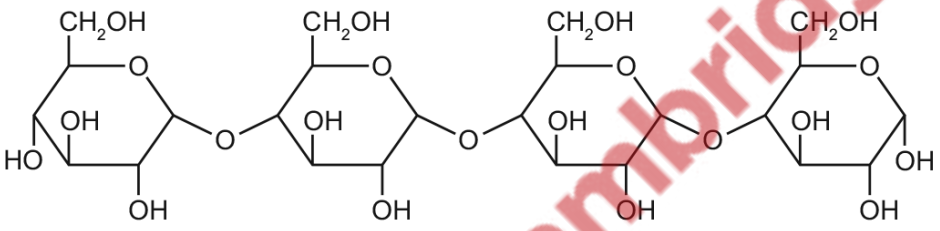
Chapter 2

Biological molecules

2.1 Testing for biological molecules

216. 9700_m20_qp_12 Q: 7

The molecule shown is a polymer of reducing sugars.



Which procedures could be carried out to show that this molecule is a polymer of reducing sugars?

1 Add hydrolytic enzyme and then heat with Benedict's solution.

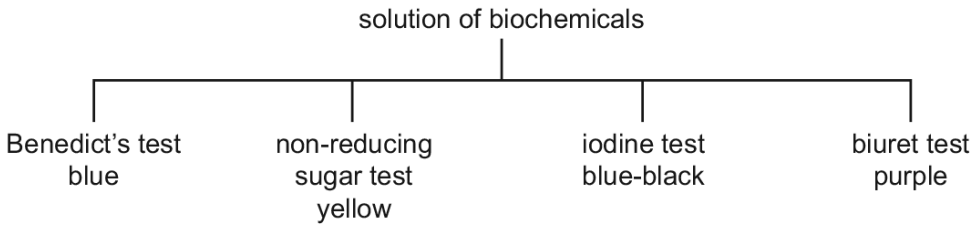
2 Dissolve in water, neutralise and then heat with Benedict's solution.

3 Boil with hydrochloric acid, neutralise and then heat with Benedict's solution.

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

217. 9700_s20_qp_11 Q: 6

The flow diagram shows the results of a number of tests on a solution of biochemicals.



Which substances are present in the solution?

A amylose, amylopectin and lipid

B glucose, starch and catalase

C sucrose, amylase and triglyceride

D sucrose, starch and catalase

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218. 9700_s20_qp_12 Q: 7

A student carried out the Benedict's test on a sample and got a negative result.

What should the student do to confirm there are no sugars present in the sample?

A boil the sample for 5 minutes then repeat the Benedict's test

B boil with alkali, neutralise with hydrochloric acid and repeat the Benedict's test

C boil with hydrochloric acid, neutralise with alkali and repeat the Benedict's test

D repeat the Benedict's test but add more Benedict's reagent

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219. 9700_s20_qp_13 Q: 6

The colour of a positive Benedict's test is due to the formation of copper oxide. The mass of copper oxide is proportional to the mass of reducing sugar present.

Samples of fruit juice were tested for the presence of reducing sugars and non-reducing sugars using the Benedict's test.

The table shows the mass of copper oxide after boiling with Benedict's solution and after acid hydrolysis and boiling with Benedict's solution.

Which sample contained the most **non-reducing** sugar?

	mass of copper oxide / mg	
	after boiling with Benedict's solution	after acid hydrolysis and boiling with Benedict's solution
A	20	20
B	30	45
C	50	55
D	65	75

220. 9700_w20_qp_11 Q: 7

A student carried out the Benedict's test on two different types of milk, X and Y.

A sample of each type of milk was heated to 100 °C in a water-bath with Benedict's solution and the time taken for the first appearance of a colour change was recorded.

The results are shown in the table.

type of milk	time for first appearance of a colour change with Benedict's solution / s
X	13
Y	26

Which row shows the biological molecule the student detected in each sample of milk and the sample of milk with the highest concentration of this biological molecule?

	biological molecule present in each sample of milk	sample of milk with the highest concentration of this biological molecule
A	glucose	X
B	glucose	Y
C	reducing sugar	X
D	reducing sugar	Y

---

221. 9700_w20_qp_12 Q: 7

Diastase is an enzyme that breaks down starch into maltose. Maltose is a reducing sugar.

A sample of starch is treated with boiled diastase and left for 15 minutes.

Samples of the mixture are then tested with iodine solution and with Benedict's reagent.

What are the results?

	iodine solution	Benedict's reagent
A	blue-black	blue
B	blue-black	red
C	brown	blue
D	brown	red

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222. 9700_w20_qp_13 Q: 7

A student carried out tests for biological molecules on the **same** sample of milk.

The tests and their results were as follows.

- Heating to 80 °C with Benedict's solution gave a red colour.
- Boiling with acid, followed by neutralisation, then heating to 80 °C with Benedict's solution also gave a red colour.
- Adding Biuret solution gave a purple colour.
- Adding iodine solution gave a yellow colour.

Which biological molecules **must** be present in the milk?

1 non-reducing sugars

2 protein

3 reducing sugars

4 starch

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

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223. 9700_m19_qp_12 Q: 7

Four solutions were tested with Benedict's solution. The table shows the colour of the solutions after testing.

solution	colour
1	green
2	blue
3	brick red
4	yellow

Which row shows solutions that could have given these results?

	solution 1	solution 2	solution 3	solution 4
A	0.05% reducing sugar	0.5% non-reducing sugar	1.0% reducing sugar	0.1% reducing sugar
B	0.5% reducing sugar	0.0% reducing sugar	1.0% reducing sugar	0.1% reducing sugar
C	1.0% reducing sugar	1.0% non-reducing sugar	1.5% reducing sugar	0.5% reducing sugar
D	0.05% non-reducing sugar	0.5% reducing sugar	1.0% non-reducing sugar	0.1% non-reducing sugar

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224. 9700_s19_qp_11 Q: 7

A solution of amylase was added to a suspension of starch. After 30 seconds, three samples of the mixture were tested with iodine solution, Benedict's solution or with biuret reagent.

Which are the expected results?

	colour with test reagent		
	iodine solution	Benedict's solution	biuret reagent
A	black	green	purple
B	black	red	blue
C	brown	blue	purple
D	brown	yellow	blue

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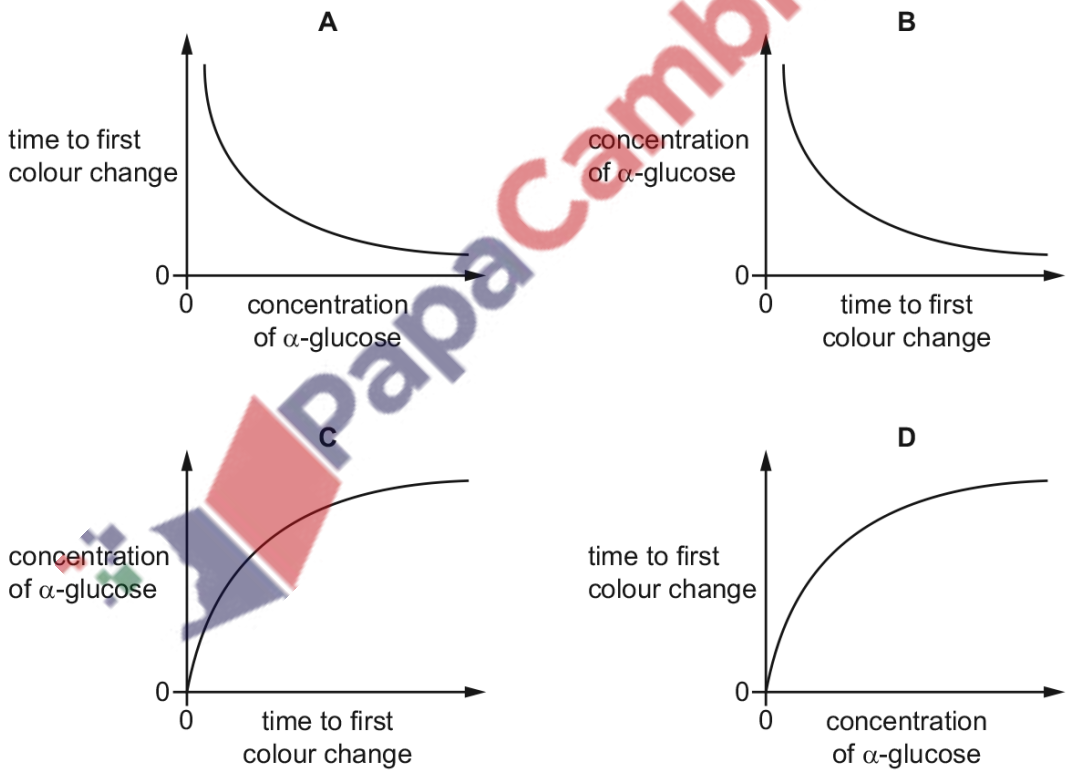
225. 9700_s19_qp_11 Q: 8

A student carried out a Benedict's test on several different known concentrations of α-glucose.

Which graph represents the results correctly?



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226. 9700_s19_qp_12 Q: 5

After boiling a sample of milk with Benedict's solution, a yellow colour is observed.

Which conclusion about the sample of milk is correct?

A Reducing sugars are not present.

B Reducing sugars are present.

C There is a high concentration of fructose.

D There is a low concentration of sucrose.

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227. 9700_s19_qp_13 Q: 7

A solution of amylase was added to a suspension of starch. The mixture was stirred and kept at 40 °C for 45 minutes.

Samples were then tested with various reagents.

What is the expected set of results?

	test and resulting colour		
	iodine test	Benedict's test	biuret test
A	black	blue	blue
B	black	orange	purple
C	brown	blue	blue
D	brown	orange	purple

---

228. 9700_w19_qp_11 Q: 7

Which colour indicates the lowest concentration of reducing sugar present in a solution after testing with Benedict's solution?

A brown

B green

C red

D yellow

---

229. 9700_w19_qp_12 Q: 8

A student was asked to estimate the concentration of reducing sugar in an unknown solution using the Benedict's test. Five reducing sugar solutions with different concentrations were provided in order to produce a calibration curve.

The student added 2 cm^3 of Benedict's solution to each of the reducing sugar solutions, heated them in a water-bath and recorded the time taken for the first appearance of a colour change.

Which variables should the student standardise, when carrying out the Benedict's test on each reducing sugar solution, to ensure the results are comparable?

1 volume of reducing sugar used

2 the temperature of the water-bath

3 the time the solutions are heated

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

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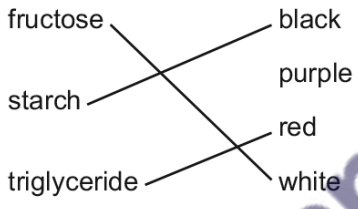
230. 9700_w19_qp_13 Q: 6

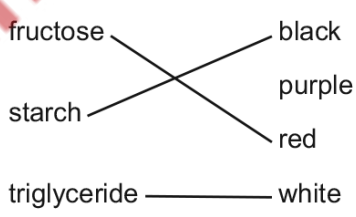
Tests for biological molecules were carried out on food samples.

Which correctly matches the biological molecules in the food samples with the colour for a positive result?

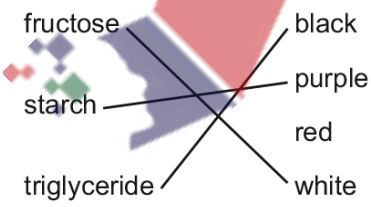
A



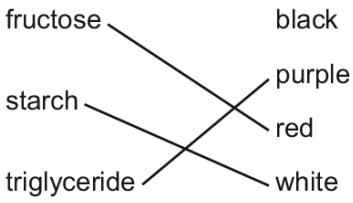
B



C



D



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231. 9700_s18_qp_12 Q: 6

A student was asked to estimate the concentration of glucose in a solution using the Benedict's test. The student was provided with a 1.0 mol dm^{-3} glucose solution and was told to make a 0.6 mol dm^{-3} solution by proportional dilution.

Which row shows the correct volumes of both 1.0 mol dm^{-3} glucose solution and distilled water needed to make the 0.6 mol dm^{-3} solution?

	volume of 1.0 mol dm^{-3} glucose solution / cm^3	volume of distilled water / cm^3
A	12	8
B	10	10
C	8	12
D	6	14

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232. 9700_w18_qp_13 Q: 7

A student carried out tests on the same volume of four different solutions to investigate the presence of protein, starch and reducing sugar in each.

The results are shown in the table.

solution	Benedict's solution	biuret reagent	iodine solution
1	blue	purple	yellow
2	orange	pale purple	blue-black
3	orange	purple	yellow
4	red	pale blue	yellow

Which conclusion can be drawn from these results?

A Solution 1 has a lower protein and lower reducing sugar content than solution 2.

B Solution 2 has less starch compared to solutions 1, 3 and 4.

C Solution 3 has the most protein and the least starch.

D Solution 4 has a high reducing sugar content and no starch.

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233. 9700_m17_qp_12 Q: 7

A sample of milk is tested with Benedict's solution. After boiling, a yellow colour is observed.

Which conclusion is correct?

A A high concentration of glucose is present.

B A low concentration of sucrose is present.

C No reducing sugars are present.

D Reducing sugars are present.

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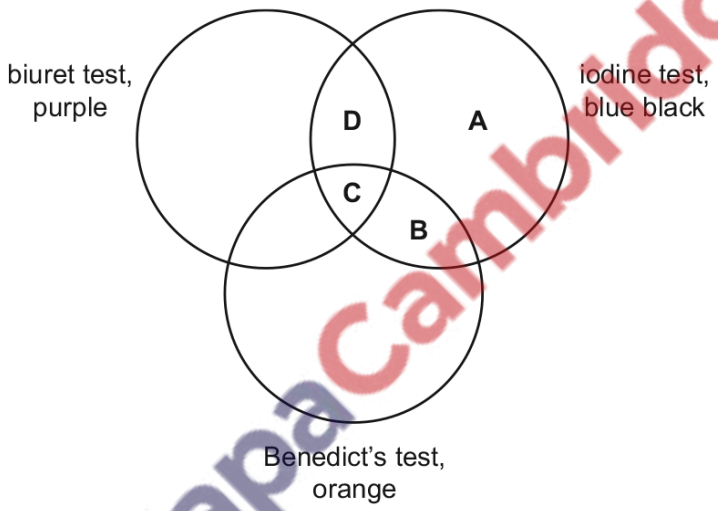
234. 9700_s17_qp_12 Q: 9

The diagram shows the results of tests on four solutions containing biological molecules.

Which shows the solution that contains only starch and protein?



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235. 9700_s17_qp_13 Q: 5

Steps 1–4 are used to test for a non-reducing sugar.

1 Put 5 cm^3 of solution into a test-tube.

2 Add a few drops of acid.

3 Neutralise with alkali.

4 Add 6 cm^3 Benedict's solution.

When is the solution boiled?

A between steps 1 and 2

B between steps 2 and 3 and after step 4

C between steps 2 and 3 only

D after step 4 only

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236. 9700_w17_qp_11 Q: 6

Which carbohydrate gives a brick red colour when boiled with Benedict's solution?

A cellulose

B fructose

C glycogen

D sucrose

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237. 9700_w17_qp_12 Q: 7

A student carried out four tests for biological molecules on a sample of milk.

The tests and their results were as follows.

- Heating to 80 °C with Benedict's solution gave a brick red colour.
- Adding Biuret solution gave a purple colour.
- Adding iodine solution gave an orange colour.
- Boiling with acid, followed by neutralisation, then heating to 80 °C with Benedict's solution gave a brick red colour.

Which biological molecules **must** be present in the milk?

1 non-reducing sugars

2 protein

3 reducing sugars

4 starch

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

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238. 9700_w17_qp_13 Q: 6

A student carried out four tests for biological molecules on a sample of milk.

The tests and their results were as follows.

- Heating to 80 °C with Benedict's solution gave a green colour.
- Adding Biuret solution gave a purple colour.
- Adding iodine solution gave an orange colour.
- Boiling with acid, followed by neutralisation, then heating to 80 °C with Benedict's solution gave a brick red colour.

Which conclusion about these results is correct?

A only protein and reducing sugar present

B only protein and non-reducing sugar present

C only protein, reducing sugar and non-reducing sugar present

D only starch, protein and sugar present

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239. 9700_s16_qp_11 Q: 6

Two solutions, 1 and 2, one containing starch and sucrose, and the other containing glucose and protein, were tested with a variety of reagents to confirm their identity.

The table shows the conclusions from the results recorded for the various tests.

Which row identifies the two solutions?

	add iodine solution		boil with Benedict's solution		boil with Benedict's solution after acid hydrolysis		add biuret solution	
	1	2	1	2	1	2	1	2
A	+	–	+	–	–	+	–	+
B	–	+	+	–	+	–	–	+
C	+	–	–	+	+	–	–	+
D	–	+	+	–	+	+	+	–

key

+ = biological molecule present

– = biological molecule absent

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240. 9700_s16_qp_13 Q: 6

A sample of milk was tested with Benedict's solution and a yellow colour was observed.

Which conclusion is correct?

A No non-reducing sugars are present.

B Reducing sugars are present.

C There is a high concentration of glucose.

D There is a high concentration of sucrose.

---

241. 9700_w16_qp_11 Q: 6

In order to estimate the quantity of glucose in a solution, equal volumes of a range of known concentrations were mixed with equal excess volumes of Benedict's solution and placed in a thermostatically controlled water-bath at 90 °C for the same length of time.

The unknown solution was then treated in the same way and the colours of the known and unknown solutions compared.

What is the independent variable in this procedure?

A concentration of glucose

B final colour of solutions

C temperature of water-bath

D volumes of glucose solutions

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242. 9700_w16_qp_13 Q: 6

A student carried out the Benedict's test on four different concentrations of glucose solution and then recorded the time taken for the first appearance of a colour change (the end-point).

The student found it difficult to identify the first appearance of a colour change and consistently timed each solution for two seconds after it had appeared. This introduced a source of error into the experiment.

Which statements about this error are correct?

1 The effect of the error will be reduced if the student performs three repeats at each concentration of glucose.

2 The error will prevent the student from identifying which solution has the highest concentration of glucose.

3 The error is systematic as the student consistently timed each solution for two seconds after the end-point.

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

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243. 9700_s15_qp_11 Q: 7

A student carried out four tests for biological molecules on a solution. The observations are shown in the table.

test for biological molecules	observation
iodine solution	orange
biuret	purple
Benedict's	orange
emulsion	cloudy

Which molecules may be present in this solution?

A glucose, starch, protein

B lipid, protein, glucose

C protein, starch, sucrose

D starch, protein, lipid

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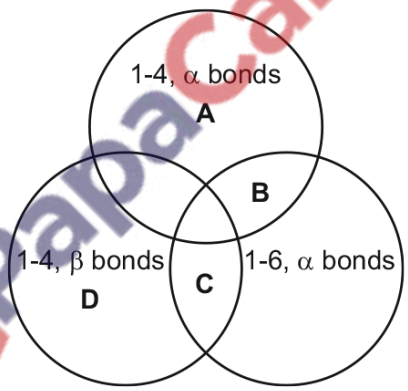
244. 9700_s15_qp_12 Q: 11

Which bonds are found in glycogen?



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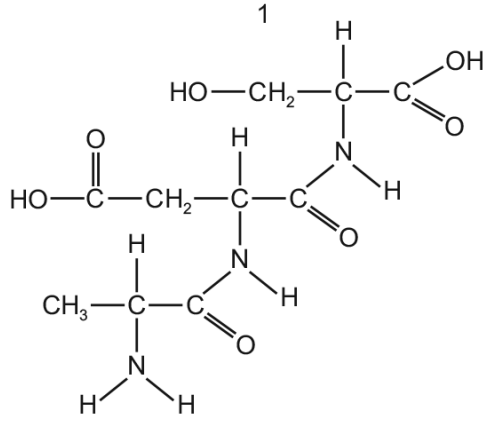
245. 9700_s15_qp_13 Q: 12

A student carried out four tests for biological molecules. The observations are shown in the table.

test	observations
iodine	orange
biuret	purple
Benedict's	orange
emulsion	clear

Which molecules are present in the solution?

1



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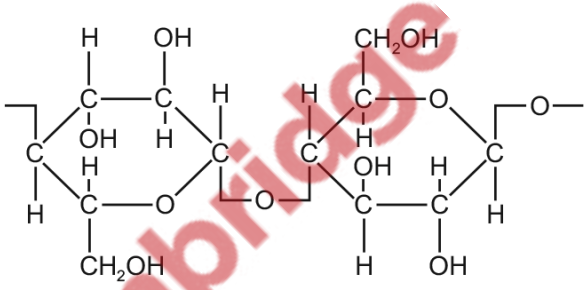

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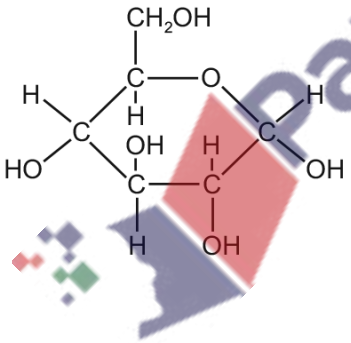

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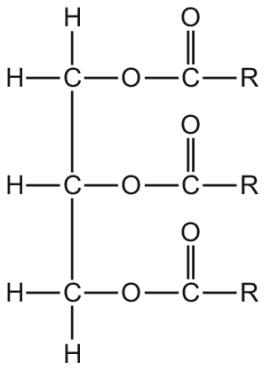

A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 3 and 4

246. 9700_w15_qp_11 Q: 8

Tests for biological molecules were carried out on three solutions.

The observations were as follows.

solution 1	Benedict's test – blue to orange
solution 2	Benedict's test after acid hydrolysis – blue to red
solution 3	biuret test – blue to purple

Which observations would show the solutions that contained sucrose and amylase?

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

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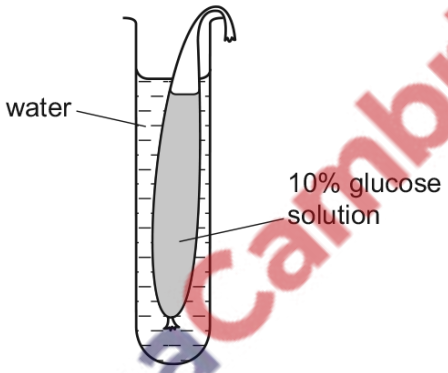
247. 9700_w15_qp_11 Q: 17

The diagram shows apparatus set up to investigate the effect of putting a 10% glucose solution in a selectively permeable bag (Visking tubing) and surrounding it with water.



Samples from the surrounding water were tested with Benedict's solution after 10 minutes and after 20 minutes. The change in volume of glucose solution was observed after 20 minutes.

Which row is correct?

	result of Benedict's test		volume of glucose solution in Visking tubing / cm^3
	after 10 minutes	after 20 minutes	
A	green	blue	increased
B	green	orange	increased
C	red	orange	decreased
D	yellow	green	decreased

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248. 9700_w15_qp_12 Q: 7

The colour of a positive Benedict's test is due to the formation of copper oxide. The mass of copper oxide is proportional to the mass of reducing sugar present.

Samples of fruit juice were tested for the presence of reducing sugars and non-reducing sugars using the Benedict's test. The results show the mass of copper oxide after boiling with Benedict's solution and after acid hydrolysis and boiling with Benedict's solution.

Which sample contained the most **non-reducing** sugar?

	mass of precipitate / mg	
	after boiling with Benedict's solution	after acid hydrolysis and boiling with Benedict's solution
A	20	20
B	30	45
C	50	55
D	65	75

---

249. 9700_w15_qp_13 Q: 7

The table shows the results of tests carried out on a sample of biological molecules.

test	colour observed
Benedict's	blue
biuret	purple
iodine	blue-black

Which shows the types of molecules present in the sample?

	protein	reducing sugar	starch
A	✓	✗	✗
B	✗	✓	✗
C	✓	✗	✓
D	✗	✓	✓

key
✓ present
✗ absent

2.2 Carbohydrates and lipids

250. 9700_m20_qp_12 Q: 8

Which statement about biological molecules is correct?

A Amylopectin, amylose and cellulose are all polymers.

B Amylose, cellulose and glucose are all macromolecules.

C Cellulose, glucose and starch are all monomers.

D Sucrose, starch and amylopectin are all polysaccharides.

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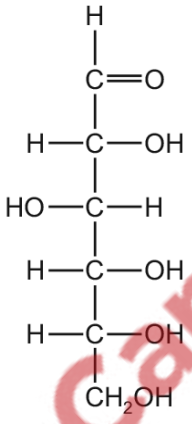
251. 9700_m20_qp_12 Q: 9

Sugars with a ring structure can also have a linear structure.



Which of these sugar molecules could be represented by the linear structure in the diagram?

1 glucose

2 ribose

3 sucrose

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

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252. 9700_m20_qp_12 Q: 10

Which statements about phospholipids and triglycerides are correct?

1 They both contain ester bonds.

2 They both have three fatty acid chains per molecule.

3 They both may have saturated and unsaturated fatty acid chains.

4 They are both used only as storage molecules.

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

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253. 9700_s20_qp_11 Q: 7

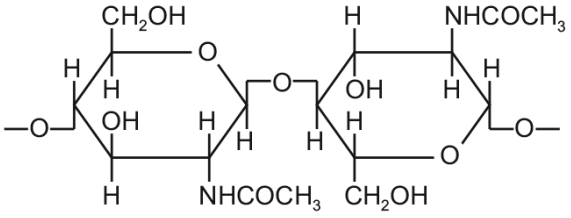
Maltose and sucrose are disaccharides. Maltose is formed from two molecules of glucose, whilst sucrose is formed from fructose and glucose.

Which row shows the molecular formulae of the two disaccharides?

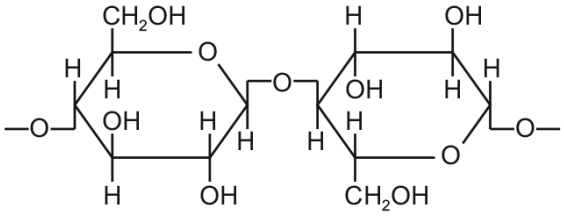
	maltose	sucrose
A	$C_{12}H_{22}O_{11}$	$C_{12}H_{22}O_{11}$
B	$C_{12}H_{22}O_{11}$	$C_{12}H_{24}O_{12}$
C	$C_{12}H_{24}O_{12}$	$C_{12}H_{22}O_{11}$
D	$C_{12}H_{24}O_{12}$	$C_{12}H_{24}O_{12}$

254. 9700_s20_qp_11 Q: 8

The diagrams show short sections of some common polysaccharides and modified polysaccharides.



1



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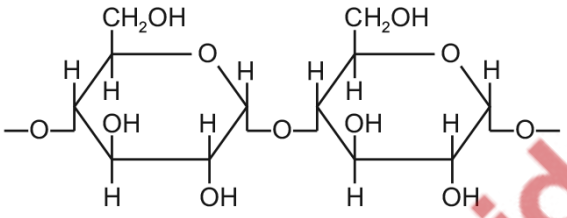


3

The polysaccharides can be described as:

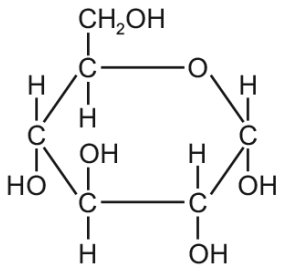
- F is composed of β-glucose monomers with 1,4 glycosidic bonds
- G is composed of α-glucose monomers with 1,4 glycosidic bonds
- H is composed of N-acetylglucosamine monomers with β-1,4 glycosidic bonds.

Which row correctly matches the numbered diagrams to the descriptions of the polysaccharides?

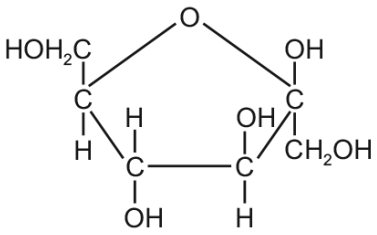
	polysaccharide F	polysaccharide G	polysaccharide H
A	2	1	3
B	2	3	1
C	3	1	2
D	3	2	1

255. 9700_s20_qp_12 Q: 8

The diagrams show three hexoses.



1



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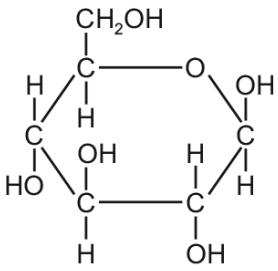

3

In which carbohydrates do these three hexoses occur?

	sucrose	cellulose	glycogen
A	1	2	3
B	1	3	2
C	2	3	1
D	3	2	1

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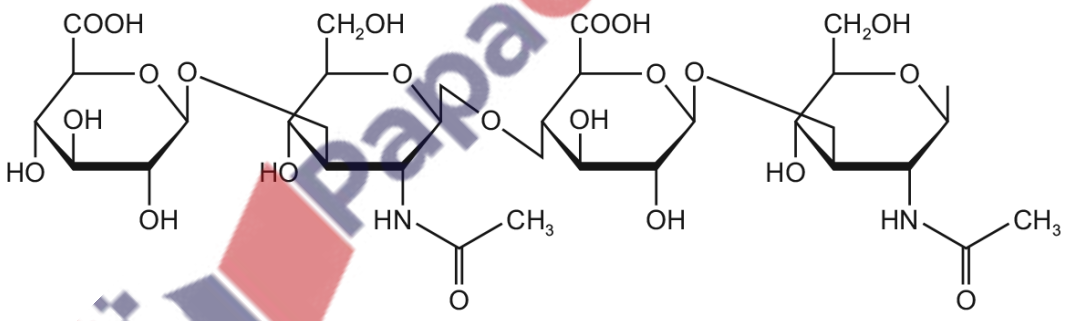
256. 9700_s20_qp_12 Q: 9

The diagram shows part of the chemical structure of a naturally occurring polysaccharide.



What types of glycosidic bonds are present?

A α-1,3 and α-1,4

B α-1,4 and α-1,6

C β-1,3 and β-1,4

D β-1,4 and β-1,6

---

257. 9700_s20_qp_12 Q: 10

What is the maximum number of water molecules produced when a triglyceride is synthesised?

A 3 **B** 2 **C** 1 **D** 0

---

258. 9700_s20_qp_13 Q: 7

Which polysaccharides contain 1, 4 **and** 1, 6 glycosidic bonds?

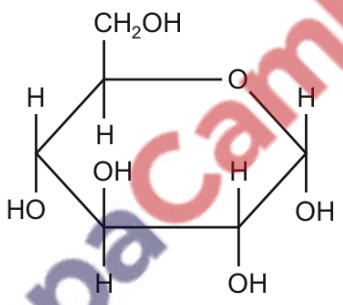
1 amylopectin
2 amylose
3 cellulose
4 glycogen

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

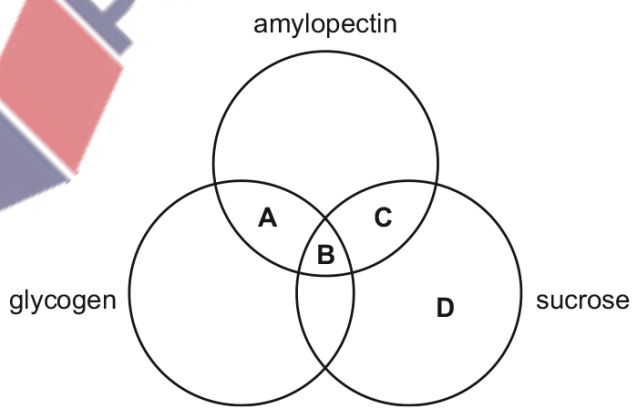
---

259. 9700_w20_qp_11 Q: 8

The diagram shows the structure of a monomer.



Which molecules contain this monomer?



---

260. 9700_w20_qp_11 Q: 9

Which molecules are formed by condensation which involves a carboxyl group?

A amylopectin, collagen, triglyceride, sucrose

B amylopectin, collagen, triglyceride

C amylopectin, β-globin, sucrose

D collagen, β-globin, triglyceride

---

261. 9700_w20_qp_11 Q: 10

Which row correctly matches the function with the structural features of cellulose, collagen, glycogen or triglyceride?

	molecule	function	structure		
			fibrous	molecules held together by hydrogen bonds	branched chains
A	cellulose triglyceride	support energy source	✓ ✗	✓ ✗	✗ ✗
B	collagen cellulose	strengthening support	✓ ✓	✓ ✗	✗ ✓
C	collagen glycogen	strengthening storage	✓ ✗	✓ ✗	✓ ✓
D	glycogen triglyceride	storage energy source	✗ ✗	✓ ✓	✓ ✗

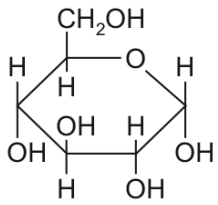
key ✓ = correct ✗ = not correct

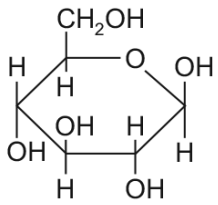
---

262. 9700_w20_qp_12 Q: 8

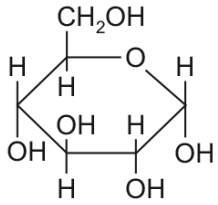
Which pair of monosaccharides forms sucrose?

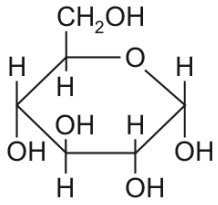
A



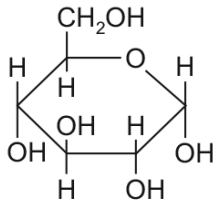


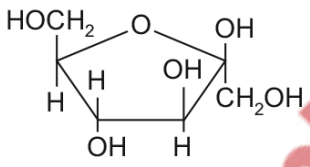
B



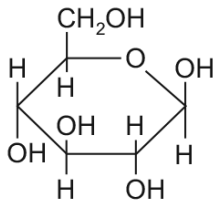


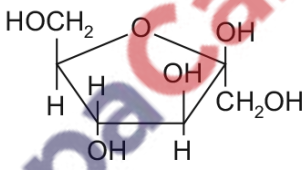
C





D





263. 9700_w20_qp_13 Q: 8

Which row is correct for carbohydrates?

	monomer	polymer	macromolecule
A	fructose	amylose	cellulose
B	glucose	deoxyribose	amylopectin
C	monosaccharide	glycogen	deoxyribose
D	sucrose	starch	glycogen

264. 9700_w20_qp_13 Q: 9

Which molecules contain 1,6 glycosidic bonds?

1 amylopectin

2 glycogen

3 starch

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

---

265. 9700_w20_qp_13 Q: 10

Which row correctly shows the ratio of carbon atoms to hydrogen atoms for glucose, a saturated fatty acid and sucrose?

	ratio of carbon atoms to hydrogen atoms		
	glucose	saturated fatty acid	sucrose
A	1:2	1:2	1:1.8
B	1:2	4:1	1:2
C	2:1	1:4	2:1
D	2:1	2:1	1.8:1

---

266. 9700_w20_qp_13 Q: 11

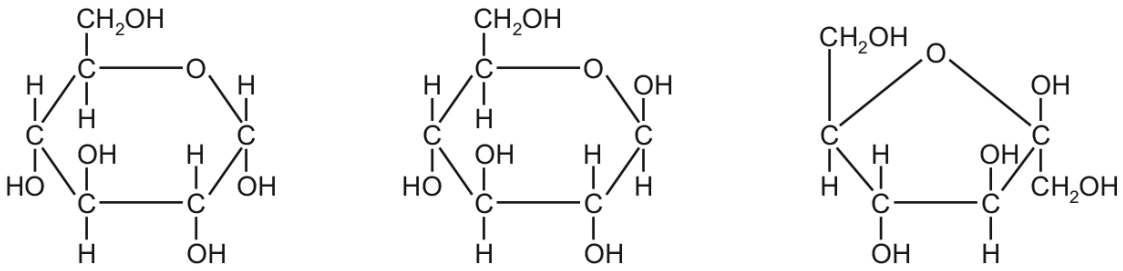
Which row shows a correct comparison between a phospholipid molecule and a triglyceride molecule?

	phospholipid molecule	triglyceride molecule
A	contains a hydrophobic phosphate group	is a hydrophobic molecule
B	contains one glycerol molecule	contains three glycerol molecules
C	fewer ester bonds	more ester bonds
D	more fatty acids	fewer fatty acids

---

267. 9700_m19_qp_12 Q: 8

The diagram shows a molecule of three hexose sugars.



1 2 3

Which row correctly shows examples of carbohydrates in which these three hexose sugars occur?

	sucrose	cellulose	amylopectin
A	1	2	3
B	1	3	2
C	2	3	1
D	3	2	1

---

268. 9700_m19_qp_12 Q: 9

Which feature of glycogen distinguishes glycogen from starch?

A All glycogen molecules are highly branched.

B All glycogen molecules are polysaccharides.

C All glycogen molecules contain α-glucose.

D All glycogen molecules contain 1,4-glycosidic bonds.

---

269. 9700_m19_qp_12 Q: 10

A student wrote four statements about what happens during hydrolysis of a carbohydrate.

1 Disaccharides are formed from monosaccharides.

2 Glycosidic bonds are broken.

3 Molecules of water are released.

4 Monosaccharides can be formed.

Which statements are correct?

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

---

270. 9700_m19_qp_12 Q: 11

The table compares three molecules, X, Y and Z, which contain the elements carbon, hydrogen and oxygen only.

The percentage of carbon, hydrogen and oxygen atoms in each molecule is shown.

molecule	% carbon	% hydrogen	% oxygen
X	25.0	50.0	25.0
Y	28.5	47.7	23.8
Z	34.6	61.6	3.8

Which row correctly identifies molecules X, Y and Z?

	molecule		
	X	Y	Z
A	monosaccharide	disaccharide	polysaccharide
B	monosaccharide	polysaccharide	triglyceride
C	polysaccharide	triglyceride	monosaccharide
D	triglyceride	monosaccharide	polysaccharide

---

271. 9700_m19_qp_12 Q: 12

Which statements about the differences between phospholipids and triglycerides are correct?

1 Phospholipids have hydrophobic regions but triglycerides do not.

2 The fatty acids in a phospholipid are always saturated but in a triglyceride they may be saturated or unsaturated.

3 Phospholipids are polar molecules but triglycerides are non-polar.

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

---

272. 9700_m19_qp_12 Q: 13

An investigation was carried out into the effect of different treatments on the permeability of the cell surface membranes and tonoplasts of beetroot cells. Beetroot cell vacuoles contain a red pigment. This pigment is unable to pass out of the cells because it cannot diffuse through the tonoplasts or cell surface membranes.

1 cm^3 cubes were cut from beetroot tissue and washed in running water for 20 minutes to remove any pigment released from damaged cells.

The cubes were then placed in test-tubes with different contents and observed for five minutes.

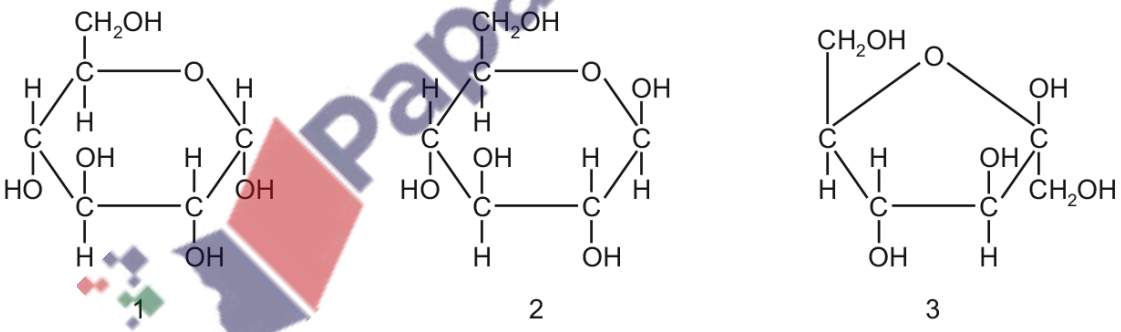
Which row shows a correct explanation for the observation recorded for one of the treatments?

	treatment	observation	explanation
A	dilute hydrochloric acid	contents of test-tube stay clear	membrane proteins have been denatured
B	ethanol	contents of test-tube turn red	lipids, including membrane phospholipids, have dissolved
C	water at 20 °C	contents of test-tube stay clear	membrane proteins have been denatured
D	water at 80 °C	contents of test-tube turn red	lipids, including membrane phospholipids, have dissolved

---

273. 9700_s19_qp_11 Q: 9

The diagram shows three hexose sugars.



Which row correctly shows examples of carbohydrates in which these three hexose sugars occur?

	sucrose	cellulose	starch
A	1	2	3
B	1	3	2
C	2	3	1
D	3	2	1

---

274. 9700_s19_qp_11 Q: 10

What can occur during condensation of carbohydrates?

A a disaccharide is produced from monosaccharides

B glycosidic bonds are broken

C molecules of water are used up

D monosaccharides are produced

---

275. 9700_s19_qp_11 Q: 11

What is true about triglycerides?

	hydrophobic	insoluble in alcohol
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = correct

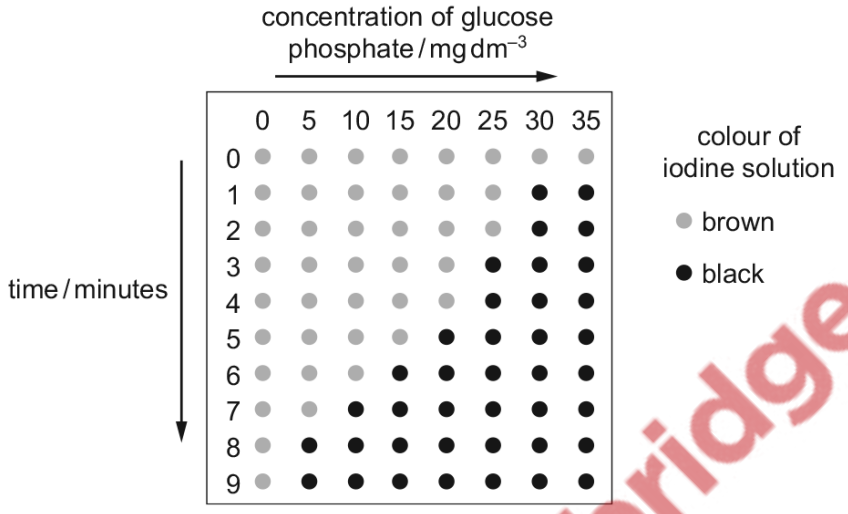
✗ = not correct

---

276. 9700_s19_qp_11 Q: 13

In an investigation, the same concentration of the enzyme phosphorylase was added to different concentrations of glucose phosphate and incubated at 30 °C. At 1 minute intervals, one drop of the reaction mixture was removed and added to a drop of iodine solution on a white tile.

The diagram shows the results of this investigation.



What explains the trend in the results of this investigation?

A Phosphorylase catalyses a reaction converting glucose phosphate to starch.

B The maximum rate of reaction is reached at 20 mg dm^{-3} of glucose phosphate.

C Substrate concentration is limiting at concentrations of glucose phosphate 25 mg dm^{-3} or less.

D Enzyme concentration is limiting at concentrations of glucose phosphate 25 mg dm^{-3} or less.

---

277. 9700_s19_qp_12 Q: 6

Which of the statements about polysaccharides can be used to describe amylose and cellulose?

1 contains 1,4 glycosidic bonds

2 contains 1,6 glycosidic bonds

3 polymer of glucose

A 1 and 2

B 1 and 3

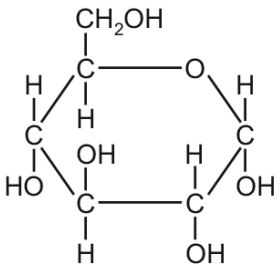
C 1 only

D 2 and 3

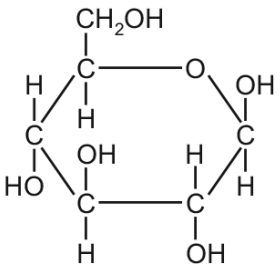
---

278. 9700_s19_qp_13 Q: 8

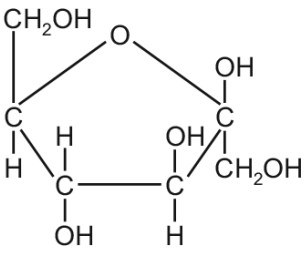
The diagram shows three hexose sugars.



1



2



3

Which row correctly shows examples of carbohydrates in which these three hexose sugars occur?

	sucrose	cellulose	amylose
A	1	2	3
B	1	3	2
C	2	3	1
D	3	2	1

279. 9700_s19_qp_13 Q: 9

What can occur as a result of a condensation reaction?

1 A disaccharide is formed.

2 A glycosidic bond is broken.

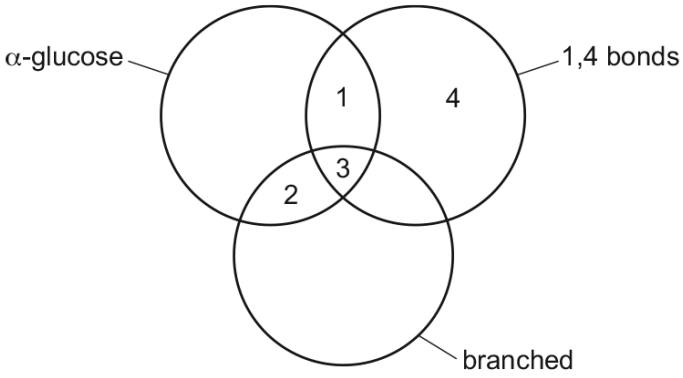
3 A molecule of water is produced.

4 Two monosaccharides join together.

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

280. 9700_s19_qp_13 Q: 10

The diagram shows some relationships between features of carbohydrates.



Which row correctly matches the carbohydrate with some of its features?

	1	2	3	4
A	amylopectin	sucrose	glycogen	cellulose
B	amylose	glycogen	amylopectin	cellulose
C	cellulose	amylopectin	glycogen	sucrose
D	glycogen	cellulose	amylose	amylopectin

---

281. 9700_s19_qp_13 Q: 11

Which row describes a triglyceride?

	hydrophilic	insoluble in alcohol
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

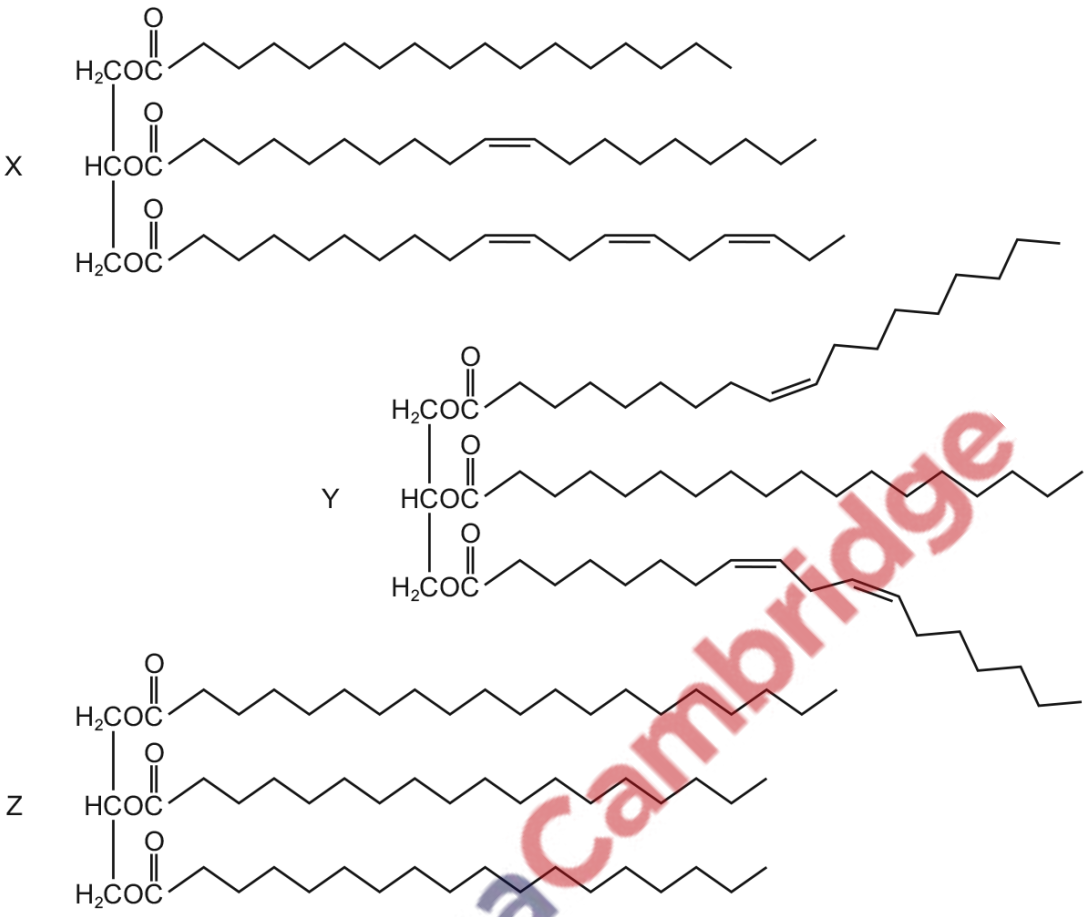
✓ = correct

✗ = not correct

---

282. 9700_s19_qp_13 Q: 12

The diagram shows three triglycerides, X, Y and Z.

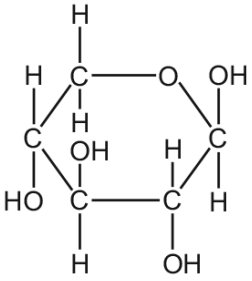


What is correct for these triglycerides?

	contains saturated fatty acids	contains unsaturated fatty acids	contains more than two different fatty acids
A	X, Y and Z	X and Y	X and Y
B	X, Y and Z	Z	X and Y
C	X and Y	X, Y and Z	X, Y and Z
D	Z	X and Y	X, Y and Z

283. 9700_w19_qp_11 Q: 6

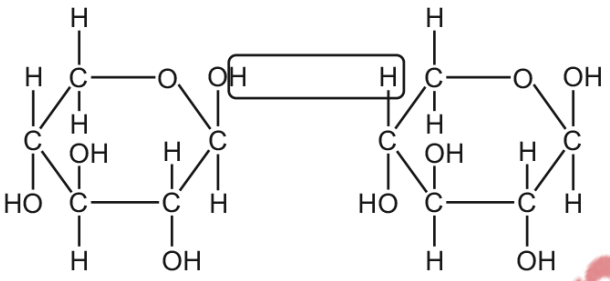
The diagram shows the monosaccharide xylose.



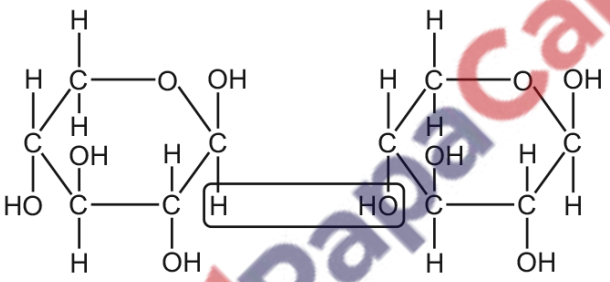
Many xylose monomers can be joined by glycosidic bonds to form a polysaccharide which is found in plant cell walls.

Which diagram shows the formation of a glycosidic bond between two xylose monomers?

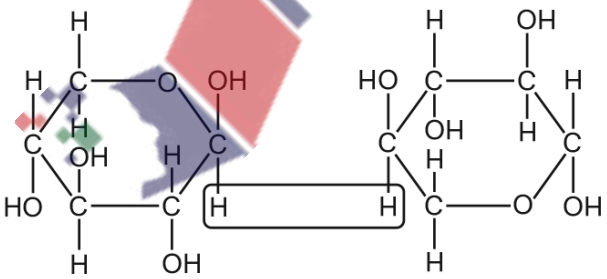
A



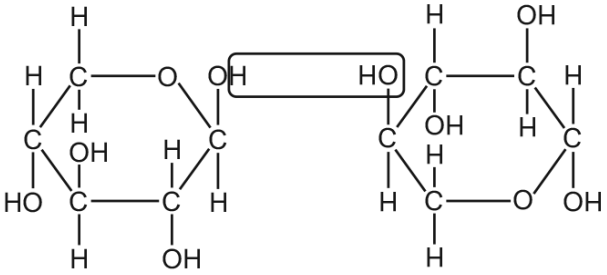
B



C



D



284. 9700_w19_qp_11 Q: 8

Which molecules are monomers?

1 ribose
2 glucose
3 deoxyribose
4 sucrose

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

---

285. 9700_w19_qp_11 Q: 9

Which molecules have properties that are dependent on hydrogen bonds?

1 cellulose
2 glycogen
3 haemoglobin
4 water

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

---

286. 9700_w19_qp_11 Q: 10

Some features of triglycerides are listed.

1 can be liquid or solid at room temperature
2 contains a high proportion of carbon–hydrogen bonds
3 insoluble in water
4 less dense than water

Which of these features make triglycerides suitable energy stores?

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

---

287. 9700_w19_qp_12 Q: 7

A student carried out four tests for biological molecules on a solution. The results are shown in the table.

test for biological molecules	observation
iodine	orange-brown
biuret	purple
Benedict's	orange
emulsion	clear

Which three molecules may be present in this solution?

A glucose, starch, globin

B globin, glucose, collagen

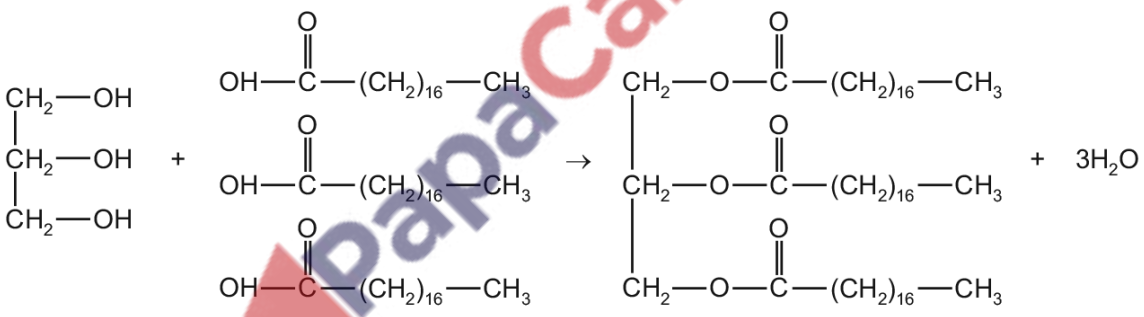
C starch, sucrose, collagen

D sucrose, globin, collagen

---

288. 9700_w19_qp_12 Q: 10

The diagram shows the formation of a biological macromolecule.



Which type of bonds are formed in the macromolecule product?

A ester bonds

B glycosidic bonds

C hydrogen bonds

D peptide bonds

---

289. 9700_w19_qp_13 Q: 7

What occurs during the formation of a glycosidic bond between two α-glucose molecules?

A a 1, 4 bond is always formed

B a hydrogen bond is always formed

C a molecule of water is always formed

D a hydroxyl (OH) group is always formed

---

290. 9700_w19_qp_13 Q: 8

What is the maximum number of condensation reactions that occur when a triglyceride is synthesized?

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

---

291. 9700_m18_qp_12 Q: 7

Which concentrations could be produced by a serial dilution of an 8.00% glucose solution?

A 4.00%, 2.00%, 1.00%, 0.50% and 0.25%

B 4.00%, 3.00%, 2.00%, 1.00% and 0.00%

C 6.00%, 4.00%, 2.00%, 1.00% and 0.50%

D 8.00%, 6.00%, 4.00%, 2.00% and 0.00%

---

292. 9700_m18_qp_12 Q: 8

A student wrote these statements about polysaccharides.

1 Amylose is formed from condensation reactions between β-glucose monomers.

2 Branches in amylopectin molecules form between carbon atoms 1 and 4 on α-glucose molecules.

3 In unbranched β-glucose chains, each monomer is rotated 180° relative to its adjacent monomer.

Which of these statements are correct?

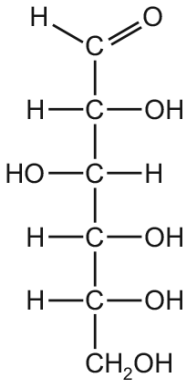
A 1 and 2 **B** 1 only **C** 2 and 3 **D** 3 only

---

293. 9700_m18_qp_12 Q: 10

Sugars with a ring structure can also have a linear structure.

Which sugar molecules could be represented by the linear structure shown in the diagram?



A α-glucose, deoxyribose and ribose

B α-glucose only

C deoxyribose and ribose only

D deoxyribose only

---

294. 9700_s18_qp_11 Q: 6

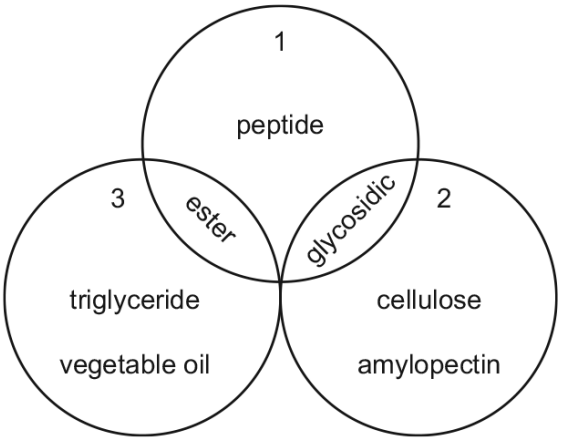
What is the general formula for amylose?

A $(C_5H_{10}O_5)_n$ **B** $(C_5H_{10}O_6)_n$ **C** $(C_6H_{10}O_5)_n$ **D** $(C_6H_{12}O_6)_n$

---

295. 9700_s18_qp_11 Q: 7

The diagram shows relationships between some important molecules and bonds.



What is represented by circles numbered 1, 2 and 3?

	1	2	3
A	bonds formed by condensation	carbohydrates	lipids
B	bonds formed by condensation	lipids	carbohydrates
C	bonds formed by hydrolysis	carbohydrates	lipids
D	bonds formed by hydrolysis	lipids	carbohydrates

296. 9700_s18_qp_11 Q: 8

In unsaturated 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

297. 9700_s18_qp_11 Q: 9

Phospholipids and triglycerides are important biological molecules.

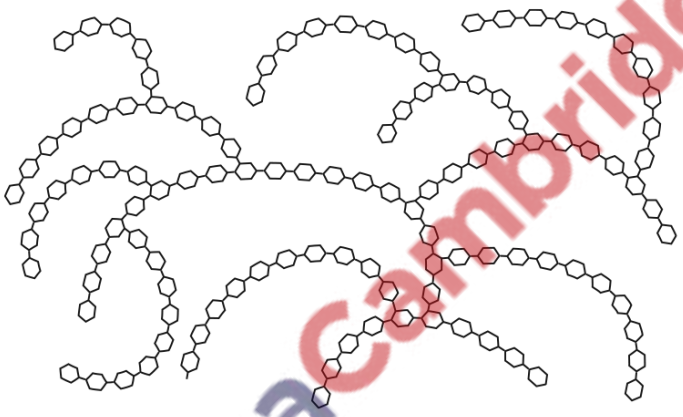
Which properties are correct for these molecules?

	non-polar	partially hydrophobic
A	phospholipid	phospholipid
B	phospholipid	triglyceride
C	triglyceride	phospholipid
D	triglyceride	triglyceride

---

298. 9700_s18_qp_12 Q: 7

The diagram shows part of a carbohydrate molecule formed by glucose.



What is the name of the molecule?

A amylose

B cellulose

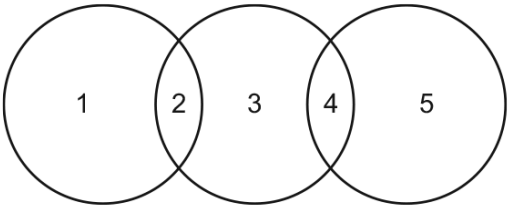
C glycogen

D starch

---

299. 9700_s18_qp_12 Q: 8

The diagram shows the relationship between some biological molecules.

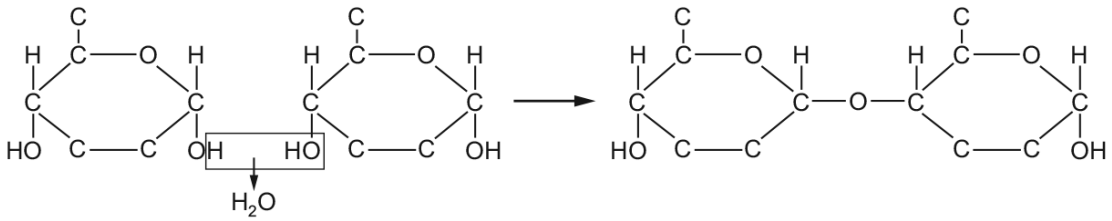


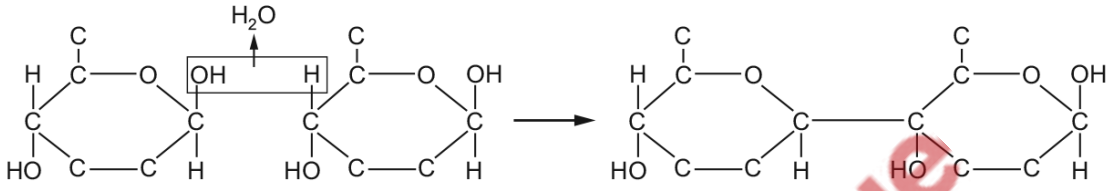
Which row is correct?

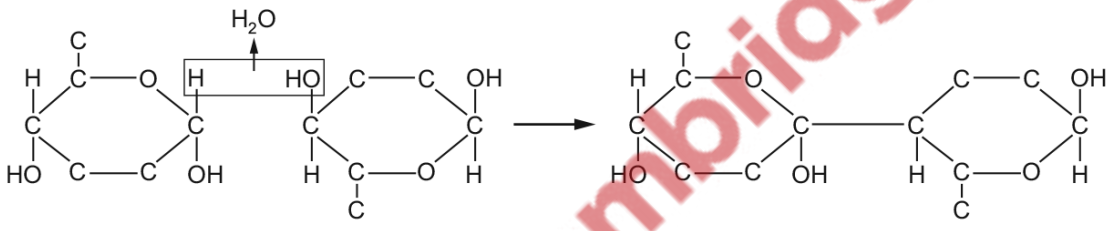
	1	2	3	4	5
A	α-glucose	carbohydrate	sucrose	monomer	fructose
B	cellulose	polymer	starch	carbohydrate	amylase
C	fructose	reducing sugar	β-glucose	monomer	amino acid
D	haemoglobin	protein	amylose	polymer	cellulose

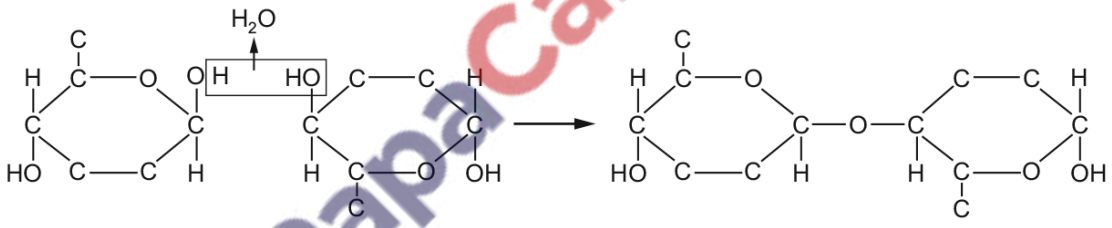
300. 9700_s18_qp_12 Q: 9

Which diagram shows the reaction that occurs to join two of the monomers that form cellulose?

A 

B 

C 

D 

---

301. 9700_s18_qp_13 Q: 7

Solutions of three biological molecules are tested for sugars. The table shows the colours of the solutions after testing.

solution	heated with Benedict's solution	boiled with hydrochloric acid, neutralised, then heated with Benedict's solution
1	blue	orange
2	green	green
3	orange	red

Which solutions contained glucose before testing?

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

---

302. 9700_s18_qp_13 Q: 8

A solution containing equal masses of amylose and amylopectin is completely hydrolysed.

Which molecules will be found after the hydrolysis?

A α-glucose only

B β-glucose only

C equal masses of α-glucose and β-glucose

D more α-glucose than β-glucose

---

303. 9700_s18_qp_13 Q: 9

Which molecules contain the following bonds?

	ester	hydrogen	disulfide
A	amylase	haemoglobin	catalase
B	glycerol	glycogen	collagen
C	lipids	amylopectin	amylose
D	phospholipids	cellulose	antibodies

---

304. 9700_s18_qp_13 Q: 10

Which feature of phospholipids enables a bilayer to form?

A They are insoluble in water.

B They are polar molecules.

C They have hydrophobic and hydrophilic components.

D They may contain saturated or unsaturated fatty acids.

---

305. 9700_w18_qp_11 Q: 6

Which comparison of bacteria cell walls and plant cell walls is correct?

	bacteria cell wall	plant cell wall
A	made of a polymer of α-glucose	made of cellulose
B	made of a polymer of β-glucose	made of a polymer of amino sugars
C	made of a polymer of amino sugars	made of a polymer of α-glucose
D	made of peptidoglycan	made of a polymer of β-glucose

---

306. 9700_w18_qp_11 Q: 7

A glycosidic bond is broken and two monosaccharides are formed during a positive test for a non-reducing sugar.

Which row identifies the catalyst and reactants in this process?

	catalyst	reactants
A	hydrochloric acid	fructose and glucose
B	hydrochloric acid	sucrose and water
C	sucrase enzyme	fructose and glucose
D	sucrase enzyme	sucrose and water

---

307. 9700_w18_qp_11 Q: 9

What is the general formula for cellulose?

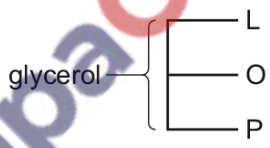
A $(C_5H_{10}O_5)_n$ **B** $(C_5H_{10}O_6)_n$ **C** $(C_6H_{10}O_5)_n$ **D** $(C_6H_{12}O_6)_n$

---

308. 9700_w18_qp_11 Q: 10

A triglyceride consists of glycerol and three different fatty acids, linoleic acid (L), oleic acid (O) and palmitic acid (P).

The diagram shows one possible arrangement of the fatty acids L, O and P in the molecule.



What is the total number of different arrangements of the fatty acids in this triglyceride?

A 3 **B** 4 **C** 5 **D** 9

---

309. 9700_w18_qp_12 Q: 7

A sample of a solution was tested for reducing sugar and the result was negative.

Another sample of the same solution was then tested for non-reducing sugar and the result was positive.

Which step in the test for non-reducing sugar breaks the glycosidic bonds?

A addition of Benedict's reagent

B addition of sodium hydroxide

C boiling with hydrochloric acid

D heating to 80 °C

---

310. 9700_w18_qp_12 Q: 8

Which row correctly identifies three polysaccharides

	α-glucose straight chain	α-glucose branching chain	β-glucose straight chain
A	amylose	amylopectin	cellulose
B	amylose	glycogen	amylopectin
C	glycogen	amylose	amylopectin
D	glycogen	amylose	cellulose

---

311. 9700_w18_qp_12 Q: 9

Which row describes a triglyceride?

	hydrophobic	insoluble in alcohol
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = correct

✗ = not correct

---

312. 9700_w18_qp_13 Q: 8

Which words correctly complete the description of amylose?

The ……1…… amylose is a ……2…… made up of ……3…… of the ……4…… glucose.

	1	2	3	4
A	macromolecule	monomer	polymers	disaccharide
B	macromolecule	monomer	polymers	monosaccharide
C	polysaccharide	polymer	monomers	disaccharide
D	polysaccharide	polymer	monomers	monosaccharide

---

313. 9700_w18_qp_13 Q: 9

Which statements about glycosidic bonds are correct?

1 They occur by condensation reactions between the OH groups of two molecules.

2 They occur only between glucose molecules.

3 The bonds can only be formed between carbon 1 and carbon 4 or carbon 1 and carbon 6 of adjacent molecules.

4 Hydrolysis of the bonds releases energy.

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

---

314. 9700_w18_qp_13 Q: 10

What is the general formula for glycogen?

A $(C_5H_{10}O_5)_n$ **B** $(C_5H_{10}O_6)_n$ **C** $(C_6H_{10}O_5)_n$ **D** $(C_6H_{12}O_6)_n$

---

315. 9700_w18_qp_13 Q: 11

Which statements are correct?

1 In a triglyceride molecule the bonds between the fatty acids and the glycerol molecule are called ester bonds.

2 Triglycerides are formed by a condensation reaction between the hydroxyl group of a fatty acid molecule and one of the carboxyl groups of the glycerol molecule.

3 Triglycerides are insoluble in water because the fatty acid carbon chain is non-polar.

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

---

316. 9700_m17_qp_12 Q: 8

The table shows some information about carbohydrate polymers.

Which row describes amylose?

	α-1,4 glycosidic bonds	α-1,6 glycosidic bonds	shape of molecule
A	✓	✓	branched
B	✓	✗	helical
C	✗	✓	branched
D	✗	✗	helical

key
✓ = present
✗ = absent

---

317. 9700_m17_qp_12 Q: 9

Which row about α-glucose and β-glucose molecules is correct?

	carbon atom on which the OH position is different	cellulose contains both molecules
A	1	no
B	1	yes
C	4	no
D	4	yes

---

318. 9700_s17_qp_11 Q: 7

What is the general formula for amylopectin?

A $(C_5H_{10}O_5)_n$ **B** $(C_5H_{10}O_6)_n$ **C** $(C_6H_{12}O_6)_n$ **D** $(C_6H_{10}O_5)_n$

---

319. 9700_s17_qp_11 Q: 8

Which statement describes how the molecular structure of starch is suited to its function?

A Amylose has a branched structure and amylopectin is coiled to give a compact molecule for transport.

B In the breakdown of amylose and amylopectin, many condensation reactions release stored energy.

C In the formation of amylose and amylopectin, many hydrolysis reactions allow the release of stored energy.

D The amylose-amylopectin complex is insoluble and does not affect the water potential of the cell.

---

320. 9700_s17_qp_11 Q: 9

Cows and whales are mammals that produce milk to feed their babies. Newborn whales grow faster than newborn cows. The milk of both cows and whales contains saturated fatty acids with different chain lengths.

The table shows the percentage of saturated fatty acids of different lengths in cow and whale milk.

chain length of saturated fatty acid / number of carbon atoms	percentage of saturated fatty acids in milk	
	cow	whale
4–12	22.2	0
14	10.6	13.8
16	25.5	27.9
18	40.1	29.4
> 18	1.6	28.9

Which statement about the ratio of short fatty acids (4–16 carbons) to long fatty acids (18 or more carbons) in the milk of cows and whales is correct?

A The ratio in cow milk is higher because young cows need more energy than young whales.

B The ratio in cow milk is lower because young cows need less energy than young whales.

C The ratio in whale milk is higher because young whales need less energy than young cows.

D The ratio in whale milk is lower because young whales need more energy than young cows.

---

321. 9700_s17_qp_11 Q: 10

The structure of phospholipids and triglycerides include the following.

1 glycerol linked to fatty acids

2 hydrophobic fatty acid chains

3 saturated fatty acid chains

Which structures enable the formation of a lipid bilayer in cell surface membranes?

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

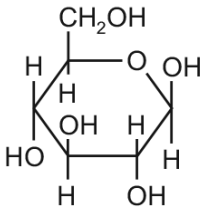
---

322. 9700_s17_qp_12 Q: 7

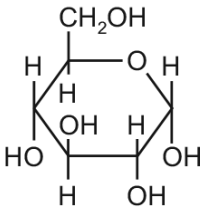
The diagrams show four monosaccharides with the formula $C_6H_{12}O_6$.

Which diagram shows α-glucose?

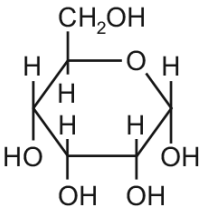
A



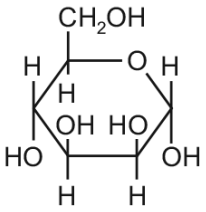
B



C



D



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323. 9700_s17_qp_12 Q: 8

Complete digestion of polysaccharides requires all the glycosidic bonds between the monomers to be broken.

Amylase only breaks α-1,4 glycosidic bonds.

Which row shows how completely amylase can digest molecules of cellulose, amylopectin or amylose?

	polysaccharide		
	cellulose	amylopectin	amylose
A	–	++	+
B	–	+	++
C	+	++	–
D	++	–	+

key

– no digestion

\+ some digestion

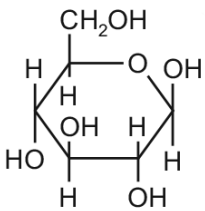
++ most digestion

---

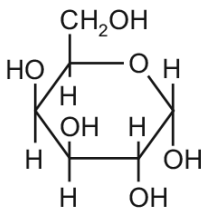
324. 9700_s17_qp_13 Q: 6

Which diagram shows the monomer of cellulose?

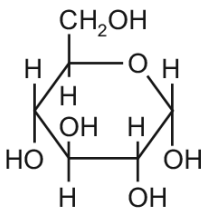
A



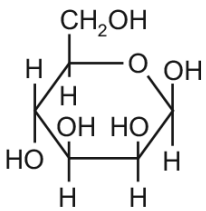
B



C



D



---

325. 9700_s17_qp_13 Q: 9

Which statements about **both** amylose and amylopectin are correct?

1 They are polymers.

2 They are formed by hydrolysis reactions.

3 They are linear molecules.

4 They contain α-1,4 glycosidic bonds.

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1 and 4 only

D 2 and 3 only

---

326. 9700_w17_qp_11 Q: 1

Which row is correct for a typical plant cell?

	cell wall	cell diameter	ribosomes
A	cellulose	1-5 μm	80S
B	cellulose	5-40 μm	70S and 80S
C	peptidoglycan	1-5 μm	70S
D	peptidoglycan	5-40 μm	70S and 80S

---

327. 9700_w17_qp_11 Q: 7

Which two polysaccharides both have 1,6 glycosidic bonds **and** are branched?

A amylopectin and amylose

B amylopectin and glycogen

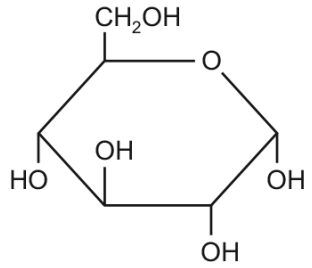
C amylose and glycogen

D glycogen and cellulose

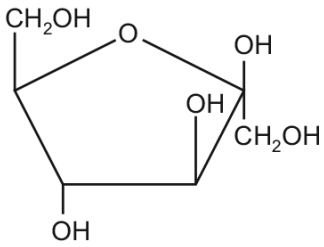
---

328. 9700_w17_qp_11 Q: 8

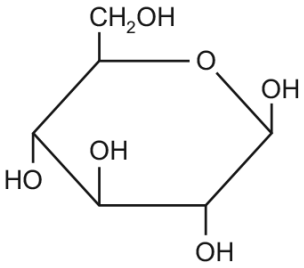
Three carbohydrate molecules are shown.



1



2



3

Which two molecules combine to form a molecule of sucrose?

A 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** two of molecule 1

---

329. 9700_w17_qp_12 Q: 8

Which features adapt a cellulose molecule for its function?

1 Long chains of glucose molecules coil into a helix.

2 Many hydrogen bonds form between adjacent chains.

3 It is insoluble in water.

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

---

330. 9700_w17_qp_12 Q: 9

Two disaccharides are maltose and sucrose. Maltose is formed from two molecules of glucose, whilst sucrose is formed from fructose and glucose.

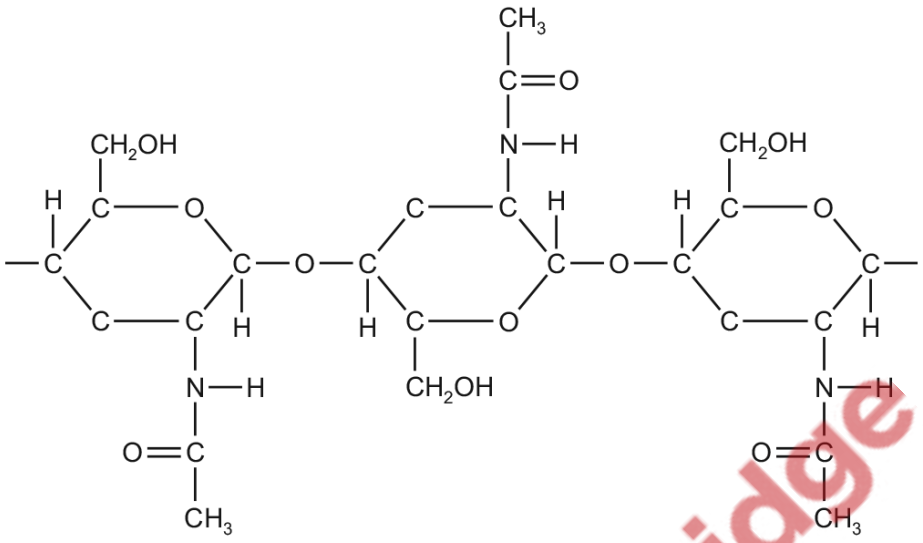
Which row shows the molecular formulae of the two disaccharides?

	maltose	sucrose
A	$C_{12}H_{22}O_{11}$	$C_{12}H_{22}O_{11}$
B	$C_{12}H_{22}O_{11}$	$C_{12}H_{24}O_{12}$
C	$C_{12}H_{24}O_{12}$	$C_{12}H_{22}O_{11}$
D	$C_{12}H_{24}O_{12}$	$C_{12}H_{24}O_{12}$

---

331. 9700_w17_qp_12 Q: 10

The diagram shows the structure of the polysaccharide chitin which is found in the cell wall of fungi.



Which statements are correct for chitin **and** for cellulose?

1 The monomers are joined by 1,4 glycosidic bonds.

2 Every second monosaccharide in the polysaccharide chain is rotated by 180°.

3 The polysaccharide contains the elements carbon, hydrogen, oxygen and nitrogen.

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

---

332. 9700_w17_qp_12 Q: 13

What are the features of triglycerides?

	polar	less dense than water	lower proportion of hydrogen than in carbohydrates
A	✓	✓	✗
B	✓	✗	✓
C	✗	✓	✗
D	✗	✗	✓

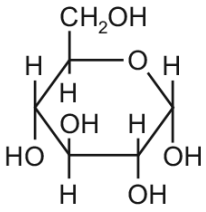
key
✓ = yes
✗ = no

---

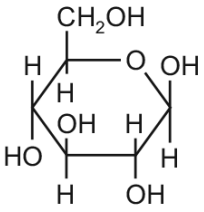
333. 9700_w17_qp_13 Q: 7

The diagrams show four monosaccharides with the formula $C_6H_{12}O_6$.

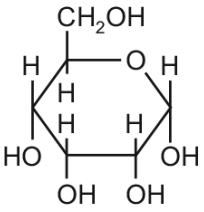
1



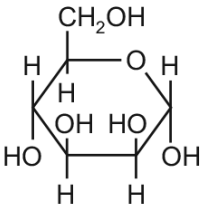
2



3



4



Which diagrams show glucose molecules?

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

---

334. 9700_w17_qp_13 Q: 8

Which bonds will be broken when a molecule of glycogen is broken down?

1 α-1, 4

2 β-1, 4

3 α-1, 6

4 β-1, 6

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

---

335. 9700_m16_qp_12 Q: 6

What may take place during a hydrolysis reaction?

1 a molecule of water is produced

2 a glycosidic bond is broken

3 a sucrose molecule is split into fructose and glucose

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

---

336. 9700_m16_qp_12 Q: 7

The table shows some information about four carbohydrate polymers.

polymer	α-1,4 glycosidic bonds	α-1,6 glycosidic bonds	shape of molecule
1	✓	✗	helical
2	✗	✓	branched
3	✓	✓	helical
4	✓	✓	branched

key
✓ = present
✗ = absent

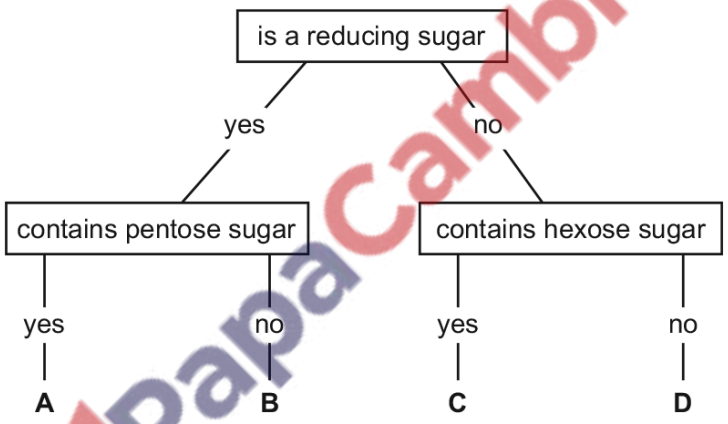
Which two polymers form starch?

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

---

337. 9700_m16_qp_12 Q: 8

Which molecule in the key is sucrose?



---

338. 9700_m16_qp_12 Q: 9

Which statements about triglycerides and phospholipids are correct?

1 Triglycerides and phospholipids both have a hydrophobic region.

2 Triglycerides are non-polar molecules and phospholipids are polar.

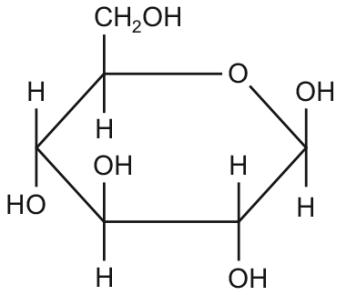
3 Fatty acids in a triglyceride may be saturated or unsaturated but in a phospholipid they are always saturated.

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

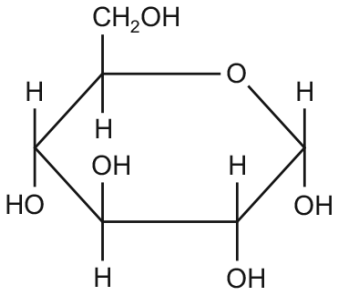
---

339. 9700_s16_qp_11 Q: 7

X and Y are two monomers found in biological polymers.



X



Y

Which monomer is found in each of cellulose, glycogen, amylopectin and amylose?

	cellulose	glycogen	amylopectin	amylose
A	X	Y	X	Y
B	X	Y	Y	Y
C	Y	X	X	X
D	Y	X	Y	X

---

340. 9700_s16_qp_11 Q: 8

Chitin is a polysaccharide consisting of long straight chains of the monosaccharide acetylglucosamine, linked by 1,4 glycosidic bonds.

Acetylglucosamine is similar in structure to glucose, but contains nitrogen, allowing hydrogen bonds to form between adjacent chains of chitin when they lie parallel to each other.

Which polysaccharide is most similar in structure to chitin?

A amylopectin

B amylose

C cellulose

D glycogen

---

341. 9700_s16_qp_11 Q: 9

Which statement about triglycerides is correct?

A They are made up of three fatty acids combined with glycogen.

B They are more saturated with hydrogen compared with phospholipids.

C They form a bilayer in the cell surface membranes of cells.

D They have a lower ratio of oxygen to carbon compared with carbohydrates.

---

342. 9700_s16_qp_12 Q: 5

Which row shows the monomer and type of bond that form the polymer?

	monomer	type of bond	polymer
A	α-glucose	1,4 only	starch
B	α-glucose	1,4 and 1,6	amylopectin
C	β-glucose	1,4 only	glycogen
D	β-glucose	1,4 and 1,6	cellulose

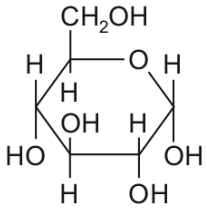
---

343. 9700_s16_qp_13 Q: 7

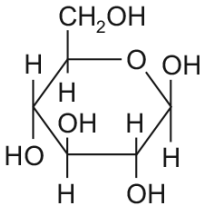
The diagrams show four monosaccharides with the formula $C_6H_{12}O_6$.

Which diagram shows β-glucose?

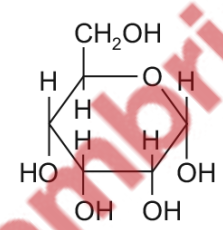
A



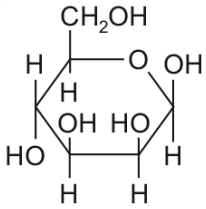
B



C



D



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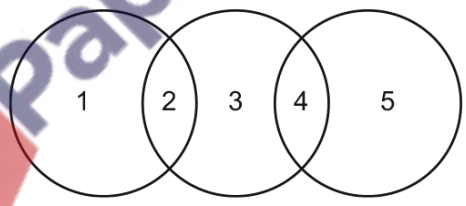
344. 9700_s16_qp_13 Q: 8

The diagram shows the relationship between different polysaccharides and the glycosidic bonds formed between the monomers.



Which row is correct?

	1	2	3	4	5
A	amylopectin	α-1,-6	glycogen	α-1,-4	amylopectin
B	amylose	α-1,-4	cellulose	β-1,-4	glycogen
C	cellulose	α-1,-4	amylose	α-1,-4	glycogen
D	glycogen	β-1,-6	amylopectin	α-1,-4	amylose

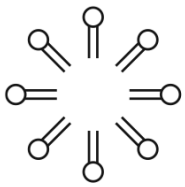
---

345. 9700_s16_qp_13 Q: 9

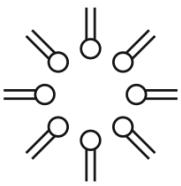
When a small quantity of phospholipid is added to a test-tube of water and then shaken vigorously, an emulsion is formed by small droplets called liposomes.

Which diagram shows the arrangement of phospholipid molecules in a cross-section of a liposome?

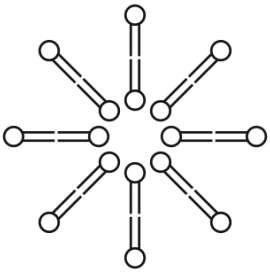
A



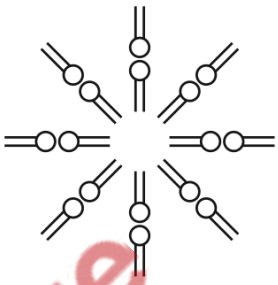
B



C



D



---

346. 9700_w16_qp_11 Q: 7

What **cannot** occur as a result of a condensation reaction?

A breaking of a glycosidic bond

B formation of a disaccharide

C joining together two amino acids

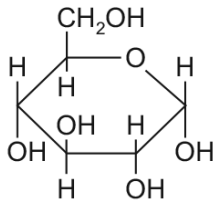
D production of a molecule of water

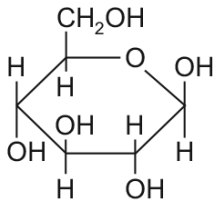
---

347. 9700_w16_qp_11 Q: 8

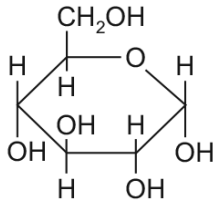
Which pair of monosaccharides forms sucrose?

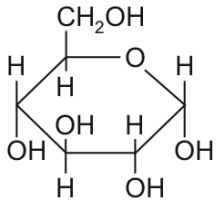
A



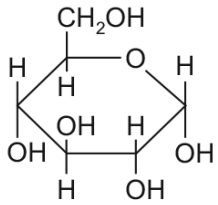


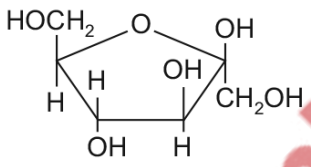
B



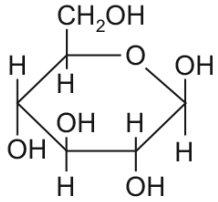


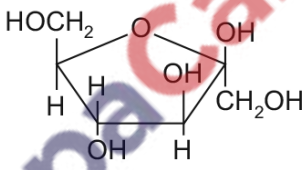
C





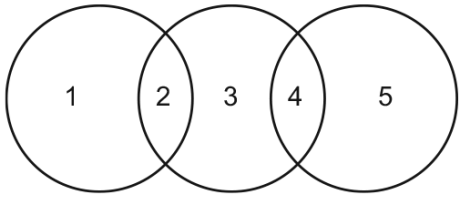
D





348. 9700_w16_qp_11 Q: 9

The diagram shows the relationship between different polysaccharides and the glycosidic bonds formed between the monomers.



Which row is correct?

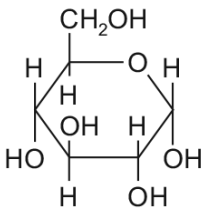
	1	2	3	4	5
A	amylopectin	α-1,6	cellulose	β-1,4	glycogen
B	amylose	α-1,4	glycogen	β-1,4	amylopectin
C	cellulose	β-1,4	amylose	α-1,4	glycogen
D	glycogen	α-1,6	amylopectin	α-1,4	amylose

---

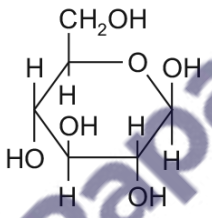
349. 9700_w16_qp_12 Q: 7

The diagrams show four monosaccharides with the formula $C_6H_{12}O_6$.

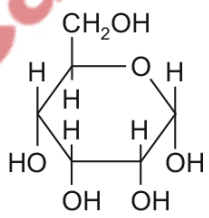
1



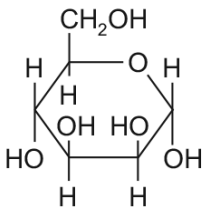
2



3



4



Which diagrams do **not** show glucose molecules?

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

---

350. 9700_w16_qp_12 Q: 8

Complete digestion of polysaccharides requires all the glycosidic bonds between the monomers to be broken.

Amylase breaks only α-1,4 glycosidic bonds.

How completely can amylase digest molecules of amylose, amylopectin or glycogen?

	carbohydrate		
	amylose	amylopectin	glycogen
A	+	+++	++
B	+	++	+++
C	++	+	+++
D	+++	++	+

key	
+	some digestion
++	more digestion
+++	most digestion

---

351. 9700_w16_qp_12 Q: 9

Which statements about a triglyceride molecule are correct?

1 It always contains unsaturated hydrocarbon tails.

2 It is formed using ester bonds.

3 It does not form hydrogen bonds.

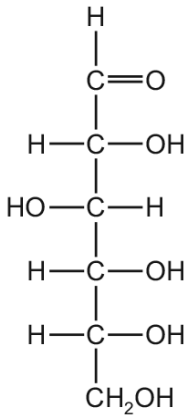
4 It contains a hydrophilic glycerol head.

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

---

352. 9700_w16_qp_12 Q: 11

The ring structure of sugars can also be represented as a linear structure, as shown in the diagram.



Which of the sugar molecules could be represented by this formula?

1 β-glucose

2 ribose

3 sucrose

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

353. 9700_w16_qp_13 Q: 7

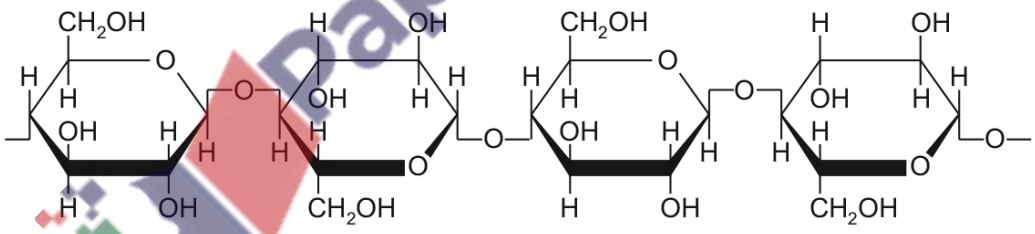
Which row is correct for each of the molecules?

	collagen	haemoglobin	sucrose
A	has a structural function, found in blood vessel walls	contains the elements carbon, hydrogen, iron, nitrogen and sulfur	formed by releasing a molecule of water in a hydrolysis reaction
B	molecules consist of three polypeptide chains, linked by ionic bonds	each non-protein haem group contains a central iron ion	composed of two monosaccharides linked by a glycosidic bond
C	molecules lie parallel to each other, with cross-links and staggered ends	has two identical α chains and two identical β chains	formed by condensation of two identical monosaccharides
D	polypeptide chains interact to produce a fibrous protein	has all four levels of protein structure and at least four types of bond	digestion yields glucose and fructose in equal proportions

---

354. 9700_w16_qp_13 Q: 8

The diagram shows how the β-glucose units of cellulose are linked to each other.



What is the significance of the fact that the OH groups on carbon 2 in adjacent glucose molecules are on opposite sides of the molecule?

A They can cross-link with other cellulose molecules by both hydrogen and glycosidic bonds.

B They can form glycosidic bonds with adjacent OH groups of other cellulose molecules.

C They can form hydrogen bonds between the CH_2OH and OH on adjacent glucose molecules of the cellulose molecule.

D They can form hydrogen bonds with adjacent OH and CH_2OH groups of other cellulose molecules.

---

355. 9700_s15_qp_11 Q: 9

Which row shows the correct match between the descriptions of biological molecules and where they are found?

1 a linear polymer of 1,4 linked β-glucose molecules

2 a bipolar, phosphate containing molecule

3 a highly branched polymer of 1,4 and 1,6 linked α-glucose molecules

	1	2	3
A	eukaryote and prokaryote cell walls	cell surface membranes of both eukaryotes and prokaryotes	forming storage granules in the cells of prokaryotes
B	eukaryote cell walls	cell surface membranes of both eukaryotes and prokaryotes	forming storage granules in the cells of some eukaryotes
C	eukaryote cell walls	cell surface membranes of both eukaryotes and prokaryotes	forming starch grains in the cells of all eukaryotes
D	forms storage granules in the cells of eukaryotes	prokaryote cell walls	eukaryote cell walls

---

356. 9700_s15_qp_11 Q: 10

Which is the correct description for the structure of amylose and cellulose?

	amylose	cellulose
A	α-glucose 180° rotation 1,4 and 1,6 linkages	β-glucose no rotation 1,4 linkages
B	α-glucose no rotation 1,4 linkages	β-glucose 180° rotation 1,4 linkages
C	α-glucose no rotation 1,4 linkages	α-glucose 180° rotation 1,4 and 1,6 linkages
D	β-glucose no rotation 1,4 linkages	α-glucose 180° rotation 1,4 linkages

---

357. 9700_s15_qp_12 Q: 10

Which bonds hold together the structure of cellulose?

1 glycosidic

2 hydrogen

3 ionic

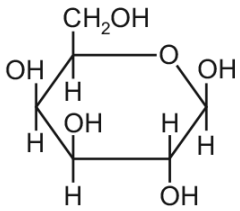
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

---

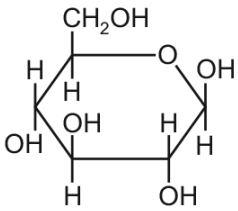
358. 9700_s15_qp_13 Q: 7

Which molecule is α-glucose?

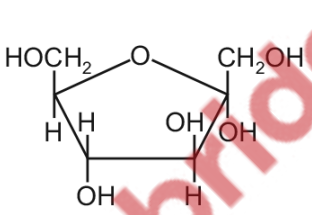
A



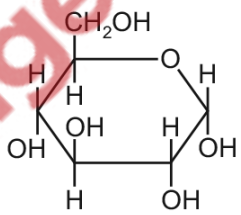
B



C



D

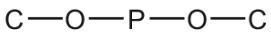


---

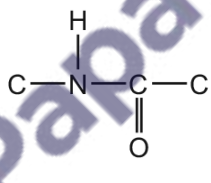
359. 9700_w15_qp_11 Q: 7

Which diagram shows the bond linking the individual units of both glycogen and amylose?

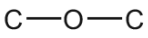
A



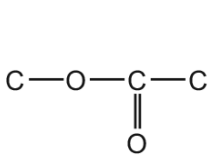
B



C



D



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360. 9700_w15_qp_11 Q: 9

Which row describes a triglyceride?

	hydrophilic	insoluble in alcohol
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = correct

✗ = not correct

---

361. 9700_w15_qp_11 Q: 10

A solution containing equal masses of amylose and amylopectin is completely hydrolysed.

Which molecules will be found after the hydrolysis?

A α-glucose only

B β-glucose only

C equal masses of α-glucose and β-glucose

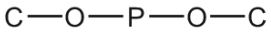
D more α-glucose than β-glucose

---

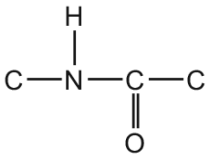
362. 9700_w15_qp_12 Q: 8

Which diagram shows the bond linking the individual units of both cellulose and glycogen?

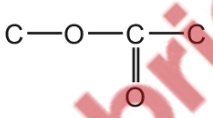
A



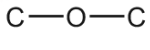
B



C



D



---

363. 9700_w15_qp_12 Q: 9

Which row describes a triglyceride?

	hydrophilic	soluble in alcohol
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ correct

✗ not correct

---

364. 9700_w15_qp_13 Q: 8

The synthesis of biological molecules requires the formation of bonds.

Which row is correct?

	a bond forms between the phosphate of one monomer and the sugar of the next monomer	a β-1,4 bond forms between the monomers to give an unbranched chain	the hydroxyl group of the carboxylic acid group is removed and a carbon-nitrogen bond is formed to give an unbranched chain
A	polynucleotide	amylose	polypeptide
B	polynucleotide	cellulose	polypeptide
C	phospholipid	amylose	polynucleotide
D	phospholipid	cellulose	polynucleotide

---

365. 9700_w15_qp_13 Q: 9

Which row describes a triglyceride?

	hydrophobic	insoluble in alcohol
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

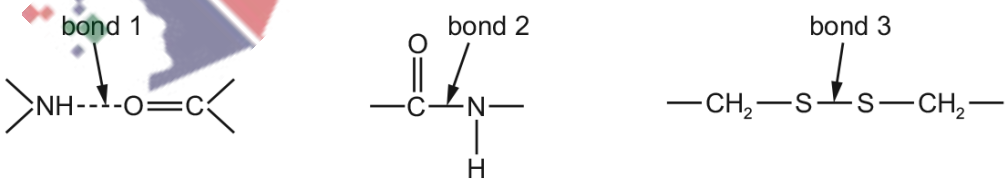
✓ correct

✗ not correct

2.3 Proteins and water

366. 9700_m20_qp_12 Q: 11

The diagrams show three examples of different bonds.



Which bonds hold the secondary structure of proteins together?

A 1, 2 and 3

B 1 and 2 only

C 1 only

D 2 and 3 only

---

367. 9700_m20_qp_12 Q: 12

Hydrogen bonding explains many of the properties of water, including the high latent heat of vapourisation and high specific heat capacity.

For which processes in plants is hydrogen bonding in water important on hot sunny days?

1 preventing denaturation of enzymes in leaves

2 reducing water loss by evaporation

3 allowing leaves to cool down quickly at night

4 holding the column of water in xylem vessels together

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1, 3 and 4 only

D 2 and 3 only

---

368. 9700_s20_qp_11 Q: 9

Which molecules contain at least two double bonds?

1 unsaturated fatty acid

2 collagen

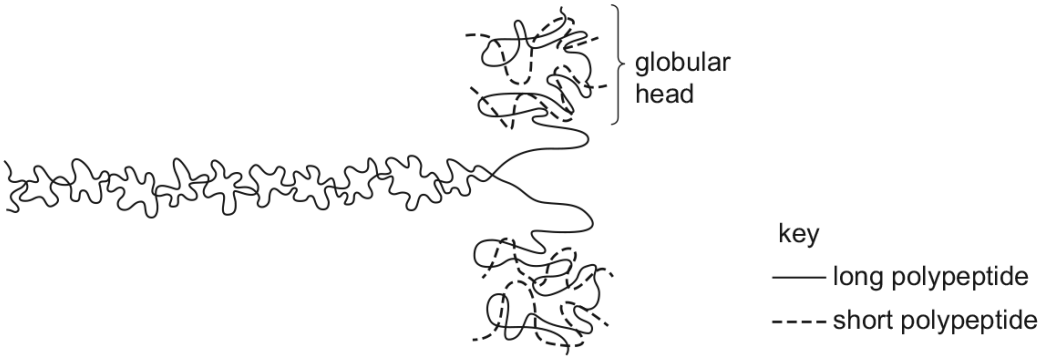
3 haemoglobin

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

---

369. 9700_s20_qp_11 Q: 10

The diagram shows a protein molecule.



Two long polypeptides each form α-helices for much of their length and these twist together into a fibre.

At one end, each of these polypeptides coils into a globular head.

Two short polypeptides bind to each globular head.

What describes the protein structure of this molecule?

A quaternary structure because each molecule consists of six polypeptides

B secondary structure because the long polypeptides form α-helices

C tertiary structure because the α-helices form a fibre

D tertiary structure because the heads form globular proteins

---

370. 9700_s20_qp_11 Q: 11

Which types of bond will keep a folded protein in its precise shape for the longest time as the temperature rises?

A disulfide

B hydrogen

C hydrophobic interactions

D ionic

---

371. 9700_s20_qp_12 Q: 11

What occurs during the formation of a peptide bond between two amino acids?

A OH is removed from COOH and H is removed from an R group.

B OH is removed from COOH and H is removed from NH_2.

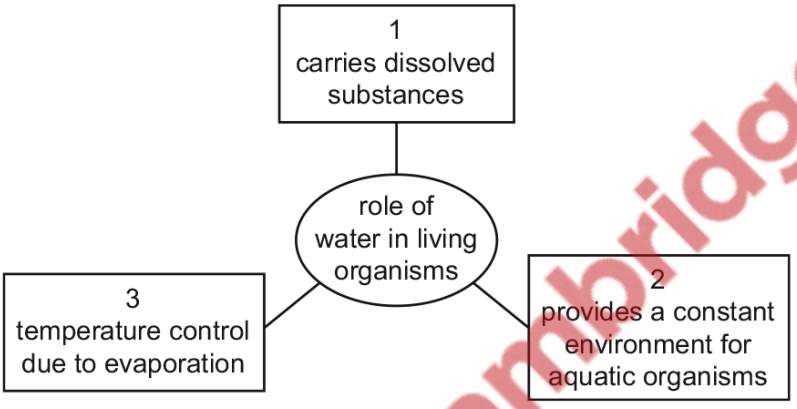
C H is removed from COOH and OH is removed from an R group.

D O is removed from COOH and 2H is removed from NH_2.

---

372. 9700_s20_qp_12 Q: 12

The diagram represents roles of water in living organisms.



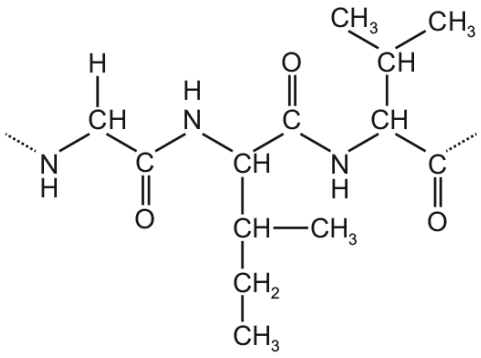
Which roles are dependent upon hydrogen bonds between water molecules?

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

---

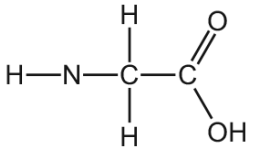
373. 9700_s20_qp_13 Q: 8

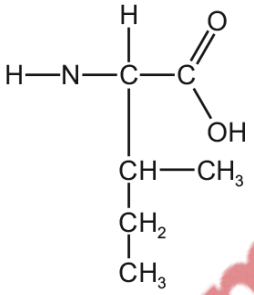
The diagram shows a small part of a polypeptide.

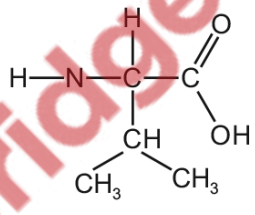


What would the products be if the part shown was completely hydrolysed?

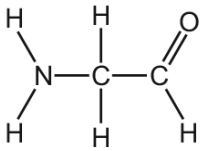
A

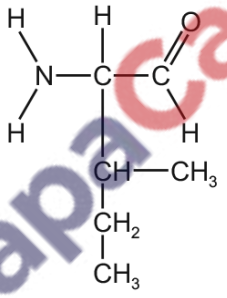


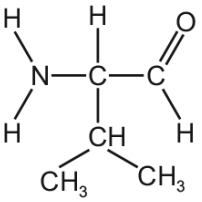




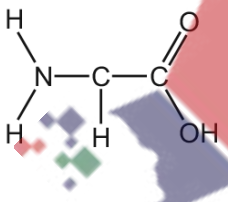
B

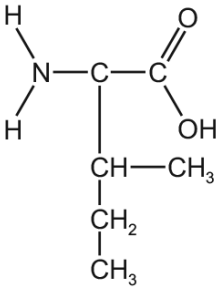


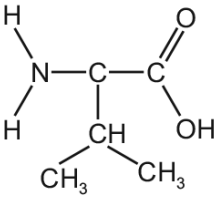




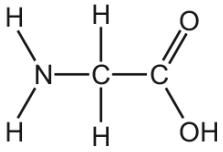
C

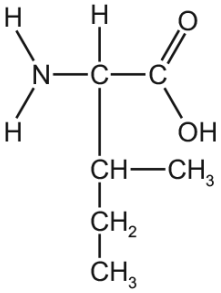


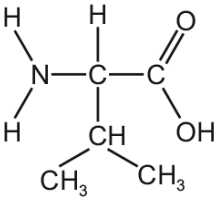




D







374. 9700_s20_qp_13 Q: 9

The enzyme trypsin hydrolyses proteins to amino acids. Trypsin does not function when the pH is very low as its 3D shape would be changed.

What explains this change in 3D shape?

A Hydrogen ions attach themselves to negatively charged R groups.

B Hydrogen ions disrupt disulfide bonds.

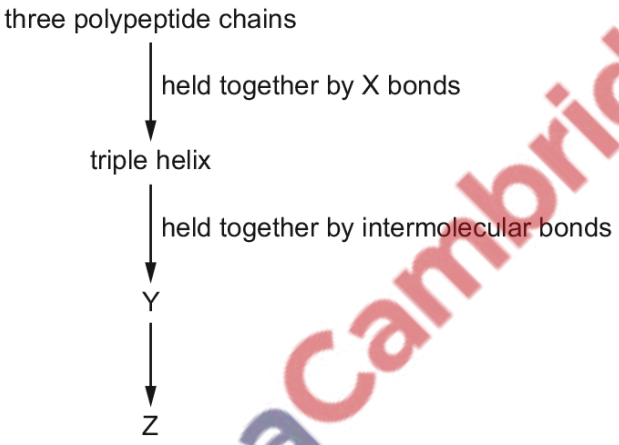
C Hydrogen ions increase hydrogen bonding between amino acids.

D Hydrogen ions reduce the affinity of hydrophilic R groups for water.

---

375. 9700_s20_qp_13 Q: 10

The flow chart shows some of the steps in the formation of collagen.



Which row correctly identifies X, Y and Z?

	X	Y	Z
A	disulfide	fibres	fibrils
B	hydrogen	fibrils	fibres
C	hydrogen	microfibrils	fibres
D	peptide and hydrogen	fibres	microfibrils

---

376. 9700_s20_qp_13 Q: 11

Which molecules contain at least two double bonds?

1 saturated fatty acid

2 collagen

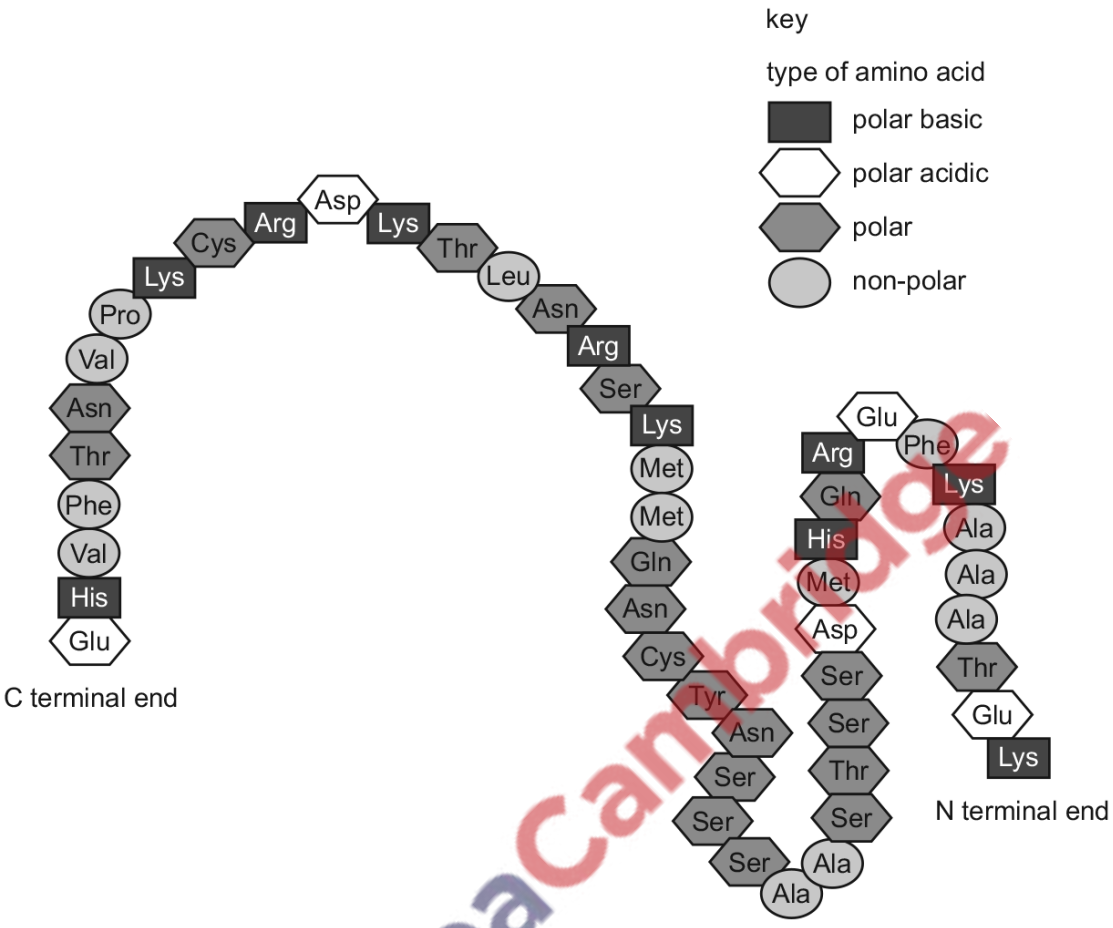
3 haemoglobin

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

---

377. 9700_w20_qp_11 Q: 11

The diagram shows the amino acids in a polypeptide.



An enzyme catalyses the hydrolysis of **any** peptide bond between a non-polar amino acid **and** any polar amino acid.

How many small peptides and single amino acids will be formed by the action of this enzyme?

	small peptides	single amino acids
A	6	1
B	8	1
C	12	3
D	13	4

378. 9700_w20_qp_11 Q: 12

Which properties of water reduce temperature changes inside cells?

1 cohesion

2 latent heat of vaporisation

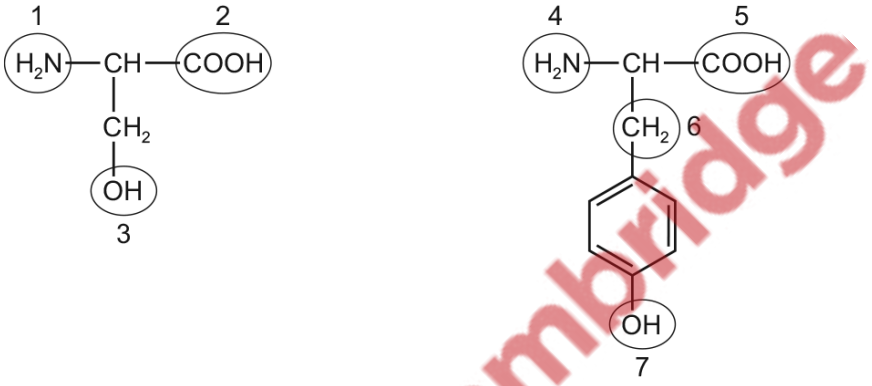
3 specific heat capacity

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

---

379. 9700_w20_qp_12 Q: 9

The diagram shows the structures of two amino acids.



These amino acids will form part of a protein that has a tertiary structure.

Which numbered groups could form hydrogen bonds to maintain the tertiary structure of the protein?

A 1 and 6 **B** 2 and 4 **C** 3 and 5 **D** 3 and 7

---

380. 9700_w20_qp_12 Q: 10

Which row about the structure of proteins is correct?

	primary structure	tertiary structure	quaternary structure
A	is the number of amino acids present in a protein	is the result of cross bonding between all the amino acids in the primary structure	is the polypeptides that link together to form a protein
B	is the order of amino acids present in a protein encoded by DNA	is the shape formed by folding of a polypeptide and held together by hydrogen bonds	contains two types of polypeptide that interact forming the shape of a protein
C	is the result of translation of an mRNA molecule by a ribosome into a chain of amino acids	is the result of ionic and hydrogen bonds, disulfide bridges and hydrophobic interactions between amino acids	is formed by four polypeptides and an additional reactive group attached to the protein
D	is the sequence of amino acids in a protein coded by an mRNA molecule	is formed as a result of interaction of the side chains of amino acids in the primary structure	is formed by the linking together of more than one polypeptide to form a protein

---

381. 9700_w20_qp_12 Q: 11

Which row correctly identifies structural features of a collagen molecule and a haemoglobin molecule?

	molecule consists of more than one polypeptide	globular protein
A	collagen and haemoglobin	collagen and haemoglobin
B	collagen and haemoglobin	haemoglobin only
C	haemoglobin only	collagen and haemoglobin
D	haemoglobin only	haemoglobin only

---

382. 9700_w20_qp_13 Q: 12

Adult human haemoglobin typically consists of two α chains and two β chains.

Approximately 5% of humans have one amino acid in the β chain that has been changed. This change affects the structure and stability of haemoglobin.

Which levels of protein structure could be affected in the haemoglobin of the humans with the changed amino acid?

A primary only

B primary and quaternary only

C secondary, tertiary and quaternary only

D primary, secondary, tertiary and quaternary

---

383. 9700_m19_qp_12 Q: 14

Which levels of protein structure can determine the specificity of an enzyme?

1 primary

2 secondary

3 tertiary

4 quaternary

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1, 2 and 4 only

D 3 and 4 only

---

384. 9700_s19_qp_11 Q: 12

What is the minimum number of carbon atoms in an amino acid?

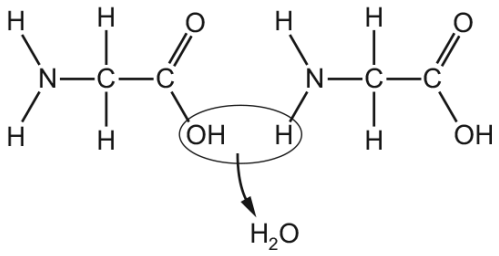
A 1 **B** 2 **C** 3 **D** 4

---

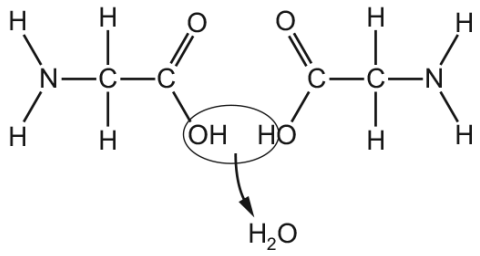
385. 9700_s19_qp_12 Q: 7

Which diagram shows the formation of a peptide bond?

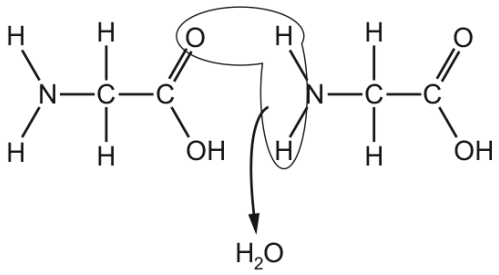
A



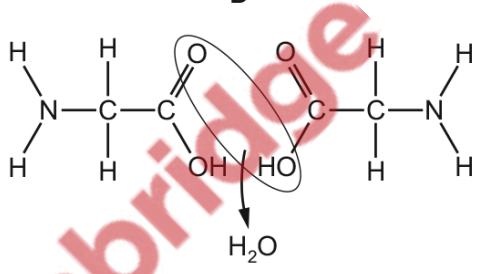
B



C



D



---

386. 9700_s19_qp_12 Q: 8

In enzyme-catalysed reactions, the position of the amino acids found at the active site is important.

During the synthesis of enzymes, amino acids are brought together in the correct position to form the active site.

Which levels of protein structure **must** be involved in forming the active site?

	level of protein structure			
	primary	secondary	tertiary	quaternary
A	✓	✓	✓	✓
B	✓	✓	✓	✗
C	✗	✓	✓	✓
D	✗	✓	✗	✓

key

✓ = involved

✗ = not involved

---

387. 9700_s19_qp_12 Q: 9

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 bonds between collagen molecules

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1 and 3 only

D 2, 3 and 4 only

---

388. 9700_s19_qp_13 Q: 13

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

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

---

389. 9700_s19_qp_13 Q: 14

Which levels of protein structure would always be changed if an enzyme works by the induced fit hypothesis?

	primary	secondary	tertiary	quaternary
A	✓	✓	✓	✓
B	✓	✓	✗	✗
C	✗	✓	✗	✗
D	✗	✗	✓	✗

key

✓ = always changed

✗ = not changed

---

390. 9700_w19_qp_11 Q: 11

Some foods contain hydrogenated vegetable oils. These are unsaturated fats that have been converted to saturated fats.

Which property of the fats will have changed?

A Their hydrocarbon chains will fit together more closely.

B Their solubility in water will increase.

C They will have more double bonds in their molecules.

D They will remain liquid at room temperature.

---

391. 9700_w19_qp_11 Q: 12

Which statements could be used to describe enzyme molecules **and** antibody molecules?

1 Hydrogen bonds stabilise the structure of the protein and are important for it to function efficiently.

2 Hydrophilic R-groups point in to the centre of the molecule and cause it to curl into a spherical shape.

3 The tertiary structure of the protein molecule plays an important role in the functioning of the protein.

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

---

392. 9700_w19_qp_12 Q: 9

Which rows show the chemical groups present in the biological molecules listed?

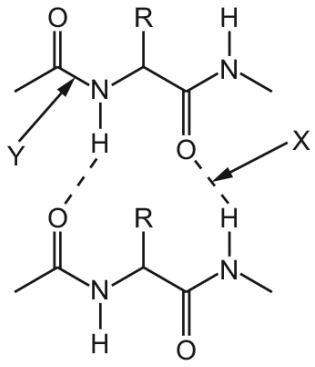
	biological molecule	presence of carboxyl (COOH) groups	presence of two or more hydroxyl (OH) groups
1	amino acid	yes	no
2	β-glucose	no	yes
3	glycerol	no	no
4	fatty acid	yes	no

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

---

393. 9700_w19_qp_12 Q: 11

Fibrous proteins are composed of chains of amino acids held together by bonds. An example of part of a fibrous protein is shown.



Which type of bond is at X and Y?

	X	Y
A	disulfide	hydrophobic interaction
B	hydrogen	peptide
C	hydrophobic interaction	ionic
D	ionic	peptide

394. 9700_w19_qp_12 Q: 12

Which row about the structure of proteins is correct?

	primary structure	secondary structure	quaternary structure
A	is the number of amino acids present in a protein	is the left-handed spiral formed by the primary structure	is the sub-unit polypeptides that link together to form a protein
B	is the order of amino acids present in a protein encoded by DNA	is the coiling of a chain of amino acids to form a β-pleated sheet or α-helix	contains two types of polypeptide that interact forming the shape of a protein
C	is the result of translation of an mRNA molecule by a ribosome into a chain of amino acids	occurs because of attraction between hydrogen and oxygen atoms in the peptide bonds	is formed by four polypeptides and an additional reactive group attached to the protein
D	is the sequence of amino acids in a protein coded by an mRNA molecule	is formed by hydrogen bonding between amino acids forming the primary structure	is formed by the linking together of more than one polypeptide to form a protein

---

395. 9700_w19_qp_12 Q: 13

A student wrote four statements about water.

1 Water has a high specific heat capacity which maintains the temperature of water within cells.

2 Mammals rely on water having a relatively low latent heat of vapourisation to keep them cool.

3 When a negatively charged ion is added to water, the δ^+ charge on the hydrogen atom is attracted to the ion.

4 When surrounded by water, non-polar molecules tend to be pushed apart from one another.

Which statements are correct?

	1	2	3	4
A	✓	✗	✓	✓
B	✓	✗	✓	✗
C	✗	✓	✗	✓
D	✗	✓	✗	✗

key
✓ = correct
✗ = not correct

---

396. 9700_w19_qp_13 Q: 9

Three proteins that have a quaternary structure are listed.

- Type IX collagen is formed from three different polymers.
- The main form of haemoglobin contains two alpha globins and two beta globins.
- HIV protease consists of two identical polymers.

Which row shows the correct number of genes needed to code for each protein?

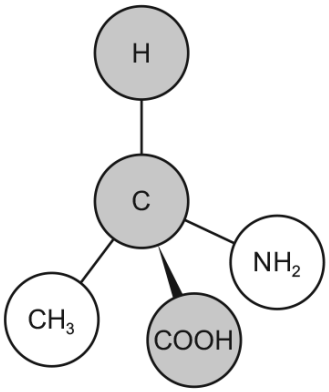
	number of genes		
	type IX collagen	haemoglobin	HIV protease
A	1	2	2
B	1	4	1
C	3	2	1
D	3	4	2

397. 9700_w19_qp_13 Q: 10

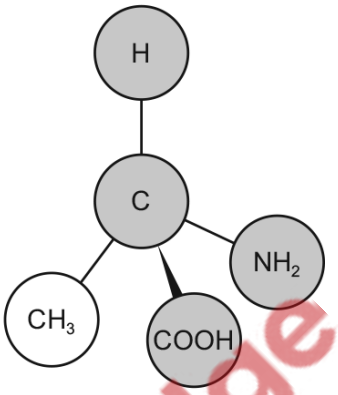
The diagrams show the structure of an amino acid with some parts of the molecule shaded.

Which diagram shows the shaded part of the molecule that is common to all amino acids?

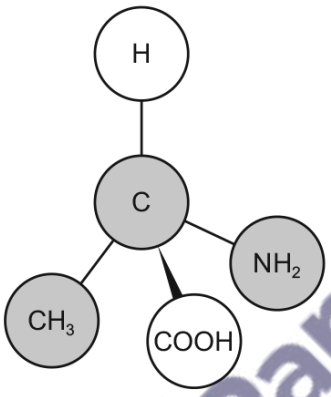
A



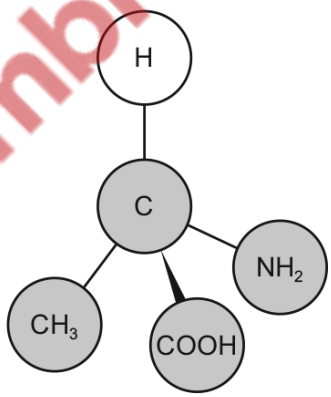
B



C



D



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398. 9700_w19_qp_13 Q: 11

Some extracellular protease enzymes are synthesised in an inactive form called zymogen.

Zymogen is converted to the active protease in the Golgi body.

What is the purpose of producing zymogen before converting it to the extracellular protease?

A to avoid unwanted digestion of proteins inside the cell

B to avoid unwanted digestion of proteins outside the cell

C to catalyse digestion of proteins in the cytoplasm

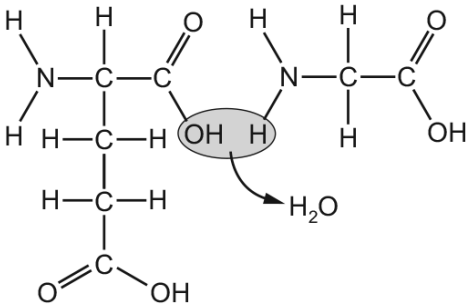
D to catalyse digestion of proteins in the rough endoplasmic reticulum

---

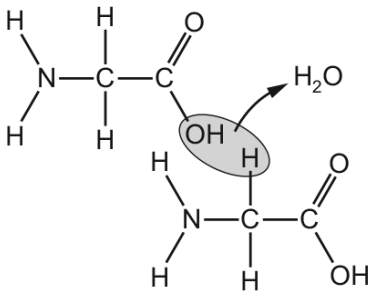
399. 9700_m18_qp_12 Q: 9

Which diagram correctly shows the formation of a peptide bond between two amino acids?

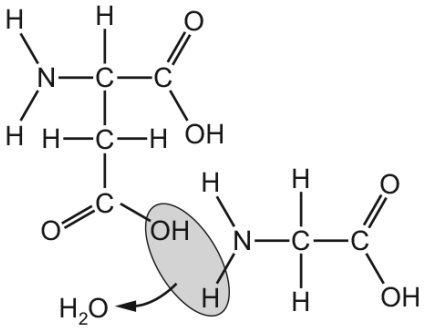
A



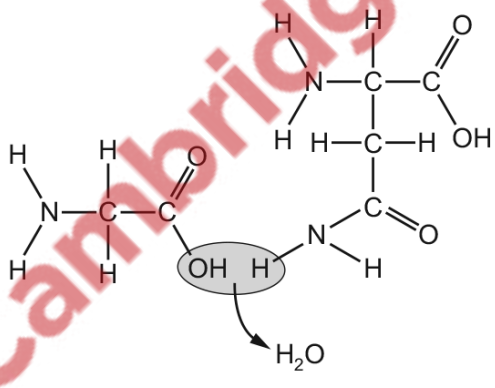
B



C



D



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400. 9700_m18_qp_12 Q: 11

Which molecules are globular proteins?

1 amylase

2 haemoglobin

3 DNA polymerase

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

---

401. 9700_m18_qp_12 Q: 12

When hydrolysed, which molecules have products containing a carboxyl group?

1 phospholipids

2 polysaccharides

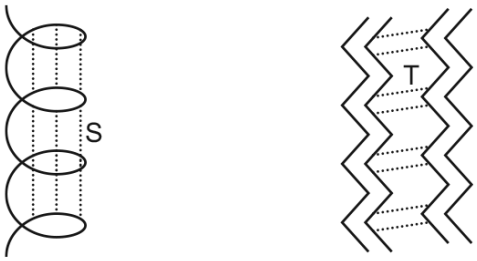
3 proteins

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

---

402. 9700_s18_qp_11 Q: 10

The diagrams show two arrangements of amino acids in a protein.



Which row correctly names the bonds at S or T?

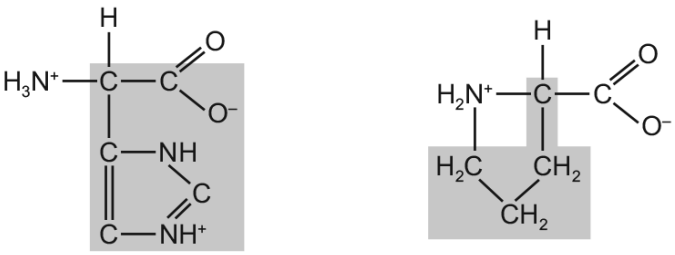
	ionic bond	hydrogen bond
A	absent	S and T
B	S only	T only
C	S and T	absent
D	T only	S and T

403. 9700_s18_qp_11 Q: 11

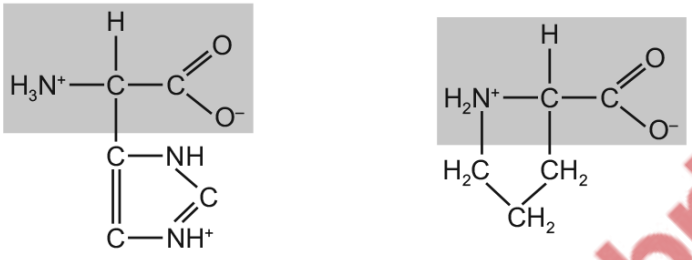
Students were asked to highlight only the R groups of two ring-shaped amino acids.

Which pair of diagrams are correct for both amino acids?

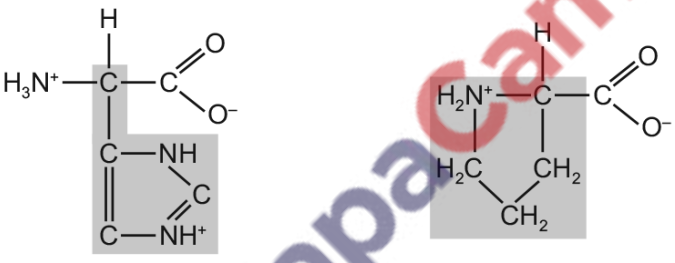
A



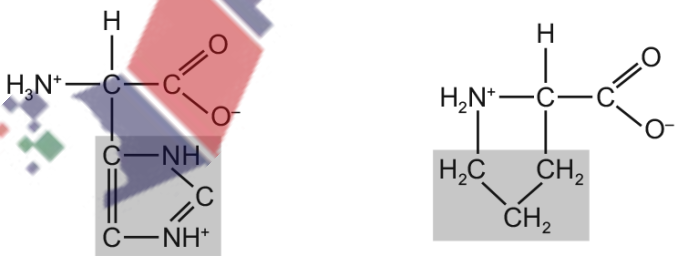
B



C



D



404. 9700_s18_qp_12 Q: 10

Which molecules contain C=O bonds?

1 amino acids

2 fatty acids

3 glycerol

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

---

405. 9700_s18_qp_12 Q: 11

Which row describes a collagen molecule?

	bonds stabilising the molecule	properties	primary structure	helix
A	disulfide	high temperatures increase flexibility	high proportion of glycine	double
B	disulfide	resistant to stretching	repeat sequences of three amino acids	single
C	hydrogen	high tensile strength	repeat sequences of three amino acids	triple
D	hydrogen	insoluble in water	high proportion of glycine and proline	alpha

---

406. 9700_s18_qp_13 Q: 11

Which description is correct for collagen?

A A collagen molecule has a high proportion of the amino acid glycine, which has a very small R group.

B A group of three collagen fibres forms a strong, insoluble coiled structure termed a triple helix.

C Each of the collagen polypeptides in a collagen molecule has a regular spiral arrangement of many alpha helices.

D Peptide bonds are present between amino acids of the different polypeptides forming the collagen molecule.

---

407. 9700_s18_qp_13 Q: 12

Which statement about the properties of water is correct?

A Bonds between hydrogen atoms cause water to have a high specific heat capacity.

B The high latent heat of vaporisation of water is due to the presence of hydrogen bonds.

C The high specific heat capacity of water causes cooling during evaporation.

D Water can dissolve amylopectin as it has hydrophilic side chains.

---

408. 9700_w18_qp_11 Q: 11

Which statements about a peptide bond are correct?

1 It joins two monomers which are always identical to each other.

2 It contains four different atoms.

3 It can be broken by the addition of water at room temperature.

4 It is important in the primary structure of proteins.

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

---

409. 9700_w18_qp_11 Q: 12

Which statements about the primary structure of a protein are correct?

1 It may be branched.

2 It is determined by the sequence of DNA bases.

3 It is unique to that protein.

4 It determines the tertiary structure of the protein.

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

---

410. 9700_w18_qp_11 Q: 13

A mutation occurred within the DNA sequence coding for an enzyme, causing a decrease in the rate of a reaction catalysed by this enzyme.

Which statements could explain the decrease in the rate of reaction?

1 An inhibitor for this enzyme has an increased affinity for the enzyme and forms an enzyme–inhibitor complex more easily.

2 The active site of the enzyme might have changed shape and so is no longer complementary.

3 The activation energy for the reaction with the mutated enzyme is greater than with the non-mutated enzyme.

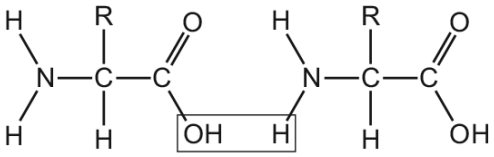
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

---

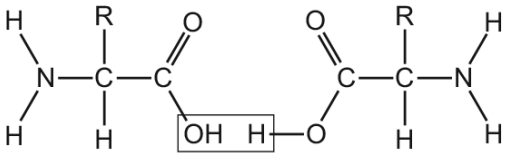
411. 9700_w18_qp_12 Q: 10

Which diagram shows where a peptide bond would be formed?

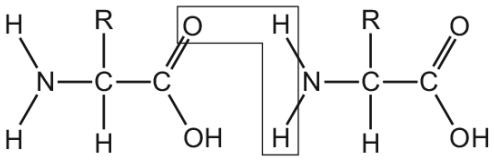
A



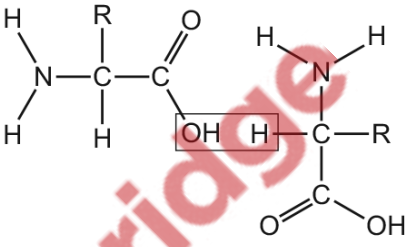
B



C



D



412. 9700_w18_qp_12 Q: 11

Which statements about collagen molecules are correct?

1 Both types of secondary structure occur within the molecules.

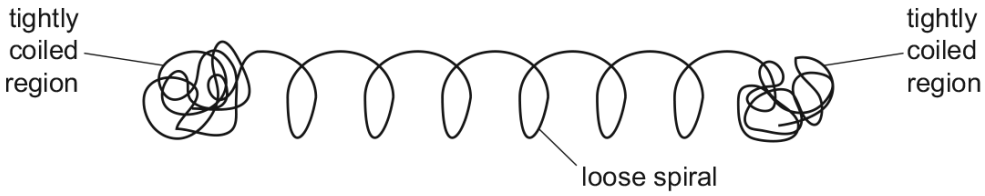
2 Large numbers of hydrogen bonds stabilise the molecules.

3 Repeated amino acid sequences determine the tertiary structure.

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

413. 9700_w18_qp_12 Q: 12

The protein glutenin gives bread dough its elasticity. The diagram represents a polypeptide of glutenin.



What describes the structure of glutenin?

A quaternary structure because there are both globular and fibrous regions

B quaternary structure because there are both spiral and tightly coiled regions

C secondary structure because the loose spiral is an α-helix

D tertiary structure because the different regions form a 3D shape

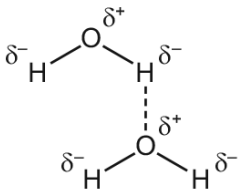
---

414. 9700_w18_qp_12 Q: 13

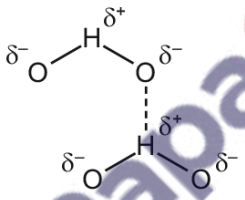
Which diagram correctly shows hydrogen bonding between water molecules?

The symbol δ indicates the partial charge on an atom in the water molecule.

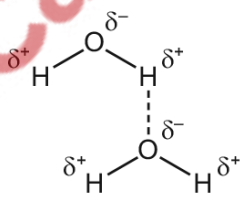
A



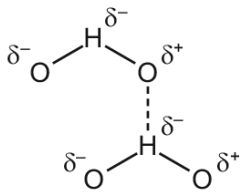
B



C



D



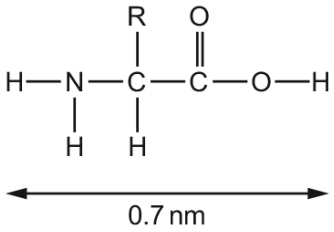
---

415. 9700_w18_qp_13 Q: 12

The table shows the diameter of some atoms when they form bonds.

atom	single bond / nm	double bond / nm
H	0.060	–
O	0.132	0.110
N	0.140	0.120
C	0.154	0.134

The approximate length of the amino acid shown was estimated using the figures in the table.



What would be the approximate length of a dipeptide formed using this amino acid?

A 0.9 nm **B** 1.2 nm **C** 1.4 nm **D** 1.7 nm

---

416. 9700_w18_qp_13 Q: 14

Some animals produce antimicrobial proteins which protect them from pathogens. These proteins could be used to kill human pathogens, however when used as a medicine they are broken down by protein-digesting enzymes.

Replacing one of the amino acids found in the protein with one that had been synthesised in the laboratory resulted in a modified protein that was not broken down.

What could explain why this modified protein was not broken down by the protein digesting enzymes?

1 The modified protein has a different tertiary structure to the original protein.

2 The modified protein is not complementary in shape to the enzyme's active site.

3 The modified protein is unable to induce a fit with the protein digesting enzyme.

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

---

417. 9700_m17_qp_12 Q: 10

Some of the molecules found in animal tissues are grouped into three lists.

1 glucose, cholesterol, triglycerides, water

2 glycogen, antibodies, adenine, phospholipids

3 haemoglobin, carbon dioxide, mRNA, monosaccharides

Which lists include one or more molecules that always contain nitrogen atoms?

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

---

418. 9700_m17_qp_12 Q: 11

Haemoglobin consists of two α chains and two β chains. Approximately 5% of all humans have one amino acid in the β chain that has been changed, affecting the structure and stability of haemoglobin.

Which of the levels of protein structure could be changed in the haemoglobin of these humans?

A primary only

B primary and quaternary only

C primary, secondary, tertiary and quaternary

D secondary, tertiary and quaternary only

---

419. 9700_m17_qp_12 Q: 12

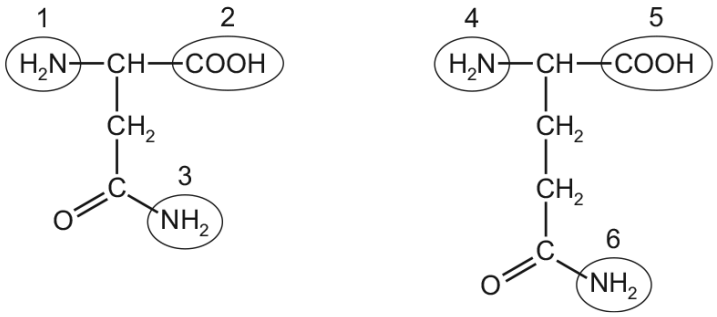
Which row gives the correct description of **both** a collagen molecule and a collagen fibre?

	collagen molecule	collagen fibre
A	α and β polypeptide chains forming a double helix, held together by disulfide bonds	molecules of collagen arranged randomly to each other, linked by hydrogen bonds
B	a polypeptide chain, with repeating amino acids, forming an α-helix	three molecules of collagen, forming a triple helix, held together by hydrogen bonds
C	a polypeptide chain, with three repeating amino acids, forming a helix	three α helical collagen molecules, forming a triple helix, held together by ionic bonds
D	three helical polypeptide chains, forming a triple helix, held together by hydrogen bonds	molecules of collagen lying parallel and cross-linked to each other

---

420. 9700_m17_qp_12 Q: 13

The diagrams show the structures of two amino acids, each of which has two amine ($-NH_2$) groups.



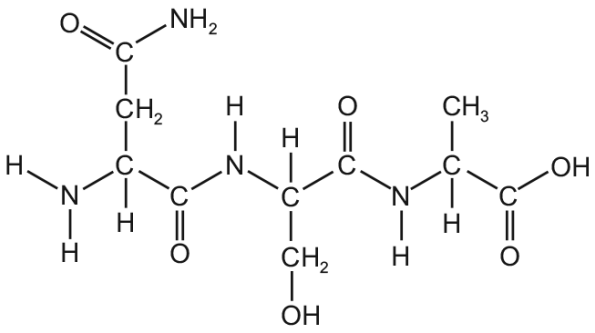
A peptide bond is formed between the two amino acids.

Which groups could form the peptide bond?

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

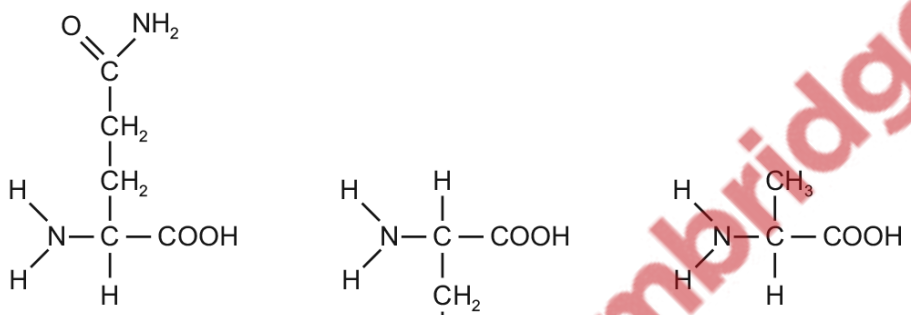
421. 9700_s17_qp_11 Q: 11

The diagram shows the molecular structure of a peptide.

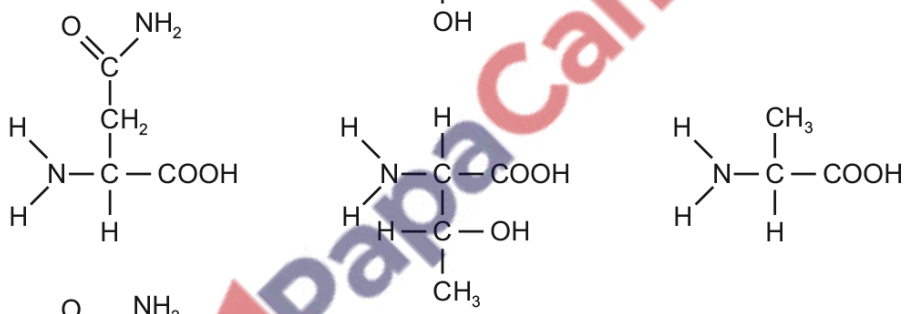


Which molecules would result from the complete hydrolysis of the peptide?

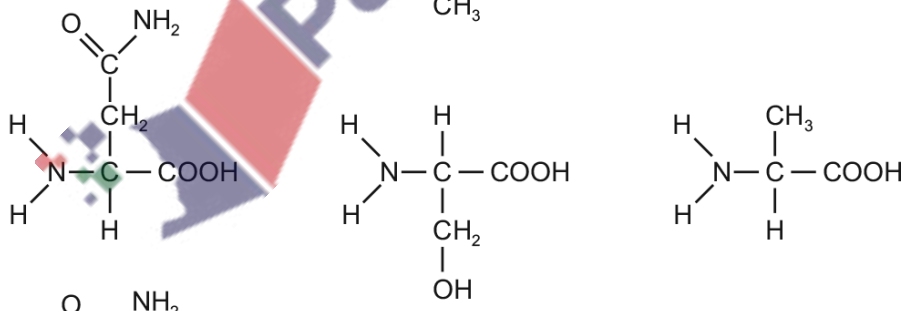
A



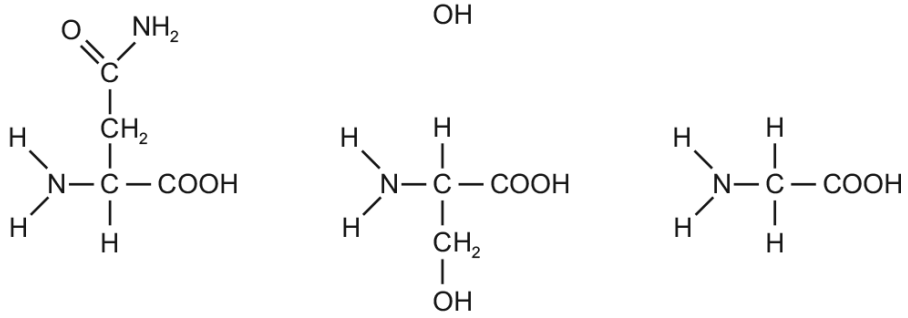
B



C

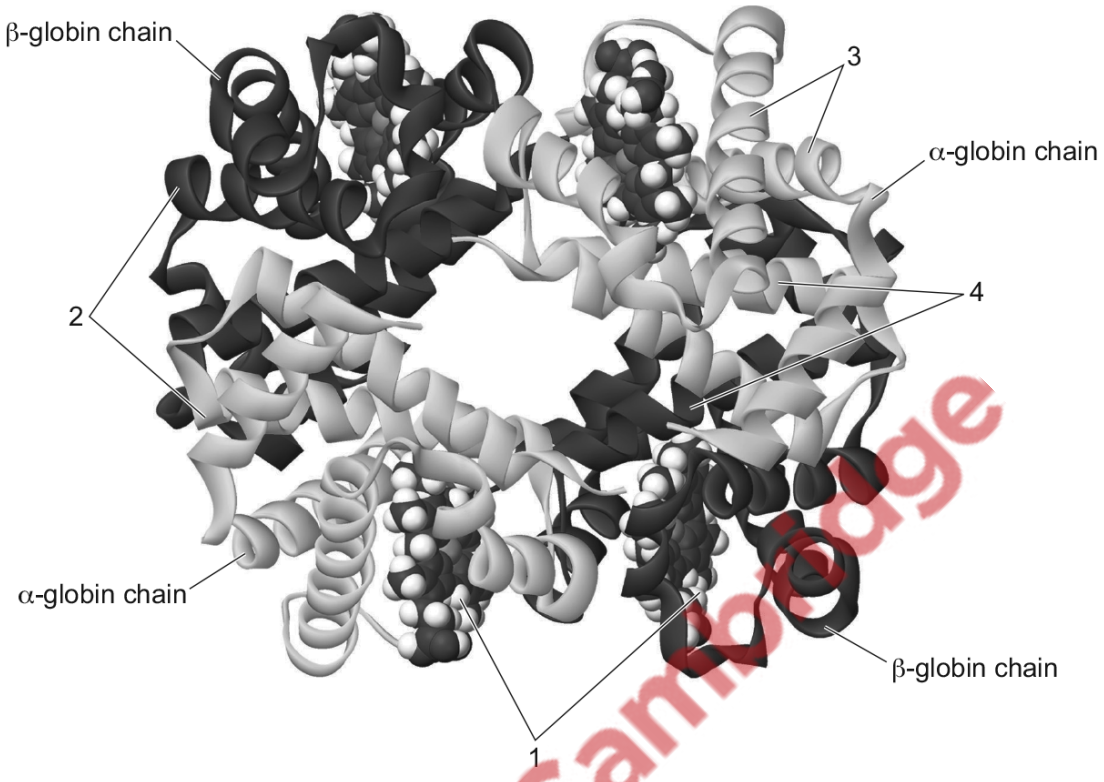


D



422. 9700_s17_qp_11 Q: 12

The diagram shows a haemoglobin molecule.



Which row identifies the different parts of the molecule?

	1	2	3	4
A	α-helix	β-pleated sheet	binding site	hydrophobic amino acids
B	binding site	hydrophilic amino acids	α-helix	hydrophobic amino acids
C	haem group	hydrophobic amino acids	α-helix	hydrophilic amino acids
D	hydrophobic amino acids	β-pleated sheet	haem atom	binding site

423. 9700_s17_qp_12 Q: 5

Boiling the bones and teeth from dead animals can be used to produce a type of glue.

The glue is formed from the collagen fibres present in bones and teeth.

Which statement describes the changes to collagen that occur when the glue is produced?

A The fibres of collagen become more coiled.

B The fibres of collagen become more flexible.

C The helices of collagen molecules unwind.

D The molecules of collagen dissolve in water.

---

424. 9700_s17_qp_12 Q: 6

What describes the primary structure of a protein?

A α-helix

B a dipeptide

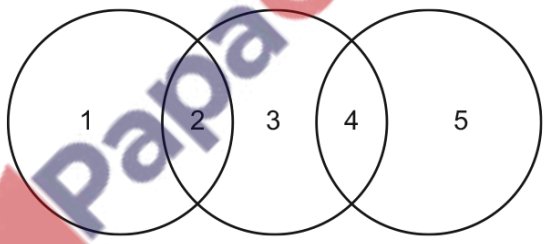
C a globular structure

D the specific order of amino acids

---

425. 9700_s17_qp_13 Q: 7

The diagram shows some of the relationships between cellulose, collagen and haemoglobin.



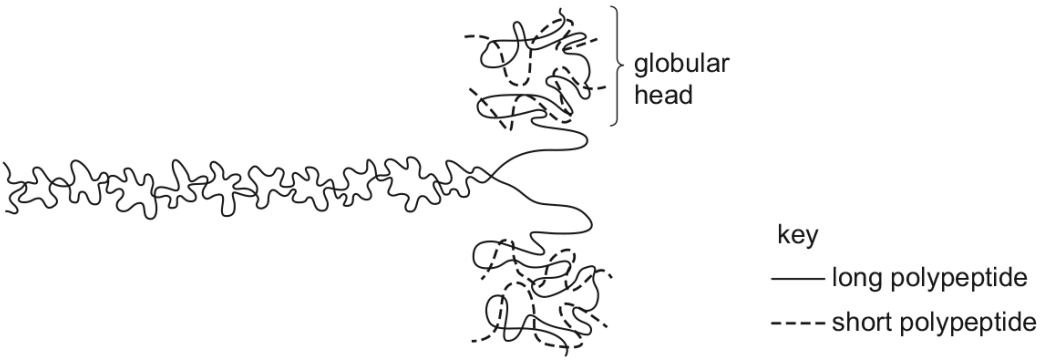
Which row is correct?

	1	2	3	4	5
A	cellulose	carbohydrate	collagen	protein	haemoglobin
B	cellulose	fibrous	haemoglobin	structural	collagen
C	haemoglobin	globular	cellulose	carbohydrate	collagen
D	haemoglobin	protein	collagen	structural	cellulose

---

426. 9700_s17_qp_13 Q: 8

The diagram shows a protein molecule.



Two long polypeptides each form α-helices for much of their length and these twist together into a fibre.

At one end, each of these polypeptides coils into a globular head.

Two short polypeptides bind to each head.

What describes the protein structure of this molecule?

A quaternary structure because each molecule consists of six polypeptides

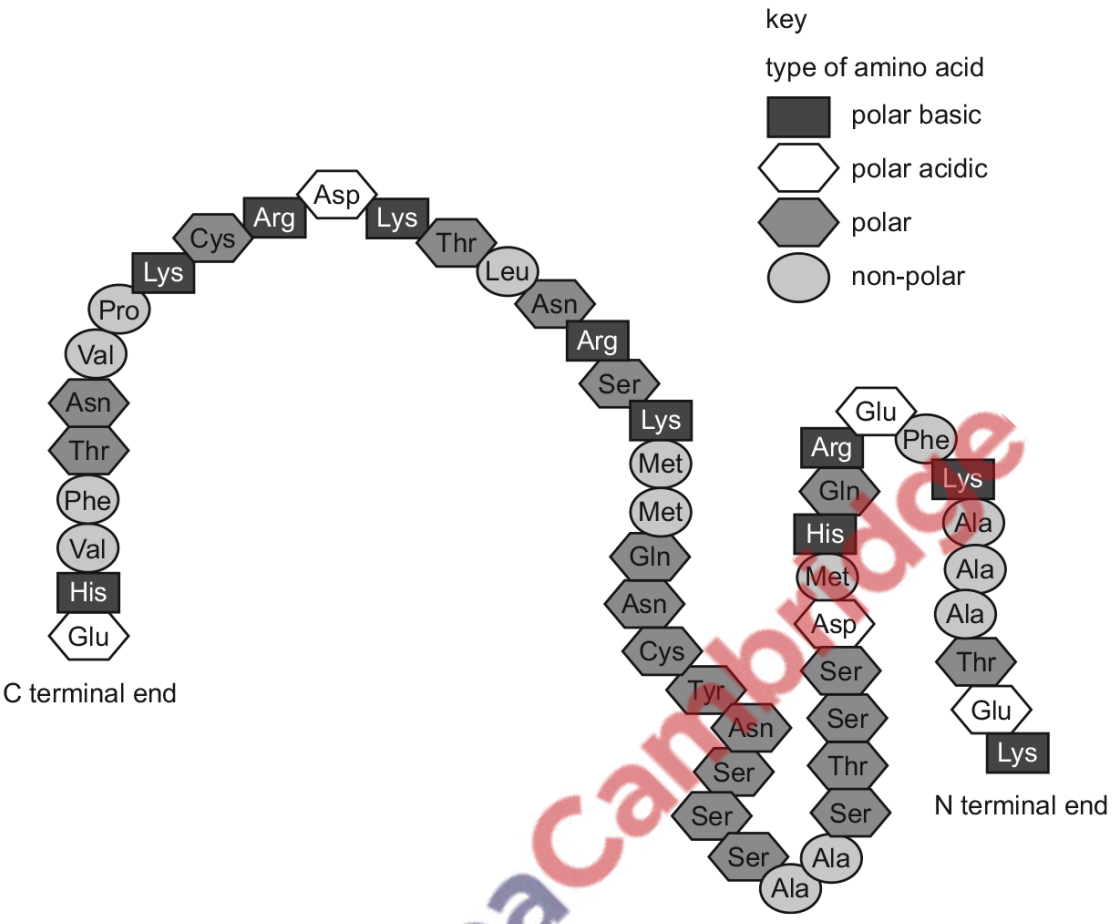
B secondary structure because the long polypeptides form α-helices

C tertiary structure because the α-helices form a fibre

D tertiary structure because the heads form globular proteins

427. 9700_w17_qp_11 Q: 9

The diagram shows the amino acids in a polypeptide.



An enzyme catalyses the hydrolysis of bonds between polar basic amino acids and non-polar amino acids.

How many peptides (chains of amino acids) will be formed as the result of the hydrolysis of this polypeptide?

A 5 **B** 6 **C** 8 **D** 13

---

428. 9700_w17_qp_11 Q: 10

Lysozyme is an enzyme found in tears and saliva.

Which statement refers only to the tertiary structure of lysozyme?

A A section of the molecule consists of an α-helix.

B It consists of a single polypeptide.

C It is 129 amino acids long.

D The 35th and 52nd amino acids help form the active site.

---

429. 9700_w17_qp_12 Q: 11

Which row correctly matches the functional and structural features of cellulose, collagen, glycogen or triglyceride?

	molecule	function	structure		
			fibrous	molecules held together by hydrogen bonds	branched chains
A	cellulose triglyceride	support energy source	✓ ✗	✓ ✗	✗ ✗
B	collagen cellulose	strengthening support	✓ ✓	✓ ✗	✗ ✓
C	collagen glycogen	strengthening storage	✓ ✗	✓ ✗	✓ ✓
D	glycogen triglyceride	storage energy source	✗ ✗	✓ ✓	✓ ✗

key ✓ = true ✗ = false

---

430. 9700_w17_qp_12 Q: 12

A polypeptide has a number of amino acids (*n*).

How many peptide bonds and R groups (side chains) does this polypeptide have?

A *n* – 1 peptide bonds and *n* – 1 R groups

B *n* – 1 peptide bonds and *n* R groups

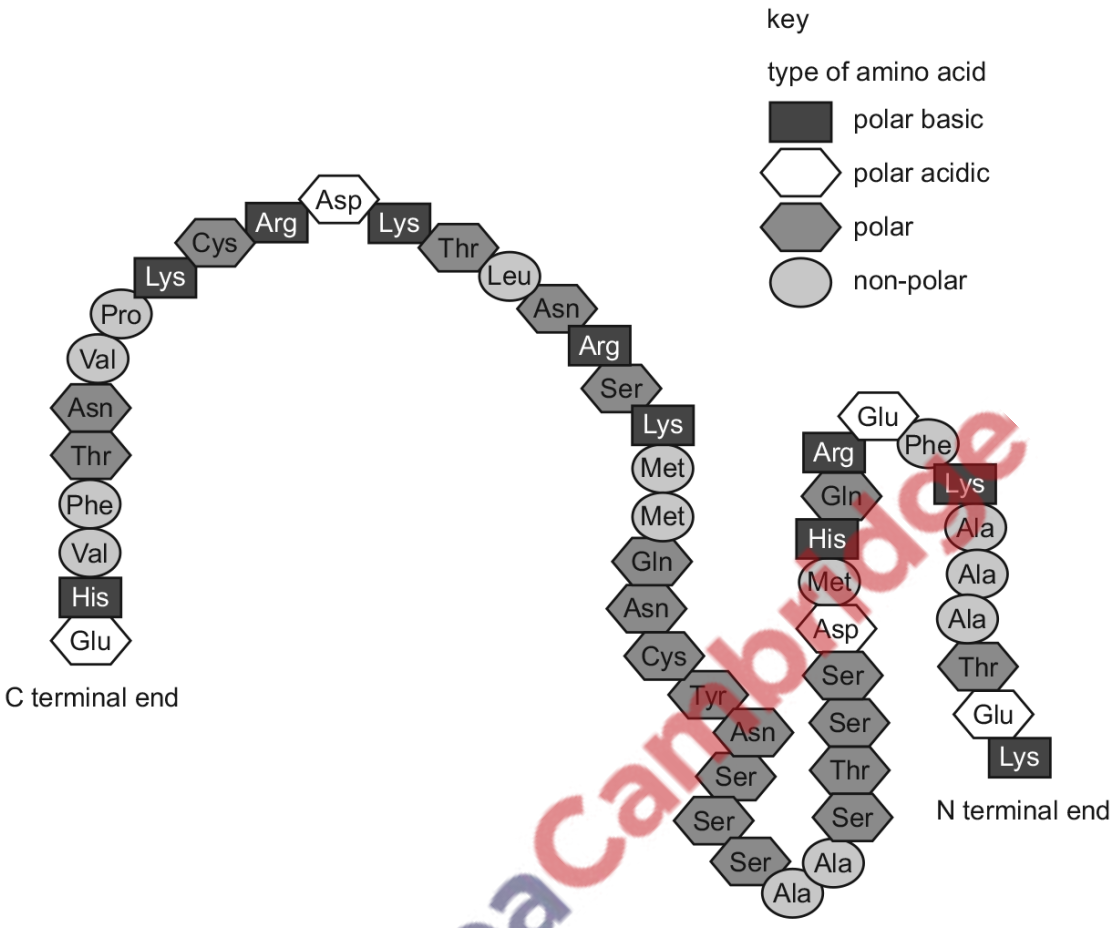
C *n* peptide bonds and *n* – 1 R groups

D *n* peptide bonds and *n* R groups

---

431. 9700_w17_qp_13 Q: 9

The diagram shows the amino acids in a polypeptide.



An enzyme catalyses the hydrolysis of **any** peptide bond between a non-polar amino acid **and** any polar amino acid.

How many small peptides and single amino acids will be formed by the action of this enzyme?

	small peptides	single amino acids
A	6	1
B	8	1
C	12	3
D	13	4

432. 9700_w17_qp_13 Q: 10

A person with diabetes is unable to make enough of the protein insulin.

Some forms of diabetes can be treated by using insulin produced by animals. Scientists have compared the amino acids in insulin produced by animals to human insulin.

Which level of protein structure were the scientists studying?

A primary

B secondary

C tertiary

D quaternary

---

433. 9700_w17_qp_13 Q: 12

Which levels of protein structure are maintained by disulfide bonds?

A secondary, tertiary and quaternary

B tertiary and quaternary only

C quaternary only

D tertiary only

---

434. 9700_m16_qp_12 Q: 10

When proteins are mixed with some organic solvents, hydrophobic interactions and hydrogen bonding are changed in the protein molecules.

Which levels of protein structure would be affected?

	level of protein structure		
	secondary	tertiary	quaternary
A	✓	✓	✗
B	✓	✗	✓
C	✗	✓	✓
D	✓	✓	✓

key

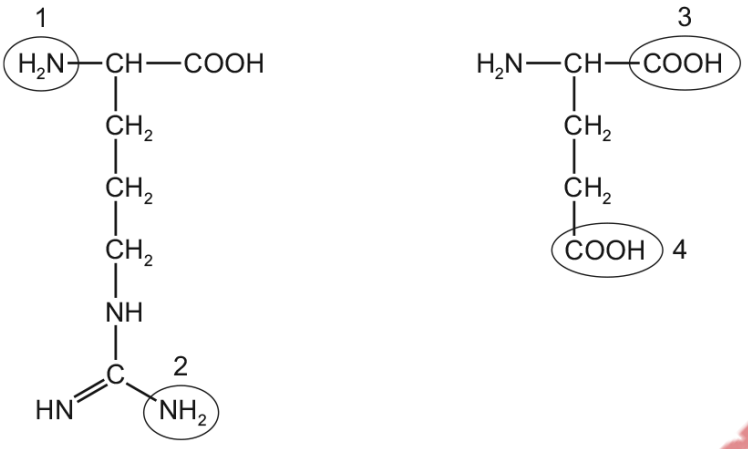
✓ = affected

✗ = not affected

---

435. 9700_s16_qp_11 Q: 10

The diagrams show the structures of two amino acids, one of which has two amine ($-NH_2$) groups and the other has two carboxylic (–COOH) groups.



A peptide bond is formed between the two amino acids.

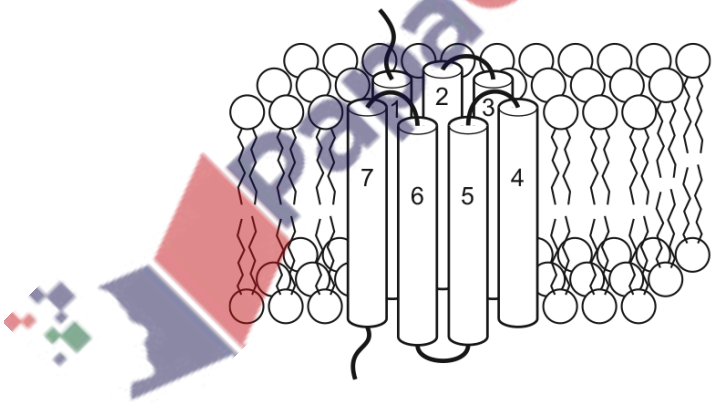
Which groups form the peptide bond?

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

---

436. 9700_s16_qp_11 Q: 11

Proteins which transport sugars out of cells have been identified. These proteins are called SWEETs. Each SWEET has seven coiled, cylindrical regions which together make up a pore through the cell surface membrane bilayer, as shown in the diagram.



What describes each of the seven coiled regions (1-7) of a SWEET shown in the diagram?

A primary structure held in its shape by bonds such as hydrogen bonds

B primary structure held in its shape by peptide bonds

C secondary structure held in its shape by bonds such as hydrogen bonds

D secondary structure held in its shape by peptide bonds

---

437. 9700_s16_qp_12 Q: 7

Which statement about the quaternary structure of proteins is correct?

A consists of four subunits

B depends on the presence of metal ions

C depends on the primary structure of the subunits

D is made of α and β subunits

---

438. 9700_s16_qp_12 Q: 8

Which set of statements correctly describes haemoglobin?

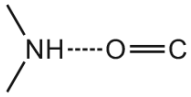
A	four polypeptide chains, each containing a haem group	iron ions can associate with oxygen forming oxyhaemoglobin	in each chain, hydrophobic R groups of amino acids point towards the centre of the molecule	at 50 % saturation, two oxygen molecules are transported by the molecule
B	polypeptide chains interact to produce a globular chain	each chain contains a haem group of amino acids surrounding an iron ion	consists of two identical alpha chains and two identical beta chains	each chain can transport an oxygen molecule
C	polypeptide chains interact to produce an almost spherical molecule	an iron ion is present within each haem group	quaternary structure has two alpha chains and two beta chains	each molecule can transport a total of four oxygen atoms
D	polypeptide chains produce a loose helical shape, which folds to form a spherical molecule	iron ions in the molecule can bind reversibly with oxygen	in each chain, hydrophobic R groups of amino acids surround the iron ion	each molecule can transport a total of eight oxygen atoms

---

439. 9700_s16_qp_12 Q: 9

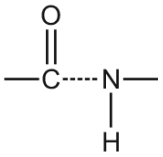
The diagrams show different types of bond found in biological molecules.

1

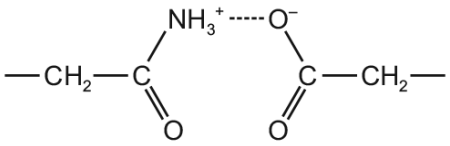


2

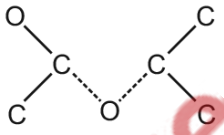
3



4



5



Which bonds are found in proteins with a tertiary structure?

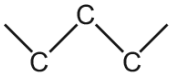
A 1, 2, 3 and 4 **B** 2, 3, 4 and 5 **C** 1 and 5 **D** 2 and 4 only

---

440. 9700_w16_qp_11 Q: 10

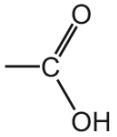
The diagrams show some of the types of bond in fatty acids.

1



2

3



Which row shows the bonds found in each type of molecule?

	unsaturated fatty acid	saturated fatty acid
A	1, 2 and 3	1 and 3 only
B	1, 2 and 3	2 and 3 only
C	1 and 3 only	1, 2 and 3
D	2 and 3 only	1, 2 and 3

---

441. 9700_w16_qp_11 Q: 11

What could describe the tertiary structure of a protein?

1 α-helix

2 a globular structure

3 the specific order of amino acids

4 a specific three-dimensional (3D) shape

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

---

442. 9700_w16_qp_12 Q: 10

The table shows some features of collagen and haemoglobin.

Which row is collagen?

	type of protein	number of polypeptides	solubility in water
A	fibrous	three	insoluble
B	fibrous	four	soluble
C	globular	three	insoluble
D	globular	four	soluble

---

443. 9700_w16_qp_12 Q: 12

What is the minimum number of carbon atoms in an amino acid?

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

---

444. 9700_w16_qp_12 Q: 13

HIV-1 protease is an enzyme produced by the HIV virus.

Two identical chains of 99 amino acids form the enzyme. In each chain, amino acids 25, 26 and 27 in the sequence form part of the active site.

Which orders of protein structure control the shape of the active site?

A primary, secondary, tertiary and quaternary

B primary, secondary and tertiary only

C primary and quaternary only

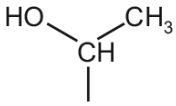
D quaternary only

---

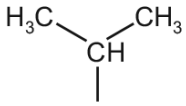
445. 9700_w16_qp_13 Q: 9

Threonylvaline is a dipeptide formed from the two amino acids, threonine and valine. A peptide bond forms between the carboxyl group of threonine and the amine group of valine.

The side-chains (R groups) of the two amino acids are shown.



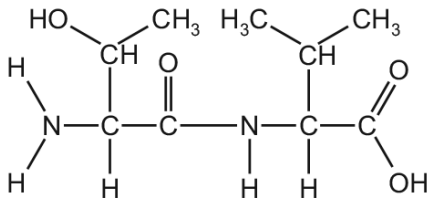
threonine



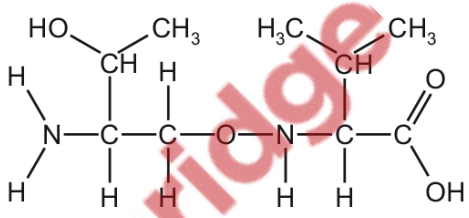
valine

Which molecular structure is threonylvaline?

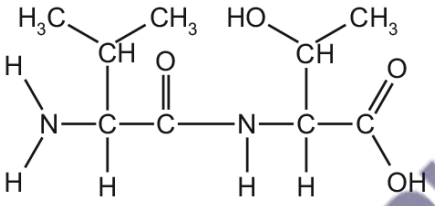
A



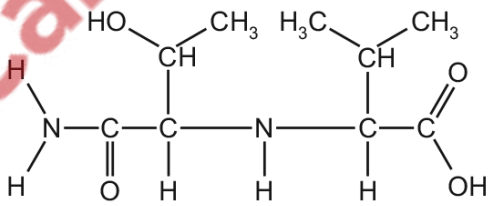
B



C



D



446. 9700_w16_qp_13 Q: 10

Which feature explains why haemoglobin is soluble?

A All four polypeptide chains are linked together to form a spherical molecule.

B Each polypeptide chain folds due to interactions between hydrophobic R groups.

C The hydrophilic R groups are arranged around the outside of the molecule.

D The iron-containing haem group of each polypeptide chain is water soluble.

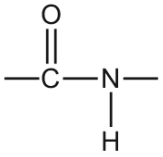
447. 9700_s15_qp_11 Q: 8

The diagrams show different types of bond found in biological molecules.

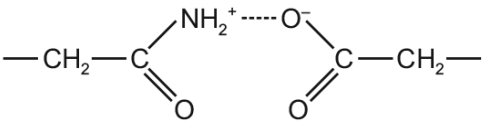
1

2

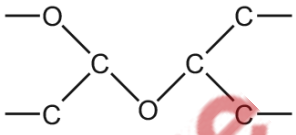
3



4



5



Which combination of bonds could **not** be found in a protein with a tertiary structure?

A 1, 2, 3 and 4 **B** 1, 2 and 4 only **C** 3 and 5 **D** 5 only

---

448. 9700_s15_qp_11 Q: 11

Which description is correct?

A A collagen molecule has a high proportion of the amino acid glycine, which has a very small side chain.

B A group of three collagen fibres forms a strong, insoluble coiled structure termed a triple helix.

C Each of the collagen polypeptides in a collagen molecule has a regular spiral arrangement of many alpha helices.

D Peptide bonds are present between amino acids of the same polypeptide and between the different polypeptides forming the collagen molecule.

---

449. 9700_s15_qp_11 Q: 12

Polar molecules form hydrogen bonds with each other.

Which properties of water result from its molecules being polar?

1 good solvent
2 high specific heat capacity
3 high surface tension
4 cohesive

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

---

450. 9700_s15_qp_12 Q: 7

Which type of bond holds together an α-helix or β-pleated sheet of a protein?

A disulfide
B hydrogen
C ionic
D peptide

---

451. 9700_s15_qp_12 Q: 8

What describes only the quaternary structure of haemoglobin?

1 α-helix
2 a dipeptide
3 a globular structure
4 the specific order of amino acids
5 four polypeptide chains joined together

A 1, 2 and 3 **B** 2, 4 and 5 **C** 1 and 4 **D** 5 only

---

452. 9700_s15_qp_12 Q: 9

The statements are about the properties of water.

1 ability to form hydrogen bonds with other molecules

2 less dense when frozen

3 able to hold a lot of heat

What allows a small insect to rest on the surface of a pond?

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

---

453. 9700_s15_qp_12 Q: 12

Solutions of biological molecules are tested for sugars. The table shows the colours of the solutions after testing.

solution	heated with Benedict's solution	boiled with hydrochloric acid, neutralised, then heated with Benedict's solution
1	blue	orange
2	green	green
3	yellow	red

Which may contain non-reducing sugars?

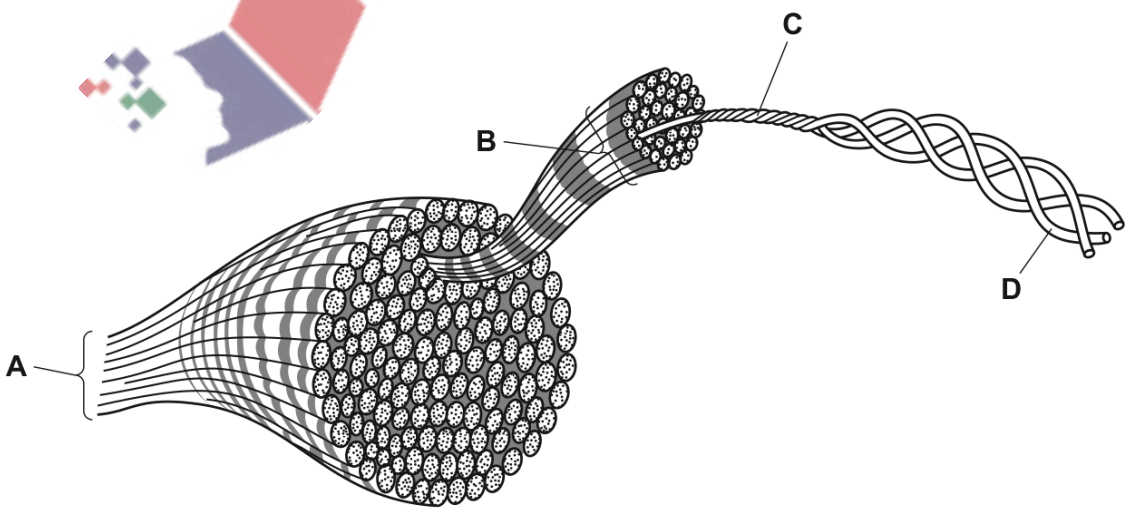
A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

---

454. 9700_s15_qp_13 Q: 8

The diagram shows the three dimensional structure of collagen.

Which labelled part represents a molecule of collagen?



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455. 9700_s15_qp_13 Q: 9

Which type of bond does **not** hold together the tertiary structure of a protein?

A disulfide

B hydrogen

C hydrophobic interactions

D peptide

---

456. 9700_w15_qp_11 Q: 11

When a lake begins to freeze, which properties of water are needed for fish to survive?

1 Water has a high surface tension.

2 Water has a high latent heat of vaporisation.

3 Water has a high thermal capacity.

4 Water has its maximum density at 4 °C.

	1	2	3	4
A	✓	✓	✓	✗
B	✓	✗	✓	✗
C	✗	✓	✗	✓
D	✗	✗	✓	✓

key

✓ = needed

✗ = not needed

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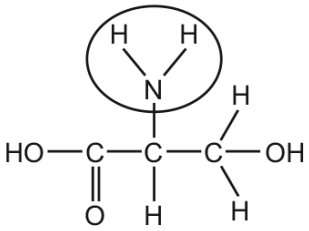
457. 9700_w15_qp_12 Q: 10

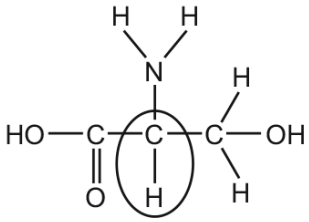
The diagrams show the amino acid serine.

Which circled area is different in all other amino acids?

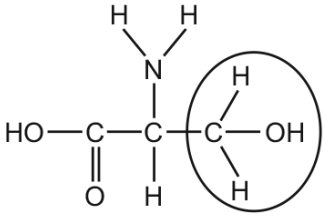
A



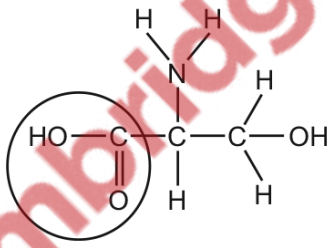
B



C



D



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458. 9700_w15_qp_12 Q: 11

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

---

459. 9700_w15_qp_13 Q: 10

High concentrations of urea break all bonds, except covalent bonds, in protein molecules.

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

A primary

B secondary

C tertiary

D quaternary

---

460. 9700_w15_qp_13 Q: 11

Haemoglobin, a globular protein, consists of four polypeptide chains, two alpha chains and two 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 mutates and codes for valine.

What does this mutation change in the haemoglobin molecule?

A the iron content

B the primary structure

C the quaternary structure

D the secondary structure
