

OCR style

GCSE (9-1) Combined Science A (Gateway Science)

Paper 7: Biology (Higher Tier) – Practice Paper

J250/07 · Higher Tier · Practice paper

Time allowed: 1 hour 10 minutes

Candidate name	
Centre number	
Candidate number	

Materials

- a scientific or graphical calculator
- a ruler (cm/mm)
- Black ink pen
- HB pencil (for graphs and diagrams only)
- You may use a calculator.

Instructions

- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer all the questions.

Information

- The total mark for this paper is 60.
- The marks for each question are shown in brackets [].
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This paper covers topics B1 (Cell level systems), B2 (Scaling up), B3 (Organism level systems) and CS7 (Practical skills).
- Original Teach io practice paper written in the style of OCR GCSE (9–1) Combined Science A (Gateway Science) J250/07. Not an OCR paper.

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Section A

Answer all the questions. You should spend a maximum of 20 minutes on this section. Write your answer (A, B, C or D) in the box marked 'Your answer'.

1 Which structure is a small ring of DNA found in many prokaryotic cells? [1]

Tick (✓) one box.

A	Nucleus	
B	Plasmid	
C	Chromosome in a nuclear membrane	
D	Mitochondrion	

2 What determines the order of amino acids in a protein made by a cell? [1]

Tick (✓) one box.

A	The shape of the ribosome	
B	The sequence of bases in a gene	
C	The number of phosphate groups in DNA	
D	The amount of glucose in the cytoplasm	

3 A student increases the concentration of substrate in an enzyme reaction. At high substrate concentrations the rate stops increasing. Which statement explains this? [1]

Tick (✓) one box.

A	The enzyme has been denatured	
B	All of the active sites are occupied	
C	The substrate has been used up	
D	The temperature has decreased	

4 Which is the word equation for aerobic respiration? [1]

Tick (✓) one box.

A	glucose → lactic acid	
B	carbon dioxide + water → glucose + oxygen	
C	glucose + oxygen → carbon dioxide + water	
D	glucose → ethanol + carbon dioxide	

5 Proteins are polymers. Which monomers join together to make a protein? [1]

Tick (✓) one box.

A	Amino acids	
B	Simple sugars	
C	Fatty acids	
D	Nucleotides	

6 A cell cycle lasts 18 hours. In a sample of dividing cells, 5% of the cells are in mitosis. Assuming this percentage shows the fraction of the cycle spent in mitosis, how long does mitosis last?

[1]

Tick (✓) one box.

A	9 minutes	
B	36 minutes	
C	54 minutes	
D	90 minutes	

7 Which change would increase the rate of diffusion of oxygen into a cell?

[1]

Tick (✓) one box.

A	A thicker cell membrane	
B	A smaller surface area	
C	A steeper concentration gradient	
D	A lower temperature	

8 Which chamber of the heart pumps blood into the aorta?

[1]

Tick (✓) one box.

A	Left atrium	
B	Left ventricle	
C	Right atrium	
D	Right ventricle	

9 Which type of neurone carries impulses from a receptor to the central nervous system?

[1]

Tick (✓) one box.

A	Motor neurone	
B	Relay neurone	
C	Sensory neurone	

D	Effector neurone	
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10 Which hormone causes the liver to convert glycogen into glucose when blood glucose concentration is low?

[1]

Tick (✓) one box.

A	Insulin	
B	Glucagon	
C	Adrenaline	
D	Thyroxine	

Section B

Answer all the questions.

11

(a) A scientist uses an electron microscope to produce a photograph of a chloroplast.

The chloroplast is 48 mm long in the photograph. Its real length is 3.2 μm .

Calculate the magnification of the photograph.

1 mm = 1000 μm

[2]

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(b) Electron microscopes have a higher resolution than light microscopes.

State what is meant by resolution.

[1]

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(c) Name two sub-cellular structures found in a leaf palisade cell and state the function of each.

[2]

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(d) A student uses a light microscope with a $\times 10$ eyepiece lens and a $\times 40$ objective lens.

Calculate the total magnification.

[1]

(e) In the student's image, a cheek cell has a diameter of 36 μm at a magnification of $\times 400$.

Calculate the real diameter of the cheek cell in micrometres (μm).

[2]

12 Milk looks cloudy because it contains the protein casein. The enzyme trypsin digests casein, so the milk slowly turns clear.

A student investigates the effect of temperature on the activity of trypsin.

- He mixes 2 cm^3 of trypsin solution with 5 cm^3 of milk in a water bath.
- He records the time taken for the milk to turn clear.
- He stops timing after 600 seconds if the milk has not turned clear.

The table shows his results.

Temperature ($^{\circ}\text{C}$)	Time for milk to turn clear (s)
20	380
30	190
40	95
50	120
60	did not turn clear in 600 s

(a) Calculate the rate of reaction at 40 °C.

Use the equation: rate = 1000 ÷ time

Give your answer to 3 significant figures.

[2]

(b) Describe and explain the effect of temperature on the activity of trypsin shown by the results.

[3]

(c) Identify the independent variable and the dependent variable in this investigation.

[2]

(d) The student put the trypsin solution and the milk in separate tubes in the water bath for 5 minutes before mixing them.

Suggest why.

[1]

13 A student cuts discs from a spinach leaf and removes the air from them so they sink. She places 10 discs in a beaker of sodium hydrogencarbonate solution, which releases carbon dioxide.

She places a lamp at different distances from the beaker and records the time taken for all 10 discs to float.

The table shows her results.

Distance of lamp from beaker (cm)	Time for all 10 discs to float (s)
10	295
20	300
30	380
40	620

(a) Explain why the leaf discs float to the surface.

[2]

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(b) Calculate the rate of photosynthesis when the lamp is 40 cm from the beaker.

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

Give your answer to 3 significant figures.

[2]

(c) There is almost no difference between the times at 10 cm and 20 cm.

The student repeats the test at 10 cm using a more concentrated sodium hydrogencarbonate solution.

Predict and explain the result.

[2]

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(d) In a fourth test, with the lamp very far away, the discs did not float at all.

Use your knowledge of respiration to suggest why.

[1]

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14 A student prepares a squash of an onion root tip and looks at it with a light microscope. In five fields of view she counts the number of cells in interphase and the number of cells undergoing mitosis.

The table shows her results.

Field of view	1	2	3	4	5
Cells in interphase	33	35	32	34	34
Cells in mitosis	7	5	8	6	6

(a) Describe what happens to the chromosomes during the cell cycle so that two genetically identical cells are produced.

[2]

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(b) Calculate the mitotic index for this sample.

mitotic index = number of cells in mitosis ÷ total number of cells counted

[2]

(c) One complete cell cycle in onion root tip cells takes 22 hours.

Use your answer to (b) to estimate how long the cells spend in mitosis. Give your answer in hours.

[1]

(d) Explain why the student counted cells in five fields of view rather than one.

[1]

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(e) The student used the tip of the root rather than cells from further up the root.

Explain why.

[2]

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15 A student paints clear nail varnish on the lower surface of a leaf, peels it off and looks at the impression under a microscope. The area of the field of view is 0.12 mm^2 . She counts the stomata in five fields of view.

Her counts were: 17, 19, 18, 20, 16.

(a) Calculate the mean number of stomata per mm^2 on the lower surface of the leaf.

[3]

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(b) The mean for the upper surface was 25 stomata per mm^2 .

Suggest why most stomata are on the lower surface of the leaf.

[2]

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(c) Describe how water moves from the soil to the air around a leaf.

[2]

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(d) State one environmental change that would increase the rate of transpiration.

[1]

16 The table shows the concentration of four hormones in the blood of a woman during one 28-day menstrual cycle.

Day of cycle	FSH (arbitrary units)	LH (arbitrary units)	Oestrogen (arbitrary units)	Progesterone (arbitrary units)
1	6	5	2	1
4	8	5	3	1
8	7	6	6	1
12	9	20	12	1
14	12	60	9	2
16	6	12	5	6
20	3	4	6	14
24	3	3	5	10
28	5	4	2	2

(a) Name the gland that releases FSH and LH.

[1]

(b) * Use the data to describe and explain how the four hormones interact to control the menstrual cycle.

Suggest how a contraceptive pill containing oestrogen and progesterone prevents pregnancy, using evidence from the table.

[6]

17

(a) A nerve impulse travels 1.2 m along a motor neurone in 0.02 s.

Calculate the speed of the impulse in m/s.

Use the equation: speed = distance ÷ time

[2]

(b) Explain how the structure of a motor neurone is adapted to its function.

[2]

END OF QUESTIONS