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Examiners' report

BIOLOGY A

H420

For first teaching in 2015

H420/01 Summer 2023 series

Version 1

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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

H420/01 is one of three components of the GCE A Level Biology A specification assessed during this examination session. For H420/01 candidates needed to demonstrate breadth and depth of knowledge across modules 1, 2, 3 and 5 with 15 multiple choice and two Level of Response questions included in the 100 marks.

Mathematical and practical skills continue to be embedded within the multiple choice questions in section A and the longer responses of Section B. The exam paper appeared to be accessible to candidates across the ability range, and there was no evidence to suggest that candidates were under any time constraints towards the end of the paper.

Overall, candidates demonstrated a wide range of ability with more successful candidates giving succinct responses and appearing more adept at coping with the demands of the paper's mathematical and practical content to gain higher level marking points. Candidates are showing increased confidence in tackling Level of Response questions and responses are becoming more focused as candidates are writing less but including more detail. Disruption to education during COVID 19 pandemic possibly still had an impact on candidate performance for questions requiring practical skills. Most candidates were able to demonstrate their ability to learn and recall facts.

Candidates who performed less well appeared unable to apply their knowledge, evaluate or use information provided, e.g. diagrams, graphs or figures included in the questions, to support their answers.

Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• applied their knowledge to new situations • demonstrated good knowledge of mathematical skills and practical skills where possible • were able to analyse data • evaluated conclusions effectively to give balanced arguments.	• used information to describe scientific terms • completed tables and gap fill questions • provided responses to short answer questions.

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Section A overview

As in previous years, this section of the examination consisted of 15 multiple choice questions covering a range of topics across the assessed modules for this component. Only AO1 and AO2 were assessed in Section A. Some questions involved recall, while others required the use of mathematical, practical and/or analytical skills; some questions needed more time than others.

Section A achieved a good spread of marks across the range of abilities. More successful candidates were able to demonstrate knowledge of the subject content without being distracted by the alternative options offered alongside the correct response.

Candidates had been advised to spend no longer than 20 minutes on this section and most candidates appeared to have managed their time effectively with very few omissions.

Previous reports advised candidates not to change multiple choice answer by writing over the top of a previous answer, but instead to re-write the letter fully next to the box. Letters changed from one to the other do not scan well, and it is not always obvious which is the intended response meaning that a mark cannot be given. Most candidates appear to have taken on board this instruction, as there were very few unclear responses seen this year.

Some candidates wrote the letters in lower case i.e. 'a' or 'd'. This can sometimes lead to ambiguity if handwriting is unclear, so candidates are advised to use the convention of capital letters when responding to questions in Section A.

Question 3

3 Which statement about the structure of amino acids is **not** true?

A Amino acids contain amino and carboxyl groups.

B Amino acids contain the elements hydrogen, carbon and oxygen only.

C Each amino acid has a unique R group.

D The R groups in amino acids can be polar or non-polar.

Your answer ☐ **[1]**

This is an example of a multiple choice question that asks candidates to identify the option that is **not** correct/true. Most candidates were able to identify **B** as the statement that is **not** true about protein structure. Option **C** was the most common incorrect response with candidates possibly scanning for a 'correct' statement about protein structure. Candidates are advised to read all options carefully before deciding on their response.

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Question 6

6 Which of the options describes movement of water through a plant?

A The Casparian strip forces water to enter the cytoplasm before it can enter the xylem.

B Water can move across the root by the apoplast pathway because of plasmodesmata between cells.

C Water is drawn up the xylem because of adhesion between water molecules.

D Water moves by osmosis from a low water potential to a high water potential.

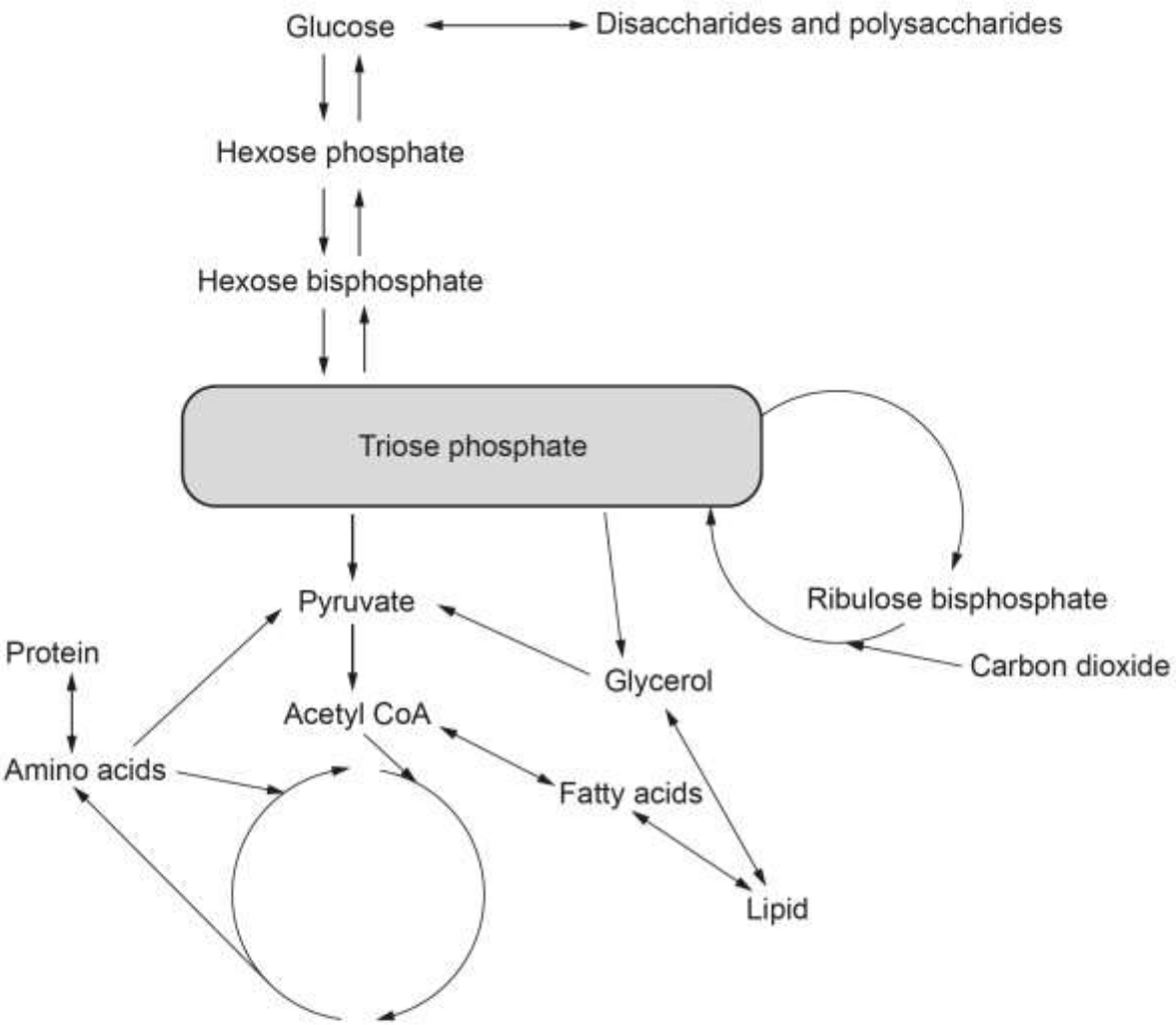
Your answer [ ] **[1]**

This question required knowledge of different water transport pathways, properties of water and also osmosis to formulate a response. A variety of incorrect options were seen, e.g. option **C** where candidates had confused adhesion and cohesion.

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Question 9

9 The diagram shows some of the reactions that take place in a leaf cell in a flowering plant.



Which of the following statements about triose phosphate is/are correct?

1 Six turns of the Calvin cycle produces 6 molecules of triose phosphate.
2 Triose phosphate from the Calvin cycle can be recycled to ribulose bisphosphate.
3 Triose phosphate from the Calvin cycle can be used to make cellulose, lipids and proteins.

A 1, 2 and 3 are correct

B Only 1 and 2 are correct

C Only 2 and 3 are correct

D Only 1 is correct

Your answer [ ] **[1]**

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This question is an example of a statement style multiple choice question. Candidates needed to use the information in the diagram and their knowledge to process information in the three statements about biochemical reactions taking place in a leaf. Many candidates gave the correct option **C** demonstrating sound knowledge and understanding of respiration and photosynthesis to identify statements 2 and 3 as being correct.

Question 15

15 The students were asked to decide whether the permeability of the membrane is significantly greater with 50% ethanol compared to 40% ethanol.

Which statistical test should they use?

A Chi squared (χ^2)

B Spearman's rank correlation coefficient

C Standard deviation

D *t*-test

Your answer ☐ **[1]**

Choosing an appropriate statistical test for analysing data or testing for significance continues to be challenging for candidates. Option C was a common incorrect response. Standard deviations (SDs) for data points were already included in the graph provided for Questions 14 and 15. SD measures the variability in a dataset and indicates the spread of data around the mean, but a *t*-test (correct option D) would be then needed to determine whether difference between the means of two datasets is significant, in this case between data obtained for 50% and 40% ethanol.

OCR support

Maths for Biology resources include a range of support on all mathematical skills required for A level Biology.

There is also a guidance for teachers on the statistical skills that candidates need to have, with examples in biology context.

The maths skills handbook also includes guidance on all the areas of mathematics that candidates need to have.

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Section B overview

Mathematical and practical skills continue to be embedded throughout the structured questions in Section B.

Assessment objectives AO1, AO2 and AO3 were addressed throughout Questions 16 to 21 with concepts from across the specification including mammalian transport systems, control and communication in both plants and animals, and movement of water.

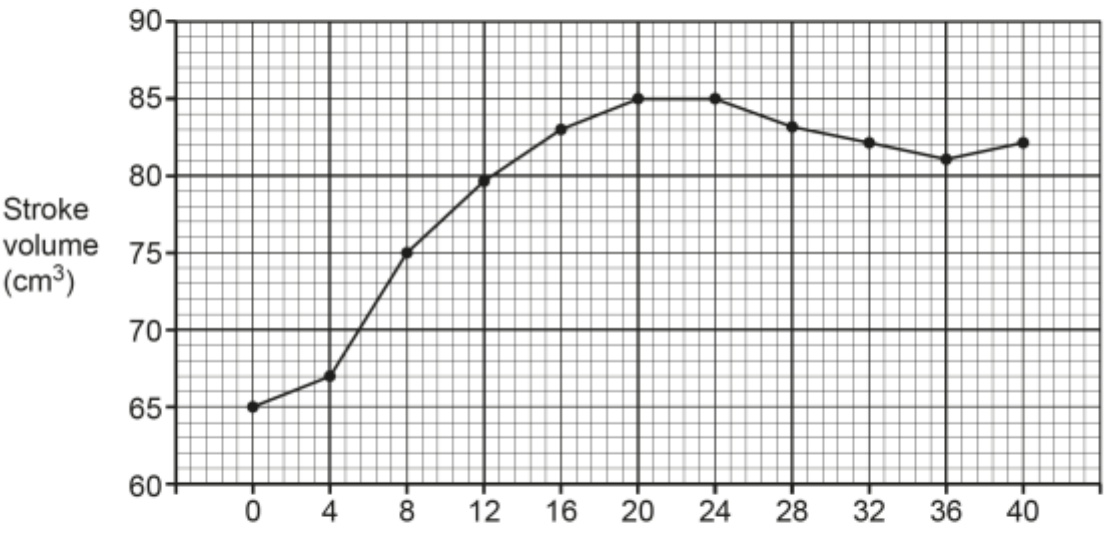
Question 16 (a) (i)

16 During pregnancy the mother's body undergoes several physiological changes to support the developing fetus. These changes affect every organ system in the body.

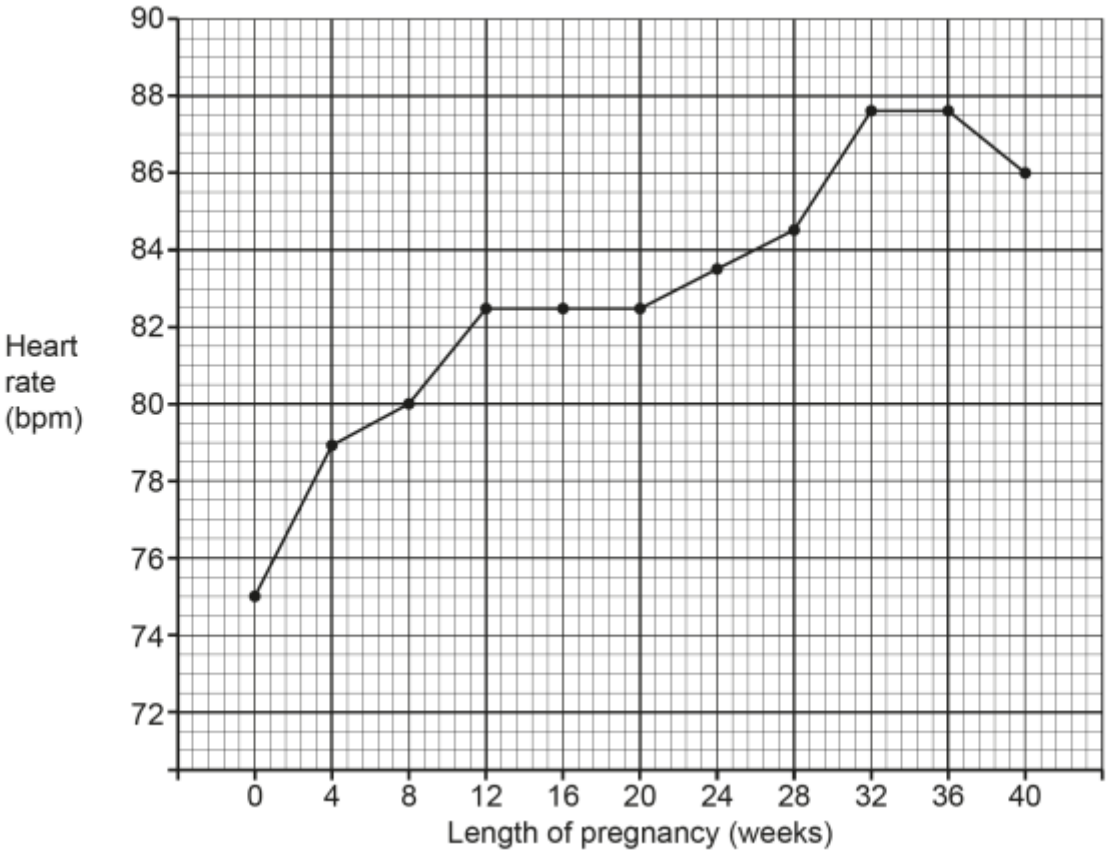
(a) Changes to the heart and circulatory system begin in the first few weeks of pregnancy.

Fig. 16.1 shows the changes in stroke volume and heart rate that occur during pregnancy.

Fig. 16.1



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(i) Use the data in **Fig. 16.1** to calculate the cardiac output in week 20.

Cardiac output = ... Unit ..... **[3]**

Most candidates selected the correct figures from the graph in Fig. 16.1 to gain 1 mark. Candidates who could recall the correct equation for cardiac output achieved 2 marks for the calculation. However, some candidates divided one figure by the other instead of multiplying them. Some candidates also struggled with the units, often stating cm^3/bpm, suggesting they have applied the logic of combining the units for stroke volume and heart rate but not appreciating that the 'beats' would not be a unit that could be used for cardiac output.

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Question 16 (a) (ii)

(ii) Suggest an advantage of the increase in cardiac output.

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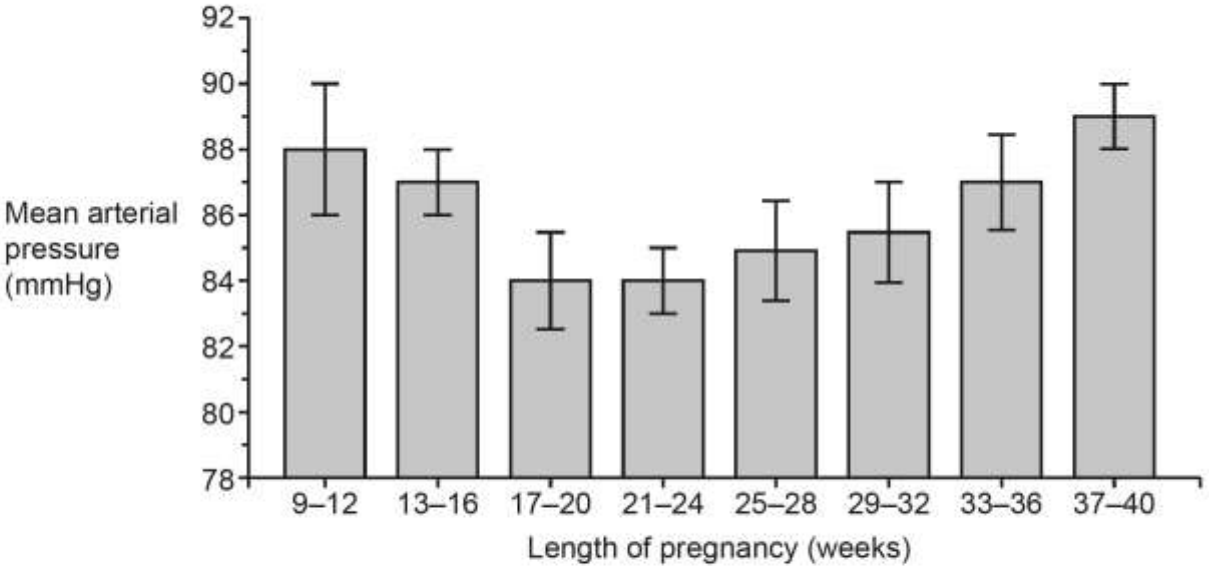
..... **[1]**

Good responses suggested that increased cardiac output would help more blood to be delivered to the placenta or more oxygen to respiring fetal cells. However, many candidates found it challenging to use the correct terminology and suggested the advantage of increase in cardiac output is to deliver more blood around the body without mentioning specifically to the (fetal/maternal) cells, tissues, organs, or placenta.

Question 16 (a) (iii)

(iii) **Fig. 16.2** shows how blood pressure varies throughout pregnancy.

Fig. 16.2



A student looked at the data in **Fig. 16.1** and **Fig. 16.2** and drew the following

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..... **[3]**

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Good responses were able to link points from the data provided in Fig. 16.1 and 16.2 to the validity of the conclusion. Many responses referred to stroke volume and heart rate rather than the consequential cardiac output and did not provide a full description of the trends shown. Time references were often focused on the lowest or highest levels of blood pressure, or just referred to early or late stages of pregnancy without quoting the correct range of weeks from the data. Successful candidates provided a balanced argument and noted the lack of a statistical test, no stated sample size or no data being seen at 0 weeks in Fig. 16.2. Some candidates referred to the overlapping error bars but were unable to correctly describe what this implied. Several candidates mentioned that correlation did not mean causation but not all followed this with the idea that the blood pressure changes may be due to another factor.

Question 16 (b)*

(b)* Describe the flow of blood through the **left** side of the heart during the cardiac cycle **and** explain the role of valves and pressure differences in this process.

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..... **[6]**

This Level of Response question was generally answered well by candidates. Most responses were presented in a logical manner, effectively describing the flow of blood through the left side of the heart from the pulmonary vein onwards, demonstrating good knowledge of the pressure differences and the role of the valves. Some candidates did not state that the pulmonary vein was delivering blood to the left atrium or confused it with the vena cava or pulmonary artery. Responses achieving Level 1 did not make a clear link between contraction and pressure differences. Some candidates described pressure differences between the two sides of the heart rather than differences within the left side. Others included unnecessary information about the role of the SAN, AVN and Purkyne tissue.

Misconception



A common misconception was about the role of pressure differences in relation to the opening and closing of valves. Some candidates wrongly stated that the left atrioventricular valve opens as a result of atrial systole rather than as a result of increased pressure when the atrium fills during diastole.

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OCR support

The delivery guide on Transport in animals offers an overview of key concepts and links to classroom activities.

Exemplar 1

Blood enters the left atrium through the pulmonary vein and passively begins to fill the left atrium and ventricle during diastole: causes gradual increase in atrial + ventricle pressure. During atrial systole, the left atrium contracts: pressure in left atrium increases, forcing blood into the left ventricle: as pressure in the atrium > pressure in ventricle ~~the left bicuspid valve closes~~ There is a slight delay between atrial and ventricular systole: The bicuspid valve closes before ventricular systole to prevent backflow of blood into the atrium: As pressure in ventricle greater than in atrium during ventricular systole, the walls of the ventricle contract (with greater force than the atria) to push blood up into the aorta: causes ^ pressure of ventricle to be greater than the pressure in the aorta so the semi-lunar valve opens to allow blood into the aorta: pressure in ventricle during ventricular systole greater than pressure in atrium [6]

Additional answer space if required.

during atrial systole: After ventricular systole, semi-lunar valve closes to prevent backflow of blood into ventricles and ventricular pressure decreases again:

A good Level 3 response is shown by this exemplar. The candidate completes their response in the space available.

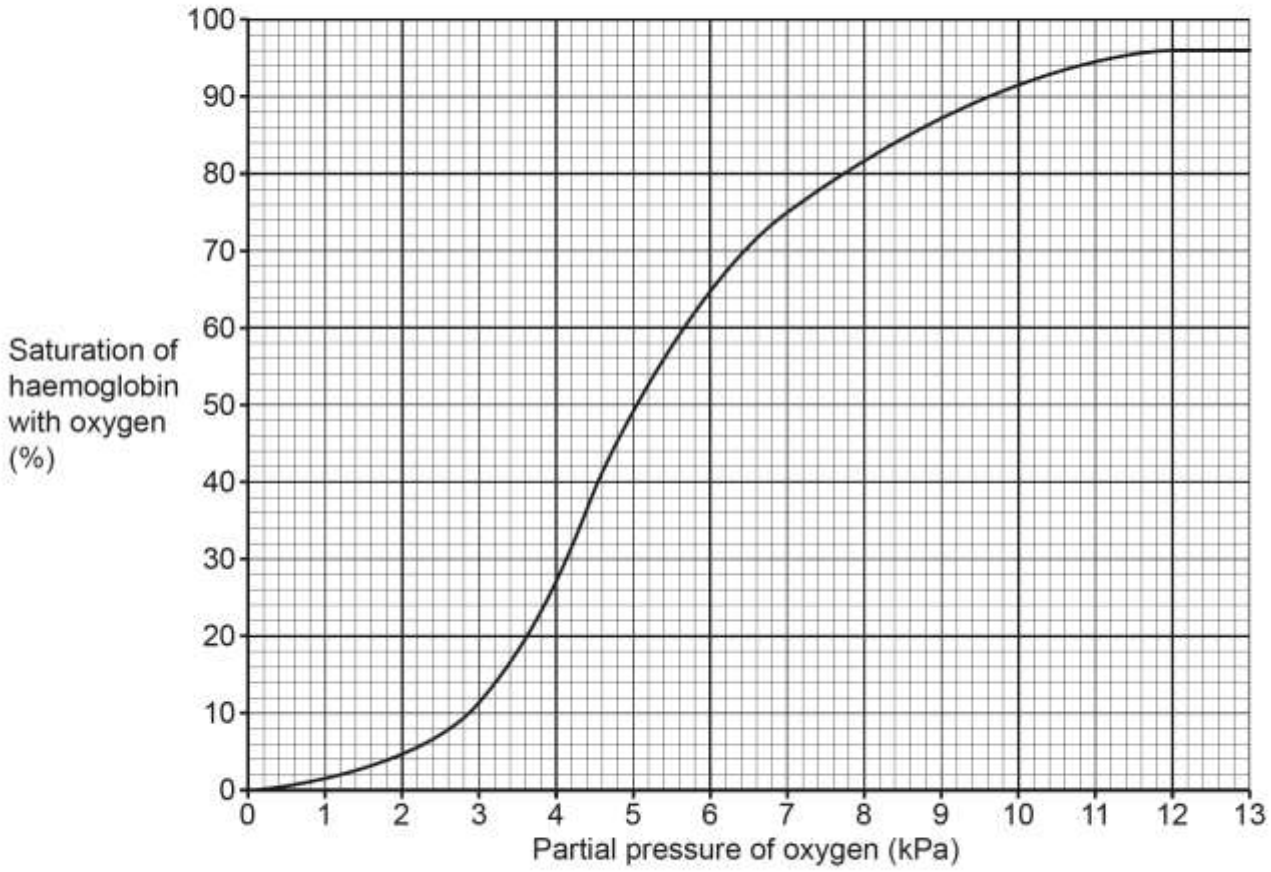
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Question 16 (c) (i)

(c) Another change that occurs in pregnancy is an increase in oxygen uptake by the mother. This is partly due to an increase in the mother's metabolic rate and partly to supply the developing fetus.

Fig. 16.3 shows the oxygen dissociation curve for the mother's haemoglobin.

Fig. 16.3



(i) Sketch the oxygen dissociation curve for fetal haemoglobin.

Answer on **Fig. 16.3**. **[1]**

Most candidates successfully drew the sigmoid curve to the left of the curve in Fig.16.3. A common error was seen in curves which either exceeded 96% before the plateau or would plateau at a higher percentage saturation than the maternal curve.

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Question 16 (c) (ii)

(ii) Explain how the different affinities of maternal and fetal haemoglobin enable transfer of oxygen from the maternal circulation to the fetus.

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..... **[3]**

Most candidates correctly stated that fetal haemoglobin (Hb) has a higher affinity for oxygen. Candidates recognised that oxygen would dissociate from maternal Hb and would be uploaded by the fetal Hb but few specified that this was at low pO_2. Less successful candidates did not write about the low pO_2 in the placenta or didn't use the correct scientific terminology to describe how oxygen moves from maternal blood to fetal blood or didn't describe the association/dissociation of oxygen.

Assessment for learning

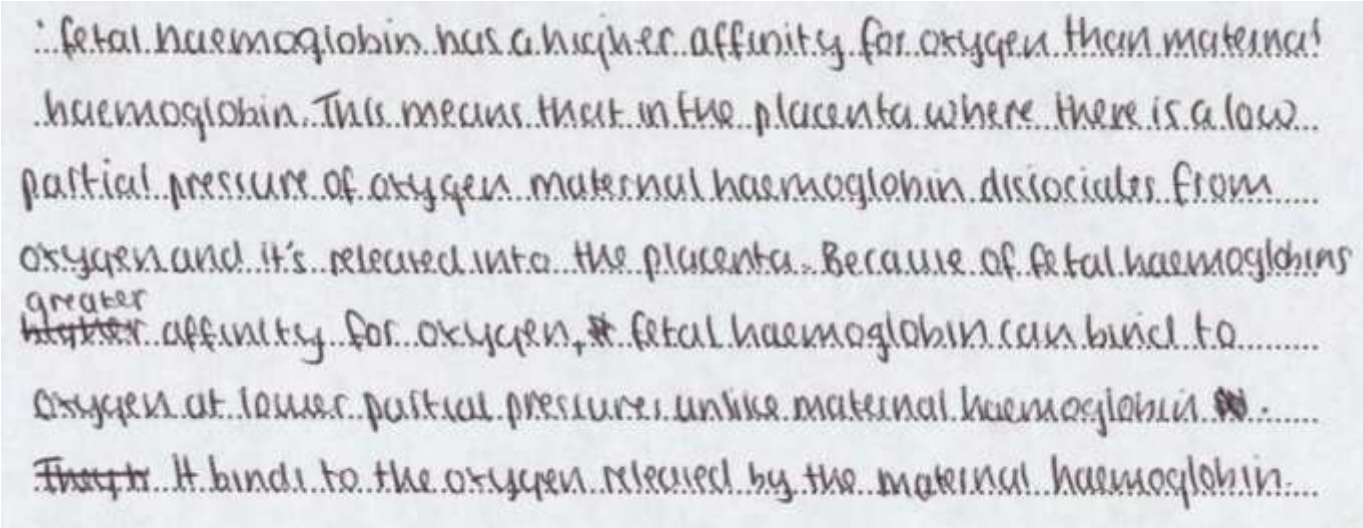
When comparing oxygen dissociation curves, it is beneficial to include details about partial pressures of oxygen understand what is occurring, e.g. it is the low pO_2 in the placenta that enables fetal Hb to associate with oxygen (from maternal) Hb and increase in saturation due to the higher affinity.

OCR support

OCR provides a Topic Exploration Pack on Oxygen Dissociation Curves to support teaching and offer advice on common misconceptions on Teach Cambridge

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Exemplar 2



A good response is shown by this exemplar. Good understanding of the dissociation curves and correct terminology used throughout.

Question 16 (d)

(d) Changes to kidney function during pregnancy can be confused with some diseases, such as chronic kidney disease or kidney failure.

The estimated glomerular filtration rate (eGFR) in a healthy 30–39-year-old is 107 $cm^3 min^{-1}$. The eGFR usually decreases with age but in pregnancy, can increase by between 50 and 85%.

The table shows the results of some of the physiological measurements that a clinic carried out on two 35-year-old women. One of the patients was pregnant.

Measurement	Patient A	Patient B
eGFR ($cm^3 min^{-1}$)	162	35
Blood glucose concentration	Normal	Slightly high
Urine glucose concentration	Moderately high	Slightly high
Urine protein concentration	Slightly high	Very high
Blood electrolytes Na^+, K^+, Cl^-	Normal	High

A doctor concluded that patient A was undergoing a normal pregnancy whereas patient B was suffering from kidney failure.

Explain the doctor's conclusion.

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..... [4]

This question proved challenging for candidates. Good responses noted the increased eGFR for patient A was within the pregnancy range stated, and also included a calculation to demonstrate this point. Some candidates misunderstood the information in the question stem and said the doctor was correct in diagnosing that patient A was pregnant. Some candidates compared the eGFR of patient B with patient A rather than to a person with a normal eGFR.

Vague responses describing that patient B's very high protein measurement was linked to kidney failure, rather than explaining the exact possible cause, e.g. damage to the Bowman's capsule or basement membrane did not gain credit. Some candidates who commented on the high electrolytes in patient B thought it was due to a lack of reabsorption, indicating that candidates did not fully understand that eGFR is linked to the ultrafiltration process at the glomerulus rather than other parts of the nephron. Very few candidates successfully linked patient A's increased glucose or protein levels to the higher eGFR. Some candidates did mention the elevated levels but linked those to complications with the pregnancy itself such as, gestational diabetes.

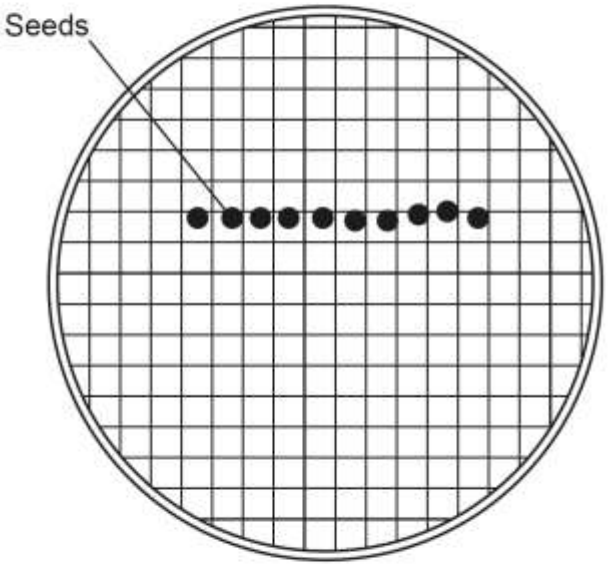
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Question 17 (a) (i)

17 Some students investigate the effect of IAA (auxin) concentration on the growth of roots and shoots in mustard seedlings.

This is the method that they use with 8 different concentrations of IAA:

- Place a filter paper on a bed of cotton wool in the Petri dish and soak it with IAA solution.
- Place 10 seeds in a horizontal line on the damp filter paper.
- Cover with a lid that has a grid marked on it, as shown in the diagram.
- Repeat this process with each different concentration of IAA.
- Add distilled water to one Petri dish in place of IAA solution.
- Place the Petri dishes vertically in a warm dark place for 2 to 3 days until the seeds have germinated and the roots and shoots have started to grow.
- Measure the length of the shoots and roots by counting the number of grid squares the shoot or root covers.



(a) (i) Explain why the Petri dishes were placed vertically and in the dark.

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..... **[2]**

Good responses showed good knowledge of phototropism and geotropism in formulating their response. Some candidates did not refer to keeping the seeds either vertically or in the dark and should be advised that if there are two conditions in a question, they should be clear which they are discussing in their responses. Most candidates were able to relate the requirement to keeping the dish in the dark to avoid phototropism, but fewer were able to explain the need for the vertical dish. In some instances where candidates came close to the mark, they had recognised that it was related to geotropism but did not relate this to the action of the root or shoot.

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Misconception

A common misconception included the idea that placing the dish vertically would stop the effects of geotropism. Candidates should be aware that geotropism is still occurring but and the placement of the dish allows growth of shoots and roots in different directions to help measurement.

Question 17 (a) (ii)

(ii) Explain the purpose of the Petri dish containing distilled water instead of IAA solution.

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..... **[2]**

Most candidates were able to identify this as a 'control experiment' but few gained an additional mark. Some candidates incorrectly used the term control 'variable' and should be advised of the difference between a 'control experiment' and a 'control variable'.

Assessment for learning

It is important to make a clear comparison between what is happening in the control experiment to the outcome of the experiment and then also consider how the data might be analysed and processed. This emphasises the important of practical based activities throughout the course that address such ideas.

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Question 17 (b)

(b) One of the students recorded the result shown in **Table 17.1**.

Table 17.1

Mean root length in test solution (number of grid squares)	Mean root length in water (number of grid squares)
16.5	13.9

Calculate the percentage change in mean root length in test solution compared with water.

Give your answer to **2** significant figures.

Change = ... % **[2]**

Candidates who were able to calculate percentage change achieved full marks for this question. A common error was to divide the difference in lengths by the final length resulting in the incorrect answer of 16%. Some candidates performed the correct calculation but lost 1 mark for not giving their response to the 2 significant figures stated in the question. Candidates should be reminded that the instruction to show their working is to help them gain marks in the event of an incorrect final response and should be encouraged to show the full steps that they have carried out.

OCR support

Maths for Biology resources include a range of support on all mathematical skills required for A level Biology.

The maths skills handbook also includes guidance on all the areas of mathematics that candidates need to have.

Assessment for learning

Candidates should be reminded that the instruction to show their working is to help them gain marks in the event of an incorrect final response and should be encouraged to show the full steps that they have carried out.

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Question 17 (c) (i)

(c) One student's results are shown in **Table 17.2**.

The results have been rounded to the nearest 5%.

Positive values represent increased growth and negative values represent decreased growth.

The concentration of IAA was measured in parts per million (ppm).

Table 17.2

Concentration of IAA (ppm)	% change in length	
	Root	Shoot
1×10^{2}	–100	0
1×10^{1}	–100	+200
1×10^{0}	–75	+140
1×10^{-1}	–45	+70
1×10^{-2}	+25	+30
1×10^{-3}	+65	+10
1×10^{-4}	+70	0
1×10^{-5}	+55	0

(i) Plot a graph of the data in **Table 17.2**. **[4]**

Good responses gave dependent and independent variables on correct axes with appropriate scales and went on to plot data for both roots and shoots, which were clearly identified by a key. However, some candidates reversed the independent and dependent variable axes, others forgot to add units or chose difficult scales that made it hard for them to plot. Some candidates did not complete appropriate lines or extrapolated lines. A common error was plotting the $1x10^{2}$ zero value for the shoot but not including it in the line drawn.

Assessment for learning

Plotting graphs is an invaluable skill included in this specification. Practice identifying dependent and independent variables for datasets and plotting a graph using appropriate scales is a recommended activity.

OCR support

Maths skills handbook can be used to support candidates preparing for assessment.

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Question 17 (c) (ii)

(ii) The students were given an IAA solution of concentration 100 ppm.

Outline a procedure the students could use to prepare the 8 test solutions required for the experiment.

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..... **[2]**

This question was generally well answered. Most candidates included the correct term 'serial dilution' in their response. A common error was to state the use of equal volumes of distilled water and solution, rather than using the figures provided in the question to give a 9 :1 (water : solution) ratio.

Question 17 (c) (iii)

(iii) Describe **two** precautions the students should take to make sure the concentrations of the solutions they prepare are accurate.

1 .....

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2 .....

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[2]

Generally, only higher achieving candidates scored 2 marks for this question. It is important to make sure that practical work and the understanding of the processes carried out are discussed using correct scientific terminology.

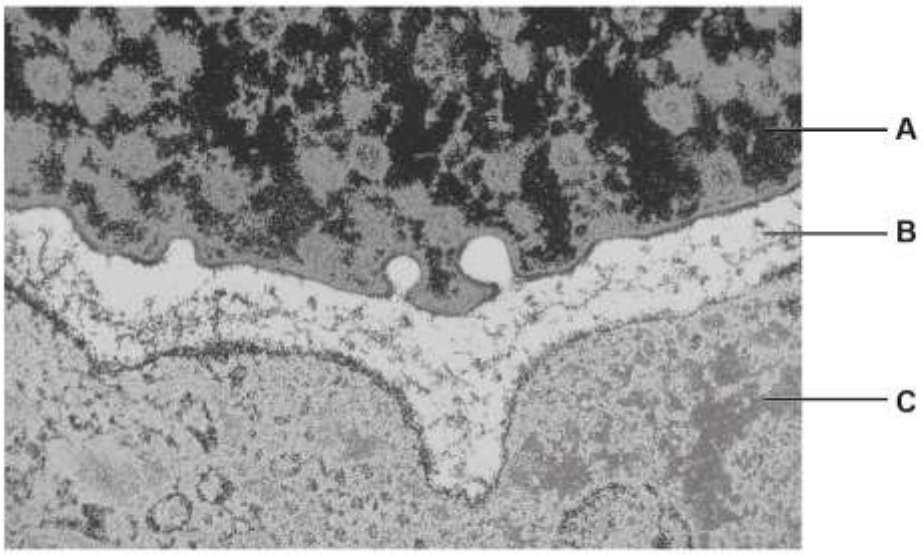
OCR support

Practical skills handbook can be used to support candidates preparing for assessment.

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Question 18 (a) (i)

18 (a) The electron micrograph shows the junction between two neurones.



(i) State the name given to the region labelled **B**.

..... **[1]**

Generally well answered by most candidates. 'Synapse' alone was not precise enough to gain a mark.

Question 18 (a) (ii)

(ii) Identify whether structure **A** or structure **C** is the first neurone in the pathway.

Use **one** piece of evidence visible in the electron micrograph to explain your choice.

.....

.....

..... **[1]**

Most candidates answered this well by identifying A and stating that vesicles could be seen. Some candidates lost the mark for stating that they could see vesicles moving across the cleft.

Misconception

A common misconception is when referring to vesicles at a synapse. It is important for candidates to be clear that vesicles fuse with the membrane and release their contents i.e. neurotransmitters that move across the synaptic cleft. *Vesicles* do not move across the synaptic cleft.

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Question 18 (b) (i)

(b) Mutations in genes coding for proteins in the cytoskeleton have been associated with several diseases of the nervous system, including neurodegenerative disorders.

(i) Give **three** functions of the cytoskeleton.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

This question was generally well answered with most candidates gaining at least 1 mark. Some candidates gave two answers that were the same marking point. For example, vesicles are considered organelles, and therefore 2 marks would not be gained for stating movement of vesicles, and movement of organelles, as this is still MP3.

Question 18 (b) (ii)

(ii) Suggest how a mutation in cytoskeleton genes could cause a disease of the nervous system.

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..... **[2]**

This question was challenging for some candidates. Good responses included suggestions that this could result in lack of movement of vesicles or affect the release of neurotransmitters and went on to suggest that this could result in loss of transmission at the synapse. Some candidates did not make the connection between mutation and change in protein structure or function and others described the effects resulting from a mutation to protein channels which, although relevant to protein structure, did not form part of the response about cytoskeleton proteins.

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Question 19 (a)

19 (a) Which statements about excretion and homeostasis are true, and which are false?

Tick (✓) **one** box in each row.

Statement	True	False
The liver, kidneys, lungs and skin are all involved in excretion.		
Carbon dioxide is formed by deamination of excess amino acids.		
Urea is less soluble and less toxic that ammonia.		
Breakdown of haem from haemoglobin produces bile pigments that are excreted in the faeces.		

[2]

Scripts showed evidence of the correction from the erratum notice and there was no evidence to show any impact on responses. Only high attaining candidates achieved both marks for this question.

Erratum notice

Instructions to invigilators:

Before the start of the exam, please read the following notice out **twice** to candidates:

Turn to **page 26** of the **question paper** and look at **question 19(a)**.

The third row of the table reads:

'Urea is less soluble and less toxic that ammonia.'

Cross out the word 'that' and replace with 'than'.

The third row of the table should now read:

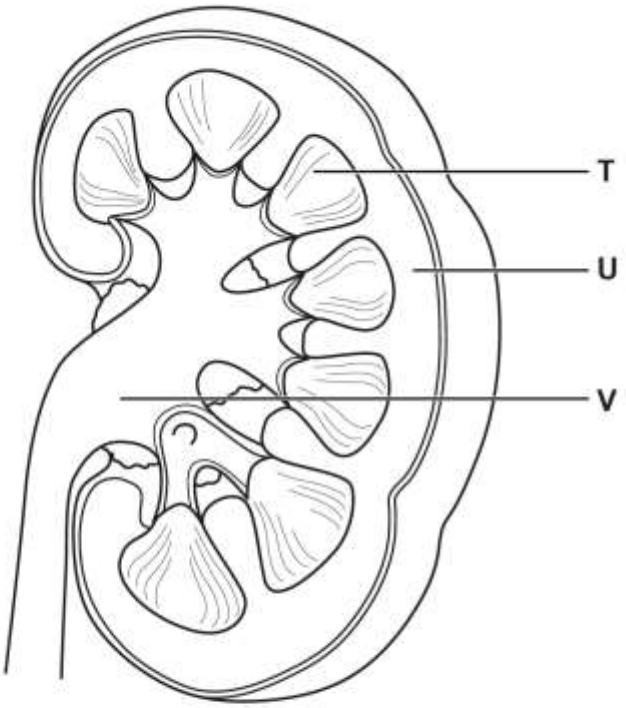
Urea is less soluble and less toxic than ammonia.

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Question 19 (b)(i)

(b) (i) **Fig. 19.1** is a drawing of a longitudinal section of a kidney.

Fig. 19.1



Identify the parts of the kidney labelled **T**, **U** and **V**.

T .....

U .....

V .....

[3]

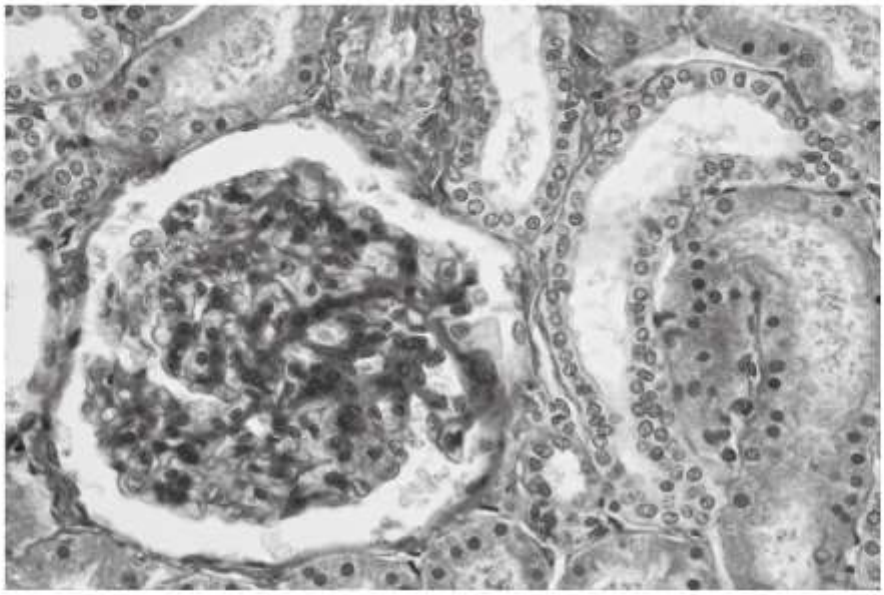
This question required straightforward recall of kidney structure. Most candidates correctly identified medulla and cortex for T and U, although some candidates gave these the wrong way round. A common error was referring to 'adrenal medulla' or 'adrenal cortex' which was not credited. Ureter or renal artery was the most common incorrect response for V.

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Question 19 (b) (ii)

(ii) **Fig. 19.2** is a photomicrograph of a cross-section of part of the kidney.

Fig. 19.2



× 360

Using the letter **T**, **U** or **V** from **Fig. 19.1**, identify the part of the kidney that was used to make the cross-section in **Fig. 19.2**.

Give a reason for your identification.

Letter representing part of the kidney .....

Reason .....

.....

[2]

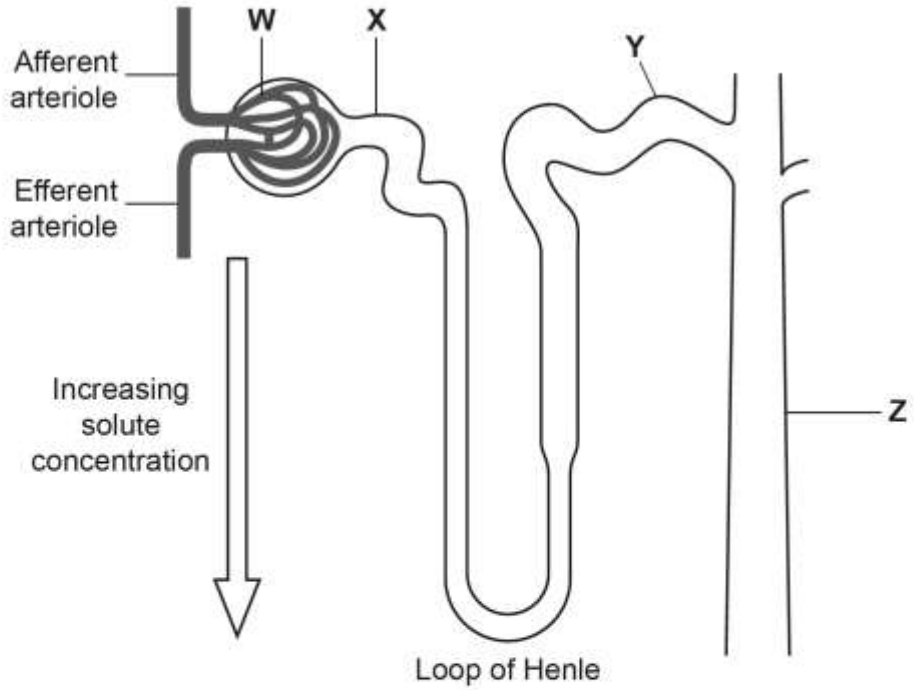
Most candidates correctly identified the region shown in the photomicrograph of the kidney and were able to give a correct explanation of the features which identified it.

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Question 19 (c) (i)

(c) **Fig. 19.3** is a diagram of a single nephron.

Fig. 19.3



(i) Complete the table using the most appropriate letter or letters, **W** to **Z**, to show which part(s) of the nephron correspond to each of the statements.

Each letter may be used once, more than once or not at all.

Statement	Letter or letters
ADH increases the permeability of the walls	
This region has the highest hydrostatic pressure	
Movement of mineral ions occurs to maintain the balance of mineral ions in the blood	

[3]

Generally, this question was well answered. Most candidates correctly identified region Z as being the site of action for ADH and W for the region with the most hydrostatic pressure. The most common incorrect response was in the third row, where candidates stated X, or X and Y, suggesting confusion between the roles of the proximal and distal convoluted tubules.

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Question 19 (c) (ii)

(ii) **Fig. 19.3** shows an increasing solute concentration.

Outline the processes in the loop of Henle that cause the solute concentration to increase.

.....

.....

.....

.....

.....

..... **[3]**

Good responses gave clear descriptions of the movement of named ions and water, correctly identifying which part of the loop was involved and were specific about the roles of the descending and ascending limb. Some candidates were unable to name the ions or did not identify the mechanism by which the ions or water were moving. Common errors included listing the wrong ions, such as K^+ or Ca^{2+}, or not mentioning which limb was being described. Weak responses stated that the loop of Henle decreased the water potential in the medulla but could not explain in detail how this was achieved. Others also often referred to solutes or salt rather than named ions.

Question 19 (d)

(d) An adult was advised to change their diet to reduce their body mass before undergoing surgery.

Over a period of several weeks their body mass reduced by 1 kg.

Suggest what happened to the 1 kg of body mass.

.....

.....

.....

.....

..... **[2]**

Good responses used correct scientific terminology to describe that body fat would be respired (aerobically) to form carbon dioxide which would then be excreted, hence losing mass. Some responses were too vague, referring to the breakdown of fat (from diet) without identifying this as stored body fat.

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Question 20 (a) (i)

20 (a) Organisms can be ectotherms or endotherms.

(i) Define the term **endotherm**.

.....

..... **[1]**

Most responses only included part of the definition for an endotherm with few responses mentioning 'heat'.

Assessment for learning

Definitions are an important part of the specification and candidates should be encouraged to learn these in full.

Question 20 (a) (ii)

(ii) Suggest **one** advantage and **one** disadvantage that ectotherms have compared to endotherms.

Advantage .....

.....

Disadvantage .....

.....

[2]

Many good responses suggested that the advantage would be that they required less energy or food. Some also recognised that the organisms would have more energy for growth.

Candidates who gained a mark for a disadvantage identified that ectotherms would be at a greater risk from predators when their body temperature was too low. Some candidates focused on the ectotherms' inability to control their body temperature without external sources but did not relate this, to how it can be a disadvantage.

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Question 20 (b)*

(b)* During a class discussion, one student stated:

'Ectotherms cannot control their body temperature.'

Another student stated:

'Ectotherms control their body temperature by behavioural responses, but endotherms do not.'

Discuss, using examples, whether these two statements are correct.

.....

.....

.....

.....

.....

..... **[6]**

Overall, this was a high scoring Level of Response question. Candidates who were familiar with the differences between endotherms and ectotherms were able to achieve Level 3 and 6 marks. Examples given in support of their comments, were well-chosen and clearly described. Typical examples used were lizards basking to increase body temperature, penguins huddling when cold and elephants splashing water when hot. Some candidates confused ectotherms and endotherms in their responses.

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Question 20 (c) (i)

(c) Infection by pathogens such as bacteria and viruses often causes release of pyrogens into the blood.

Pyrogens stimulate the enzyme COX-2 to produce the compound PGE_2.

PGE_2 binds to receptors in the hypothalamus and this results in an increase in the thermogenic set point.

(i) Suggest the consequences of an increase in the thermogenic set point.

.....

.....

.....

.....

..... **[2]**

This question proved challenging. Some candidates identified that a fever would occur but other marking points were rarely included in responses. Most candidates mentioned enzyme activity and didn't make the link between increased temperature and the body's response to pathogens.

Question 20 (c) (ii)

(ii) PGE_2 receptors are located on the cell surface membrane.

State **two** functions of the cell surface membrane that are illustrated by the action of PGE_2.

1 .....

.....

2 .....

.....

[2]

Good responses gained both marks for recognising that the functions illustrated in the question stem were those of cell signalling and control of substances into and out of the cell.

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Question 21 (a) (i)

21 (a) In 1933 two scientists published a study in which they investigated the movement of coloured dyes in the transpiration stream of the stems of sycamore trees growing in a wood.

They bored holes in the stems and poured dye solution into the borehole. Then they sealed the hole with impermeable tape.

(i) Describe what is meant by the term **transpiration stream**.

.....

.....

.....

.....

..... **[2]**

Generally, well answered with most candidates describing the movement of water. However, some candidates stated '…through the xylem', without including the fact that transport starts at the roots and ends at the leaves. Some candidates went into unnecessary detail about the cohesion-tension theory or focused on the loss of water vapour from the leaves rather than on the transpiration stream.

Question 21 (a) (ii)

(ii) Suggest why the scientists sealed the borehole with tape.

.....

.....

..... **[1]**

Good responses recognised that pathogens could potentially enter the bore hole or that it was important not to break the transpiration stream. Some candidates stated the sealing of the borehole prevented the loss of water or the dye and did not appreciate that it would prevent water vapour leaving the hole rather than liquids.

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Question 21 (a) (iii)

(iii) The scientists found that the dye moved both up and down the stems.

A student wanted to investigate this in the laboratory. They devised an experiment using water-soluble food dyes injected into the stems of sunflower plants growing in pots.

Suggest how they could observe the route taken by the dyes.

.....

.....

.....

.....

..... **[2]**

Most candidates described how to observe the dye, e.g. using microscope. It is possible that candidates lacked practical experience of sectioning and staining a specimen for viewing under the microscope as some responses were vague and did not include reference to cutting sections at intervals. Many candidates were able to gain credit for describing the visible appearance of dye in the leaves, flowers or stem, although some incorrectly described the use of fluorescent, radioactive, or different coloured dyes. Incorrect responses often gave suggestions of inappropriate apparatus to use, e.g. a potometer or colorimeter, again perhaps demonstrating lack of practical knowledge.

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Question 21 (b) (i)

(b) Plants are often watered with a solution containing minerals to help them grow.

While preparing a class practical a technician accidentally watered some sunflower plants with a mineral concentration that was 1000 times higher than normal.

(i) Explain why the plants wilted, even though they were given a lot of water.

..... **[3]**

Good responses were those where candidates recognised that increased mineral ion content would lower the water potential of the soil so prevent uptake of water into root hair cells by osmosis. Weak responses often repeated the question stem about the plant wilting rather than describing that it is the loss of turgor pressure in the cells of the leaves which caused the plant to wilt.

Exemplar 3

When a very concentrated mineral solution is added to the soil, the concentration of mineral ions in the soil increases (decreasing the water potential) / forming a steep concentration and water potential (Ψ) gradient between the root hair cells and the soil. Although the mineral ions can be actively pumped into the root hair cells to decrease the Ψ in the root hair cell, the concentration of mineral ions in the soil will still be greater than that in the root hair cell. Hence, water will move out of the root hair cells by osmosis down a steep water potential gradient. Hence, less water will enter the root hair cells and the xylem. The cells will lose turgor and the plant will wilt. The rate of photosynthesis will decrease. **[3]**

This exemplar shows a good response for this question. All 3 marking points clearly stated using appropriate scientific terminology.

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Question 21 (b) (ii)

(ii) The teacher suggested that the same effect would be seen if the plants had been watered with a solution containing cyanide ions that inhibit ATP synthesis.

Explain whether the teacher was correct.

.....

.....

.....

.....

..... **[2]**

Most candidates agreed with the teacher in the question stem for their responses so few alternative statements were seen. Some candidates were unable to link ATP to active transport of mineral ions into root hair cells, necessary to allow a water potential gradient to be established. Some responses included reference to generic situations where ATP would not be synthesised so the plants would not be able to carry out metabolic processes, growth, photosynthesis, sucrose loading etc. which were not credited.

Question 21 (b) (iii)

(iii) Explain why plants growing in high light intensity require more water than plants growing in shade, even when the temperatures are the same.

.....

.....

.....

.....

..... **[2]**

Good responses showed understanding that high light intensity would increase the rate of photosynthesis and included good use of comparative descriptions. Weak responses often stated that no photosynthesis would occur in the shade. Some candidates correctly described the effect of light intensity would have on increased stomatal opening but did not link this to more gas exchange. Although some candidates did refer to increased transpiration it was not always linked to increased loss of water vapour.

Misconception



A common misconception is about transpiration. Loss of water is often identified but it is important that correct terms are used, and candidates are aware that it is water vapour that leaves through stomata. It would be acceptable to state loss of water by evaporation.

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Question 16 (a), Fig. 16.1 taken from Fig. 2 in review article,Rev Esp Cardiol. 2011 November ; 64(11): 1045–1050. doi:10.1016/j.recesp.2011.07.009.,Hall, et al., © Hall ME, George EM, Granger JP. El corazón durante el embarazo [The heart during pregnancy]. Rev Esp Cardiol. 2011 Nov;64(11):1045-50. doi: 10.1016/j.recesp.2011.07.009. Epub 2011 Oct 1. PMID: 21962953; PMCID: PMC3802121.

Question 16 (a) (iii), Fig. 16.2 taken from Fig. 1 in review article,Rev Esp Cardiol. 2011 November ; 64(11): 1045–1050. doi:10.1016/j.recesp.2011.07.009.,Hall, et al., © Hall ME, George EM, Granger JP. El corazón durante el embarazo [The heart during pregnancy]. Rev Esp Cardiol. 2011 Nov;64(11):1045-50. doi: 10.1016/j.recesp.2011.07.009. Epub 2011 Oct 1. PMID: 21962953; PMCID: PMC3802121.

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