

PREVIOUS YEAR QUESTIONS (CU)

BIOMOLECULES

CBCS, SEMESTER-5, CC-12

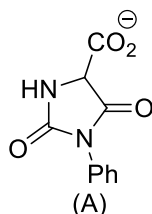
1. Designate the structures of possible dipeptides which on hydrolysis afford one mole glycine and one mole of alanine. (1M) [1c, CC-12, 2022]
2. What are the bases common both in DNA and RNA? (structures not needed). (1M) [1e, CC-12, 2022]
3. Write down the structure of one pyrimidine base present in RNA only. (1M) [1j, CC-12, 2022]
4. Write down Sanger's degradation method for the N-terminal amino acid determination of the tripeptide ala-gly-phe. (3M) [8a, CC-12, 2022]
5. Write down the reaction of proline with ninhydrin. (2M) [8b, CC-12, 2022]
6. Synthesise glutamic acid *via* phthalimidomalonic ester synthesis. (3M) [9a, CC-12, 2022]
7. Provide the structures of the nucleotides of: (2M) [9b, CC-12, 2022]
 - (i) Deoxyribose with cytosine
 - (ii) Ribose with guanine.
8. Write down the mechanism of hydrolysis of adenosine and uridine. Which one undergoes more rapid hydrolysis in aqueous acid? Give reason in favour of your answer. (3M) [11a, CC-12, 2022]
9. Write down the structure of cyclic AMP. When it is treated with aqueous sodium hydroxide, the major product is adenosine 3'-monophosphate rather than adenosine-5'-monophosphate. Explain the observation. (2M) [11b, CC-12, 2022]
10. How lysine ($pI = 9.6$) can be separated from glycine ($pI = 5.97$) by electrophoresis? (1M) [1b, CC-12, 2021]
11. Explain why the compound aspartic acid shows three pK_a values. (1M) [1e, CC-12, 2021]
12. Draw the structure of a purine base mentioning its name. (1M) [1j, CC-12, 2021]
13. How is the Boc group of an amino acid derivative removed? (1M) [1l, CC-12, 2021]
14. How would you synthesise Phe-Gly-ala applying Merrifield methodology using Boc as *N*-protecting group? (3M) [8a, CC-12, 2021]
15. What happens when alanine is heated with acetic anhydride in pyridine as solvent? Give the mechanism involved in the reaction. (2M) [8b, CC-12, 2021]
16. How would you synthesise phenylalanine employing Erlenmeyer azlactone synthesis? Is the synthesis stereospecific in nature? [12a, CC-12, 2021]
17. Show the number of hydrogen bonds present in a guanine-cytosine base pair. (1M) [1b, CC-12, 2020]
18. Draw the complete structure of the peptide Gly-Phe-Ser. (1M) [1e, CC-12, 2020]
19. How would you determine the N-terminal residue of a peptide following Edman's degradation method? why is the method preferred over Sanger's method. (1M) [9a, CC-12, 2020]
20. Guanosine is hydrolysed more rapidly than adenosine in dilute acid solution. Explain why. (2M) [9b, CC-12, 2020]
21. Write down a scheme for the synthesis of Gly-Ala using DCC promoted peptide bond formation. Give mechanism for the DCC coupling reaction step. (3M) [10a, CC-12, 2020]
22. In an electric field, towards which electrode, would an amino acid migrate at a: (2H)
 - (i) $pH < pI$, (ii) $pH > pI$. Explain. [10b, CC-12, 2020]

23. Define isoelectric point of amino acids. How can you separate a mixture of alanine and lysine on the basis of their isoelectric point? (3M) [22a, 6th, 2021]
24. Write down the pathway to synthesise the dipeptide val-gly using direct method involving DCC. (2M) [22b, 6th, 2021]
25. How is *N*-terminal amino acid determined by Edman's method? Why is this method more advantageous than Sanger's method? (3M) [23a, 6th, 2021]
26. Convert glycine to phenylalanine using Erlenmeyer's azlactone synthesis. (2M) [23b, 6th, 2021]
27. Write down the structures of A-T and G-C base pairings in DNA. (3M) [24a, 6th, 2021]
28. What are nucleosides and nucleotides? (2M) [24b, 6th, 2021]
29. How can you determine *N*-terminal amino acid of a peptide by Edman method? What advantage does it offer over FDNB method? (3M) [22a, 6th, 2020]
30. Write down the reaction which is used for the identification of amino acids using a spray reagent. (3M) [22b, 6th, 2020]
31. Write the structure of cyclic AMP. Explain why it gives adenosine-5'-monophosphate as the major product on alkaline hydrolysis. (3M) [23a, 6th, 2020]
32. State the role of DCC in direct coupling of amino acids. Give mechanism. (2M) [23b, 6th, 2020]
33. Write the structure of BOC derivative of an amino acid. For which purpose BOC is used? How this group can be removed? (3M) [24a, 6th, 2020]
34. Write the names and structures of two purine and pyrimidine bases related to the nucleic acid. (2M) [24b, 6th, 2020]
35. Outline the steps in the synthesis of Val-Phe using Merrifield resin. What are the advantages of using solid phase peptide synthesis over the solution phase? (3M) [22a, 6th, 2019]
36. How do you synthesise (\pm)-methionine using Strecker's method. (2M) [22b, 6th, 2019]
37. A tripeptide of unknown sequence on amino acid analysis was found to contain Ala, Gly, Phe and Val in equimolecular ratio. Determine the primary structure of the tetrapeptide from the following experimental observations: (3M) [23a, 6th, 2019]
- Val is *N*-terminal amino acid.
 - The tetrapeptide on hydrolysis produces a tripeptide composed of Gly, Phe and Val.
 - A dipeptide consisting of Ala and Gly is also present in the hydrolysis mixture.
38. How can lysine ($pI = 9.7$) be separated from alanine ($pI = 6.0$) by electrophoresis? (2M) [23b, 6th, 2019]
39. Write down the structures of A-T and G-C base pairings in DNA. (3M) [24a, 6th, 2019]
40. Write down the structure of the product obtained when a β -amino acid is heated. Also give the plausible mechanism. (2M) [24b, 6th, 2019]
41. Explain with mechanism the role of DCC in direct synthesis of a dipeptide. (1.5M) [22a(i), 6th, 2018]
42. Write the different interactions responsible for stabilizing the secondary structure of a protein. (1.5M) [22a(ii), 6th, 2018]
43. Write down the structure of adenosine and guanosine. Explain why guanosine is hydrolysed more rapidly than adenosine. (2M) [22b, 6th, 2018]
44. Outline briefly the chemical strategy for the synthesis of tripeptide Ala-gly-val by a suitable method. (3M) [23a, 6th, 2018]
45. How can you determine the C-terminal residue of a peptide chain? (3M) [23b, 6th, 2018]

46. Write down the structure of cyclic AMP. When it is treated with aqueous sodium hydroxide, the major product is adenosine 3'-monophosphate rather than adenosine-5'-monophosphate. Explain the observation. (3M) [24a, 6th, 2018]
47. Write down the structure of pyrimidine base and its possible tautomeric form present in DNA only. (2M) [24b, 6th, 2018]
48. Specific rotation of optically active amino acid changes when the pH of the medium is changed. Explain whether it is a case of mutarotation or any other process. (3M) [22a, 6th, 2017]
49. How would you convert glycine to phenylalanine using Erlenmeyer azalactone synthesis? (2M) [22b, 6th, 2017]
50. Write the steps for the solvent phase synthesis of a dipeptide gly-ala. (3M) [23a, 6th, 2017]
51. Predict the product with mechanism when leucine is heated with acetic anhydride in presence of pyridine. (2M) [23b, 6th, 2017]
52. How is *N*-terminal amino acid determined by Edman's method? Why is it more advantageous than Sanger's method? (3M) [24a, 6th, 2017]
53. Draw the structure of thymidine monophosphate. (2M) [24b, 6th, 2017]
54. How will you synthesise the tripeptide Phe-Gly-Ala applying Merrifield methodology and using *t*-butyloxy carbonyl group as the *N*-protecting group? (3M) [22a, 6th, 2016]
55. How can you determine the *C*-terminal residue of a peptide chain? (2M) [22b, 6th, 2016]
56. Write the names and structures of any two purine and pyrimidine bases related to nucleic acid (1.5M) [23a(i), 6th, 2016]
57. Write the name and structure of a S-containing essential amino acid. (1.5M) [23a(ii), 6th, 2016]
58. Outline Strecker synthesis of serine. (2M) [23b, 6th, 2016]
59. What is meant by specific base pairing in a double helix structure of a DNA molecule? Why have other base pairing not been observed in a DNA double helix structure? (3M) [24a, 6th, 2016]
60. Identify the products in the following reaction sequence. (2M) [24b, 6th, 2016]
- O=C1CN(C1)c2ccccc2 + HCHO $\xrightarrow[\text{Ac}_2\text{O}]{\text{AcO}^-}$? $\xrightarrow[\text{HI}]{\text{Red P}}$? $\xrightarrow{\text{H}_3\text{O}^+}$? $\xrightarrow{\text{H}_3\text{O}^+}$?
61. Draw the structure of the following compounds: (3M) [22a, 6th, 2015]
- Nucleoside containing a base unit found only in RNA and not in DNA.
 - Nucleoside containing a base unit present in DNA which is complementary to Thymine.
62. Delineate the pathway to synthesise the dipeptide val → gly using direct synthetic method involving DCC. (2M) [22b, 6th, 2015]
63. Write down the structure of the compound produced by reaction of one mole of glycine and two moles of ninhydrin. Identify the amino acid which does not give Ruheman's purple with ninhydrin. Give justification for your answer. (3M) [23a, 6th, 2015]
64. In an electric field, towards which electrode would an amino acid migrate under the following conditions? (2M)
- pH < pI
 - pH > pI
 - pH = pI
- Explain your answer showing the pertinent equilibrium equation involved. [23b, 6th, 2015]
65. Prepare (i) Leucine, (ii) Tyrosine using diethylacetamido malonate. (3M) [24a, 6th, 2015]
66. How would you determine *N*-terminal residue in peptide chain? (2M) [24b, 6th, 2015]

67. Outline briefly the chemical strategy for the synthesis of the tripeptide Ala.Gly. Val following Merrifield solid phase synthesis method. (3M) [24a, 6th, 2014]
68. Carry out the following conversion: (2M) [24b, 6th, 2014]
 Glycine \longrightarrow Phenylalanine (using Erlenmeyer azlactone synthesis)
69. How would you determine the C-terminal amino acid residue of a tripeptide chain? (2M) [25a, 6th, 2014]
70. What is meant by specific base-pairing in double helix structure of a DNA molecule? Why the other base pairing have not been observed in DNA double helix structure? (3M) [25b, 6th, 2014]
71. Define isoelectric point of amino acids. How can you separate a mixture of alanine and lysine on the basis of their isoelectric points? (3M) [26a, 6th, 2014]
72. Define with example: nucleoside and nucleotide. (2M) [26b, 6th, 2014]
73. Give the structure of L-leucine and give the mechanism of its reaction with ninhydrin. (3M) [22a, 6th, 2013]
74. Write the names and structures of any two purine and pyrimidine bases related to nucleic acids. (2M) [22b, 6th, 2013]
75. How is N-terminal amino acid determined by Edman's method? Why is it more advantageous than Sanger's method? (3M) [23a, 6th, 2013]
76. Trace the route of synthesis of Ph-CH(NH₂)-CO₂H from phthalimide. (3M) [23b, 6th, 2013]
77. Synthesise alanylglycine methyl ester using DCC. (3M) [24a, 6th, 2013]
78. Describe briefly the salient features of the double helix structure of DNA. (3M) [24b, 6th, 2013]
79. How will you synthesise the tripeptide Phe-Gly-Ala, applying Merrifield methodology and using *t*-butyloxycarbonyl group as N-protecting group? (3M) [11c, 5th, 2012]
80. Using 2,5-diketopiperazine, how would you synthesise tyrosine? (2M) [11d, 5th, 2012]
81. Identify the H-bonds between the conjugate base pairs of DNA. (2M) [11e, 5th, 2012]
82. Discuss the salient features of secondary and tertiary structures of protein molecules. (2M) [11f, 5th, 2012]
83. Predict the product with mechanism when leucine is heated with acetic anhydride in presence of pyridine. (2M) [12d, 5th, 2012]
84. How will you determine the C-terminal residue of a peptide chain? (2M) [12e, 5th, 2012]
85. Write down the structures of adenosine and guanosine. Explain why guanosine is hydrolysed rapidly than adenosine. (2M) [12f, 5th, 2012]
86. Mention the names of different types of RNA's and their functions. (3M) [12g, 5th, 2012]
87. Using 2,5-diketopiperazine, how would you synthesise tyrosine? (2M) [11e, 5th, 2011]
88. What is the difference between nucleoside and nucleotide? (2M) [11f, 5th, 2011]
89. What is denaturation of proteins? Mention the condition under which denaturation occurs. (2M) [11g, 5th, 2011]
90. Outline a synthesis of leucine from dimethyl malonate. (2M) [12d, 5th, 2011]
91. What are the factors responsible for the stability of Watson-Crick model of DNA? (2M) [12e, 5th, 2011]
92. Outline a synthesis of a dipeptide Ala-Phe starting with the N-terminal amino acid. (2M) [12g, 5th, 2011]

93. Write down the structure of the violet-coloured product from the reaction of an amino acid with ninhydrin. Explain the reaction with mechanism. (3M) [11d, 5th, 2011]
94. Write down a scheme for the synthesis of the dipeptide, Gly-Ala, using DCC promoted peptide bond formation. Give mechanism. (3M) [11e, 5th, 2011]
95. What are the components of DNA? How does RNA differ from DNA with respect to its structure and function? (4M) [11f, 5th, 2011]
96. Define the isoelectric point of an amino acid. How can lysine (pI: 9.6) be separated from glycine (pI: 5.97) by electrophoresis. (3M) [12c, 5th, 2011]
97. Carry out the following conversion: (2M) [12d, 5th, 2011]
 Glycine \longrightarrow Phenylalanine (using Erlenmeyer azlactone synthesis)
98. A tripeptide X on hydrolysis gives two amino acids, Glu (2eq.) and Ala (1 eq.). X does not react with 2,4-dinitrofluorobenzene. Ala is released first when X is incubated with carboxypeptidase. Deduce the structure for X. (3M) [12e, 5th, 2011]
99. Describe briefly the salient features of the double helix structure of DNA. (3M) [12f, 5th, 2011]
100. Outline the synthesis of (\pm)-tryptophan from acetamidomalonic ester. (2M) [11a, 5th, 2011]
101. What happens when methyl ester of (\pm)-alanine is heated? (1M) [11b, 5th, 2011]
102. Show all the steps in the synthesis of Gly-Val-Ala using the *tert*-butyloxycarbonyl as a protecting group. (3M) [11c, 5th, 2011]
103. What are essential and non-essential amino acids? (2M) [11d, 5th, 2011]
104. Write down the structures of bases present in DNA and RNA. Outline a synthesis of any one of them. (2M) [11e, 5th, 2011]
105. Outline malonic ester synthesis of isoleucine. (2M) [12i, 5th, 2011]
106. Describe how C-terminal residue of a peptide chain is determined. (2M) [12j, 5th, 2011]
107. Outline the Strecker synthesis of serine. Discuss the reaction pathway. (3M) [11c, 5th, 2010]
108. Show hydrogen bonding interactions between the complementary base pairs in DNA. (2M) [11d, 5th, 2010]
109. Explain with mechanism the role of DFNB for the determination of the N-terminal residue analysis of a peptide. (2M) [11e, 5th, 2010]
110. What is Merrifield resin? Show the steps in the synthesis of the tripeptide ala.phe.gly in the solid phase with the help of the resin. State the advantages of the solid phase peptide synthesis. (4M) [12b, 5th, 2010]
111. Outline a chemical method for the determination of C-terminal amino acid residue of a protein. (4M) [12c, 5th, 2010]
112. Give the name and structure of a purine nucleoside. (1M) [12d, 5th, 2010]
113. How would you convert glycine to the compound (A). can *dl*-proline can be synthesised from it. (3M) [11c, 5th, 2010]



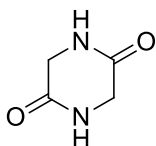
114. What is Merrifield resin? How is it used to synthesise the dipeptide gly.phe? Why cannot the amino protection be done by benzyloxycarbonyl group in this process except in the last stage? (3M) [11d, 5th, 2010]

115. What are nucleosides and nucleotides? Draw the structure of ATP. Show the H-bonding in G-C base-pairing in DNA double helix. (4M) [11e, 5th, 2010]

116. Describe the chemistry involved in the Edman degradation used to determine the *N*-terminal amino acid of a peptide. (3M) [12c, 5th, 2010]

117. What kind of bonding is largely responsible for the secondary structure of a protein? (2M) [12d, 5th, 2010]

118. A dipeptide on hydrolysis gives two amino acids X and Z. If the dipeptide is first treated with HNO_2 and then hydrolysis is carried out, X and lactic acid are obtained. X on heating gives 2,5-diketopiperazine as shown below. Identify X and Z and write the structure of the dipeptide. (4M)



[12e, 5th, 2010]

119. Which of adenosine and guanosine undergoes more rapid hydrolysis in aqueous acid? Give reasons in favour of your answer. (3M) [11a, 5th, 2009]

120. How would you determine the *C*-terminal amino acid residue of a tripeptide chain? (2M) [11b, 5th, 2009]

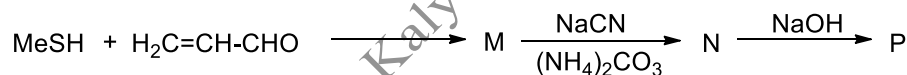
121. Write the structure of L-proline. (1M) [11c, 5th, 2009]

122. Outline the synthesis of (\pm)-tryptophan from acetamidomalonic ester. (2M) [11d, 5th, 2009]

123. Write the representative structure of a trinucleotide fragment of an RNA chain. (2M) [11g, 5th, 2009]

124. Delineate the role of dicyclohexylcarbodiimide in the formation of the peptide linkage between two different suitably-protected amino acids. (3M) [12a, 5th, 2009]

125. Write the structures of M, N and P as appear in the following conversion. (3M) [12f, 5th, 2009]



Also indicate whether P will be optically active. Write the mechanism of conversion of M to N.

126. Show how cyanogen bromide, Br-CN, is used in selective cleavage of a peptide having a methionine residue. (3M) [12g, 5th, 2009]

127. Why benzoyl group can not be used as an *N*-protecting group in the formation of peptide linkage? (2M) [11d, 5th, 2009]

128. How is L-phenylalanine synthesised by Gabriel's method? (2M) [11e, 5th, 2009]

129. Indicate the structural difference between nucleoside and nucleotide. Draw the structure of adenosine-5'-phosphate. (2M) [11g, 5th, 2009]

130. Dicyclohexylcarbodiimide (DCC) is a useful reagent for activation of -COOH group of amino acid towards nucleophilic substitution. Delineate its use during formation of a peptide bond. (3M) [12d, 5th, 2009]

131. Write a probable mechanism for the reaction of glycine with ninhydrin. (2M) [12e, 5th, 2009]

132. Write the structure showing specific hydrogen bonding between adenine and thymine? What are nucleoproteins. (1.5M) [12f, 5th, 2009]

133. "Dilute acid hydrolysis of D-glucose -1-phosphate differs from ordinary alkyl esters in two ways - it is abnormally fast and takes place with cleavage of C-O bond". Give reasons in favour of this observation. (2M) [10a(iii), 5th, 2009]

134. Write down the solid phase synthesis of the tripeptide gly.val.ala. (2M) [11a(i), 5th, 2009]

135. Describe the principle of separation of the three amino acids, differing in the values of their isoelectric points, from their mixture. (2M) [11a(ii), 5th, 2009]
136. How can you determine the C-terminal amino acid of a peptide? (2M) [11a(iii), 5th, 2009]
137. Show how can you convert: Glycine \longrightarrow Phenylalanine. (2M) [11b(ii), 5th, 2009]
138. How many types of RNAs known? What role do these RNAs play in the synthesis of proteins in living animals? (2M) [11c, 5th, 2009]
139. Comment on the role of prosthetic group in the classification of proteins. (2M) [12i, 5th, 2009]
140. Isoelectric point of glycine is 6.0, whereas that of lysine is 9.8. Explain. (2M) [12j, 5th, 2009]
141. What is Merrifield resin? Show the steps in the synthesis of the dipeptide gly.ala in the solid phase with the help of the resin. State the advantages of the solid phase peptide synthesis. (4M) [11c, 5th, 2008]
142. Predict the product with mechanism when leucine is heated with acetic anhydride in presence of pyridine. (2M) [11d, 5th, 2008]
143. What are the structural and functional differences between DNA and RNA? (2M) [11g, 5th, 2008]
144. Show a synthesis of phenylalanine using an active methylene compound. (2M) [12c, 5th, 2008]
145. Write down the reaction which is used for the identification of amino acids using a spray reagent. (2M) [12d, 5th, 2008]
146. Explain with mechanism the role of 2,4-DNFB for the determination of *N*-terminal residue of a protein. (2M) [12e, 5th, 2008]
147. Write down the structures of adenosine and guanosine. Explain why guanosine is hydrolysed more rapidly than adenosine. (2M) [12g, 5th, 2008]
148. What is a coenzyme? Give one example. (1M) [12h, 5th, 2008]
149. How can the *N*-terminal residue of a peptide chain be determined? (2M) [11a, 5th, 2008]
150. How can you determine the sequence of amino acids in the following tripeptide? Gly. Ala.Phe. (3M) [11b, 5th, 2008]
151. Explain the mechanism of reaction between ninhydrin and (S)-alanine. (2M) [11c, 5th, 2008]
152. How many types of RNA are known? What role do these RNA play in the synthesis of proteins in living animals? (2M) [11d, 5th, 2008]
153. Indicate the hydrogen bondings present among the base pairs in DNA. (2M) [11e, 5th, 2008]
154. What do you mean by the secondary structure of protein? (2M) [12i, 5th, 2008]
155. Give the name and structure of a purine nucleoside. (2M) [12j, 5th, 2008]