

GCSE Combined Science: Trilogy

Worksheet: The human digestive system

TIME 35 min	TOTAL 31 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: The human digestive system

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

A student is investigating the effect of pH on the activity of amylase, using buffer solutions of different pH. A drop of the amylase-starch-buffer mixture is spotted onto a drop of iodine solution on a spotting tile every 10 seconds, until the iodine no longer turns blue-black.

0 1 . 1

Write a hypothesis for this investigation, including scientific reasoning to justify your prediction.

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[2 marks]

0 1 . 2

Identify the independent and dependent variables. Give **one** variable that should be controlled, and explain why.

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.....

.....

[3 marks]

0 2

Digestive enzymes break down large food molecules into small soluble molecules.

0 2 . 1

Complete the sentence.
Amylase breaks down starch into _____ .

.....

.....

[1 mark]

0 2 . 2

Name the type of enzyme that breaks down proteins into amino acids.

.....

.....

.....

.....

[1 mark]

0 2 . 3

Lipase breaks down lipids.
Name the **two** products.

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.....

.....

.....

[2 marks]

0 2 . 4

Where is bile made?

Tick (✓) **one** box.

Gall bladder

☐

Liver

☐

Pancreas

☐

Stomach

☐

[1 mark]

0 3

A student tested some foods for the presence of different nutrients.

0 3 . 1

Name the reagent used to test for starch.

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.....

.....

[1 mark]

0 3 . 2

Give the colour of Biuret reagent after it has been added to a solution containing protein.

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[1 mark]

0 3 . 3

When testing for sugar with Benedict's reagent, what must the student do after adding the reagent?

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.....

[1 mark]

0 3 . 4

Give the colour of Benedict's reagent if a large amount of sugar is present.

.....

.....

[1 mark]

0 3 . 5

Give **one** safety precaution the student should take during the food tests.

.....

.....

[1 mark]

0 4

A student investigated the effect of pH on the activity of amylase. Every 30 seconds, the student tested a drop of the starch and amylase mixture with iodine solution.

At pH 7, the starch had all been broken down after 60 s.

0 4 . 1

Calculate the rate of reaction at pH 7.

Use the equation: $\text{rate} = 1000 \div \text{time}$

Give your answer to 3 significant figures.

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.....

.....

Rate =

[1 mark]

0 4 . 2

Give the colour of iodine solution when it is added to a drop that still contains starch.

[1 mark]

0 4 . 3

Give **one** variable, other than the volumes of the solutions, that the student should keep the same.

[1 mark]

0 5

A student tested some foods to find out which of them contain lipids (fats and oils).

0 5 . 1

Describe a test the student could do to find out whether food **A** contains lipids. Give the result if lipids are present.

[2 marks]

0 5 . 2

The student shook a crushed sample of food **B** with ethanol and then poured the ethanol into a test tube of water. The water turned white and cloudy. Suggest why the water turned white and cloudy.

[2 marks]

0 5 . 3

Ethanol is highly flammable.
Give **one** safety precaution the student should take when using ethanol.

[1 mark]

0 5 . 4

Table 1

Food	Benedict's test	Iodine test	Biuret test	Sudan III test
C	stayed blue	blue-black	purple	no red layer
D	orange	stayed orange-brown	purple	red layer on the surface
E	stayed blue	stayed orange-brown	stayed blue	red layer on the surface

The student then tested three more foods, **C**, **D** and **E**, with four different tests. Table 1 shows the results.
Which food, **C**, **D** or **E**, could be whole milk?
Give **one** reason for your answer.

[2 marks]

0 6

Enzymes are biological catalysts.

0 6 . 1

Use the lock and key theory to explain why an enzyme can only catalyse one specific reaction.

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[2 marks]

0 6 . 2

Explain why the rate of an enzyme-controlled reaction decreases when the temperature rises above the optimum.

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[3 marks]

0 6 . 3

The protease enzyme in the stomach works best at pH 2.
Name the substance produced by the stomach that provides this pH.

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.....

.....
[1 mark]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: The human digestive system · 31 marks

Question 1 (5 marks)

01.1 [2 marks]

- a suitable hypothesis, e.g. 'amylase activity is greatest at pH 7 and decreases as pH moves further from 7 in either direction' (1)
- with reasoning, e.g. because a pH further from the enzyme's optimum starts to change the shape of its active site, reducing how well the substrate fits and so reducing the rate of reaction (1)

01.2 [3 marks]

- independent variable: pH of the buffer solution (1)
- dependent variable: time taken for the iodine to stop turning blue-black (or the rate, $1000 \div \text{time}$) (1)
- control, e.g. temperature (using a water bath) and the concentration/volume of amylase and starch solutions — these must be kept the same because they also affect the rate of reaction, so changing them as well as pH would make it impossible to attribute any change in rate to pH alone (1)

Question 2 (5 marks)

02.1 [1 mark]

- sugars / maltose (1)

Notes: Allow glucose.

02.2 [1 mark]

Answer: protease

- protease(s) (1)

02.3 [2 marks]

- fatty acids (1)
- glycerol (1)

02.4 [1 mark]

Correct: Liver

Question 3 (5 marks)

03.1 [1 mark]

Answer: iodine solution

- iodine (solution) (1)

03.2 [1 mark]

- purple / lilac / mauve / violet (1)

Notes: Do not accept 'blue'.

03.3 [1 mark]

- heat it (in a hot water bath) (1)

Notes: Allow 'warm it' or 'heat to about 75 °C'. A time on its own (e.g. 'leave for 5 minutes') does not score.

03.4 [1 mark]

- brick red / red (1)

Notes: Allow orange-red. Do not accept orange, yellow or green (these show smaller amounts of sugar).

03.5 [1 mark]

- wear eye protection / goggles (1)

Notes: Allow 'use a water bath and not a direct flame when heating' or 'do not eat the food samples'.

Question 4 (3 marks)

04.1 [1 mark]

Answer: 16.7

- $(1000 \div 60 =) 16.7$ (1)

04.2 [1 mark]

Answer: blue-black

- blue-black (1)

Notes: Allow black / dark blue. Do not accept purple.

04.3 [1 mark]

- temperature / concentration of amylase / concentration of starch (1)
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Question 5 (7 marks)

05.1 [2 marks]

- add (a few drops of) Sudan III (stain) to a sample of the food in water and shake (gently) / shake a (crushed) sample of the food with ethanol, then pour the ethanol into water (1)
- Sudan III: a red-stained (oily) layer separates out and floats on the surface / ethanol: a white, cloudy emulsion forms (1)

Notes: The result must match the test described. Do not accept Benedict's, iodine or Biuret tests.

05.2 [2 marks]

- the lipid (from the food) dissolved in the ethanol (1)
 - lipids do not dissolve in water, so the lipid formed tiny droplets / an emulsion in the water, which made it look white and cloudy (1)
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05.3 [1 mark]

- keep the ethanol away from flames / make sure no Bunsen burners are lit nearby (1)

Notes: Ignore 'wear eye protection' on its own.

05.4 [2 marks]

- D (1)
- it contains sugar, protein and lipid / it gave a positive result for sugar, protein and lipid (and no starch) (1)

Notes: The reason mark can only be awarded if D is chosen.

Question 6 (6 marks)

06.1 [2 marks]

- the active site has a specific shape (1)
 - only one substrate has a shape that fits / is complementary to the active site (1)
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06.2 [3 marks]

- the enzyme is denatured (1)
- the shape of the active site changes (1)
- so the substrate no longer fits (the active site) (1)

Notes: Do not accept 'the enzyme is killed'.

06.3 [1 mark]

Answer: hydrochloric acid

- hydrochloric acid (1)
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