

Amines, amino acids and condensation polymers in action

Chemistry grades 11-12 (A Level · IB · Class 11-12) · Test

Name: _____ Date: _____ Class: _____ Mark: ____ / 20

This test covers amine basicity, amino acids, condensation polymers and DNA. Calculators are allowed, and you should show working for every calculation. Marks are shown beside each part.

Level: Chemistry grades 11-12 (A Level · IB · Class 11-12) · **Curriculum:** A Level 3.3.11-3.3.13

Time: 45 minutes · 8 questions · Total: 20 marks · Calculator allowed

Question 1 Basic strength (3 marks)

Ethylamine has pK_b 3.35 and phenylamine has pK_b 9.13.

- State which is the stronger base. (1 mark)
- Explain the difference in terms of the nitrogen lone pair. (2 marks)

Question 2 pH of dimethylamine (3 marks)

Calculate the pH at 25 °C of 0.0400 mol/dm³ dimethylamine, $K_b = 5.4 \times 10^{-4}$ mol/dm³, with $K_w = 1.0 \times 10^{-14}$. (3 marks)

Question 3 Serine melting point (2 marks)

Serine, HOCH₂CH(NH₂)COOH, melts above 200 °C with decomposition, much higher than a carboxylic acid of similar Mr.

- Draw the structure present in the solid. (1 mark)
- Explain the high melting point. (1 mark)

Question 4 Poly(lactic acid) (3 marks)

Lactic acid is CH₃CH(OH)COOH and it forms poly(lactic acid), PLA.

- Name the link and the small molecule lost. (1 mark)
- Calculate the Mr of the repeat unit and of a chain of 450 units (C = 12.0, H = 1.0, O = 16.0). (2 marks)

Question 5 Tripeptide (3 marks)

The diagram shows a tripeptide.

- Name the links X and Y. (1 mark)
- Calculate the Mr of the tripeptide. (2 marks)



A tripeptide built from glycine, alanine and serine.

Question 6 Nylon or polypropene (2 marks)

Explain why nylon-6,6 is broken down by boiling aqueous hydrochloric acid but poly(propene) is not. (2 marks)

Question 7 Hydrogen bonds in DNA (2 marks)

A DNA fragment has 40 base pairs and 15 of its 80 nucleotides are adenine. Calculate the total number of hydrogen bonds between the strands. (2 marks)

Question 8 Choosing the reagent (2 marks)

Propylamine is to be made from 1-bromopropane. Name the reagent and a suitable condition, and explain why a mixture forms if the reagent is limited. (2 marks)