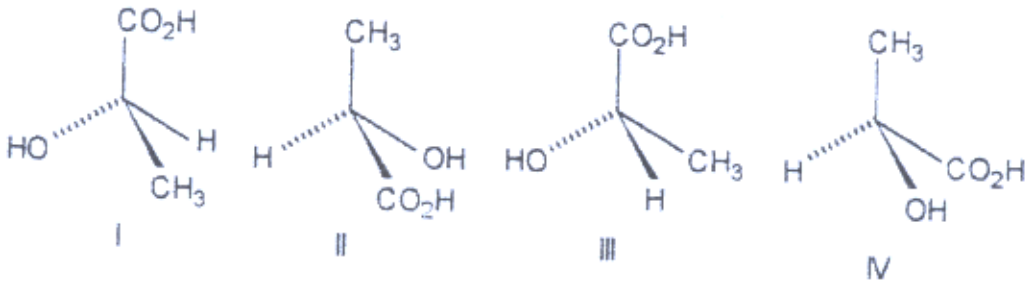
單選選擇題：(共 25 題，每題 2 分)

1. Which of these molecular orbital structures represent bonding for 1,3-butadiene?



a) I, II b) II, III c) III, IV d) I, III

2. Which forms of lactic acid are R forms?



a) I, II b) III, IV c) I, III d) II, IV

3. Which of the following statements apply to an SN_1 reaction?

I. The reaction is first order in alkyl halide and first order in the nucleophile.
II. The order of reactivity is methyl > $1^\circ > 2^\circ > 3^\circ$.
III. The reaction is first order in alkyl halide and zero order in the nucleophile.
IV. Rearrangements are common.

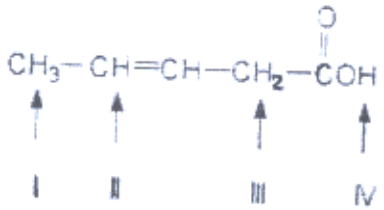
a) I, II b) III, IV c) I, IV d) III

4. Which of the following statements apply to an SN_2 reaction?

I. The reaction is first order in alkyl halide and first order in the nucleophile.
II. The order of reactivity is methyl > 1° > 2° > 3°.
III. The reaction is first order in alkyl halide and zero order in the nucleophile.
IV. Rearrangements are common.

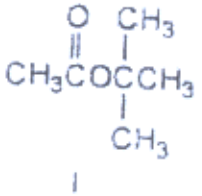
a) I, II b) III, IV c) I, IV d) II, IV

5. What is the order of increasing chemical shift values in the ^{1}H-NMR spectrum for the indicated hydrogen atoms (lowest first)?

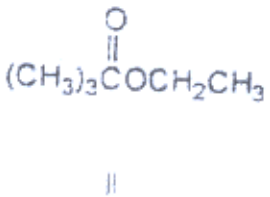


a) IV, II, III, I b) I, III, II, IV c) III, I, IV, II d) II, IV, I, III

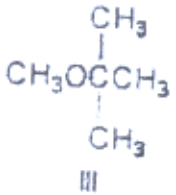
6. Which of the following compounds show spin spin splitting in the ^{1}H-NMR spectrum?



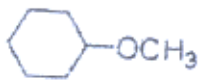
I



II



III



IV

a) I, II b) III, IV c) I, III d) II, IV

7. Which of the following reactions are good methods for preparing aldehydes?

I. $CH_3C{\equiv}CH + H_2O \xrightarrow[HgSO_4]{H_2SO_4}$

II. $CH_3CH_2CH_2OH \xrightarrow[CH_2Cl_2]{PCC}$

III. $(CH_3)_2CHCH{=}CHCH(CH_3)_2 \xrightarrow[OsO_4]{H_2O_2} \xrightarrow{Pb(OAc)_4}$

IV. $CH_3C{\equiv}CCH_3 \xrightarrow{BH_3\ /\ THF} \xrightarrow[NaOH]{H_2O_2}$

a) I, II b) II, III c) III, IV d) II, III, IV

8. Which reaction condition cannot be used for the following conversion?

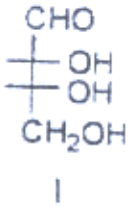
a) Zn(Hg) + HCl

b) NH_2NH_2 + KOH + heat

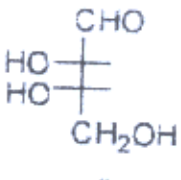
c) CH_2CH_2 (SH, SH) + BF_3 then Raney-nickel

d) Platinum + hydrogen

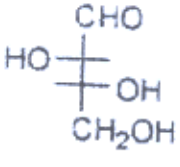
9. Two sugars give identical products when treated with sodium borohydride. Which of the following are possible structures for the sugars?



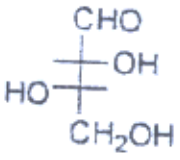
I



II



III

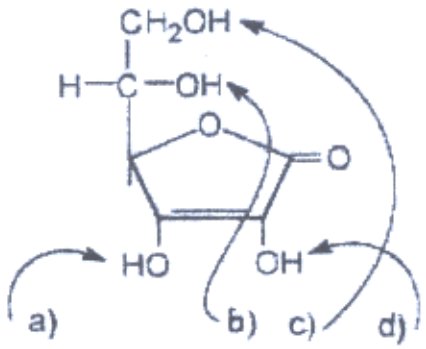


IV

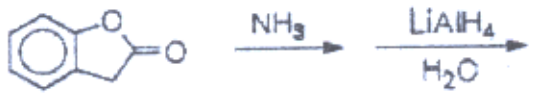
a) I, II b) I, III c) III, IV d) II, IV

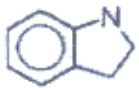
(背面仍有題目,請繼續作答)

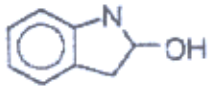
10. Identify the most acidic proton in L-ascorbic acid.

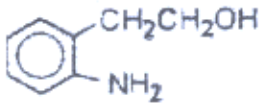


11. What is the product from the following reaction?



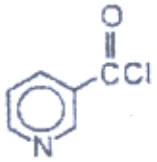
a) 

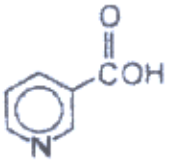
b) 

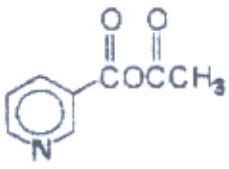
c) 

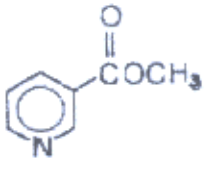
d) 

12. Which of the following compounds does not yield nicotinamide (niacin) when reacted with ammonia?

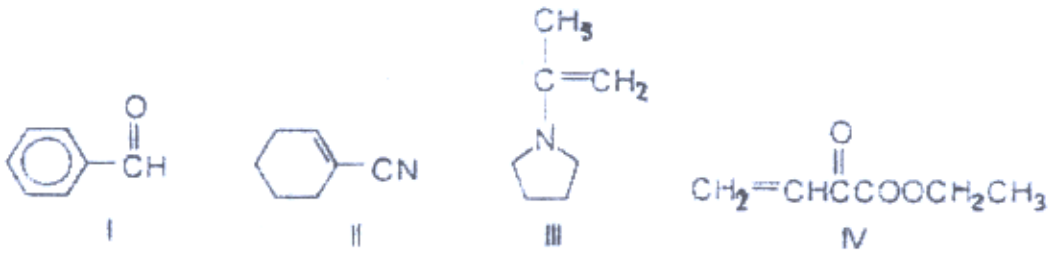
a) 

b) 

c) 

d) 

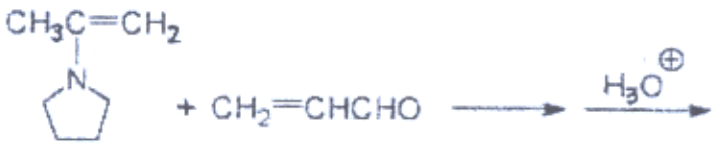
13. Which of the following molecules can act as nucleophile acceptors for the Michael reaction?

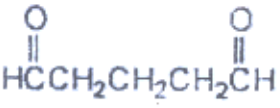


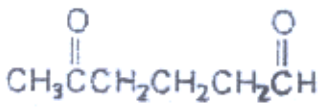
I II III IV

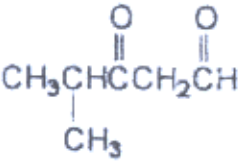
a) I, II b) III, IV c) II, IV d) I, III

14. What is the major product from the following reaction?



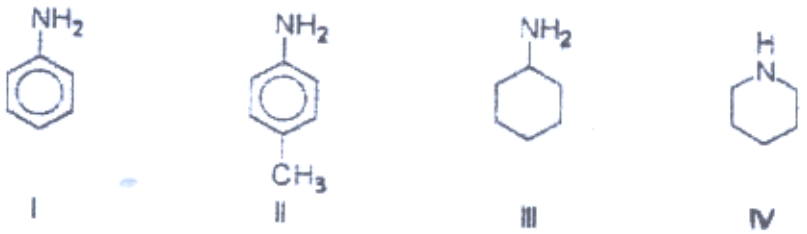
a) 

b) 

c) 

d) 

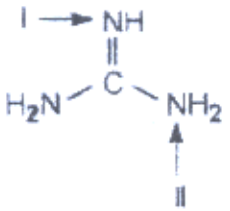
15. What is the order of increasing basicity for the following amines (weakest first)?

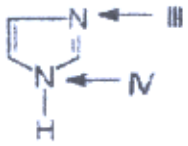


I II III IV

a) IV, II, III, I b) II, I, III, IV c) I, II, III, IV d) II, I, IV, III

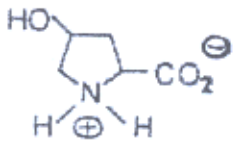
16. What are the correct positions for the most likely site for protonation of the bases, guanidine and imidizole?





a) I, III b) II, IV c) I, IV d) II, III

17. How many stereoisomers are possible for the following amino acid?

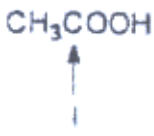


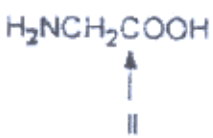
a) 2 b) 4 c) 8 d) none

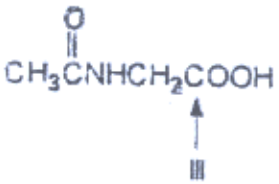
18. What is the isoelectric point for an amino acid?

a) The degree of ionization of the amino acid at pH 7.
b) The pH at which there is no net charge for the amino acid.
c) The pH at which the ionized form predominates.
d) The pH at which the amino acid is present as the dipolar ion.

19. What is the order of increasing acidity for the indicated carboxyl groups (least first)?





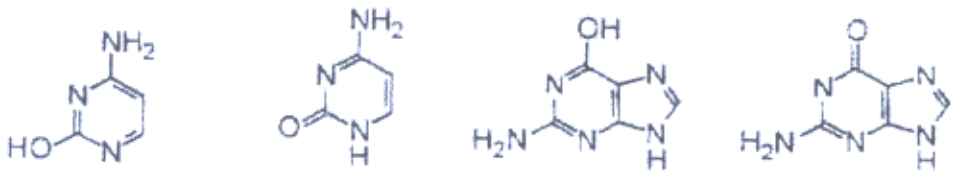


a) I, II, III b) II, III, I c) III, II, I d) I, III, II

20. In a Merrifield solid phase peptide synthesis, if there are 5 steps and each goes in 90% yield, what is the overall yield ?

a) 18% b) 45% c) 59% d) 90%

21. Hydrogen bonding is strongest between which two of the following structures?



I　　II　　III　　IV

a) I and II　　b) I and IV　　c) II and III　　d) II and IV

22. Hydrolysis of DNA gives which of the following materials?

I. ribose　　II. adenine　　III. deoxyribose　　IV. uracil

a) I, II　　b) II, III　　c) III, IV　　d) I, IV

23. DNA and RNA differ according to which of the following?

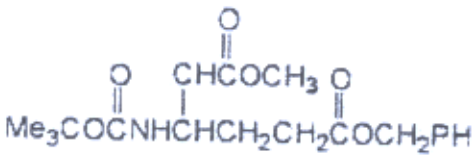
I. the position of attachment of phosphate groups
II. the position of attachment of base groups
III. the sugar structure at C 2'
IV. structure of bases

a) I, II　　b) II, III　　c) III, IV　　d) II, IV

24. In both the RNA and DNA structures, the phosphate groups are attached to the sugar structure at which positions?

a) 5', 5'　　b) 3', 3'　　c) 3', 5'　　d) 2', 5'

25. In the following structure, how can the carboxyl group be deprotected without deprotecting the amino group?



a) dilute HCl　　b) CF_3COOH　　c) NaOH　　d) Pt / H_2

簡答題：（共十題 ，每題五分）

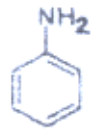
1. Both enantiomers of α-terpineol may be isolated from various natural sources: the (*S*) isomer is a constituent of long-leaf pine oil whereas the (*R*) isomer is present in the petitgrain oil. Draw the structure of (*S*)-α-terpineol

α-terpineol

2. Devise a simple chemical method that could be used to distinguish between 1,3-cyclohexadiene and benzene.

benzene 1,3-cyclohexadiene

3. The amino substituent is a powerful activating group in electrophilic aromatic substitution. However, a protonated amino substituent is strongly deactivating. Explain.



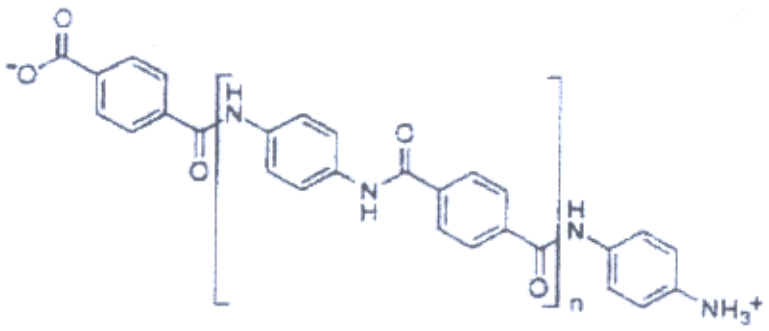
very reactive toward electrophiles

quite unreactive toward electrophiles

4. On treatment with KOH, compound A (shown below) is converted to B (C_8H_8O), which does not have an absorption in the 3200–3600-cm^{-1} region of its IR spectrum. The ^1H NMR spectrum of B shows the following resonances: δ 2.7 (triplet, 2H), 3.8 (triplet, 2H), 7.2 (multiplet, 4H). Suggest a structure for B and propose a reasonable mechanism to account for its formation.

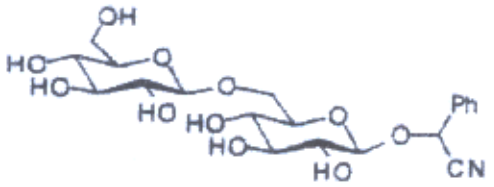
A B

5. Kevlar is an extremely strong polymer used to make bulletproof vests. Suggest suitable reagents that could be used to prepare this material in the laboratory.



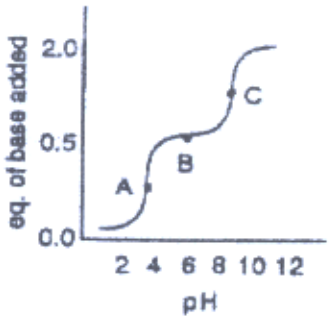
Kevlar

6. Amygdalin is a toxic carbohydrate present, for example, in the pits of peach, almond, and plum. Draw the acid hydrolysis products of amygdalin and suggest a reason for its toxicity.



Amygdalin

7. The following graph represents a titration curve for glycine. What is the significance of points A, B, and C? Based on the graph, draw the structure of glycine at pH 11



8. A mixture of aspartic acid, methionine, and arginine can be separated by electrophoresis. Explain how this would be done and what exactly happens during the separation. What would

9. How do the terms primary, secondary, and tertiary relate to the structure of proteins? Explain briefly.

10. Draw the structure of histidine at a very low pH. Which one of the imidazole ring nitrogens becomes protonated? Which proton in this structure is the most acidic?