Qualification Accredited



GCSE (9-1)

Examiners' report

GATEWAY SCIENCE COMBINED SCIENCE A

J250

For first teaching in 2016

J250/01 Summer 2022 series

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Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates.

The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. A selection of candidate answers are also provided. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report.

A full copy of the question paper and the mark scheme can be downloaded from OCR.

Advance Information for Summer 2022 assessments

To support student revision, advance information was published about the focus of exams for Summer 2022 assessments. Advance information was available for most GCSE, AS and A Level subjects, Core Maths, FSMQ, and Cambridge Nationals Information Technologies. You can find more information on our website.

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Paper 1 series overview

This paper examines the Biology content (topics B1-B3 and CS7) of Gateway Combined Science GCSE at Foundation Level. This paper links together different areas of biology within different contexts, some practical, some familiar and some novel. To do well on this paper, candidates need to

- be able to apply their knowledge and understanding to unfamiliar contexts
- be familiar with a range of practical techniques.

Candidates who did well on this paper had good subject knowledge. They were able to apply their knowledge and understanding to interpret data and reach conclusions. These candidates also applied their knowledge to unfamiliar contexts and completed mathematical calculations within a biological context. Candidates who did less well did not respond to questions asking them to apply their knowledge or did not apply their knowledge appropriately. They also did not answer questions with precision or interpret data correctly.

Candidates who did well on this paper generally did the following:

- correctly performed calculations to mathematical questions in part A and part B and showed their working in Question 15 (c) (iii)
- produced clear and concise responses to the level of response question to describe and explain the pattern shown
- demonstrated a good understanding of the reflex arc (Question 11 (b))
- demonstrated a good understanding of the scientific method and the need to control variables (Question 13)
- read questions carefully taking note of process words such as 'describe' and 'explain'
- applied knowledge and understanding to questions set in a novel context.

Candidates who did less well on this paper generally did the following:

- did not perform mathematical calculations correctly or show their working
- found the level of response question challenging and did not describe and explain the results in the context of their knowledge and understanding of enzymecontrolled reactions
- had a lack of knowledge and understanding of the reflex arc (Question 11) and of transport systems in plants and animals (Question 15)
- showed a lack of awareness of the skills involved in practical activities and investigations
- found it difficult to apply knowledge and understanding to questions set in a novel context.

Section A overview

Candidates coped well with selecting choices. Almost all candidates attempted every question demonstrating good examination technique. Questions 5 and 10 proved to be the most challenging with few candidates selecting the correct answer.

Que	estic	on 1	
1	Whi	ch part of the cell provides a selective barrier to molecules entering the cell?	
	Α	Cell membrane	
	В	Cell wall	
	С	Cytoplasm	
	D	Plasmid	
	You	r answer	[1]
		alf of candidates correctly identified the cell membrane as a selective barrier (Answer A). A umber incorrectly selected the cell wall. This question assessed AO1.	
Que	estic	on 2	
2	A m	icroscope has a ×10 eyepiece lens and a ×40 objective lens.	
	Wha	at is its magnification?	
	Α	×10	
	В	×40	
	С	×50	
	D	×400	
	You	r answer	[1]
		ndidates correctly identified the magnification as being x400 (Answer D). This question I AO2.	

[1]

Question 3

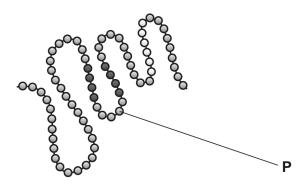
- **3** Which two terms describe the structure of DNA?
 - A Monomer and double helix
 - **B** Monomer and triple helix
 - C Polymer and double helix
 - **D** Polymer and triple helix

Your answer								
-------------	--	--	--	--	--	--	--	--

A majority of candidates correctly identified DNA as being a polymer and double helix. This question assessed AO1.

Question 4

4 The diagram shows a model of a protein molecule.



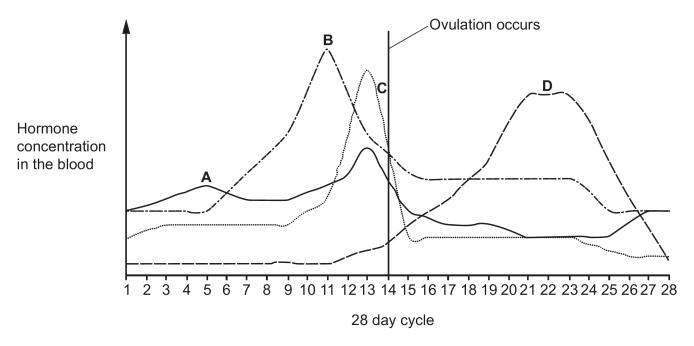
Which substance is labelled **P** in the diagram?

- A Amino acid
- B Fatty acid
- **C** Glucose
- **D** Glycerol

Your answer [1]

Over half of candidates identified substance P as being an amino acid. This question assessed AO2.

5 The diagram shows the changes in female hormones during the menstrual cycle.



Which line, A, B, C or D, represents FSH?

Your answer [1]

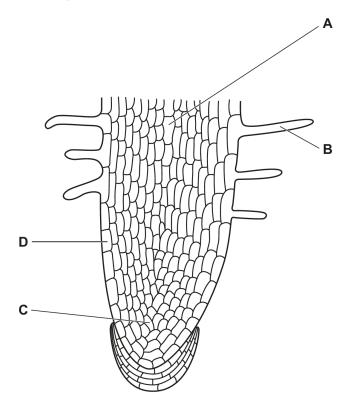
Few candidates were unable to identify that Line A represents FSH levels. This question assessed AO2.

6		ch statement describes a substance being transported into the human body from the side?	
	Α	Carbon dioxide diffuses into the blood from the cells.	
	В	Food molecules diffuse into the liver from the blood.	
	С	Oxygen diffuses into the blood from the air.	
	D	Urea diffuses into the blood from the liver.	
	You	r answer	[1]
Most	t can	didates identified statement C as being correct. This question assessed AO1.	
Que	estic	on 7	
7	Wh	y do root hair cells require large numbers of mitochondria?	
	Α	For the uptake of minerals by active transport.	
	В	For the uptake of water by active transport.	
	С	For the uptake of minerals by osmosis.	
	D	For the uptake of water by osmosis.	
	You	r answer	[1]
by a	ctive hly e	alf of candidates correctly identified mitochondria as being required for the uptake of minerals transport. Candidates who answered the question incorrectly selected the other options in qual proportions, suggesting they did not correctly link active transport of minerals to the need. This question assessed AO1.	

8	Whi	ich statement is true for type 1 diabetes and false for type 2 diabetes?	
	Α	The body stops responding to insulin, insulin injections are needed.	
	В	The body stops responding to insulin, insulin injections are not needed.	
	С	The pancreas stops making insulin, insulin injections are needed.	
	D	The pancreas stops making insulin, insulin injections are not needed.	
	You	ır answer	[1]
sele	cted	er half of candidates correctly identified statement C as being correct. Answer D was ofter by the remainder indicating that candidates understand that the pancreas stops making ir diabetes. This question assessed AO1.	
Qu	estic	on 9	
9	Whic	ch statement is true of both adult and embryonic stem cells?	
	Α	They are in all adult and embryonic tissues.	
	В	They are only used to make blood cells.	
	С	They can divide by mitosis.	
	D	They cannot differentiate.	
	Your	ranswer [1]	
Διοι	ınd h	half of candidates correctly identified both adult and embryonic stem cells as dividing by m	itosis

Around half of candidates correctly identified both adult and embryonic stem cells as dividing by mitosis (Answer C). This question assessed AO1

10 The diagram shows the root tip of a plant.



Which label, A, B, C or D, identifies the position of stem cells in the root tip?

Your answer		[1]
-------------	--	-----

Around a quarter of candidates correctly identified region C. Regions B and D were the most common incorrect answers. This question assessed AO2

Section B overview

This section tested candidates against AO1, 2 and 3, drawing on familiar and novel contexts. Some of the questions required candidates to answer precisely, applying their knowledge to the context given. In other questions they had to make use of stimulus material to work out the answer, using analytical and observational skills. Very few candidates described the patterns in full in Question 12 (c) (i) and Question 13 (b) (ii). Practical skills need to be developed, including the ability to recognise standard apparatus and the importance of controlling variables when conducting experiments. Careful reading of the question, and care in answering the question precisely was important to gain full marks. Candidates appeared to find Question 15 on transport systems in plants and animals the most challenging.

Question 11 (a)

11 (a) The diagram shows the central nervous system (CNS).



Complete the sentence to describe the structure of the CNS. Use the dia	gram.
The CNS is made up of the and the and the	

12

[2]

A large majority of candidates gained both marks for this question. This question assessed AO1

Question 11 (b) (i)

(D) (I)	The response is a reflex action because it is controlled by a reflex arc.
	Suggest two other reasons why the response is a reflex action.
	1
	2 [2]

Around half of candidates gained at least one mark. Incorrect answers often mentioned parts of the reflex arc, linked the response to the brain or copied ideas from the stem of the question. This question assessed AO1

Question 11 (b) (ii)

(ii) Draw lines to connect each **part** of the reflex arc to its correct **function** when responding to a hot object.

Part	Function
muscles	detects the hot object
motor neurone	move the hand away
receptor in skin	carries electrical impulses to the CNS
sensory neurone	carries electrical impulses to the muscles

[3]

Most candidates gained at least 2 marks and demonstrated knowledge of the reflex arc. This question assessed AO1

Question 11 (c) (i)

(c) A student uses a computer program to measure the reaction times of their friends.

The table shows their results.

Friend	Sex of friend	Age of friend	Time spent each week playing computer games (hours)	Reaction time (s)
Α	male	14	5	0.34
В	male	14	7	0.29
С	female	15	6	0.26
D	female	14	15	0.24
E	male	15	3	0.27

(i) Identify the **median** reaction time for the five friends.

Median reaction time =s [1]

Most candidates identified the median as being 0.27 s. This question assesses AO2.

Question 11 (c) (ii)

(ii) Calculate the mean reaction time for the five friends.

Mean reaction time = s [2]

A large majority of candidates calculated the mean reaction time as 0.28 s. Around half of candidates did not show any working. In cases where their final answer was incorrect, they could possibly pick up one mark if some working was shown. For example, a common incorrect answer was 28 s which gained zero marks. This question assessed AO1 and AO2.

(iii)	Use the data in the table to suggest one reason why friend D has the fastest reacti time.					
	[1]					

Most candidates correctly identified that friend D spent the most time playing computer games from the data provided. This question assessed AO2

Question 11 (d)

(d)	Adrenaline is a hormone that speeds up reaction times.
	Describe the typical features of hormonal coordination such as adrenaline in the body.
	101

Assessment for learning

Very few candidates identified that this question was asking them to describe features of hormonal coordination. Candidates should be encouraged to highlight key words or phrases that are important to consider in their responses. Most candidates described the effects of adrenaline rather than the features of hormonal coordination. It was very rare for candidates to score 2 marks and a large majority gained no marks. This question assessed AO1

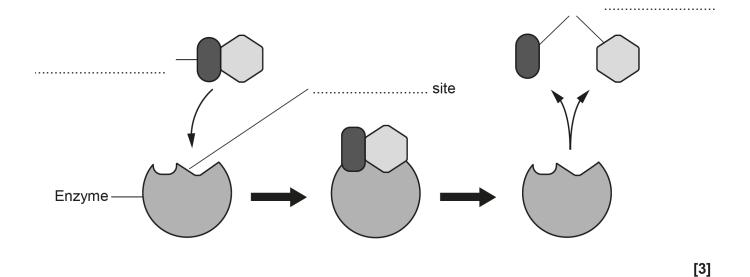
Question 12 (a)

12 (a) Fig. 12.1 shows a model of the lock and key hypothesis for enzymes.

Label Fig. 12.1. Use words in the list.

active	catalyst	helix	products
specific	substrate	yields	

Fig. 12.1



Around half of candidates correctly completed all three labels. A common misconception was switching the substrate and products around. This question assessed AO2.

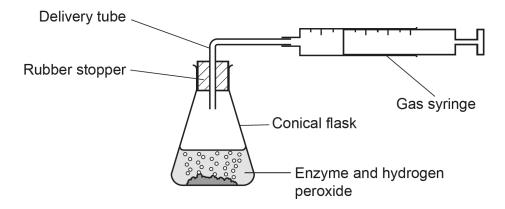
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Question 12 (b)

(b) Fig. 12.2 shows apparatus that could be used to investigate an enzyme-controlled reaction.

Fig. 12.2



The enzyme breaks down hydrogen peroxide to produce oxygen.

Complete these sentences to describe how to use the apparatus.

Put the enzyme and hydrogen peroxide into the

Measure the volume of oxygen that collects in the after 5 minutes.

[2]

Almost all candidates correctly identified the correct pieces of apparatus. This question assessed AO2.

Question 12 (c) (i)

(c) A student uses the apparatus in Fig. 12.2 to find the pH at which the enzyme works best (optimum pH).

The table shows the results.

рН	Volume of gas (cm ³)
1	2
6	20
14	1

` '	•	•		

*(i) Describe and explain the pattern in the results.

Use ideas about the lock and key hypothesis in your answer.
[6]

To achieve Level 3 for this question candidates needed to address both assessment objectives (AO1 and AO3). Knowledge and understanding of the lock and key hypothesis needed to be linked to a description and an explanation of the results. Most candidates were able to describe part of the pattern, e.g., identifying most gas is produced at pH 6 to reach Level 1. If they linked a partial description to an explanation of the pattern, this was sufficient to take the response to Level 2, e.g. stating most gas is produced at pH 6, as this is the optimum for the enzyme satisfies this requirement. Alternatively, demonstrating some knowledge of the lock and key hypothesis and describing part of the pattern was also a Level 2 response. Relatively few candidates reached Level 3, as they did not address all both assessment objectives. This question discriminated well.

Exemplar 1

The amount of gets volume produced
is decreased when the pt is too
high or lever by this the enzyme
is denarured by its too law and high
pth only producing long gas and zon3 of
ges. Though at around a neurrell pt
of 6 the volume of gos is resulted
in more production luis is because
the enzyme doesn't lose it's specific
shake suddenly meaning it can bind
Lo more Substrates. This resulss in a
nigher voume of ges. [6]

This response achieved Level 3, with 5 marks. The candidate has described the pattern in full and linked this to a detailed explanation of the pattern. However, the lock and key hypothesis is not well communicated – there is no mention of the substrate fitting into the active site, but the candidate does include the idea that the structure of the enzyme is changed.

Question 12 (c) (ii)

(ii)	Describe how the student could improve their investigation to find a more accurate optimum pH for the enzyme.					
	[2]					

A majority of candidates gained 1 mark for this question for the idea of using more or different pH values. Very few achieved 2 marks for the idea of testing more values around pH 6. This question assessed AO3.

Question 13 (a)

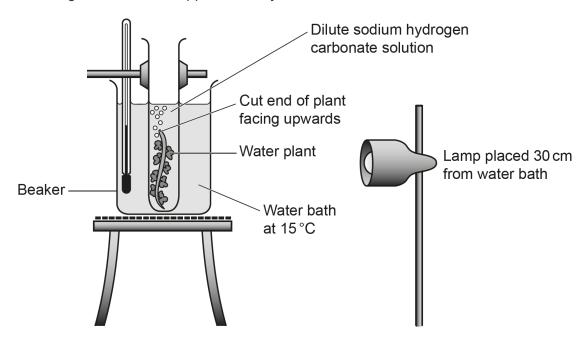
			[4]
		Describe one other reason why plants are important to life on Earth.	
13	(a)	Plants are important for life on Earth as they photosynthesise and provide oxygen.	

Most candidates correctly answered this question by identifying a reason why plants are important for life on Earth. This question assessed AO1

Question 13 (b) (i)

(b) A scientist investigates the effect of temperature on the rate of photosynthesis.

The diagram shows the apparatus they use.



The scientist counts the number of bubbles released by the water plant in 10 minutes.

They repeat this method with different temperatures of water.

The table shows their results.

Temperature (°C)	Number of bubbles
15	22
20	8
25	36
30	26
35	22
40	2

(i)	The scientist decides to repeat the investigation for 20 °C. Suggest why.
	[1

A majority of candidates identified that the result for 20 °C did not fit the pattern. This question addressed AO3b.

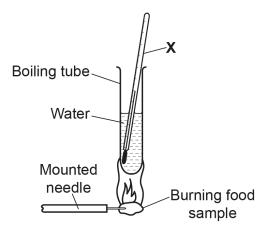
Question 13 (b) (ii)

	(ii)	When the scientist repeats the investigation at 20 °C the result is 26 bubbles.	
		Use this result and the results in the table to describe the effect of temperature on the rate of photosynthesis.	
		[2]	
Most candidates described part of the pattern, e.g. that as you increase the temperature the rate of photosynthesis increases. Few described the whole pattern by identifying the increase and then a decrease in the rate. This question assessed AO3.			
Questic	on 1	3 (c)	
(c)		scientist decides to use the apparatus to investigate the effect of light intensity on tosynthesis.	
	Des	cribe how they could use the apparatus to change light intensity.	

In this question most candidates identified the need to move the lamp to change the light intensity. Very few gained the second mark for identifying the need to control a variable. This question assessed AO3.

Question 14 (a) (i)

- 14 Respiration releases energy from food. The energy content of food can be measured by burning the food. A student measures the energy content of some different foods.
 - (a) The diagram shows the apparatus they use.



(i) The student finds the energy content by measuring the change in temperature of the water.

Identify the piece of apparatus labelled X in the diagram.
[1]

The thermometer was correctly identified by almost all candidates in this AO2 question.

Question 14 (a) (ii)

(ii) The table shows the change in temperature for one type of food.

Temperature at the start (°C)	Temperature at the end (°C)		
20	65		

Calculate the energy content of the food using this formula.

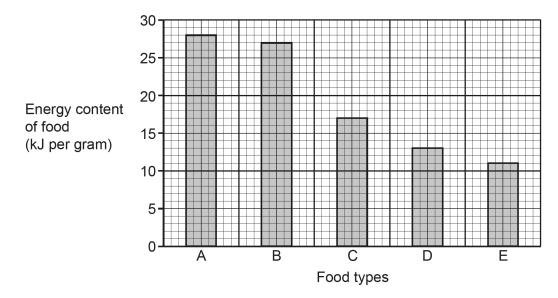
Energy content = $20 \times 4.2 \times$ change in temperature

A majority of candidates correctly calculated the energy content of the food. The most common error was to use the end temperature in place of the change in temperature. One mark was given for candidates who carried this error forward. This question was assessed AO2

Question 14 (b) (i)

(b) The student converted all their results to find the energy content in kJ per gram of food.

The graph shows the results.



(i) What is the energy content of food type **D**?kJ per gram [1]

The correct value was read from the bar chart in most cases. This question assessed AO2

Question 14 (b) (ii)

(ii)	Eating food type B provides the body with more ATP molecules than eating the same mass of food type E .
	Use your knowledge of cellular respiration to explain why.

Misconception



Very few candidates appreciated that ATP is made during cellular respiration. A common misconception is that the higher energy food source is providing the body with more ATP molecules as the ATP is contained in the food. Very few candidates scored marks on this question which assessed AO1 and AO2.

Question 15 (a) (i)

- 15 Plants and animals both have transport systems.
 - (a) Fig. 15.1 shows cells found in the transport system of animals.

Fig. 15.1



(i) Identify the type of cell shown in Fig. 15.1.

Almost all candidates correctly identified red blood cells. This question assessed AO2

Question 15 (a) (ii)

		- ,					
(H)	The transport s	ystem in	animals is	the (circulatory	' system

Describe the relationship between the circulatory system and the gas exchange system in the human body.
ro.
[31

Around a quarter of candidates did not attempt this question and very few scored any marks. Where candidates gained one mark it was often for identifying that the circulatory system transports oxygen around the body. Very few addressed the other marking points. This question assessed AO1.

Exemplar 2

in the human body.

When blo the blood press through the blood of the up decrygended blood of the up decrygended blood of the lungs oxygen is being picked up also because the capilaxies.

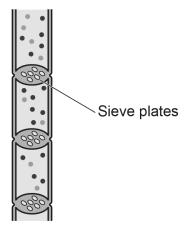
Nove moist walls the oxygen can diffuse inside the walls making agas exchange happened. Then the oxygenatod of blood is sent to our heart and the left ventrical Pumps the blood in our to our body. This process repeats so every time the blood travels got exchange on happens because the arteries and capilaxies have moist walls.

Here the candidate has identified that oxygen enters the blood in the gas exchange system. They have then gone on to state that the heart pumps oxygenated blood around the body. These points have been well communicated and this response scores 2 marks.

Question 15 (b)

(b) Phloem is part of the transport system in plants. **Fig. 15.2** is a diagram of phloem sieve tubes.

Fig. 15.2



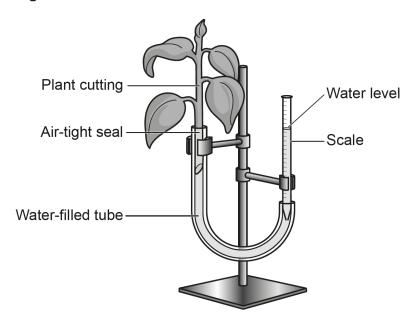
Explain how phloem sieve tubes are adapted to their function. Use Fig. 15.2.				
[2]				

Very few candidates gained marks on this question. Many copied 'sieve' or 'sieve plates' from the question without explaining how they are adapted. The most commonly named substances as being transported which did not gain a mark were water, minerals or glucose. The terms sugar or sucrose should be used when referring to translocation. This question assessed AO1

Question 15 (c) (i)

(c) Fig. 15.3 shows apparatus used to investigate the rate of water uptake in plants.

Fig. 15.3



(i) Name the apparatus shown in Fig. 15.3.

.....[1]

Potometer was correctly identified by a small fraction of candidates. This question assessed AO1.

Question 15 (c) (ii)

(ii) The air-tight seal stops air getting into the water-filled tube.

Suggest why it is important to stop air getting into the tube.

Very few candidates gained a mark on this question. Most wrote vague statements such as 'it will affect the results' without giving an explanation. This question assessed AO2.

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OCR support



This <u>Practical support guide</u> has a variety of videos, activities and simulations that can be shared with candidates. These link to the Practical Activity Groups, and the apparatus and skills candidates must be aware of. Some of the practicals shown are in a different context than they may be carried out in the classroom, giving candidates further practice for examinations.

Question 15 (c) (iii)

(iii) The apparatus is set up and left for 10 minutes. The water level moved 8 mm.

Calculate the rate of water uptake in **mm per second**.

Give your answer to 2 significant figures.

Rate of water uptake = mm per second [3]

This guestion covers AO2. Many candidates did not show their working and could not gain marks if their final answer was incorrect. A significant number of those who correctly completed the calculation did not round it correctly to 2 significant figures, giving their final answer as 0.013 recurring. A common error was not to convert minutes to seconds. Marks were available for candidates who carried forward this error, but few of these candidates scored more than one mark as they did not round their final answer correctly to 2 significant figures.

Exemplar 3

(iii) The apparatus is set up and left for 10 minutes. The water level moved 8 mm.

Calculate the rate of water uptake in mm per second

Give your answer to 2 significant figures.

time (5) 800 × 600 = 4800

10×60 = 600

Assessment for learning



In this exemplar, the candidate has gained the first 2 marking points for showing their working. However, the final answer on the answer line is incorrect. This highlights the importance of showing the working as the answer on its own would not score any marks.

Question 15 (c) (iv)

(iv)	The investigation is	s repeated with	an electric fan	switched on	next to the apparatus.
------	----------------------	-----------------	-----------------	-------------	------------------------

Predict what would happen to the rate of water uptake by putting a ring around the correct choice to complete the sentence. Explain your answer.

The rate of water uptake would increase / decrease / stay the same.

Reason:	 	
	 	 [1]

Very few candidates gained marks on this question. Around half of the candidates correctly circled increase but did not link this to the idea there is an increase in air movement or evaporation/transpiration. Many made references to photosynthesis or more wind which did not gain marks. This question assessed AO3.

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