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A LEVEL

Examiners' report

BIOLOGY B (ADVANCING BIOLOGY)

H422

For first teaching in 2015

H422/03 Summer 2023 series

Version 1

Contents

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.

Paper 3 series overview

H422/03 is one of the three examination units for the Advanced Level examination for GCE Biology B.

This practical skills unit uses a range of short, structured questions and extended response questions to

test:

- candidates' knowledge and understanding of the entire specification subject content and related practical outcomes
- candidates' ability to apply their knowledge to novel practical scenarios and to solve problems and perform calculations
- candidates' ability to analyse, interpret and evaluate scientific information.

Compared to both H420/01 and H420/02 there are proportionally more marks for the practical skills including planning, data interpretation and application.

The 2023 paper provided many opportunities for candidates to apply their knowledge within new contexts, including practical scenarios and to interpret data. To do well in this unit candidates need to be able to integrate new ideas and data with their existing knowledge to make and/or evaluate conclusions.

Practical work should be integrated into the programme of study of in Advancing Biology. Where candidates had opportunities to extensively experience practicals in laboratory situations, this clearly allowed them to answer questions on this paper more confidently.

While it is a requirement that all centres provide sufficient practical opportunities for candidates to undertake assessments for their practical skills components (CPACs) it is also essential that candidates are able to develop their understanding of the theory of such practical activities. Centres are reminded that it is not mandatory to use OCR PAG practical activities. Any practical activities that provide candidates with opportunities to develop both practical skills and theoretical understanding are beneficial and are actively encouraged. Centres must be aware of the need to cover the whole of the specification content for this component.

Support and guidance can be found here with practicals and developing a positive practical experience. There are also practice materials available on Teach Cambridge to help.

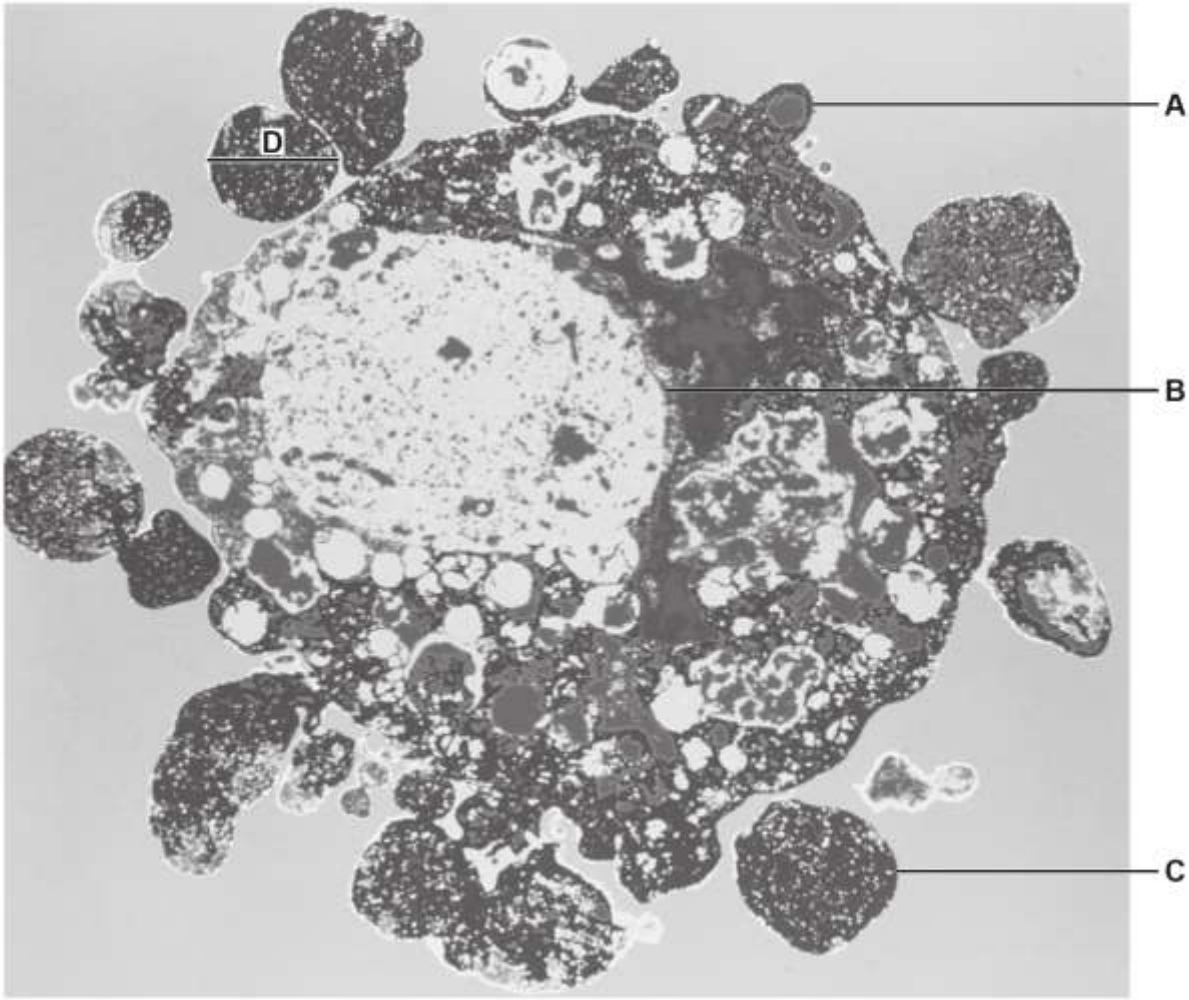
Candidates who did well on this paper generally:	Candidates who did less well on this paper generally:
• applied knowledge to new situations • demonstrated competent mathematical skills • were able to analyse data effectively • drew appropriate from data and gave detailed explanations for trends • gave detailed procedural steps for practicals • read the questions carefully and gave clear, concise yet detailed answers with only relevant information.	• gave generic answers rather than providing details that addressed the specific context of the question • used information to describe scientific terms • completed tables and gap fill questions • provided responses to short answer questions • did not show workings in calculations preventing examiners being able to credit some marks for intermediate working when their final answer was incorrect.

Question 1 (a) (i)

1 Apoptosis is the programmed cell death of damaged or unwanted cells.

(a) **Fig. 1.1** shows a transmission electron micrograph (TEM) of apoptosis of a leucocyte.

Fig. 1.1



(i) Name the following structures and processes shown in **Fig. 1.1**:
- the structure labelled **A** forming in the cell surface membrane
- the process occurring to the organelle labelled **B**
- the structure labelled **C**.

Structure **A** .....

Process **B** .....

Structure **C** .....

[3]

This question was generally answered well by candidates. Some mistakenly used plant cell terms or gave descriptions of the diagram and did not follow the command word to name a single structure or process. Descriptions were not credited. This might seem harsh but illustrates the importance of precise use of command words and key terms in biology.

Question 1 (a) (ii)

(ii) The magnification used to produce the TEM in **Fig. 1.1** was ×20 000.

Calculate the actual diameter of the structure labelled **D** in **Fig. 1.1**.

Give your answer in standard form.

Diameter of structure **D** = ... m **[2]**

Many candidates gained full marks for this question. Some did not measure the diameter of **D** accurately. Others did not convert their measurement to metres. A common error was not accurately converting the answer to standard form.

Assessment for learning

Good examination practice can be achieved by using past question papers to access micrographs for candidates to practice measuring, calculating and converting measurements.

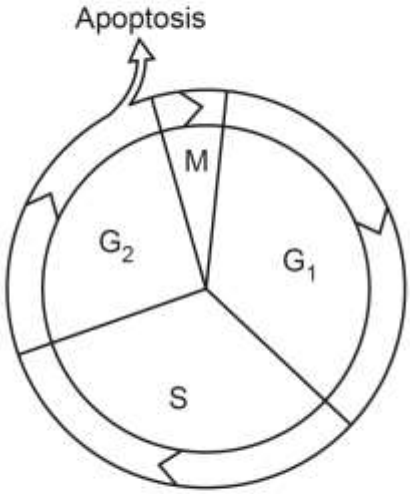
OCR support

Mathematical support on using standard form, for both teachers and candidate, can be found on page 9 of the Biology Mathematical Skills Handbook

Question 1 (b) (i)

(b) A diagram of the cell cycle is shown in **Fig. 1.2**. The diagram shows a cell entering apoptosis from the G_2 phase.

Fig. 1.2



(i) Suggest and explain why the cell in **Fig. 1.2** entered apoptosis from G_2.

.....

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

This question was generally accessed by the higher attaining candidates. Answers tended to be superficial referring generically to the idea of mutations. Few candidates referred to checkpoints and fewer successfully identified that specifically the checkpoint in G2 would detect the damage to the DNA (after the S phase had been completed).

Question 1 (b) (ii)

(ii) Outline a molecular mechanism that caused the cell to start apoptosis.

.....

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

Candidates generally gave descriptions of the process of apoptosis, possibly as they misinterpreted the question. Some good answers were seen making references to activated CDKs, caspases and external signals (cytokines).

Question 1 (c)

(c) Stem cells go through many cycles of cell division but remain undifferentiated.

The table shows some of the features of stem cells.

Complete the table. Use ticks (✓) to indicate the features that are observed in different types of stem cell.

Feature	Totipotent	Pluripotent	Multipotent
Can differentiate into any type of cell			
Present in an embryo			
Present in an adult human			

[2]

As stated in the examiner's report for H422/01 in June 2022, it is evident that despite having knowledge of the terms pluripotent and multipotent many candidates still struggle to distinguish between them in context. Many candidates did not score full marks on this question. Most candidates accurately identified the different types of stem cells which can differentiate into any type of stem cell, totipotent. However, few candidates successfully identified the different types of stem cells in an embryo and adult human being. More recent research has shown presence of pluripotent stem cells in adult humans. However, this was not an expected knowledge for candidates, since the established biological knowledge up until recently is that pluripotent stem cells are not present in adult humans. For this reason both answers were accepted as correct.

In terms of examination technique, most candidates completed the rows in the table by entering ticks rather than a combination of ticks and crosses in their tables. Hybrid ticks and crosses are not credited by examiners and should be actively discouraged by training candidates to cross out their mistake and make the replacement decision clear.

Assessment for learning

The potency of different types of stem cells and the properties of stem cells should be covered. Resources for this topic can be found at:

www.dnalc.org/resources/animations/stemcells.html

www.eurostemcell.org/resource/introducing-stem-cells-power-point

Candidates should be encouraged to learn detailed definitions for each stem cell type, including where they can be found.

Question 2 (a)

2 The conditions in a plant's habitat affect its rate of photosynthesis.

(a) Explain why plants are dependent on photosynthesis for their survival.

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

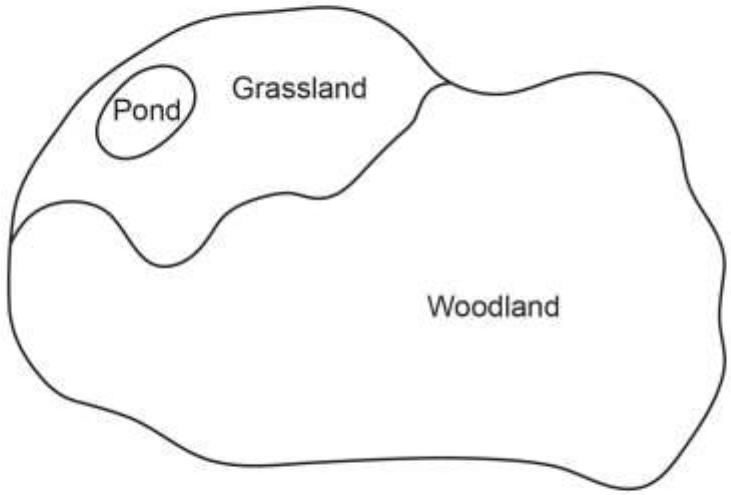
This question was answered well by most candidates. Many made reference to the products of photosynthesis and how glucose could be used as respiratory substrate demonstrating synoptic links across modules.

Question 2 (b) (i)

(b) Black medic, *Medicago lupulina*, is a species of plant that tends to grow best in open areas, where it is exposed to high light intensities.

Lady fern, *Athyrium filix-femina*, is a species of plant that tends to grow best in damp, shaded woodland.

(i) A student observed both species of plant growing in their local area, which is shown in the diagram.



The student outlined a plan for sampling the abundance and distribution of the two species:

- Pick 10 locations on the map, 5 in the woodland and 5 in the grassland.
- Record whether the species (black medic and lady fern) are visible at each location.

Describe how the student can improve their plan for sampling the abundance and distribution of the two species.

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..... **[4]**

Candidates showed a good awareness of the importance of randomly sampling and the use of quadrats. Fewer candidates gave details of stratified sampling with many referring to systematic sampling. Many also extended their answer to give details of how to calculate the Simpson's Diversity Index which was not relevant in this question. A significant number of candidates also unnecessarily gave a full procedural set of steps including identification of variables, safety considerations, etc.

Assessment for learning

Candidates often write too much for questions worth 4 marks, often extending them to almost a LoR question by continuing their answer on the additional pages in the question paper. A good lesson is to practice this style of question with a time limit, allowing 1.25 minutes per mark.

OCR support

This online resource from Science & Plants for Schools can be used for comparing the abundance of plant species in two different locations.

There are interactive areas, a plant ID sheet and tables for recording results. It is possible to perform species diversity index calculations and address 3.1.3 The development of species: evolution and classification (Biology B).

Please note: Completing this virtual investigation is insufficient to meet this PAG, practical sampling techniques must be experienced.

This resource from Grand Valley State University provides an inquiry-based activity to show the importance of sample size and random sampling.

Question 2 (b) (ii)*

(ii)* The student read that woodland plants, such as lady fern, might not receive all wavelengths of visible light equally.

The student planned to investigate the effect of light wavelength on the rate of photosynthesis in black medic and lady fern.

The student planned to measure rates of photosynthesis by placing each plant in a sealed, transparent container. Each container had a sensor connected to computer software to monitor carbon dioxide concentration.

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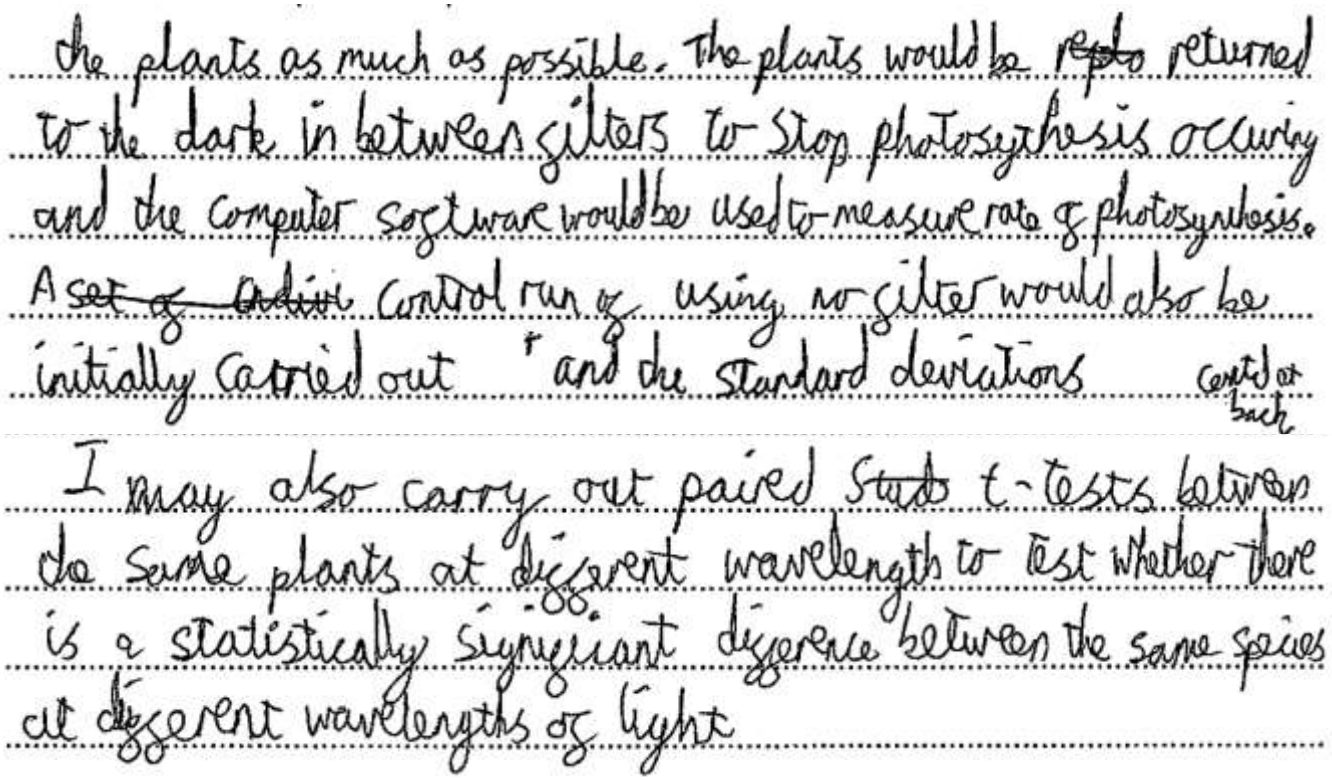
..... **[6]**

Many candidates did not interpret this question correctly. The question is focussed on the effect of wavelength of light on the rat of photosynthesis. However, many candidates gave details of how to change the light intensity by varying the distance between the light and the plant which did not answer the question. A significant number of candidates gave answers using a potometer. Some good answers were seen with candidates suggesting the use of different coloured filters between the lamp and the box or wrapping the box in different coloured acetate sheets.

In a significant number of answers, candidates rewrote the details already provided in the stem of the question. Others again gave full write-up of the proposed procedure, possibly as they had not interpreted the command word, 'outline', correctly.

Exemplar 1

I would take 20 plants of equal species of equal ages and maturities (eg all not flowering). I would keep them in the dark for 3hours before then use a colour filter in front of the lamp of the same distance with a ~~heat~~ transparant heat absorber between lamp and container. I would leave both sets of plants for the same time of 1hour in front of the light source. I would use containers of the same model and would open the containers in between runs to reset the internal atmosphere and would repeat at the same temperature for red, blue, yellow, green, orange and purple light allowed onto the plants. I would take the calculated mean rates of photosynthesis after 1 hour ~~and calculate~~ at each light wavelength and carry out an unpaired t-test between the 2 species at the same wavelength. There are no major ~~ethical or~~ safety concerns but I would check for allergies to the plants and would avoid disrupting the ecosystem when collecting [6]


the plants as much as possible. The plants would be ~~repto~~ returned to the dark in between filters to stop photosynthesis occuring and the computer software would be used to measure rate of photosynthesis. A ~~set of Odin~~ control run of using no filter would also be initially carried out and the standard deviations cont'd at back

I may also carry out paired ~~Stud~~ t-tests between the same plants at different wavelength to test whether there is a statistically significant difference between the same species at different wavelengths of light

This response shows how candidates frequently included more detail than was necessary. This candidate gave details of how to change the wavelengths of the light by using 6 different coloured filters as well as how to control variables. Their response gave details of statistical testing including an unpaired t-test between the two different species of plant for the same wavelength and the calculation of the standard deviation. This response achieved Level 3.

Misconception

Candidates should understand the difference between the 3 different aspects of light that can affect the rate of photosynthesis: light duration, light intensity and wavelength(s) of light. Each aspect can be investigated in a variety of ways.

Candidates should also understand that the potometer is used to measure the rate of water uptake as an indirect method to determine the rate of transpiration, not photosynthesis.

Assessment for learning

Candidates often write too much for LoR questions with many continuing their answer on the additional pages in the question paper. Examiners appreciate how candidates want to demonstrate their knowledge, but they should be aware that marks are not given in proportion to the quantity that they write. It is important that candidates understand that a concise answer often achieves maximum marks. A good lesson in exam technique could be to encourage candidates to see if they can write a response and gain all 6 marks using only the space available.

Candidates could be shown the command words resource and be asked to make their own Biology version, by listing all the command words used on this examination paper

OCR support

An exhaustive list of command words used is provided in this resource. It illustrates how to recognise and interpret the different command words.

Question 2 (b) (iii)

(iii) The student performed the Benedict's test on solutions from the leaves of both species.

- For each of the species, the same method was used to prepare the solution.
- The Benedict's test was performed on samples of each solution using a measuring cylinder to measure the volume of each solution.
- After performing each Benedict's test, the student compared the final colour of the solution to a colour chart.
- The student repeated the Benedict's test five times.

Describe and explain **one** way to improve the precision of the student's results.

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

Many candidates misinterpreted this question and incorrectly gave answers referring to improving resolution and/or accuracy of the measurements. Few candidates referred to the principle of collecting more data through carrying out repeats to enable a mean to be determined thereby reducing the effect of any random error(s).

Assessment for learning

Precision refers to more than one value. Precise results are clustered together. Reducing the effect of random errors improves precision. A systematic error does not affect precision, as it is the same error each time. It is possible to have precise results with a systematic error, but not accurate results.

OCR support

A useful resource which illustrates the use of the language of measurement terms in the context of a Biology practical activity.

Question 2 (b) (iv)

(iv) The student also tested for the presence of starch in various tissues of the plants.

State how to test for starch.

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

Many candidates referred to the use of iodine solution which was allowed. Some candidates did correctly refer the use of iodine and potassium iodide solution. Other candidates gave details of incorrect food test reagents such as Biuret reagent.

OCR support

This is a useful online resource for qualitative testing.

This comprehensive resource includes an information and practical outline video (with transcript) detailing the biological molecule tests. It also has a teacher walkthrough version of the video which includes additional safety considerations and teacher notes, as well as a virtual experiment video with questions for candidates to consider and links to the worksheets throughout.

An alternative resource from Cleapss which provides methods and visual instructions for food tests.

Question 2 (c) (i)

(c) When a plant is exposed to high light intensities, excess light energy is absorbed by photosystem II in chloroplasts. This can potentially damage the photosystems.

A process called nonphotochemical quenching (NPQ) protects plants by converting the excess light energy absorbed by photosystem II to heat energy.

NPQ can continue even when light intensity has decreased and NPQ is no longer needed. This makes photosynthesis inefficient and reduces the rate of CO_2 fixation.

(i) Explain why the continuation of NPQ in low light intensities reduces the rate of CO_2 fixation.

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

This question was generally answered superficially by candidates. Few candidates recognised that with lower light intensity less photolysis of water would occur resulting in less electrons entering the electron transport chain. Some candidates recognised less ATP and less reduced NADP would be produced but did not provide details of how this would then reduce the rate of carbon dioxide fixation.

Misconception

A common misconception was that reduced NAD was made in the light dependent reactions rather than reduced NADP. Key biochemical similarities and differences between respiration and photosynthesis should be understood.

Question 2 (c) (ii)

(ii) Genes responsible for NPQ and other aspects of photosynthesis in plants can be identified by sequencing and analysing DNA.

DNA needs to be extracted and purified before it is analysed.

Name the substances that should be added to remove histone proteins from DNA and to precipitate the DNA.

Remove histone proteins .....

Precipitate DNA .....

[2]

It was clear that many candidates were aware of the details of how to extract and purify DNA which was encouraging. However, many candidates were not aware of the purpose for using key chemicals. A significant number of candidates incorrectly referred to DNA polymerase as the enzyme responsible for removing the histone coat.

Another common incorrect answer for this stage was the use of detergent which is actually used to dissolves the fatty acids in the cell surface membrane and nuclear envelope thereby releasing the DNA into the solution. The most common correct answer was the use of (ice cold) ethanol to precipitate the DNA.

Question 3 (a)

3 The kidney is an organ of filtration and osmoregulation, but its functions can be hindered by several different diseases.

(a) A student dissected a kidney. One half of the dissected kidney is shown in **Fig. 3.1** on the **Insert**.

Draw a simple diagram of the dissected kidney, shown in **Fig. 3.1**, in the space below.

On your diagram, label the cortex, renal pyramids and ureter.

[3]

A common error here was for candidates to draw a theoretical drawing of a dissected kidney which did not resemble the specimen shown on the insert. Another common error was the incorrect labelling of the parts, especially the renal pyramids which were often labelled in the medulla region. These of horizontal label lines and continuous lines in the drawing were also not demonstrated well.

OCR support

Support and guidance on biological drawings can be found in this support guide.

This resource explains the requirements of good biological drawings and includes a common errors activity.

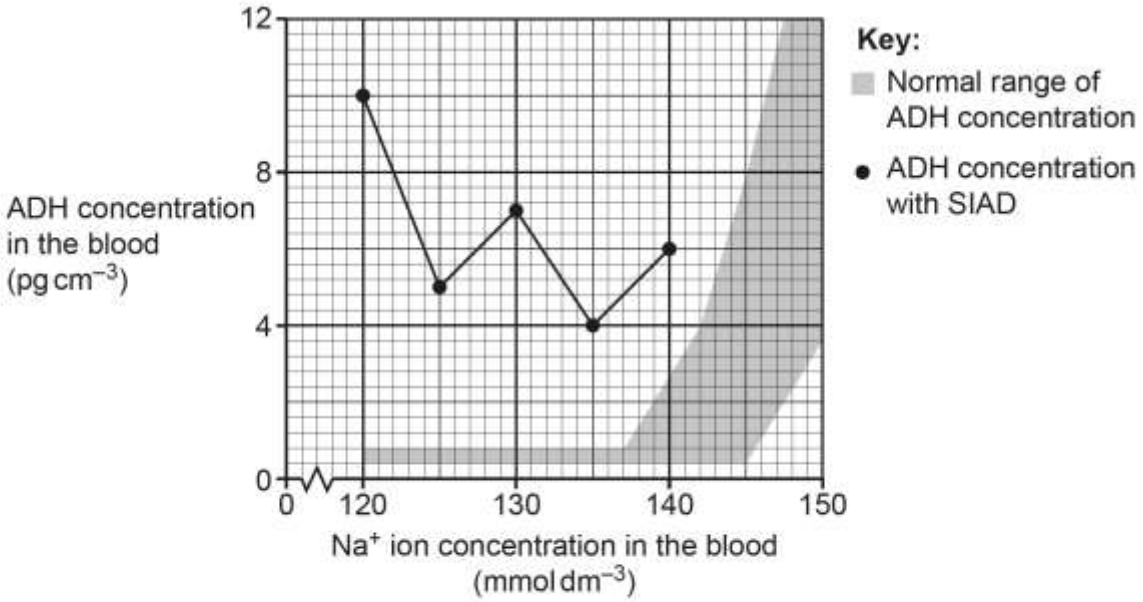
Question 3 (b)

(b) Osmoregulation in the kidney can be affected by a condition called syndrome of inappropriate antidiuresis (SIAD).

Fig. 3.2 shows how ADH concentration in the blood changes with blood sodium ion (Na^+) concentration in:

- normal homeostasis
- people with one type of SIAD.

Fig. 3.2



Explain the conclusions you can make from **Fig. 3.2** about the effect of SIAD on osmoregulation.

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

This question was not answered well by the majority of candidates. Most gave descriptions of the data and quoted data directly from the graph. Some recognised that there was a higher concentration of ADH resulting in more water being reabsorbed into the blood. Few gave details of the role of aquaporins or the effect of water reabsorption on the water potential of the blood plasma. Some candidates incorrectly referred to other parts of the nephron rather than the collecting duct.

Exemplar 2

[X] = concentration of X. (mmol dm^{-3})

Explain the conclusions you can make from **Fig. 3.2** about the effect of SIAD on osmoregulation.

SIAD increases ADH concentration far above the normal amount from [Na$^+$] 120 - 140 mmol dm^{-3} e.g. 10 vs 2 pg cm^{-3}, especially in lower [Na$^+$]. At lower [Na$^+$], increase in [ADH] causes more aquaporins to fuse with plasma surface membrane of collecting duct, causing more water to be taken up in the kidney. This decreases water potential and volume of urine and increases water potential of blood and blood pressure, in people with SIAD. [3]

This response demonstrates how candidates used time and space to describe the data, including data quotes, which was not necessary. This candidate does then explain how the higher ADH concentration results aquaporins being added to the cell surface membrane of the cells of the collecting duct. They give further details of how this allows more water to the absorbed into the blood plasma increasing the water potential of the plasma. This response gained 3 marks.

Misconception

Candidates may have missed the command word 'explain' and thought they needed to describe the data instead.

Assessment for learning

Interpreting data and being able to explain the reasons for any trend(s) is an important skill in A level Biology and candidates should be taught to take an analytical approach to interpreting experimental data. A good examination technique to practice is to make use of graph question from previous examination papers and ask candidates to produce separate and distinct 2 answers; one describing the data and one explaining the data.

OCR support

An exhaustive list of command words used is provided in this resource. It illustrates how to recognise and interpret the different command words.

Question 3 (c)

(c) Glucose is normally reabsorbed from the proximal convoluted tubule of the kidney.

In some conditions, such as diabetes mellitus, glucose remains in the filtrate and can be detected in urine.

Biosensors are used to detect glucose in urine.

The sentences describe how biosensors can detect glucose in urine.

Complete the sentences using the most appropriate words or phrases.

Glucose test strips contain an enzyme called ..... ,

which converts glucose to gluconic acid and hydrogen peroxide. Another enzyme,

..... , converts hydrogen peroxide to oxygen and water. Oxygen

reacts with a chemical on the test strip to produce a colour change. In recent years, a

polarimeter device has been developed. The polarimeter gives a digital readout of the

glucose concentration in urine, in units such as ..... .

[3]

This question was generally answered well although there were some common errors: naming catalase as the enzyme in gap 2 and giving incorrect units in gap 3.

Question 3 (d)

(d) Kidney failure has a variety of possible causes.

This is a description of kidney failure:

The person noticed their symptoms developing over a long period of time. Unusual tissue, not normally found on a healthy kidney, could be seen on the outside of the kidney.

Suggest and give a reason for a possible cause of kidney failure in this person.

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

Many candidates were able to suggest that the kidney failure was a chronic condition. Some gave generic answers suggesting cancer in an unqualified context which was not credited. Several candidates suggested the unusual tissue was a build-up of fat due to obesity, possibly not identifying the context of tissue development.

Question 3 (e)

(e) Outline the possible future use of stem cells in kidney transplant surgery.

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

Further to Question 1 (c) many candidates again confused stem terminology. Several candidates suggested taking totipotent stem cells of the *patient* to use to develop new kidney tissue. Several candidates gave generic responses about the use of stem cells rather than relating it specifically to the context of kidney transplant surgery. Some candidates were able to describe use of iPScs and the subsequent lower risk of rejection.

Question 4 (a)

4 The domestic rabbit, *Oryctolagus cuniculus domesticus*, is a subspecies of European rabbit. It is a popular pet and has been selectively bred for fur colour and other features.

(a) Complete the taxonomic ranks to show the classification of *Oryctolagus cuniculus domesticus*.

Domain: .....

Kingdom: .....

Phylum: Chordata

Class: Mammalia

Order: Lagomorpha

Family: Leporidae

Genus: .....

Species: .....

[2]

Only a few candidates gained both marks for this question. Many candidates made errors with terms for the domain and kingdom. Common errors included stating *Oryctolagus* as the kingdom, *cuniculus* as the genus and *domesticus* as the species. Genus and species must be formatted correctly as a binomial name. Some candidates were unclear with the upper-case 'O' for *Oryctolagus* and as such were not credited.

Assessment for learning

Candidates can practice this skill by being given a list of animals and plants and asked to complete the taxonomic ranks accordingly.

A useful resource for studying the binomial system of classification can be found on the BBC site.

Question 4 (b) (i)

(b) A student bred two pet rabbits several times to produce a total of 48 offspring.

One of the parental rabbits had upright ears and black fur. The other parental rabbit had floppy ears and brown fur.

The student researched the genetics of the two traits (ear position and fur colour) and the family tree of the two rabbits. The student predicted the offspring phenotypes would be:

- 25% black fur, upright ears
- 25% black fur, floppy ears
- 25% brown fur, upright ears
- 25% brown fur, floppy ears

The student used the chi squared (χ^2) test to determine whether the phenotypic ratio of the offspring was significantly different from their expectations.

Their null hypothesis was:
'There is no difference between the expected phenotypic ratio of the offspring and the observed phenotypic ratio of the offspring.'

The student's expected and observed results are shown in **Table 4.1**.

Table 4.1

Phenotype	Expected number	Observed number
Black fur, upright ears	12	10
Black fur, floppy ears	12	17
Brown fur, upright ears	12	8
Brown fur, floppy ears	12	13

(i) Calculate χ^2 for the results shown in **Table 4.1**. Use the formula:

$$\chi^2 = \sum \frac{(f_o - f_e)^2}{f_e}$$

Give your answer to **3** significant figures.

χ^2 = ... **[3]**

Many candidates scored full marks on this question. Some candidates did not give their answer to 3 significant figures. Others made rounding errors when performing intermediate steps.

Question 4 (b) (ii)

(ii) A χ^2 probability table is shown in **Table 4.2**.

Table 4.2

Degrees of freedom	Probability (p)		
	0.10	**0.05**	**0.01**
1	2.71	3.84	6.64
2	4.60	5.99	9.21
3	6.25	7.82	11.34
4	7.78	9.49	13.28
5	9.24	11.07	15.09

Using your answer to **(i)** and the data in **Table 4.2**, state and explain what you can conclude about the student's results.

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

Many candidates were unable to deduce the correct number of degrees of freedom to use. Several candidates were also unable to draw the correct conclusion and incorrectly rejected the null hypothesis as a consequence. Few candidates were confident in demonstrating the significance of accepting the null hypothesis and relating this conclusion to the chance of these results being obtained.

Misconception

There was a lot of misunderstanding here when using the statistical tests. It is worth noting that using Chi-squared test allows us to assess the significance of the difference between the observed and expected results.

OCR support

Centres can find extra help with maths skills in the OCR Maths Skills Handbook, as well as the Mathematical skills statistics booklet.

Question 4 (c)

(c) Another aspect of rabbit fur colour is colour density.

One gene controls colour density. This gene has several alleles, including:

- C^F, which results in full colour. This allele is dominant to the other two alleles.
- C^S, which results in shaded colour. This allele is dominant to C^A.
- C^A, which results in albino fur (no colour).

A pair of rabbits were bred. 50% of their offspring had full colour, 25% were shaded, and 25% were albino.

State the genotypes of the two parental rabbits that produced these offspring.

Parent 1 .....

Parent 2 .....

[2]

Most candidates gained 2 marks on this question. Those that did not often gave genotypes with 4 alleles or just one allele.

Question 4 (d) (i)

(d) (i) Rabbits can inherit genetic diseases.

The probability of a rabbit inheriting a genetic disease can be assessed.

Name the method used for assessing the risk of an animal inheriting a genetic disease.

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

A common response for this question was to refer to a punnet square or the process of karyotyping as the method to determine the risk. Some candidates correctly referred to the process of pedigree analysis.

Question 4 (d) (ii)*

(ii)* Rabbits can also develop diseases such as anaemia and lymphosarcoma that affect the number of erythrocytes and leucocytes in their circulatory system.

If such a disease is suspected, the rabbit's blood can be sampled and the blood cells can be analysed.

Describe a method that could be used to observe blood cells **and** a method used to identify blood cells from the blood of a rabbit.

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.....

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

A significant number of candidates gave responses detailing the use of a haemocytometer to count the cells which was not relevant to the question. As a consequence, these candidates often did not then write about the blood smear procedure which limited the level of attainment. Other candidates also described using an electron microscope.

Some candidates referred to the use of differential stains but then did not give further detail such as a named stain and how the stain would enable the different types of blood cells to be identified. Some poor use of terminology was also seen such as the use of glass slides (rather than microscope slides), use of a microscope (rather than light microscope), and the use of a dye (rather than a differential stain).

Many candidates filled the answer lines with irrelevant material and there was no logical line of reasoning in their answer. Hence, they didn't achieve the communication mark within a given level, particularly at Levels 2 and 3.

Exemplar 3

Prepare a blood smear. wear gloves and take a sterile slide. Add a drop of rabit blood and smear with another sterile slide at a 30° angle. Allow the smear to air dry and fix with ethanol, leave for 1 minute. Add leishmen stain which stains the nucleus of blood cells dark purple so they are visible. Rinse. Leave for 3 minutes and rinse with a sterile distilled water. Blot the slide dry. Add a drop of glycerine and apply a coverslip. Observe the slide under a light microscope. identify different blood cells by looking at the shapes of the nucleus (monocytes have a bean shaped nucleus, leucocytes have a lobed nucleus and neutrophils have a nobbly nucleus).

[6]

Additional answer space if required.

A good Level 3 response is shown by this exemplar. The candidate completes their response in the space available. The candidate gives details of both methods:

Observation of the blood cells: the candidate provides a detailed answer on how to prepare a blood smear including the importance of air drying the smear before fixing with ethanol.

Identification of the blood cells: the candidate provides details of using correctly named differential stain to distinguish between the different shaped nuclei of the specific leucocytes.

This answer scored maximum marks and demonstrated how candidates can achieve Level 3 comfortably within the space provided.

Question 4 (e)

(e) Rabbits, like all mammals, have a double circulatory system.

Explain the importance to mammals, such as rabbits, of having a double circulatory system.

.....

.....

.....

.....

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

Most candidates were able to explain that a double circulatory system ensured oxygenated and deoxygenated blood did not mix. Few candidates were able to gain a second mark as answers were often superficial, incorrect or imprecise.

Misconception

Several candidates implied a misconception between the term 'system' and 'circuit' with many referring to the "two systems that deliver blood to the different parts of the body". Candidates should be reminded that the double circulatory system is a single system consisting of 2 specific circuits: pulmonary and systemic.

OCR support

Centres can find resources and suggested activities for teaching transport systems in this delivery guide.

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Question 1 (a), Fig. 1.1. Apoptosis TEM, © DR GOPAL MURTI/SCIENCE PHOTO LIBRARY

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