InkChemistry

QUESTION WORKBOOK

Amino acids, proteins, enzymes and DNA

Aromatic chemistry and amines · Unit C21

AQA 3.3.13.1 to 3.3.13.5 · OCR A 6.2.2

19 questions · 63 marks

NAVY SCREEN EDITION

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SECTION A · Short, 1 to 2 marks

A1 AAP-Q21

Suggest a buffer pH that would make glycine (isoelectric point 6.0) and lysine (isoelectric point 9.7) move in opposite directions in electrophoresis. [2]

A2 AAP-Q23

Explain why cisplatin is supplied as the cis isomer alone rather than as a mixture with the trans isomer. [2]

SECTION B · Standard, 3 to 5 marks

B1 AAP-Q7

Give the type of reaction and the other product when glycine, H_2NCH_2COOH, and serine, $H_2NCH(CH_2OH)COOH$, join to form a dipeptide, and the condensed formulae of the two dipeptides that contain one of each. [4]

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B2 AAP-Q8 Describe the primary, secondary and tertiary structure of a protein, and the bonds that maintain the secondary and tertiary structure. [4]

B3 AAP-Q12 Describe how the amino acids in a protein can be released and then identified by thin-layer chromatography. [4]

B4 AAP-Q15 Describe the structure of a DNA molecule, from the nucleotide to the double helix. [4]

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B5 AAP-Q24 Explain how computer modelling helps a research team that has the X-ray structure of an enzyme a bacterium needs to design a drug that inhibits it, and why the drug may have to be made as a single enantiomer. [4]

B6 AAP-Q2 Explain why glycine, $H_2NCH(R)COOH$ with R = H, is not optically active, whereas alanine, with R = CH_3, is. [3]

B7 AAP-Q3 Give the formula of the species serine, $H_2NCH(CH_2OH)COOH$, forms in a solution at pH 2 and in a solution at pH 12, and give the meaning of the term isoelectric point. [3]

B8 AAP-Q4 Explain why alanine, Mr 89, is a solid that decomposes near 300 °C, whereas butanoic acid, Mr 88, is a liquid that freezes at about -5 °C. [3]

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B9 AAP-Q9 Explain how a disulfide bridge forms in a protein, what it does to the protein's structure, and why it survives warming that breaks hydrogen bonds. [3]

B10 AAP-Q11 Calculate the Mr of the tripeptide gly-ala-gly. Mr of glycine is 75.0, of alanine 89.0 and of water 18.0. [3]

B11 AAP-Q13 Explain why an enzyme catalyses the reaction of only one enantiomer of a chiral substrate. [3]

B12 AAP-Q14 Suggest how a drug could be designed to inhibit an enzyme whose active-site shape is known. [3]

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B13 AAP-Q16 Explain why adenine pairs only with thymine and guanine only with cytosine in DNA, and state the number of hydrogen bonds in each pair. [3]

B14 AAP-Q19 Suggest the formula and the overall charge of the species that lysine, $H_2N(CH_2)_4CH(NH_2)COOH$, isoelectric point about 9.7, forms at pH 7. [3]

B15 AAP-Q20 Explain why, in electrophoresis with a buffer at pH 6.0, alanine (isoelectric point 6.0) stays at the starting line while aspartic acid (isoelectric point 2.8) moves towards the positive electrode. [3]

B16 AAP-Q22 Give the equation for the esterification of glycine with ethanol, the conditions used, and the form the ester takes in the reaction mixture. [3]

SECTION C · Long, 6 marks or more

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C1 AAP-Q17 Evaluate the use of cisplatin, cis-$[Pt(NH_3)_2Cl_2]$, as an anticancer drug, explaining how it stops cancer cells dividing. [6]

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