

Amines, Amides, Amino Acids & Proteins

Question Paper

Level	A Level
Subject	Chemistry
Exam Board	Edexcel
Topic	Organic Chemistry III
Sub Topic	Amines, Amides, Amino Acids & Proteins
Booklet	Question Paper
Paper Type	Multiple Choice

Time Allowed: 39 minutes

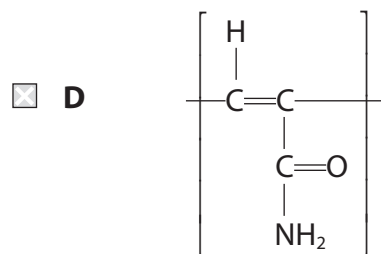
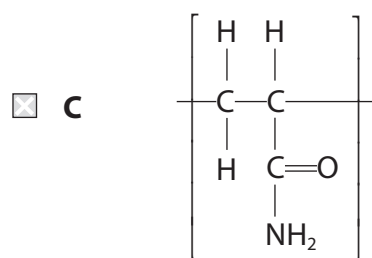
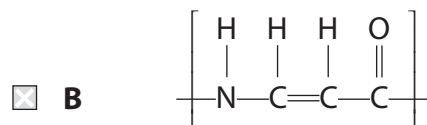
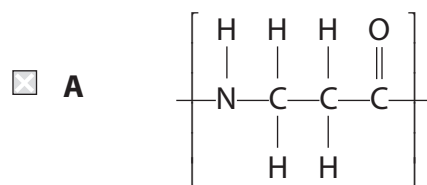
Score: /32

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 The repeat unit for poly(propenamamide) is



(Total for Question = 1 mark)

2 The structures of three amino acids are shown in the table.

Amino acid	Structure
cysteine	$\text{HSCH}_2\text{CH}(\text{NH}_2)\text{COOH}$
glycine	$\text{H}_2\text{NCH}_2\text{COOH}$
threonine	$\text{CH}_3\text{CH}(\text{OH})\text{CH}(\text{NH}_2)\text{COOH}$

The tripeptide glycine-cysteine-threonine is

- A $\text{H}_2\text{NCH}_2\text{CONHCH}(\text{CH}(\text{OH})\text{CH}_3)\text{CONHCH}(\text{CH}_2\text{SH})\text{COOH}$
- B $\text{H}_2\text{NCH}_2\text{CONHCH}(\text{CH}_2\text{SH})\text{CONHCH}(\text{CH}(\text{OH})\text{CH}_3)\text{COOH}$
- C $\text{H}_2\text{NCH}(\text{CH}(\text{OH})\text{CH}_3)\text{CONHCH}(\text{CH}_3\text{SH})\text{CONHCH}_2\text{COOH}$
- D $\text{H}_2\text{NCH}(\text{CH}_2\text{SH})\text{CONHCH}_2\text{CONHCH}(\text{CH}(\text{OH})\text{CH}_3)\text{COOH}$

(Total for Question = 1 mark)

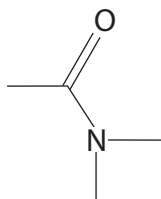
3 The amino acid alanine, $\text{H}_2\text{NCH}(\text{CH}_3)\text{COOH}$, exists as a solid at room temperature.

The most important reason for this is that it

- A exists as a zwitterion.
- B forms hydrogen bonds.
- C is amphoteric.
- D has strong London forces.

(Total for Question = 1 mark)

4 The skeletal formula of an organic compound is shown below.

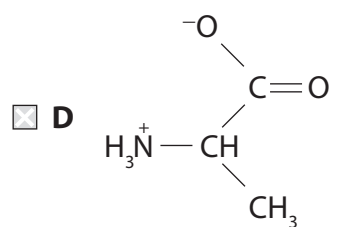
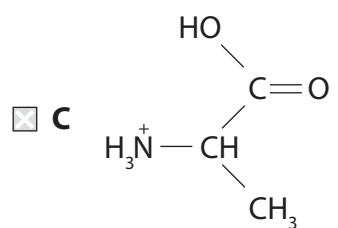
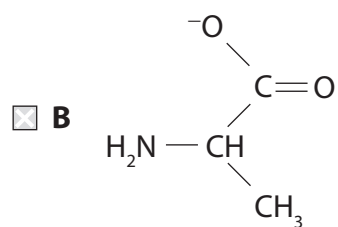
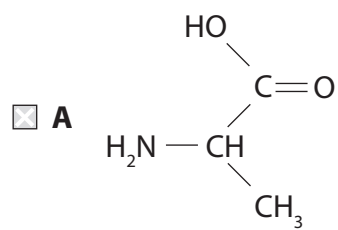


This compound is

- A** an amino acid.
- B** an amide.
- C** a primary amine.
- D** a secondary amine.

(Total for Question = 1 mark)

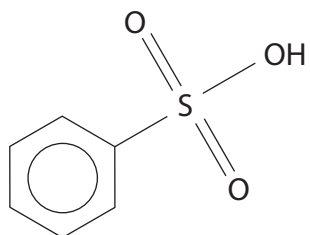
5 In an aqueous solution with a pH of 7, the amino acid alanine exists mainly as



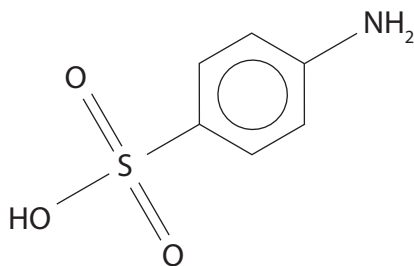
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6 Excess dilute sulfuric acid is added to phenylamine. What is the product of the reaction?

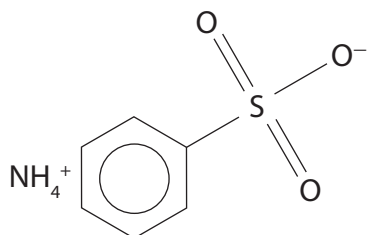
A



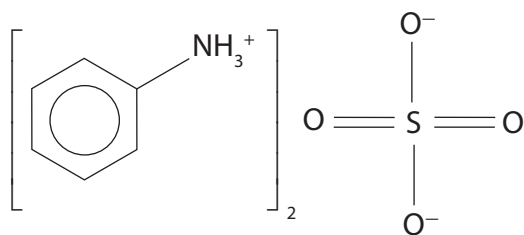
B



C



D



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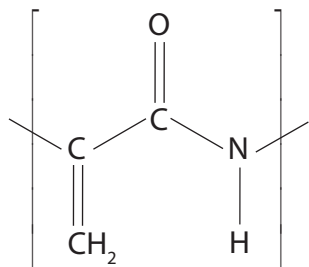
7 Butylamine ($T_b = 77.8^\circ\text{C}$) has a higher boiling temperature than propylamine ($T_b = 47.7^\circ\text{C}$). This is because the

- A** hydrogen bonds of butylamine are stronger than the hydrogen bonds of propylamine.
- B** London forces of butylamine are stronger than the hydrogen bonds of propylamine.
- C** London forces of butylamine are stronger than the London forces of propylamine.
- D** C—H bonds of butylamine are stronger than the C—H bonds of propylamine.

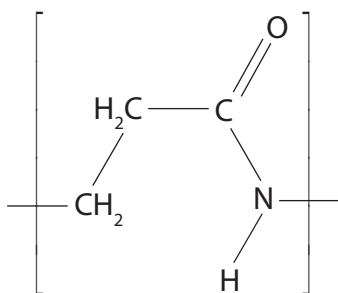
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- 8 The monomer of the addition polymer poly(propenamide) is $\text{CH}_2=\text{CHCONH}_2$. The repeat unit of the polymer is

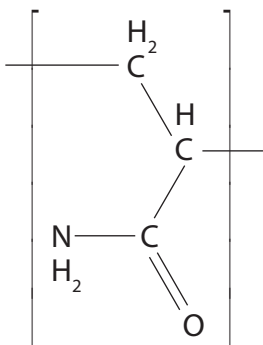
A



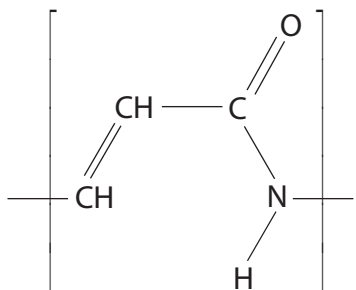
B



C

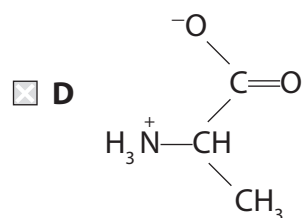
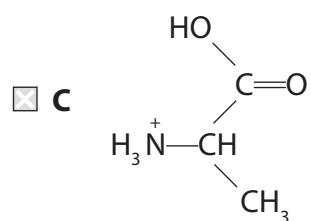
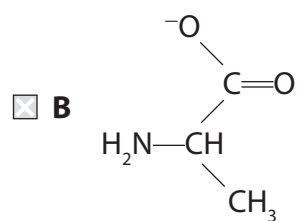
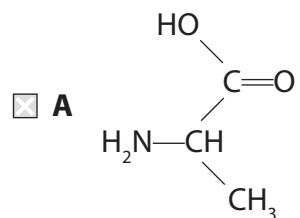


D



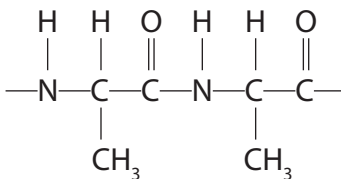
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9 In an aqueous solution with a pH of 12, the amino acid alanine exists mainly as



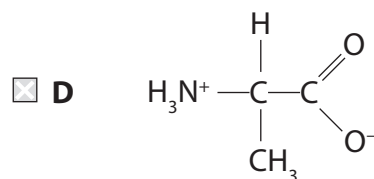
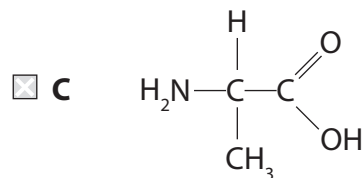
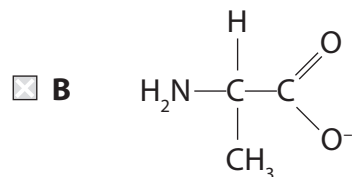
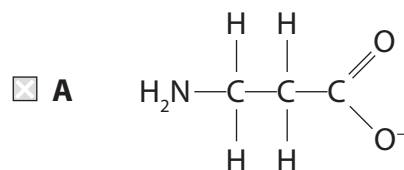
(Total for Question = 1 mark)

10 A section of the polypeptide made from a single amino acid is shown below.



The polypeptide was heated with excess dilute sodium hydroxide solution until no further change took place.

Which of the following products is formed?



(Total for Question = 1 mark)

11 Which of the following pairs of compounds could form a polyamide?

- A** $\text{Cl}-\text{CH}_2-\text{CH}_2-\text{Cl}$ and $\text{H}_2\text{N}-\text{CH}_2-\text{CH}_2-\text{NH}_2$
- B** $\text{HO}-\text{CH}_2-\text{CH}_2-\text{OH}$ and $\begin{array}{c} \text{O} \\ \parallel \\ \text{C}-\text{CH}_2-\text{CH}_2-\text{C} \\ \diagup \quad \diagdown \\ \text{H}_2\text{N} \quad \text{NH}_2 \end{array}$
- C** $\begin{array}{c} \text{O} \\ \parallel \\ \text{C}-\text{CH}_2-\text{CH}_2-\text{C} \\ \diagup \quad \diagdown \\ \text{HO} \quad \text{OH} \end{array}$ and $\text{CH}_3-\text{CH}_2-\text{NH}_2$
- D** $\begin{array}{c} \text{O} \\ \parallel \\ \text{C}-\text{CH}_2-\text{CH}_2-\text{C} \\ \diagup \quad \diagdown \\ \text{Cl} \quad \text{Cl} \end{array}$ and $\text{H}_2\text{N}-\text{CH}_2-\text{CH}_2-\text{NH}_2$

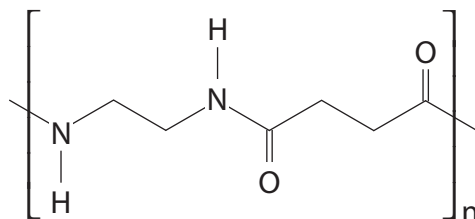
(Total for Question = 1 mark)

12 Methylamine, CH_3NH_2 , is **very** soluble in water. This is because it

- A** forms hydrogen bonds with water.
- B** forms London forces with water.
- C** exists mainly as ions in aqueous solution.
- D** exists as a zwitterion.

(Total for Question = 1 mark)

13 The structure below shows the repeating pattern of a polymer.

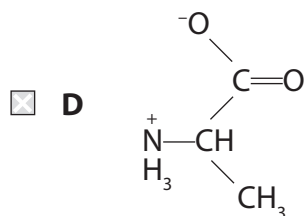
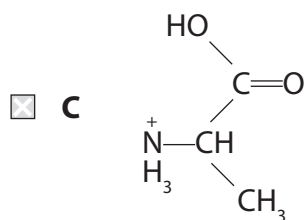
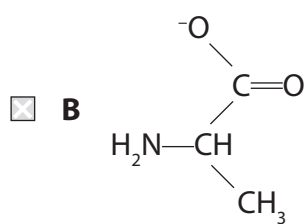
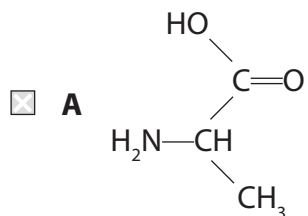


Which of the following pairs of compounds could react **rapidly** to form this polymer?

<input type="checkbox"/> A		
<input type="checkbox"/> B		
<input type="checkbox"/> C		
<input type="checkbox"/> D		

(Total for Question = 1 mark)

14 Which of the following structures best represents the amino acid, alanine, in an aqueous solution with a pH of 12?



(Total for Question = 1 mark)

15 Which of the following is true for **all** amino acids?

All amino acids

- A exist as optical isomers.
- B are neutral in solution.
- C are essential to life.
- D are crystalline solids at room temperature.

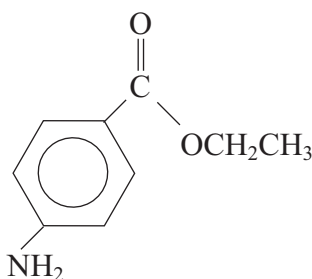
(Total for Question = 1 mark)

16 In order to make $\text{CH}_3\text{CH}_2\text{CONHCH}_3$, you could use

- A $\text{CH}_3\text{CH}_2\text{COOCH}_3 + \text{NH}_3$
- B $\text{CH}_3\text{CH}_2\text{COCl} + \text{CH}_3\text{NH}_2$
- C $\text{CH}_3\text{CH}_2\text{COO}^-\text{Na}^+ + \text{CH}_3\text{NH}_2$
- D $\text{CH}_3\text{CH}_2\text{CONH}_2 + \text{CH}_3\text{NH}_2$

(Total for Question = 1 mark)

17 Benzocaine is used as a local anaesthetic.



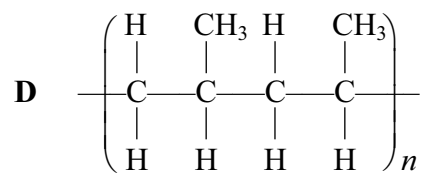
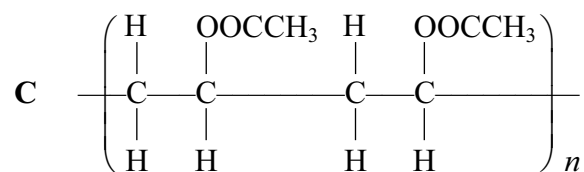
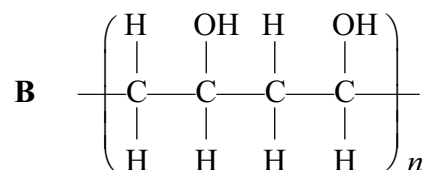
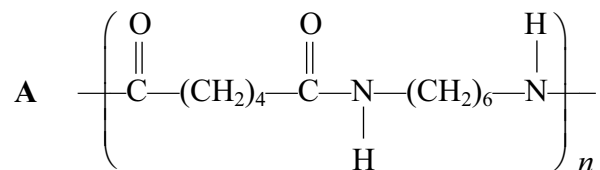
Separate samples of a solution of benzocaine are added to 2,4-dinitrophenylhydrazine, hot aqueous sodium hydroxide, and dilute hydrochloric acid.

Which chemicals react with benzocaine?

- A All three
- B Only sodium hydroxide and hydrochloric acid
- C Only hydrochloric acid
- D Only sodium hydroxide

(Total for Question = 1 mark)

18 Four polymers labelled **A to D** have the following formulae:



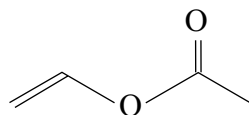
(a) Which polymer is most soluble in hot water?

- A**
 B
 C
 D

(1)

(b) Which polymer is formed from the monomer shown below?

(1)



- A
- B
- C
- D

(c) Which polymer is a condensation polymer?

(1)

- A
- B
- C
- D

(Total for Question = 3 marks)

19 Ammonia (NH_3), butylamine ($\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$) and phenylamine ($\text{C}_6\text{H}_5\text{NH}_2$) all form alkaline solutions in water. The order of **increasing** pH of equimolar solutions is

- A $\text{C}_6\text{H}_5\text{NH}_2 < \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2 < \text{NH}_3$
- B $\text{NH}_3 < \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2 < \text{C}_6\text{H}_5\text{NH}_2$
- C $\text{C}_6\text{H}_5\text{NH}_2 < \text{NH}_3 < \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$
- D $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2 < \text{NH}_3 < \text{C}_6\text{H}_5\text{NH}_2$

(Total for Question = 1 mark)

20 Amino acids are crystalline solids with a high melting temperature because

- A each molecule has a large number of electrons.
- B each molecule forms hydrogen bonds at both ends.
- C a proton is transferred from one end of the molecule to the other.
- D their shape allows the molecules to pack close together.

(Total for Question = 1 mark)

21 An organic compound **X** is much more soluble in dilute hydrochloric acid than in water. Compound **X** forms a coloured complex with aqueous copper(II) ions.

Compound **X** could be

- A $\text{C}_6\text{H}_5\text{COOH}$
- B $\text{C}_6\text{H}_5\text{NO}_2$
- C $\text{C}_6\text{H}_5\text{NH}_2$
- D $\text{C}_6\text{H}_5\text{OH}$

(Total for Question = 1 mark)

22 1-butylamine, $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$, reacts with ethanoyl chloride to form

- A $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_3^+\text{Cl}^-$
- B $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NHCOCH}_3$
- C $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NHCH}_2\text{CH}_3$
- D $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}(\text{COCH}_3)\text{NH}_2$

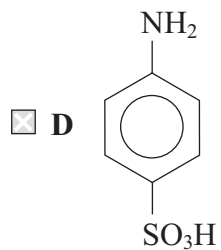
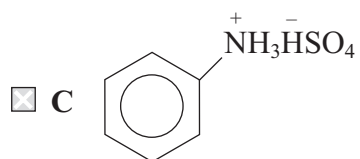
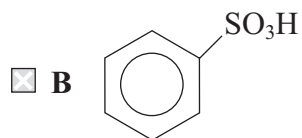
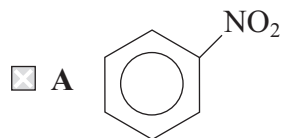
(Total for Question = 1 mark)

23 Glycine, $\text{H}_2\text{NCH}_2\text{COOH}$, is a solid that has a melting temperature of about 250°C , and it is very soluble in water. This is because of the

- A formation of intermolecular hydrogen bonds in the solid and hydrogen bonds with water.
- B formation of $\text{H}_3\text{N}^+\text{CH}_2\text{COO}^-$ ions which interact strongly with each other in the solid and with water.
- C dissociation of the molecule to form $\text{H}_2\text{NCH}_2\text{COO}^-$ and H^+ ions in the solid and the solution.
- D protonation of the molecule to form $\text{H}_3\text{N}^+\text{CH}_2\text{COOH}$ ions in both the solid and the solution.

(Total for Question = 1 mark)

24 Which of the following products is formed when phenylamine (aniline) is reacted with **dilute** sulfuric acid?

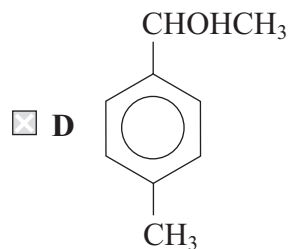
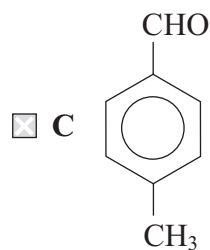
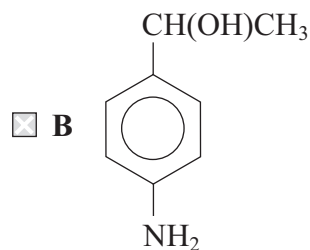
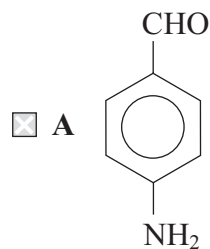


(Total for Question = 1 mark)

25 An organic compound, X, shows the following properties:

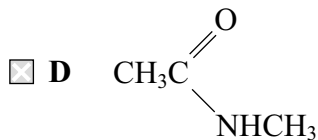
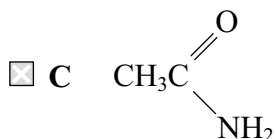
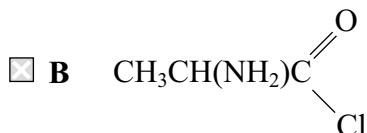
- Oxidation of compound X produces a substance that reacts with 2,4-dinitrophenylhydrazine to give a yellow precipitate but does **not** react with Fehling's or Benedict's solution.
- Compound X reacts with ice-cold nitrous acid to form a compound that gives a yellow precipitate with an alkaline solution of phenol.

What is the formula of compound X?



(Total for Question = 1 mark)

26 The organic product of the reaction between ethanoyl chloride and methylamine has the formula



(Total for Question = 1 mark)

27 In the solid state, the amino acid serine exists in the form



(Total for Question = 1 mark)

28 The best method for separating a mixture of amino acids in solution is

- A distillation.
- B solvent extraction.
- C chromatography.
- D recrystallization.

(Total for Question = 1 mark)

29 Which of these compounds will **not** form an amide in a reaction with ethanoyl chloride?

- A NH_3
- B $\text{CH}_3\text{CH}_2\text{NH}_2$
- C $\text{CH}_3\text{CH}_2\text{NH}(\text{CH}_3)$
- D $\text{CH}_3\text{CH}_2\text{N}(\text{CH}_3)_2$

(Total for Question = 1 mark)

30 Which of the following reagents could be used to produce propanamide, $\text{CH}_3\text{CH}_2\text{CONH}_2$?

- A Ammonia and 1-chloropropane
- B Ammonia and propanoyl chloride
- C Methylamine and 1-chloropropane
- D Methylamine and propanoyl chloride

(Total for Question = 1 mark)