

Biological Molecules

Question Paper 2

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Biological Molecules
Sub Topic	
Booklet	Multiple Choice
Paper Type	Question Paper 2

Time Allowed : 62 minutes

Score : / 51

Percentage : /100

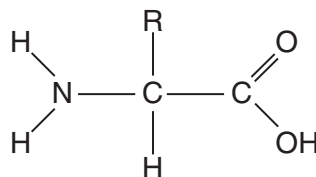
Grade Boundaries:

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

1 Which substance contains carbon, hydrogen, oxygen and nitrogen?

- A collagen
- B glycogen
- C amylopectin
- D triglyceride

2 The diagram shows a molecule which is an important component of living organisms.

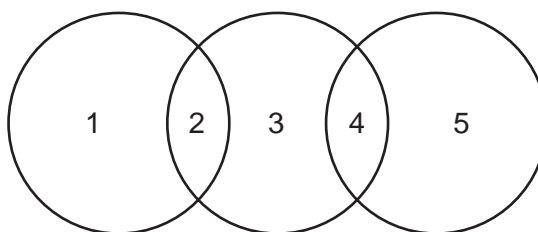


A forensic sample is tested for the presence of a polymer of this molecule.

Which polymer is tested for?

- A DNA
- B lipid
- C protein
- D starch

- 3 The diagram shows the relationship between the levels of protein structure and bonds.



Which row is correct?

	1	2	3	4	5
A	primary	peptide	secondary	ionic	tertiary
B	secondary	hydrogen	tertiary	peptide	primary
C	tertiary	ionic	primary	peptide	quaternary
D	quaternary	ionic	tertiary	ionic	secondary

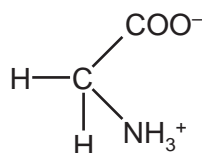
- 4 How many molecules of oxygen are bound to one molecule of haemoglobin, when it is fully saturated with oxygen?

A 1 **B** 2 **C** 4 **D** 8

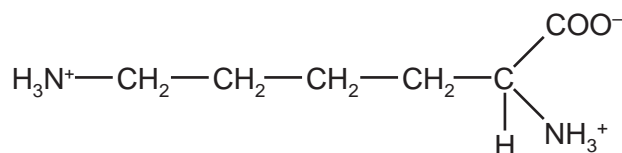
- 5 Which of the bonds stabilising the tertiary structure of a protein would be **least** likely to break when the temperature is increased above the optimum for the protein?

A disulfide
B hydrogen
C hydrophobic
D ionic

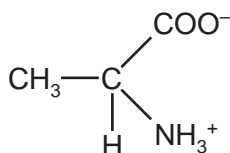
6 The diagram shows the structure of four amino acids in solution.



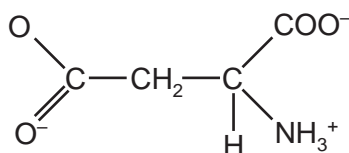
glycine



lysine



alanine



aspartate

Which amino acids have **no** overall charge?

- A alanine and aspartate
- B alanine and glycine
- C aspartate and lysine
- D glycine and lysine

7 The statements are about the properties of water.

- 1 It requires a lot of heat to evaporate.
- 2 It retains a lot of heat.
- 3 It is able to form hydrogen bonds with other water molecules.
- 4 It is able to form hydrogen bonds with other polar and non-polar molecules.

Which properties are important in transpiring plants to prevent enzymes in leaves from being denatured?

- A 1 only
- B 1 and 2 only
- C 2 and 3 only
- D 1, 2, 3 and 4

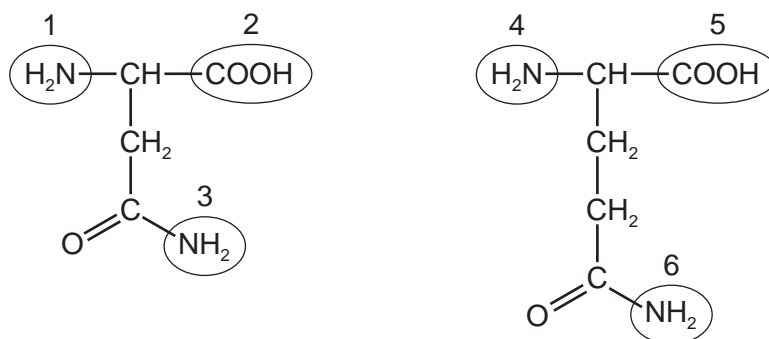
- 8 In all lipid molecules, where are double bonds located?
- A between fatty acids and glycerol
 - B within fatty acids and within glycerol
 - C within fatty acids only
 - D within glycerol only
- 9 Which of the following terms can be used to describe the secondary structure of a protein?
- 1 dipeptide
 - 2 specific order of amino acids
 - 3 α -helix
 - 4 fibrous structure
 - 5 β -pleated sheet
- A 1, 3
 - B 1, 2
 - C 2 and 4 only
 - D 3 and 5 only
- 10 Why is haemoglobin stated to have a quaternary structure?
- A It has four haem groups.
 - B It has two or more polypeptide chains.
 - C It is coiled into a precise shape.
 - D It is held together by four types of bonds.

- 11 Collagen is a macromolecule with three polypeptides lying closely side by side in the form of a triple helix.

Every third amino acid in each polypeptide has the shortest possible R-group or side chain (– H) to allow close packing of the polypeptides.

Which is the amino acid?

- A glucose
 - B glycerol
 - C glycine
 - D guanine
- 12 The diagrams show the structures of two amino acids, each of which has two amine (–NH₂) groups.



A peptide bond is formed between the two amino acids.

Which groups form the peptide bond?

- A 1 and 4
- B 1 and 5
- C 2 and 6
- D 3 and 5

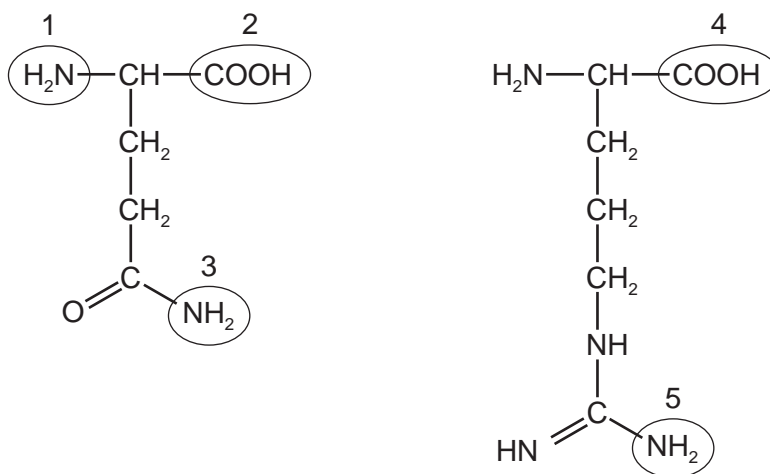
13 The statements describe some of the properties of water.

- 1 requires a lot of heat energy to evaporate
- 2 retains a lot of heat energy
- 3 is able to form hydrogen bonds with other water molecules
- 4 is able to form hydrogen bonds with other polar and non-polar molecules

Which properties are important for transport in xylem?

- A** 1, 2 and 3
B 1, 2 and 4
C 1 and 3 only
D 3 and 4 only

14 The diagrams show the structures of two amino acids, each of which has more than one amine ($-\text{NH}_2$) group.



A peptide bond is formed between the two amino acids.

Which groups form the peptide bond?

- A** 1 and 4 **B** 2 and 4 **C** 2 and 5 **D** 3 and 4

15 Which explains why haemoglobin is able to carry oxygen?

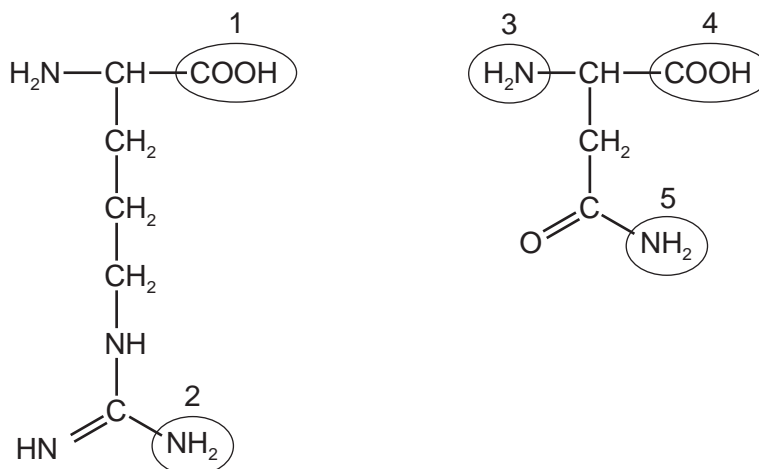
- A** It consists of four polypeptides.
B It contains iron.
C It has a quaternary structure.
D It is a globular protein.

16 Which explains why haemoglobin is suitable as an oxygen carrier?

- 1 The haem group combines with oxygen.
- 2 The iron combines with oxygen reversibly.
- 3 Haemoglobin changes shape as oxygen loads.

- A** 1 only
B 1 and 2 only
C 2 and 3 only
D 1, 2 and 3

17 The diagrams show the structures of two amino acids, each of which has more than one amine ($-\text{NH}_2$) group.



A peptide bond is formed between the two amino acids.

Which groups form the peptide bond?

- A** 1 and 3 **B** 1 and 5 **C** 2 and 4 **D** 2 and 5

- 18 Which combination of bond types correctly shows the weak and strong bonds that hold a molecule of protein in shape?

	types of bond		
	hydrogen	disulfide	ionic
A	strong	strong	weak
B	strong	weak	strong
C	weak	strong	strong
D	weak	strong	weak

- 19 Haemoglobin consists of two α chains and two β chains. Approximately 5% of all humans have one amino acid in the β chain different from normal.

Which level(s) of protein structure could be changed in these humans?

- A** primary only
 - B** primary and quaternary only
 - C** primary, secondary and tertiary only
 - D** quaternary only
- 20 Which row shows the types of bond found at different levels of protein structures?

	level of protein structure	bonds			
		peptide	hydrogen	ionic	hydrostatic
A	primary	✓	x	x	✓
B	secondary	x	✓	✓	x
C	tertiary	x	✓	✓	✓
D	quaternary	✓	x	✓	✓

key

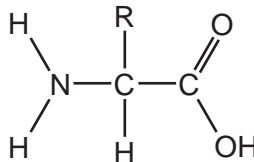
✓ = present

x = absent

- 21 What is the general formula for starch?
- A** $(C_5H_{10}O_5)_n$ **B** $(C_5H_{10}O_6)_n$ **C** $(C_6H_{12}O_6)_n$ **D** $(C_6H_{10}O_5)_n$
- 22 What describes a globular protein that is **not** soluble in water?
- A** having amino acids with hydrophilic R groups facing out
B having amino acids with polar R groups facing out
C having a central core of amino acids with hydrophobic R groups
D having amino acids with hydrophobic R groups facing out
- 23 Which is the strongest type of bonding found in proteins?
- A** disulfide bonds
B hydrogen bonds
C hydrophobic interactions
D ionic bonds
- 24 Which property of water makes it most suitable for transport in eukaryotic organisms?
- A** density
B ionisation
C latent heat of vaporisation
D solvent properties

- 25 Water is important to living organisms because it
- A** acts as an excellent solvent for transport of dissolved glucose and urea.
 - B** becomes more dense in its solid form, ice, than its liquid state.
 - C** is used in condensation reactions to synthesise macromolecules.
 - D** requires a small increase in heat energy to raise its temperature.
- 26 A peptide bond is formed between atoms of which two elements?
- A** carbon and carbon
 - B** carbon and hydrogen
 - C** carbon and nitrogen
 - D** hydrogen and nitrogen
- 27 Which features affect the tensile strength of collagen?
- 1 the helical structure of collagen chains
 - 2 the small R group of the amino acids in collagen
 - 3 the insoluble nature of collagen
 - 4 the covalent bonds between collagen molecules
- A** 1, 2 3 and 4
 - B** 1 and 3 only
 - C** 1, 2 and 3
 - D** 2, 3 and 4

28 An amino acid can be represented as



where R represents a variable side chain.

Which is **not** a possible side chain?

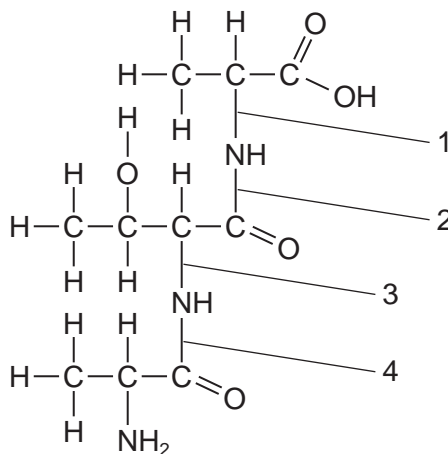
- A CH₃
- B CH₂CH₂SCH₃
- C CH₂CONH₂
- D HOCH₂CH(OH)CH₂OH

29 When red cells leave the lungs, haemoglobin is 98 % saturated.

How many molecules of oxygen will be carried by the majority of haemoglobin molecules?

- A 2 B 4 C 6 D 8

30 The diagram shows a tripeptide molecule.



At which two points will hydrolysis occur to release three amino acids?

- A** 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 2 and 4

31 Which combination of bond types correctly shows the weak and strong bonds that hold a molecule of protein in shape?

	types of bond		
	hydrogen	disulfide	ionic
A	strong	strong	weak
B	strong	weak	strong
C	weak	strong	strong
D	weak	strong	weak

32 Which features of collagen result in it having high tensile strength?

- 1 covalent bonds form between adjacent molecules
- 2 each three-stranded molecule is held together by hydrogen bonds
- 3 every third amino acid in the polypeptide is small
- 4 the primary structure is held together by peptide bonds

- A** 1 and 2 **B** 1, 2 and 3 **C** 1, 3 and 4 **D** 2, 3 and 4

- 33 A number of different types of bonds maintain the structure of proteins. These include disulphide, hydrogen and ionic bonds, as well as hydrophobic interactions. Some of these are stronger than others.

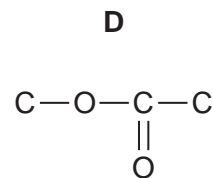
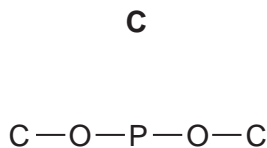
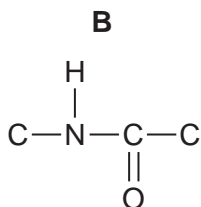
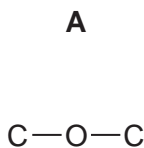
Which are the strongest?

- A disulphide bonds
 - B hydrogen bonds
 - C hydrophobic interactions
 - D ionic bonds
- 34 Haemoglobin is a globular protein consisting of four polypeptide chains – 2 alpha chains and 2 beta chains. In normal individuals, in the DNA which codes for each beta chain, the sixth triplet has a code for glutamic acid.

In individuals with sickle cell anaemia this base triplet changes and codes for valine.

What aspect of the haemoglobin molecule does this mutation change?

- A the iron content
 - B the primary structure
 - C the quaternary structure
 - D the secondary structure
- 35 Which diagram shows the bond linking the individual units of a nucleic acid?



- 36 An investigation was carried out into the effect of various chemicals on the permeability of the plasma membrane and tonoplast of beetroot cells. Beetroot cell vacuoles contain a red pigment, which cannot pass out of the cells because it cannot diffuse through their tonoplasts and plasma membranes.

1 cm³ cubes were cut from beetroot and washed in running water for twenty minutes to remove any pigment released from damaged cells.

They were then placed in different solutions and the results observed. In each case the solution turned red.

What shows the correct behaviour of phospholipids and proteins in different solutions?

	solution	phospholipids dissolve	solution	protein denatures
A	dilute HCl	✓	water at 40°C	✓
B	dilute HCl	✓	ethanol	✓
C	ethanol	✓	dilute HCl	✓
D	water at 40°C	✓	ethanol	✓

- 37 Which level of protein structure maintains the globular shapes of enzymes?

- A** primary
- B** secondary
- C** tertiary
- D** quaternary

- 38 Which type of bond is involved in maintaining primary, secondary and tertiary structure in protein molecules?

	level of structure		
	primary	secondary	tertiary
A	disulphide	ionic	hydrogen
B	covalent	peptide	ionic
C	ionic	disulphide	covalent
D	peptide	hydrogen	disulphide

- 39 What is the function of iron in the haemoglobin molecule?

- A** It binds oxygen to the haemoglobin molecule.
- B** It makes the haemoglobin more soluble in the red blood cell.
- C** It stabilises the quaternary structure of the protein.
- D** It undergoes reversible oxidation and reduction.

- 40 As a frozen lake warms after a cold winter, mineral nutrients are brought to the surface.

Which properties of water contribute to this process?

- 1 its greatest density is at 4 °C
- 2 it has high specific heat capacity
- 3 it is a solvent
- 4 its molecules form hydrogen bonds

- A** 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

41 Certain insects are able to stand on the surface of ponds.

Which property of water allows them to do this?

- A adhesion with other molecules
- B cohesion between water molecules
- C low viscosity
- D maximum density at 4 °C

42 Which term describes the type of bonding responsible for stabilising the secondary structure of a protein?

- A disulphide
- B hydrogen
- C hydrophobic
- D ionic

43 How many different polypeptides, each consisting of r amino acids, can be made if the number of different amino acids available is n ?

- A n^r
- B r^n
- C $n \times r$
- D $\frac{n}{r}$

44 Urea is a reagent which disrupts all bonds except covalent bonds in protein molecules.

Which level of protein structure would remain intact when a protein is treated with urea?

- A primary
- B secondary
- C tertiary
- D quaternary

45 What is the function of iron in the haemoglobin molecule?

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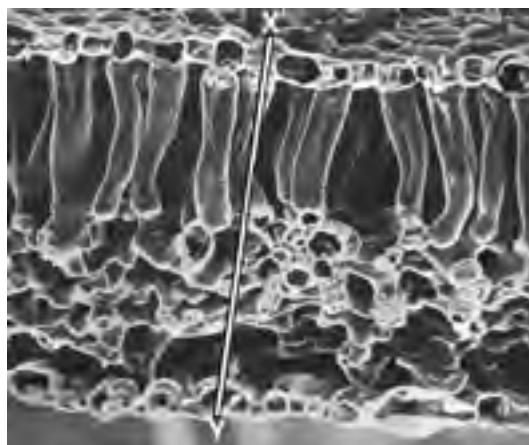
46 The diagram shows part of a macromolecule in the form of triple helices, lying side by side with covalent cross links between them.



What is the name of the molecule?

- A cellulose
- B collagen
- C glycogen
- D triglyceride

47 This electron micrograph of a section of a leaf has a magnification of $\times 210$.



What is the actual width of the leaf along the line X – Y?

- A $2.43 \mu\text{m}$
- B $24.3 \mu\text{m}$
- C $243.0 \mu\text{m}$
- D $2430 \mu\text{m}$

- 48 Which level of protein structure maintains the globular shapes of enzymes?
- A primary
 - B secondary
 - C tertiary
 - D quaternary
- 49 What will break an ionic bond between amino acids?
- A condensation
 - B high temperature
 - C hydrolysis
 - D pH change
- 50 To maintain health, infants should receive about 1.50 g of protein per kg body mass per day whilst adults only require 0.55 g of protein per kg body mass per day.

What is the reason for the difference in protein requirement?

- A Adults have sufficient protein reserves for oxidation.
 - B Growth has ceased in adults.
 - C Infants have a smaller body mass.
 - D Protein digestion is inefficient in infants.
- 51 What causes the swelling of the body tissues of a child with the protein deficiency disease kwashiorkor?
- A Fat stores in the abdomen are used up and converted to tissue fluid which makes the liver swell.
 - B Few plasma proteins form, raising the blood water potential and causing fluid to accumulate in the tissues.
 - C Proteins in the gut wall are used up and replaced by body tissue fluid.
 - D The glycogen stores in the liver are used up and replaced by body tissue fluid.