2. Biological Molecules

2.1 Testing for biological molecules

Paper 1

Question Paper

1 Tests for biological molecules were carried out on three solutions. Each solution contained only one type of biological molecule.

The observations were as follows.

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

Which solutions would contain either sucrose or amylase?

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

2 Two solutions, 1 and 2, each contained a mix of two different biological molecules. One solution contained starch and sucrose, and the other contained glucose and protein.

The two solutions were tested with a variety of reagents to identify the presence of the biological molecules in the solution.

The table shows 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

✓ = positive result

✗ = negative result

3 The table shows some steps that can be made in carrying out the Benedict's test.

Which combination of steps is required to carry out a semi-quantitative test on a reducing sugar solution?

	standardise volume of Benedict's solution and volume of test solution	boil with hydrochloric acid and then neutralise with alkali	standardise boiling time with Benedict's solution and compare final colour with numbered colour standards
A	✓	✗	✗
B	✗	✓	✗
C	✓	✗	✓
D	✗	✗	✓

key

✓ = step made

✗ = step not made

4 Which set of steps is the best method for conducting the emulsion test for lipids?

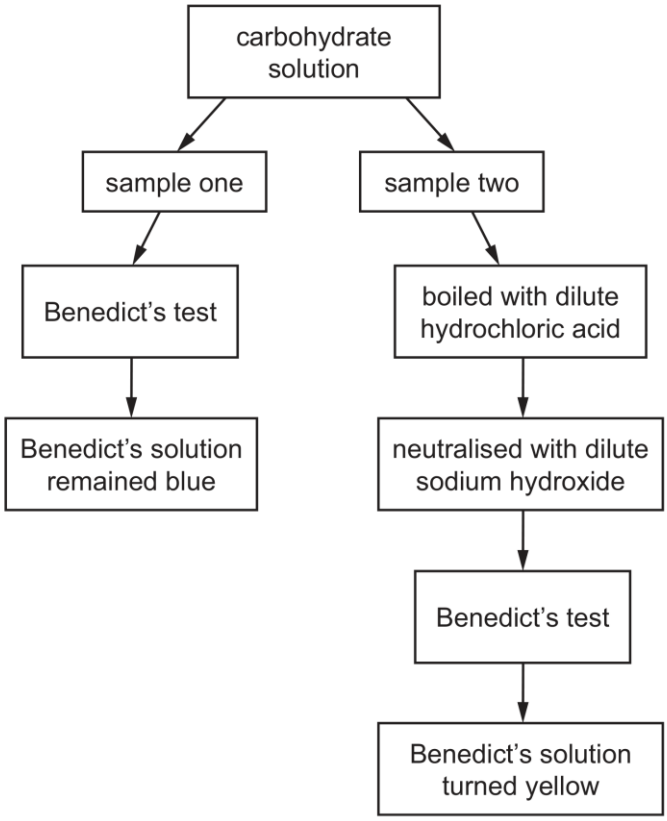
A Add 2 cm^3 of water to the sample.
Pour the water into a test-tube containing 2 cm^3 of ethanol.
Lipids are present if the mixture becomes cloudy.

B Add 2 cm^3 of ethanol to the sample and shake.
Pour the ethanol into a test-tube containing 2 cm^3 of water and boil.
Lipids are present if the mixture becomes clear.

C Add 2 cm^3 of water to the sample and shake.
Pour the water into a test-tube containing 2 cm^3 of ethanol and boil.
Lipids are present if the mixture becomes cloudy.

D Add 2 cm^3 of ethanol to the sample and shake.
Pour the ethanol into a test-tube containing 2 cm^3 of water and shake again.
Lipids are present if the mixture becomes cloudy.

5 A student was provided with a solution of carbohydrate. They removed two samples from the solution and performed tests on each sample, as shown.



Which statement explains the results?

A Condensation reactions occur in sample two to release reducing sugar.

B Glycosidic bonds in a polysaccharide have been broken to release reducing sugar.

C Sample one shows that sucrose is present in the carbohydrate solution.

D The change in colour to a yellow solution shows that glucose is present.

6 The test for non-reducing sugars requires a second Benedict's test to be carried out.

Which set of steps is the correct method for carrying out the non-reducing sugar test **before** carrying out the second Benedict's test?

A Perform the Benedict's test, which gives a negative result.
Warm gently with dilute hydrochloric acid.
Neutralise with sodium hydrogencarbonate.

B Perform the Benedict's test, with the colour of the solution remaining red.
Boil with dilute hydrochloric acid.
Neutralise with sodium hydrogencarbonate.

C Perform the Benedict's test, with the colour of the solution remaining blue.
Boil with dilute hydrochloric acid.
Neutralise with sodium hydrogencarbonate.

D Perform the Benedict's test, which gives a negative result.
Neutralise with sodium hydrogencarbonate.
Warm gently with dilute hydrochloric acid.

7 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 the colour change first 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

8 Samples of glucose, sucrose, and a mixture of glucose and sucrose were divided into two halves **M** and **N**.

M was then tested with Benedict's solution.

N was boiled with dilute hydrochloric acid, neutralised and then tested with Benedict's solution.

The colour of the solution was compared to colour standards.

Which table identifies the correct colour changes for these samples?

A

sample	**M**	**N**
glucose	blue	blue
sucrose	blue	yellow
mixture	blue	yellow

B

sample	**M**	**N**
glucose	yellow	yellow
sucrose	blue	yellow
mixture	blue	yellow

C

sample	**M**	**N**
glucose	yellow	yellow
sucrose	blue	yellow
mixture	yellow	red

D

sample	**M**	**N**
glucose	yellow	red
sucrose	blue	red
mixture	yellow	red

9 Four extracts from different plant materials were made and tested with Benedict's solution.

The extracts were boiled with Benedict's solution for 240 seconds and the final colour was recorded.

extract	colour produced after 240 seconds
1	red
2	yellow
3	blue
4	green

Which sequence of plant extracts represents an increasing quantity of reducing sugar?

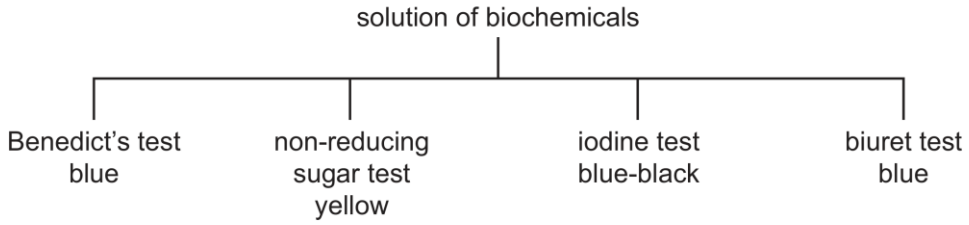
A $1 \rightarrow 2 \rightarrow 4 \rightarrow 3$

B $3 \rightarrow 1 \rightarrow 2 \rightarrow 4$

C $3 \rightarrow 2 \rightarrow 1 \rightarrow 4$

D $3 \rightarrow 4 \rightarrow 2 \rightarrow 1$

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



Which substances are present in the solution?

A non-reducing sugar and starch only

B protein, non-reducing sugar and starch

C starch and reducing sugar

D starch only

11 The table shows the observations recorded from tests for biological molecules on four samples, **A**, **B**, **C** and **D**.

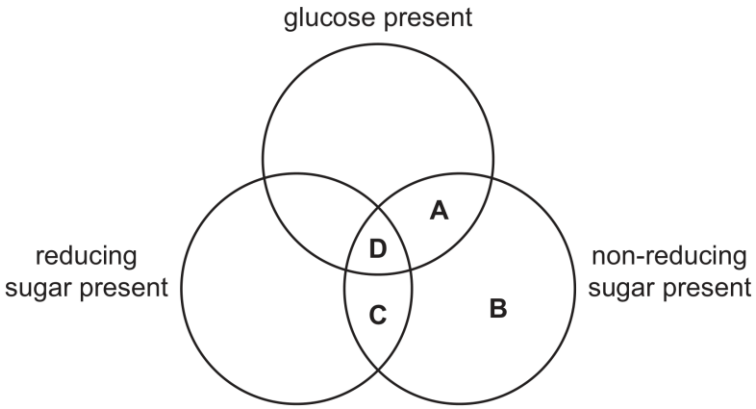
Which conclusion is correct?

	Benedict's solution	biuret reagent	iodine solution	conclusion
A	blue	blue	blue-black	contains starch only
B	blue	purple	orange	contains reducing sugar only
C	green	blue	orange	contains reducing sugar and protein
D	red	blue	blue-black	contains starch and protein

12 A sample of food was heated with Benedict's solution which changed colour to green.

A second sample of the same food was boiled with dilute hydrochloric acid and neutralised using sodium hydrogencarbonate. It was then heated with Benedict's solution which changed colour to red.

What did these results show?



13 A student carries out a semi-quantitative test with Benedict's solution.

Which statement about this procedure is correct?

A It detects only the presence or absence of glucose.

B It provides an indication of relative reducing sugar concentrations.

C The precipitate needs to be filtered, dried and weighed to give the reducing sugar concentration.

D A colorimeter needs to be used to determine the glucose concentration.

14 Tests on four samples from a mixture of biological molecules gave the results shown in the table.

test	boiled with excess Benedict's solution	boiled with excess Benedict's solution after acid hydrolysis and neutralisation	biuret reagent	iodine solution
result	blue	red	purple	yellow

Which biological molecules were in the mixture?

A reducing sugar and protein

B reducing sugar, non-reducing sugar and starch

C non-reducing sugar and protein

D non-reducing sugar and starch only

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

test	observation
emulsion	cloudy
Benedict's	yellow
biuret	purple
iodine	yellow

Which conclusions made by the student are correct?

1 Fat was present.

2 Glucose was present.

3 Protein was present.

4 Starch was not present.

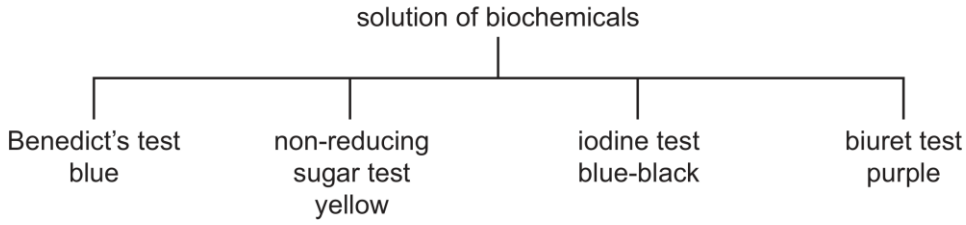
A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1, 3 and 4 only

D 2 and 3 only

16 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

17 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

18 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

19 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

20 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.

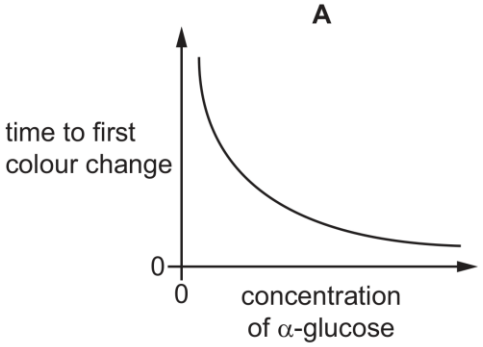
Which are the expected results?

	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

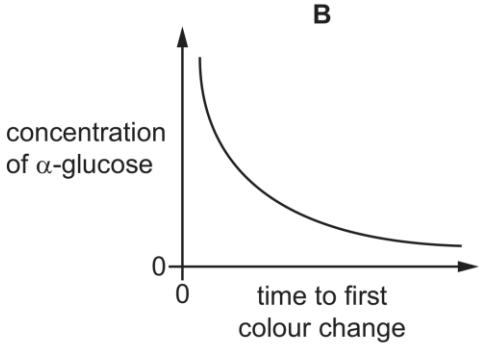
21 A student carried out a Benedict's test on several different known concentrations of α-glucose.

Which graph represents the results correctly?

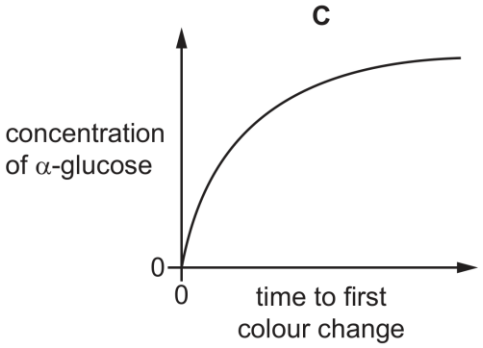
A



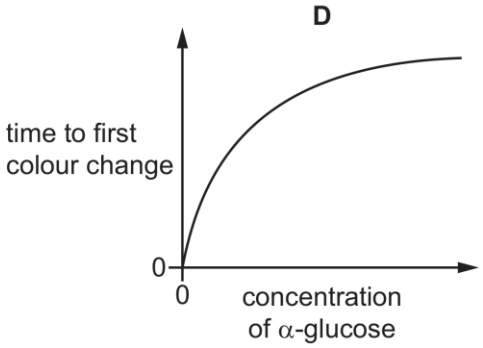
B



C



D



22 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.

23 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

24 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

25 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

26 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

27 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

28 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