

Solutions

Original marking guidance: M1 method, A1 accuracy, B1 explanation.

2.1 $^+\text{H}_3\text{NCH}_2\text{COOH}$; $^+\text{H}_3\text{NCH}_2\text{COO}^-$; $\text{H}_2\text{NCH}_2\text{COO}^-$.

2.2 Glycine central carbon has two H atoms; alanine has four different groups at its central carbon.

2.3 $-\text{C}(=\text{O})-\text{NH}-$ peptide/amide linkage; water.

3.1 $\text{H}_2\text{NCH}_2\text{CONHCH}(\text{CH}_3)\text{COOH}$. $\text{H}_2\text{NCH}(\text{CH}_3)\text{CONHCH}_2\text{COOH}$.

3.2 $\text{CH}_2=\text{CHCONH}_2$, propenamide; addition, because $\text{C}=\text{C}$ opens without eliminating a small molecule.

3.3 Many OH groups hydrogen-bond to water, supporting dissolution. Polyamide N–H and C=O groups hydrogen-bond between chains, requiring energy to separate them/holding chains together.

3.4 Zero a polarimeter with solvent and use plane-polarised monochromatic light. Match concentration/path length and temperature/wavelength. Pure alanine enantiomers give equal opposite rotation; glycine is inactive. Zero can mean achiral glycine or cancellation in a racemate, so it is not unique evidence.