Qualification Accredited



GCSE (9-1)

Examiners' report

GATEWAY SCIENCE BIOLOGY A

J247

For first teaching in 2016

J247/01 Summer 2023 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 is 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.

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Paper 1 series overview

J247/01 is the first paper candidates take for the foundation tier Gateway GCSE Biology suite. It assesses content from specification topics B1-3 and B7 practical skills. Therefore, for candidates to perform well on this paper they will need to have sound knowledge of the theory covered in B1-3 and be able to apply this to novel situations. The J247/01 component includes a multiple choice question section and a short answer section that also includes one Level of Response type question. The Level of Response question assesses the quality of communication as well as knowledge and understanding. Candidates also need to apply the skills and understanding that they have developed in the practical activities covered in B7. There are also questions that involve the assessment of key mathematical requirements from Appendix 5f of the specification.

This is the first examination without an advance information notice of topics to be tested in the specification since the Covid pandemic which led to two years of teacher and centre assessed grades. This is the first full series which is comparable with the June 2019 series except that there has been disruption in the learning and the current cohort have experienced remote teaching during their secondary education.

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Candidates who did well on this paper generally:

demonstrated knowledge and understanding of DNA in Question 16 (a), cell structure in Questions 16 (b) and 23 (a), microscopes in Questions 16 (b) (ii), 23 (b) (ii) and (c), the role of digestive enzymes in Question 21 (a) and blood vessels in Question 24 (a)

- demonstrated application of knowledge and understanding of cell division in Question 17 (b) (ii) and electron microscopes in Question 23 (b) (ii)
- performed correct calculations in Questions 17
 (b) (ii), 18 (b) (i) and 24 (c)
- demonstrated and applied knowledge and understanding in measuring the rate of photosynthesis in pondweed in Question 20*
- demonstrated the ability to analyse information and ideas to evaluate and interpret in Questions 21 (b) and 22 (a)
- demonstrated the ability to analyse and draw conclusions in Question 19 (b)
- demonstrated the ability to analyse information to develop and improve experimental procedures in Questions 19 (d) and 20*.

Candidates who did less well on this paper generally:

- could not demonstrate knowledge and understanding of DNA in Question 16 (a), cell structure in Question 16 (b), the endocrine and nervous system in Question 17 (a), and microscopes in Questions 16 (b) (ii), 23 (b) (ii) and (c)
- could not demonstrate application of knowledge and understanding of cell division in Question 17 (b) (ii), identifying ovulation in Question 22 (b) and advantages of the electron microscope Question 23 (b) (ii)
- could not perform calculations in Questions 17
 (b) (ii), 18 (b) (i) and 24 (c)
- could not demonstrate and apply knowledge and understanding in measuring the rate of photosynthesis in pondweed in Question 20*.

Section A overview

Candidates responded well with selecting choices in this section, attempting all questions. However there were still some instances where candidates used lower case letters in their response. This should be discouraged as it can be difficult to distinguish the desired letter due to handwriting styles.

OCR support



<u>Multiple choice questions</u> can be used to check knowledge recall and practice examination techniques, such as only using upper case letters in answers.

Question 1

1	A plant is placed near a window.
	The plant grows towards the light.

Which hormone is responsible for this growth movement?

- A Auxin
- B Insulin
- C Oestrogen
- D Testosterone

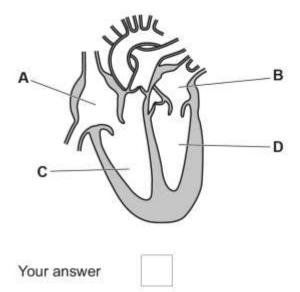
Your answer	[1]
	F-1

This was the most accessible question in the multiple choice Section A, with most candidates correctly answering A and identifying auxin as the plant hormone which is responsible for growth towards the light-phototropism.

[1]

Question 4

4 Which chamber in the human heart contracts with the greatest force?



The candidates were challenged by this question, demonstrating a seeming lack of understanding of the chambers of the heart and contraction. Candidates incorrectly identified the right ventricle just as much as choosing the left atrium.

Question 13

13 What is the percentage change in mass of the potato chip during an experiment?

Mass of potato chip before (g)	Mass of potato chip after (g)
5.7	5.2

- A -0.5%
- B -8.8%
- C -9.6%
- D -91.2%

Your answer [1]

This proved the most challenging multiple choice question by calculating percentage change. Candidates' responses ranged equally from A-D.

Section B overview

Candidates performed well on questions testing their knowledge and understanding of cell structure and organelles in both prokaryotic and eukaryotic cells. Most candidates could identify a correct statement about DNA. In addition, knowledge and understanding questions on microscopes were answered well. Most candidates could plot a line graph, but could not apply this to a line of best fit, which was a curve. Candidates attempted and gained marks for extracting data from tables/graphs and simple calculations. Candidates had clearly improved from last year's paper, responding well on the Level of Response extended writing question in identifying independent, dependent and control variables.

However, candidates demonstrated knowledge gaps in understanding of stem cells, kidney structure and function in its role in water balance. Candidates should also further develop their ability in AO2 assessment objectives to applying their knowledge and understanding of scientific ideas and enquiry, such as biological molecules, reagent tests and adaptations of red blood cells which candidates found the least accessible to gain marks.

Assessment for learning



There were some candidates who had 'no response' answers or misread the instructions throughout Section B which could be easily overcome through developing examination technique. For example, when instructed to tick one box in each row, do not tick more than one which would negate the mark.

Question 16 (a)

16 (a) Put ticks in the table to show whether each statement is true or false about the structure of DNA.

Tick (✓) one box in each row.

True	False
	True

[2]

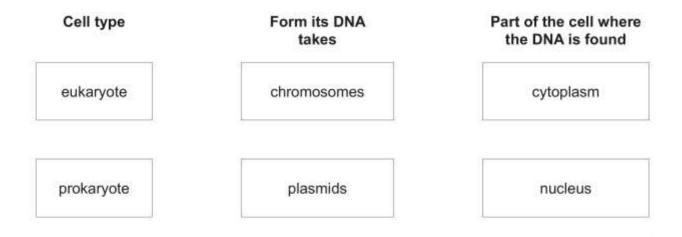
[1]

This question on DNA was a good discriminator between candidates at different grades. Most candidates were able to correctly identify one true or false statement about DNA, with many candidates gaining maximum marks.

Question 16 (b)

(b) DNA is found in both eukaryotic and prokaryotic cells.

Draw lines to connect the cell type to the form its DNA takes then to the part of the cell where the DNA is found.



The majority of candidates were able to correctly identify the cell type with the form of DNA it takes and location within the cell.

Question 16 (c) (i)

(c) A light microscope is used to see structures in cells.

Complete these sentences about the parts of a light microscope.

Use words from the list.

clips	eyepiece	focusing knob	light
objective	stage	stain	

i) The microscope slide is placed on the of the microscope.

Most candidates were able to identify that microscope slides are placed on the stage of a microscope.

QUESTION TO TO THE	Qu	estion	16	(C)) (ii)
--------------------	----	--------	----	-----	-----	-----

(ii)	The	lens is used to change the magnification of the object	t
	being viewed.		[1]

Many candidates were able to identify the objective lens is used to change the magnification of the object to be viewed.

Question 16 (c) (iii)

(iii)	The part of the microscope that moves the lens	to see the image more clearly is called	
	the	[1	

Most candidates correctly identified the focussing knob moves the lens.

Question 17 (a)

17 (a) The table lists some structures in the human body.

Identify whether each structure is:

- part of the nervous system
- · part of the endocrine (hormonal) system
- not part of either system.

Tick (✓) one box in each row.

Structure	Part of the nervous system	Part of the endocrine system	Not part of either system
Insulin producing cells in the pancreas			
Kidney tubules			
Pituitary gland			
Spinal cord			
Temperature receptors in the skin			

10

[5]

This question discriminated between candidates at different grades well. The majority achieved 3 or more marks in identifying structures of the nervous and endocrine system.

Assessment for learning



The most common incorrect response was not identifying insulin producing cells in the pancreas was part of the endocrine system. Candidates thought it was not part of either system. Centres could reinforce the key endocrine glands in future as a key knowledge gap.

Question 17 (b) (i)

(b)	(i)	Stem cells are found in human embryos.
		Describe what happens to stem cells as the embryo develops into a baby.
		[2

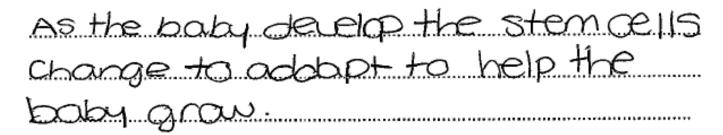
This question was challenging for the candidates. The majority of candidates gave generic responses such as 'stem cells divide to make the baby grow and develop'. They did not demonstrate understanding that they are undifferentiated cells that have the ability to divide into any type of cell that makes the baby. Very few candidates gained maximum marks.

Assessment for learning



Knowledge gap identified in AO1 knowledge and understanding of stem cells. Candidates would benefit with the reinforcement of stem cells to increase their knowledge and understanding.

Exemplar 1



Exemplar 1 demonstrates the knowledge and understanding gap of the role of embryonic stem stells in the development into a baby.

Question 17 (b) (ii)

(ii) It takes one cell 12 hours to divide to produce two cells.

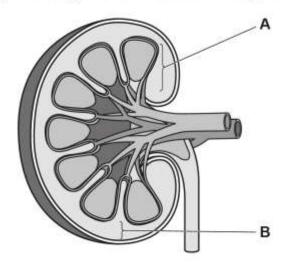
Starting with one cell, calculate how many cells there will be after 2 days.

Number of cells =[3]

This question discriminated well between candidates at different grades with an equal range of marks given from 0 through to maximum. Most candidates were able to work out that there were 48 hours in two days and some managed to apply this knowledge that four divisions would be possible. Very few candidates then went on to show their understanding of mitosis to work out there would be 16 cells over two days.

Question 18 (a) (i) and (ii)

18 (a) The diagram shows a section through a kidney.



- (i) Name the region labelled A. [1]
- (ii) Name the region labelled B.[1]

This was one of the most challenging questions on the paper. Very few candidates could correctly identify region A as the medulla and B as the cortex. The majority of incorrect responses stated the nephron/tubules or stated random blood vessels. A large number of candidates did not attempt this question and were awarded a 'no response' which was not representative for the paper as a whole.

Assessment for learning



Knowledge gap identified in the application of knowledge and understanding of the structure of the kidney. Candidates would benefit with the reinforcement of the kidney structure to increase their knowledge and understanding.

Question 18 (a) (iii)

(iii) Which type of blood vessel brings blood to the kidney?

Put a (ring) around the correct word.

artery capillary vein

[1]

Roughly half of candidates could correctly identify the artery brings blood to the kidney.

Question 18 (b) (i)

(b) The table shows the volume of water gained and lost by one person in one day.

Water gained (litres per day)		Water lost (litres per day)	
Food and drink	2.2	From skin and lungs	0.9
Metabolic processes	0.3	Faeces	0.1
		Urine	

(i) Calculate the volume of urine that will be produced by this person on this day.

Volume of urine = litres [2]

Just over half of candidates could correctly calculate the volume of urine produced by taking the water gained from the water loss per day to gain full marks. The candidates who could not do this could also not total the water gained and lost each day correctly. Therefore candidates either gained full or 0 marks.

Question 18 (b) (ii)

The same person runs a marathon race the next day.
Explain how the kidney will maintain the water balance within this person's body during the race.

The candidates seemed to find the application of their knowledge and understanding of water balance difficult. The most common scored mark was idea of water loss through sweating. A lot of candidates could not correctly describe what was happening in the kidney to reduce water loss. Less successful responses gave answers such as they would drink more fluids during the race. This was also a question which had a high number of 'no responses' which was not representative for the rest of the paper.

THI	E PKR	NOZ	will s	SWERT	WHICH	pear 15
						WATER
BUT	THEY	will	ALSO	DRINT	RUT T	HEU

WILL NEED TO DRINK MORE TO ACCOUNT FOR

Exemplar 2 demonstrates the typical response for explaining water balance during running a race. This candidate gained the mark for losing water through sweat but gave no further detail of how the kidney would maintain this.

Assessment for learning



Exemplar 2

Knowledge gap identified in the application of knowledge and understanding of the role of the kidney in maintaining water balance. Candidates would benefit with the reinforcement of the kidney's role in homeostatic control of water balance to increase their knowledge and understanding.

Question 19 (a) (i)

19 A student investigates the effect of pH on an enzyme called catalase. Catalase breaks down hydrogen peroxide into water and oxygen.

The student collects the oxygen produced by the reaction. The table shows their results.

pН	Volume of oxygen collected (cm ³)
2	1
4	12
6	24
8	26
10	8

(a) (i) Plot a graph of the results.

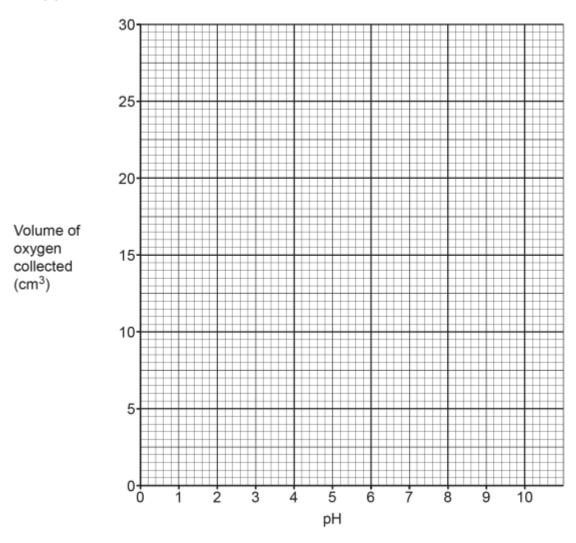
[2]

More candidates scored maximum marks than either 0 or 1 mark. The most incorrectly plotted point was for pH 10. Candidates need to make sure they look at the scales and are precise with their plotting as only half a square error margin is allowed.

Question 19 (a) (ii)

(ii) Draw a line of best fit.

[1]



The majority of candidates could plot points on a graph correctly, however the vast number of candidates did not draw a line of best fit increasing and decreasing when pH increases through most points. The majority of candidates only drew a straight line of best fit showing a positive correlation.

Assessment for learning



Knowledge gap identified in the application of a line of best fit. Candidates should be prepared to draw straight and curved lines of best fit where appropriate. This should be reinforced throughout the KS4 curriculum.

Question 19 (b)

(b)	Write down a conclusion for the student's results. Include data in your answer.
	[2]

This question to analyse information to draw conclusion was challenging for the candidates. The more successful responses identified the trend and a small number of candidates were able to apply this to denaturing of enzymes above and/or below the optimum pH.

Question 19 (c)

(c) When collecting data, it is important that it is accurate, valid and repeatable.

Draw lines to link each **improvement** the student could make to the **effect** this improvement has on the data.

Improvement Effect The experiment is completed three times for each pH. The experiment is completed three times for each pH. Use a measuring cylinder, not a beaker, to measure

Place the mixture of catalase and hydrogen peroxide in a waterbath.

the volume of enzyme.

This will keep the temperature the same for each pH.

makes the data more valid

identification of any

anomalous results

[2]

This question was a good discriminator. The most successful responses gained full marks in correctly identifying how the improvement when collecting data effected accuracy, validly and identifying anomalies.

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U	c_{κ}	sup	port



Our <u>Language of measurement in context</u> resource can be used with candidates to help familiarise them with terms such as validity, repeatability and anomalies.

Question 19 (d)

(d)	The student wants to increase their confidence in finding the correct optimum pH for
	catalase.

What should the student do?

Tick (✓) one box.

Repeat the experiment at a higher temperature.

Repeat the experiment using less enzyme.

Repeat the experiment using pH 1, 3, 5, 7, 9 and 11.

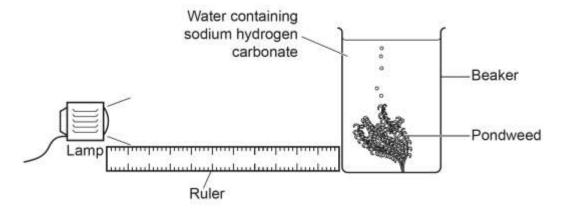
Repeat the experiment using pH 6.5, 7, 7.5, 8 and 8.5.

[1]

This question was challenging for the candidates, with a minority analysing the information to correctly identify how to improve the experiment in finding the correct optimum pH.

Question 20*

20* A student plans to investigate photosynthesis using this apparatus.



Describe how the student could use this apparatus to investigate the effect of light intensity on the rate of photosynthesis.

In your answer you should include:

- · how to change the light intensity
- the variables that need to be kept constant
 the measurements that should be taken.

re

The Level of Response extended writing question was based on a PAG practical that the candidates should have been familiar with. This was accessible by most candidates who achieved Level 1 and 2 responses on correctly identifying independent and dependent variables. Some candidates were able to reach Level 3 with a detailed description on changing the independent variable, measuring the dependent variable and identifying the control variables.

Exemplar 3

The Student can us this alkaratus to investigate
the effect of light intensity by Putting the Comp
the effect of light intensity by lutting the lamp a certain distance away. Such as soon and
then count how many oxygen bubbles the Bondubed (eleases in a certain time. Then they can move
Celeases in a certain time. Then they can move
the land to notion away and releat making
Scre bey count for the Same amount of Johns
at each measurent. The Student Can then test this
For hoem, 15, lon and 5 cm away. The rate
Or respiration should Increase as the land gets
Closer as there will be a greater light
intensity,
()

Exemplar 3 demonstrates a candidate who provided a detailed description of how to change the light intensity and described in detail the measurements that should be taken. Level 2-4 marks as no reference to any control variables identified. We can ignore the incorrect use of respiration as not relevant to the question.

OCR support



Our <u>Language of measurement in context</u> resource can be used with candidates to help familiarise them with terms such as control variables, and where to identify them in a practical.

[5]

Question 21 (a)

21 (a) To try to lose weight some people go on a type of diet called a ketogenic diet.

In a ketogenic diet, a person eats food that is high in fat and protein but low in carbohydrates.

Complete each sentence about this diet.

Use the words from the list.

amino acids	enzymes	fatty acids	glycerol	
glycogen	homeostasis	respiration	sugar	

Proteins in the food are broken down to smaller molecules called
These smaller molecules are used to make more proteins in the body, such as
Fats in the food are broken down into and
These are then used by the body to make lipids.
As the diet is low in carbohydrates such as starch, the person will have less
dissolved in their blood.
This means that the body will need to use some of its fat reserves to produce ATP by

The majority of candidates gained at least 1 mark for the most common scoring mark for correctly identifying ATP is produced by respiration. A minority could correctly complete each sentence. Most candidates mixed up the role of enzymes with amino acids and also could not correctly identify fats are broken down into glycerol and fatty acids.

21

The diet is only recommended to be used for a short period of time to lose excess fat.

Assessment for learning



Knowledge gap identified with digestion of large (polymer) molecules and the role of enzymes into their constituent small molecules (monomer) respectively. Centres should reinforce the role of enzymes in digestion of protein, lipids and carbohydrates.

Explain why this student is correct.

Question 21 (b)

(b)	Three people each make a comment about this diet.
	Person A: People who are very overweight could lose weight if they went on this diet and this may make them feel better about themselves.
	Person B : This diet could be harmful to people with underlying health conditions, such as diabetes.
	Person C: There are dangers to following this diet but being very overweight also causes many health issues.
	Which person is discussing both the risks and benefits of following this diet? Explain your answer.
	Person
	Explanation
	[3
the risks which pa	didates were able to achieve at least 1 mark for correctly identifying Person C discussing both and benefits of following the diet. To gain more marks candidates needed to correctly identify rt Person C stated which referred to the risks and the benefit without simply rewriting the stem estion, which only the minority could.
Questi	on 21 (c)
(c)	A class is discussing how to test food to see if it contains carbohydrates. A student says 'You need to do two different named tests to see if carbohydrates are present'.

This tested the candidates' AO3 skills in analysis as they needed to evaluate the information and form conclusions which food reagent tests you use to test for carbohydrates. The majority of candidates could not do this and did not correctly identify the two different tests for carbohydrates, the iodine and Benedict's test.

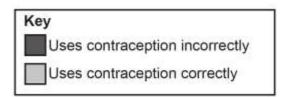
Assessment for learning

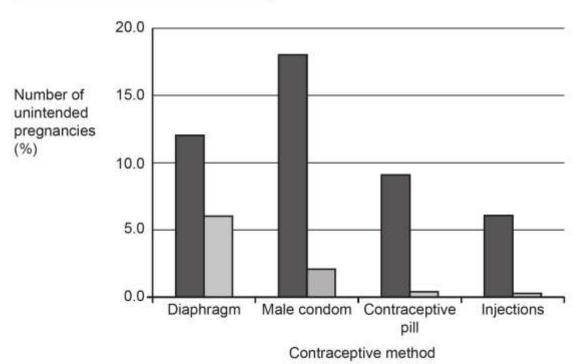


This is highlighted as a knowledge gap for food/biological molecule reagent tests. Candidates could not identify Benedict's test for sugar/glucose and iodine test for starch. This learning of a PAG should be reinforced throughout the KS4 curriculum.

Question 22 (a)

22 The graph shows the percentage of unintended pregnancies while using different types of contraception.





(a) Compare the effectiveness of the different types of contraception in preventing pregnancies. Include data from the graph.

This question discriminated well between candidates at different grades with only a few gaining full marks. The question was testing the ability to draw conclusions and evaluate from data provided. Despite the question asking to include data, most candidates did not include this. The most common scoring marks given were a correct comparison of any contraceptive method used correctly and/or used incorrectly on the number of unintended pregnancies. The less successful responses were able to gain a mark for a correct comparison between any contraception and impact on unintended pregnancies. Some candidates misinterpreted the data and stated the different contraceptive methods' success in working correctly or incorrectly instead of impact on unintended pregnancies.

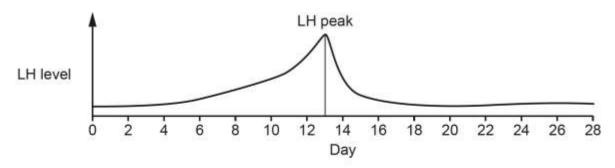
Question 22 (b)

(b) A female is trying to get pregnant.

High levels of a hormone called LH stimulate ovulation.

When is the female most likely to get pregnant?

The graph shows the levels of LH throughout the female's menstrual cycle.



Explain your answer.

More than half of candidates were able to correctly identify that around day 13 the female would ovulate and likely get pregnant, which matches the LH peak. Very few candidates could then go on and apply this knowledge that would mean the egg could be fertilised by the sperm.

Question 22 (c)

(c)	Some females produce low levels of progesterone after an egg has been fertilised.				
	Suggest how this may affect the uterus lining.				
	[1]				

A minority of candidates knew that progesterone maintains the uterus lining so could analyse the information to make judgements on what would happen if progesterone levels were low.

Question 23 (a)

23 (a) The contents of sub-cellular structures found in eukaryotic cells enable the structure to perform its function.

Draw lines to connect each **sub-cellular structure** to its **contents**.

Then draw lines to join each of the **contents** to its correct **function** within the cell.

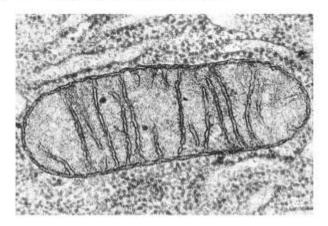
Sub-cellular structure	Contents	Function
cell membrane	chlorophyll	allows communication with other cells
chloroplast	enzymes	catalyses reactions in aerobic respiration
mitochondria	receptors	needed for photosynthesis

[4]

The vast majority of candidates achieved 3 or maximum marks, correctly identifying the sub-cellular structure with its contents and function.

Question 23 (b) (i)

(b) The image is of a mitochondrion.



(i) Draw the mitochondrion in the box. Your drawing should be a scientific drawing.



[2]

The candidates struggled to apply a structure to a biological drawing. The most common awarded mark was to correctly outline the shape of the mitochondrion with continuous lines and no shading. Most candidates did not draw a double outer membrane with internal structures.

Assessment for learning



This is highlighted as a knowledge gap for application of biological drawings. Candidates could not correctly apply the structure provided with an accurate scientific drawing. This learning of a PAG should be reinforced throughout the KS4 curriculum.

Question 23 (b) (ii)

(ii)	What type of microscope was used to create the image of the mitochondrion?	
	Explain your answer.	
	Type of microscope	
	Reason	
	r	21

When candidates could correctly identify that the electron microscope was used to create the image of the mitochondrion, they went on to correctly state the reason. However, more than half the candidates did not know the electron microscope was used and did not gain any marks. The least successful responses confused the electron and light microscope or stated the electronic microscope.

Question 23 (c)

(c)	Name one structure found in both an animal cell and a prokaryotic cell.	
	[1	1]

Roughly half of candidates could correctly identify a structure found in both an animal and a prokaryotic cell. The most common incorrect response was nucleus.

Question 24 (a)

24 (a) Arteries, capillaries and veins are blood vessels found in the human circulatory system.

Put ticks (✓) in each row to identify which blood vessels have each feature.

Feature	Arteries	Capillaries	Veins
Have valves along their length			
Have a very thick muscle wall			
Have a wide lumen			

[3]

Half of all candidates could correctly identify that veins have valves and arteries have a very thick muscle wall. Only the most successful responses also could correctly identify veins had a wide lumen.

Assessment for learning



This is highlighted as a knowledge gap for structure of blood vessels. Most candidates could not correctly identify that veins have a wide lumen. This should be reinforced throughout the KS4 curriculum.

Question 24 (b)

(b)	Chronic venous insufficiency (CVI) is a condition caused by faulty valves found in so	me
	blood vessels in the legs.	

Describe how CVI will affect the person's blood circulation. Suggest **one** symptom of this condition.

Effect on b	blood circulation	
Symptom	1	

Just under half of candidates could correctly identify a symptom of CVI and apply their knowledge and understanding of valves in veins. Only a minority of candidates could demonstrate the effect on the blood circulation. This was a higher demand question.

Question 24 (c)

(c) The volume of blood pumped from the left ventricle into the aorta during one contraction is 70 ml.

Calculate the volume of blood that will be pumped into the aorta in one hour if a person has a resting heart rate of 76 beats per minute.

Volume = ml/hour [2]

This question was a good discriminator between candidates at different grades. Roughly equal number of candidates accessed this, with ranges of 0 to full marks.

Question 24 (d)

(d)	Red bloc	d cells	contain	haemoglobin	to	transport oxygen.	

Give one other feature of red blood cells.
How does this other feature allow the cell to perform its function?
rai
[2]

A minority of candidates were able to correctly identify red blood cell adaptations. This was a higher level of demand question for the foundation paper. The most common scoring mark was large surface area correctly identified. The most common none scoring response stated that red blood cells are used in helping the body work in a generic way.

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Question 22: Graph - © Straighthealthcare, 'Graph of the hormone concentrates during the menstrual cycle', www.straighthealthcare.com

Question 23 (b): Image of a mitochondrion - © CNRI / SCIENCE PHOTO LIBRARY, www.sciencephoto.com

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For the June 2023 series, Exams Officers will be able to download copies of your candidates' completed papers or 'scripts' for all of our General Qualifications including Entry Level, GCSE and AS/A Level. Your centre can use these scripts to decide whether to request a review of marking and to support teaching and learning.

Our free, on-demand service, Access to Scripts is available via our single sign-on service, My Cambridge. Step-by-step instructions are on our <u>website</u>.

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