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Examiners' report

BIOLOGY A

H020
For first teaching in 2015

H020/02 Summer 2019 series

Version 1

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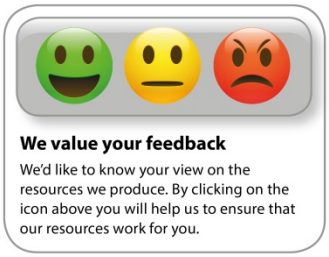
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Introduction

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. 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 can be downloaded from OCR.

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Paper 2 series overview

H020/02 is one of the two examination units for the AS Level examination for GCE Biology A. This Depth in Biology unit uses a range of short structured questions and extended response questions to test:

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

Compared to H020/01 (Breadth in Biology) there are fewer marks available on this paper for knowledge but more marks for the higher-order skills of application and analysis. The 2019 paper provided many opportunities for candidates to apply their knowledge within novel contexts, including practical scenarios. To do well on this paper candidates need to be able to integrate new ideas and data with their existing knowledge in order to make conclusions.

Questions candidates found easiest	*Questions most often omitted*
• 1(a)(ii) Applying knowledge of tests for glucose and starch to a results context. • 3(a) (i) and (iii) Applying knowledge of classification. • 3(c) (iii) Linking an action to its effect. • 4(b)(i) Understanding the effect of an anomaly on a mean. • 4(b)(iii) Calculating a rate of transpiration. • 5(a) Explaining a simple osmosis scenario. • 5(b)(i) Calculating a percentage decrease.	• 1(b) Suggesting explanations about physiology based on biochemical knowledge. • 3(b)(ii) Evaluating a complex scenario using appropriate subject-specific vocabulary. • 4(a)(ii) Describing and explaining precautions needed in setting up and using a potometer. • 4(d) Identifying a key variable to control. • 5(b)(ii) and (iii) More complex osmosis problem scenarios. • 6 Using new information productively to answer questions.

Candidates generally seemed more confident in their ability to handle mathematical calculations this year, compared to last year. Candidates who did well showed a good grasp of many aspects of practical work and data analysis and a willingness to absorb and use new information. In general candidates who did less well seemed reluctant or unable to make deductions based on integrating two or more sources of information and knowledge. It should be stressed that the bulk of this paper requires to apply their knowledge rather than simply recalling learnt information. Past papers offer an opportunity for candidates to practise these skills of creatively thinking about, analysing and evaluating different types of information.

Note

From this series students have been provided with a fixed number of answer lines and an additional answer space. The additional answer space will be clearly labelled as additional, and is only to be used when required. Teachers are encouraged to keep reminding students about the importance of conciseness in their answers. Please follow this link to our SIU (https://www.ocr.org.uk/administration/support-and-tools/siu/alevel-science-538595/)

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Question 1 (a) (i)

1 Aphids are small insects that feed on the sap that is translocated through the plant in the phloem. These insects insert their fine mouthparts, stylets, into phloem tissue and allow the sap to flow out of the phloem.

One method of collecting sap is to allow the aphid to feed as shown in Fig. 1.

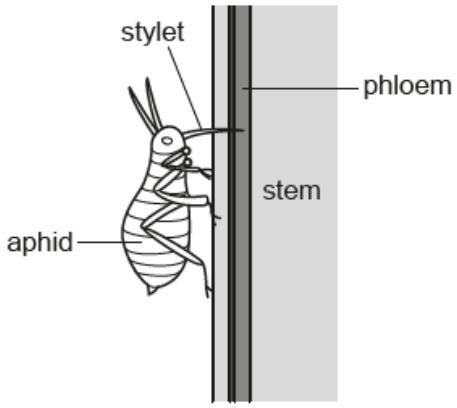


Fig. 1

The aphid is then anaesthetised and the stylet is cut off close to the aphid's head. The sap can then be collected and analysed.

A researcher analysed the sap collected and the results are shown in Table 1.

Substance tested for	Conclusion
glucose	negative
starch	negative
sucrose	positive

Table 1

(a) (i) Phloem tissue is made up of different cell types.

Identify the type of phloem cell into which the stylet is inserted to obtain the sap.

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

This was frequently correctly identified as a sieve tube cell, with errors being 'companion cell' or just 'sieve cell'.

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Question 1 (a) (ii)

(ii) Separate samples of the sap were tested for the presence of glucose, starch and sucrose.

Using Table 1, complete the following passage, using the most appropriate terms.

In order to test for the presence of glucose, ...

..... was added to the sap sample and boiled. The final colour was

..... and so it was possible to arrive at the conclusion shown in Table 1.

When iodine solution was added to the sap sample, the final colour was

..... . To test for the presence of sucrose, the sample was first boiled with ..... . After the rest of the test had been completed, the colour of the mixture indicated that sucrose was present in the sample.

[4]

Many candidates knew that Benedict's reagent is used to test for glucose. They applied knowledge of the test to Table 1 to give the colour for a negative test as blue. Similarly many integrated their knowledge with Table 1 to name orange, yellow or brown as a negative result with iodine. The use of acid or a named acid in the test for sucrose was also widely known.

i	**OCR support**	Qualitative testing for glucose and sucrose is covered in this activity: https://www.ocr.org.uk/qualifications/as-a-level-gce-biology-a-h020-h420-from-2015/delivery-guide/module-ba02-module-2-foundations-in-biology/delivery-guide-badg001-cell-structure-211#373046

Question 1 (b) (i)

(b) Sucrose is carried in phloem sap from source to sink.

(i) Explain why starch is not transported in the sap.

.....

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

Correct answers mostly related to starch being insoluble. Many candidates referred to starch being big but did not consider why this would cause a transport problem, e.g. by making the sap more viscous or by causing a problem in loading the molecule into companion cells. Some candidates did gain credit for saying that as starch is big it could block the holes in sieve plates.

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Question 1 (b) (ii)

(ii) Suggest why sucrose is a more suitable transport molecule than glucose.

.....

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

This 'suggest' question posed a challenge to candidates. Many responses showed little relevant knowledge of the differences between sucrose and glucose or how they gain access to phloem sap. Correct answers usually focused on glucose being more likely to be used up or to be lost by diffusion during the transport process. A few candidates applied their knowledge of how substances enter and leave the phloem by co-transporters at companion cell membranes to think of a difference in the transport possibilities of glucose and sucrose.

Question 2 (a)

2 Fig. 2, **on the insert**, is a photomicrograph of a mammalian blood smear.

(a) Calculate the image length, in µm, represented by the scale bar.

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

length = ... µm **[2]**

Many candidates correctly calculated that the 15mm scale bar represented a length on the magnified image equal to 12µm. Some candidates were given one mark for converting the scale bar length to µm. The use of a scale bar to *represent* a length on a magnified image confused some candidates A microscopic object such as a cell has a real-life size and a magnified image size. A scale bar's length is as measured on the page but this represents a length on the image that is smaller by a factor of the magnification shown.

i	**OCR support**	The 'Maths for Biology' website can be used in order to support students with conversion of units. https://www.ocr.org.uk/subjects/biology/maths-for-biology/arithmetic-and-numerical-computation/

Question 2 (b) (i)

(b) **(i)** Name the cell labelled **B**.

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

B was usually named as an erythrocyte or red blood cell. Some candidates mistook it as a white blood cell or a named type of white blood cell.

i	**OCR support**	Different images from the Dennis Kunkel library of photomicrographs can be shown to give candidates practice in spotting the distinctive biconcave disk shape of erythrocytes and seeing the variation in the much smaller number of leucocytes. https://www.ocr.org.uk/qualifications/as-a-level-gce-biology-a-h020-h420-from-2015/delivery-guide/module-ba02-module-2-foundations-in-biology/delivery-guide-badg001-cell-structure-211#230468

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Question 2 (b) (ii)

(ii) Cells **A**, **C** and **D** work together to carry out an important function.

State the function that cells **A**, **C** and **D** perform.

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

Correct answers included immunity, immune response and immune defence. Other answers such as phagocytosis or making antibodies did not achieve any marks, because they were specific for each cell.

Question 2 (c) (i)

(c) The smear has been stained with haematoxylin and eosin stain. This is a differential stain.

- Haematoxylin stains nucleic acid blue.
- Eosin stains protein (including cytoplasmic proteins) pink or red.

(i) Explain why it is important to use a differential stain when examining a blood smear under the microscope.

.....

.....

.....

.....

.....

.....

.....

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

A few candidates gained 2 marks out of the 3 for stating that the staining technique improves visibility of both cells and organelles. Limited vocabulary let candidates down, with frequent references to components or structures rather than 'organelles' or a named organelle. Higher ability candidates sometimes featured the word 'contrast' or made the point that white blood cells needed to be stained to be visible (or to be counted) while red blood cells contained their own pigment.

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Question 2 (c) (ii)

(ii) Using Fig. 2 **on the insert**, and the information provided, suggest **and** explain why the cytoplasm of cell **C** and cell **D** reacted differently to the stain.

.....

.....

.....

.....

.....

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

This question required candidates to use the information about the chemical staining characteristics of haematoxylin and eosin to make deductions about the contents of the cytoplasm of two cell types they observed on Fig. 2. Most creditworthy answers made the link between the colour of the stained cytoplasm and the main biomolecule contained within it. Some candidates went on to suggest that the proteins in cell D were enzymes or antibodies and gained credit. Fewer candidates linked more nucleic acid in the cytoplasm of cell C to more RNA. A pitfall for lower ability students was missing the instruction in the question to consider the cytoplasm of the cells only, not the nuclei (both of which stained purple due to DNA).

Question 3 (a) (i)

3 **(a)** The Scottish wildcat and European wildcat are both classified in the same species, *Felis silvestris*. Researchers have suggested that both wildcats originated from the same population.

During the Ice Age, the British Isles were connected by ice to mainland Europe.

- After the Ice Age, sea levels rose and the British Isles became isolated from the rest of Europe. The isolated population of wildcats in the British Isles developed slightly different characteristics from the mainland population in Europe.
- A subspecies is a group of individuals that is geographically isolated from others of the same species and that is distinguishable from other populations of the same species.
- The Scottish wildcat is now classified as the subspecies *Felis silvestris grampia* and the European wildcat as the subspecies *Felis silvestris silvestris*.

(i) Name the genus of the Scottish wildcat.

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

This was well-answered with most candidates writing '*Felis*' with a capital '*F*' for the genus name.

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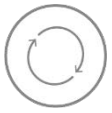
Question 3 (a) (ii)

(ii) The information above states that 'the isolated population of wildcats in the British Isles developed slightly different characteristics from the mainland population in Europe'.

What is the term used to describe the differences between the two populations of wildcat?

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

The correct answer of 'intraspecific variation' gained 2 marks. Many candidates scored one for writing 'genetic variation'.

	**Misconception**	Wrong answers included evolution and natural selection. Candidates may have missed the command word '*describe*' and thought they needed to *explain* the cause of the differences instead.
	**OCR support**	An exhaustive list of command words used in Cambridge Technicals is provided in this resource. It illustrates the use of many of the command words by applying them to an everyday object, a chair. https://www.ocr.org.uk/Images/273311-command-verbs-definitions.pdf
	**AfL**	Students 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 • using each command verb to write about a cell rather than a chair.

Question 3 (a) (iii)

(iii) Suggest why the Scottish wildcat and the European wildcat **cannot** yet be classified as different species.

.....

.....

.....

.....

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

Candidates successfully applied their knowledge of the biological species concept to the novel context, suggesting that the Scottish and European wildcats could still interbreed to produce fertile offspring and shared many phenotypic and genetic similarities.

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Question 3 (b) (i)

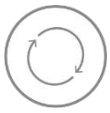
(b) By the 19th century, the wildcat population in the British Isles had decreased as it had been under threat from deforestation and hunting. The wildcat could only be found in Scotland.

(i) Suggest one reason why the wildcat was hunted.

.....

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

Candidates mostly suggested that wildcats were killed for their fur, which was given as it may have been the case in the distant past. The nineteenth century persecution was mainly due to gamekeepers protecting the eggs and chicks of ground-nesting birds.

	**AfL**	This question provides a useful springboard for a case study on evolution and conservation. Up to date information may be found at the website of Scottish Natural Heritage: https://www.nature.scot/plants-animals-and-fungi/mammals/land-mammals/wildcats Further detailed information is available at: https://www.nature.scot/snh-commissioned-report-360-scottish-wildcat-survey-2006-2008 which gives this information about historic wildcat decline: "By the end of the 19th century the wildcat was becoming scarce in Scotland (Langley & Yalden, 1977). Accounts by St John (1893) and Mackenzie (1921) highlighted the rise of game-keeping in Scotland and attitudes toward vermin indicated a wish to exterminate both wildcats and foxes. Nethersole-Thomson (1951) gives figures for the killing which took place in Glen Garry, where 198 wildcats were killed in three years, and in Glen Quoich where 207 wildcats were killed over 19 years. These may have been an exaggeration to impress estate owners but there was a substantial decline in numbers. Although general information prior to 1900 is sparse, Langley & Yalden (1977) inferred killing was the primary cause of their dramatic decline from 1800 onwards and the decline in carnivores during this period matches well with the increase in game-keeping."

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Question 3 (b) (ii)

(ii)* Current estimates of the Scottish wildcat population vary. Recent reports by the Scottish Wildcat Association indicate that fewer than 100 individuals, possibly as few as 35, remain in the wild. These individuals occur only in the most remote, uninhabited areas of the Scottish Highlands.

Biodiversity can be considered at several levels. A scientist concluded that the biodiversity of the Scottish Highlands would continue to reduce because of the small population of Scottish wildcats.

Evaluate the scientist's conclusion with reference to genetic biodiversity and species biodiversity.

.....

.....

.....

.....

.....

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

Most answers explained that small population size would reduce genetic biodiversity and many stated that a small gene pool decreased the likelihood of successful adaptation to change in environment. Few answers showed an evaluative tendency by considering that new alleles might arise due to mutation.

Candidates often referred to species biodiversity and also species richness and species evenness but not all could use these terms in a way that showed they understood their meaning. Higher ability candidates related the possible extinction of the wildcat species to a decrease in species richness or diversity, and considered the knock-on ecological effects of a decline in wildcats, suggesting an increase in prey population size or prey diversity and sometimes a corresponding decline in producer numbers or diversity.

A key feature of a high-scoring answer was following the question instruction fully to make valid points about both genetic biodiversity and species biodiversity.

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Exemplar 1

Scottish wildcats are likely to be predators and prey as can many of the inhabitants in the area reducing species biodiversity. Since they live in the wilderness, uninhabited areas, it is unlikely that they come into contact with other members of the species with "desirable" characteristics that they can produce fertile offspring with, so there will be lack of genetic biodiversity. There are only an estimated 35 Scottish wildcats, which may (if a disease comes and kills the majority of the population, since they are likely to have the same genes and thus be susceptable) later result in extinction which could reduce the species biodiversity.

[6]

Exemplar 1 uses subject-specific vocabulary correctly and shows an evaluative approach by considering the ecological role of the wildcat population within its community and habitat (L3 with communication statement met, 6/6).

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Exemplar 2

When talking about species biodiversity, the scientist is right, because as the number of wildcats decreases, as does the species biodiversity, because there are less of that species. And when talking about genetic biodiversity, it's only decreases when the wildcat becomes extinct, as even if there is one wildcat left, those genes still exist. But when they are extinct, the gene no longer exists, and the genetic biodiversity decreases.

[6]

Exemplar 2 misuses the term species biodiversity apparently to mean population size, or possibly species evenness, and wrongly implies that the members of the wildcat population are all 100% homozygous. Their only correct point is raising the possibility that the wildcat may become extinct (L1 with communication statement not met, 1/6).

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Question 3 (c) (i)

(c) With Scottish wildcat numbers at their lowest ever, decisive action has been taken.

In the West Highlands of Scotland, remote land has been targeted to establish a wildcat haven. The land chosen is mostly surrounded by sea, far away from other populations.

Table 3 lists some details of the action that has already been taken and will be taken in the future to protect the Scottish wildcat.

A	The wildcat haven has been established in an area of land mostly surrounded by sea.
B	Over the past few years all domestic cats, wild cats and Scottish wildcats in the area have been neutered.
C	Over the past few years all domestic cats, wild cats and Scottish wildcats in the area have been checked for disease.
D	In the near future, Scottish Natural Heritage and Chester Zoo plan to establish a breeding and release project for pure-bred Scottish wildcats.

Table 3

Indicate which of the **letter or letters**, **A** to **D**, in Table 3 apply to each of the following statements.

(i) An example of ex-situ conservation.

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

Candidates who understood ex-situ scored with D. Confusion with in-situ led to the wrong answer A.

Question 3 (c) (ii)

(ii) Helps to prevent the domestic and wild cats mixing freely with the Scottish wildcats in the haven.

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

Statement 'A' scored one mark. An additional answer of B was ignored since neutered cats have smaller territory sizes and so are less likely to encounter one another.

Question 3 (c) (iii)

(iii) Contributes to maintaining a healthy population in the wildcat haven.

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

Most candidates scored this mark with answer C.

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Question 3 (c) (iv)

(iv) Contributes to maintaining the genetic purity of the Scottish wildcat.

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

Either B or D scored a mark, with most candidates opting for D due to the reference to pure-bred cats in Table 3.

Question 4 (a) (i)

4 An investigation was carried out into the loss of water from a leafy shoot. The apparatus used is shown in Fig. 4.1.

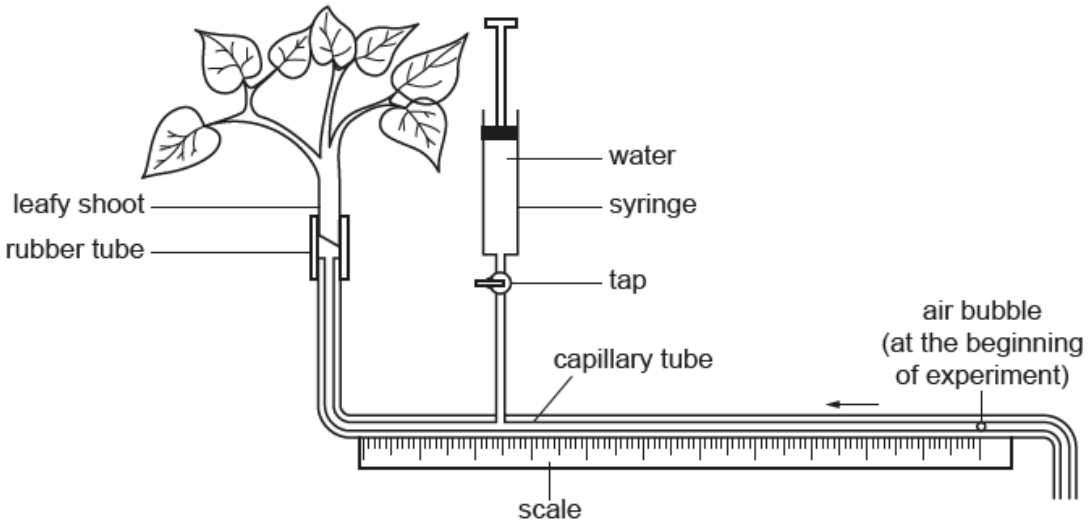


Fig. 4.1

(a) (i) State what assumption is made when using this apparatus to measure the rate of transpiration.

.....

.....

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

Candidates often wrote about details of using the apparatus such as having the tap closed. Candidates did not refer to the underlying assumption that the apparatus actually measures transpiration only if the water taken up is indeed lost (and not used) by the leafy shoot. .

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Question 4 (a) (ii)

(ii)* There must be no air in the apparatus in Fig. 4.1 for it to work correctly.

Describe and explain the precautions that need to be taken when setting up and using the apparatus in Fig. 4.1 to ensure that no air is present.

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

Most candidates made some relevant points about the precautions to be taken when *setting up* the apparatus. Candidates did not complete their answer by describing and explaining the precautions that should be taken while actually *using* the apparatus to measure the rate of transpiration. This restricted many answers to Level 1.

Exemplar 3

Firstly, the stem of the plant must be cut underwater, so that no bubbles get into the stem. The apparatus should also be set up and the plant inserted underwater so that no air gets into the tube. When using the apparatus, the opposite end of the tube to the end with the plant in should remain fully submerged in water so that no unwanted air bubbles enter the potometer. The tap should also be used to reset the air bubble and stop it from reaching the **[6]**

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stem of the plant. The apparatus should also be kept upright and the rubber tubes secured tightly when setting up the apparatus.

Exemplar 3 provides a full treatment of both aspects of the question, and the reason for each described precaution is clearly explained in terms of preventing entry of air.

Question 4 (b) (i)

(b) A student obtained replicate readings for the movement of the air bubble during five minutes in three different conditions. The results are shown in Table 4.1.

Condition	Distance moved by bubble in 5 minutes (mm)						
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5	Trial 6	Mean
In still air	89	84	86	87	85	86	86.2
With an electric fan	142	139	144	138	139	141	140.5
In still air and lower leaf surface covered with petroleum jelly	32	28	31	57	27	29	34.0

Table 4.1

(i) Identify an anomalous reading in the data **and** evaluate the extent to which it has affected the mean that has been calculated.

.....

.....

.....

.....

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

Most candidates identified the anomaly clearly and stated that including it made the mean higher. Many candidates gained full marks by performing a relevant calculation of the mean without the anomaly, or the difference between this and the existing mean.

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Question 4 (b) (ii)

(ii) Suggest a reason for the reading that you identified as anomalous in **(i)**.

.....

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

This question was widely misunderstood. Candidates gave a reason based on the difference of the anomalous number from the other readings to explain how they made their choice, rather than a reason based on a problem in the conduct of the experiment.

Question 4 (b) (iii)

(iii) The internal diameter of the capillary tubing was 0.7 mm.

Table 4.2 shows the mean rate of transpiration in each of the experimental conditions.

Condition	Mean rate of transpiration ($mm^3 min^{-1}$)
In still air	
With an electric fan	10.81
In still air and lower leaf surface covered with petroleum jelly	2.62

Table 4.2

Calculate the mean rate of transpiration for the leafy shoot in still air.

Use the formula: Volume of a cylinder = $\pi r^2 l$

rate of transpiration = ... $mm^3 min^{-1}$ **[3]**

Candidates were mostly successful in tackling this calculation. Candidates who used the diameter rather than the radius gained 2 marks, if the rest of the steps in their working were correct. Some candidates did not convert the data from Table 4.1 into a value for one minute rather than five; error carried forward marks were again given. The final answer should have been given to two decimal places to match the rest of the data in Table 4.2. Candidates were given full credit for using a more precise value of π than 3.14, such as 22/7 or the π button on a calculator.

i	**OCR support**	The Maths for Biology website contains support on calculating the surface areas and volumes of regular shapes: https://www.ocr.org.uk/subjects/biology/maths-for-biology/geometry-and-trigonometry/

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Question 4 (b) (iv)

(iv) The control experiment in this investigation was to measure the mean rate of transpiration in still air.

Explain why the control experiment is carried out in this investigation.

.....

.....

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

Few answers adequately explained the idea of comparing the effect of the other treatments using changed conditions.

Question 4 (c)

(c) Another student suggested using an alternative apparatus for measuring the rate of transpiration of a leafy shoot. Fig. 4.2 shows this apparatus.

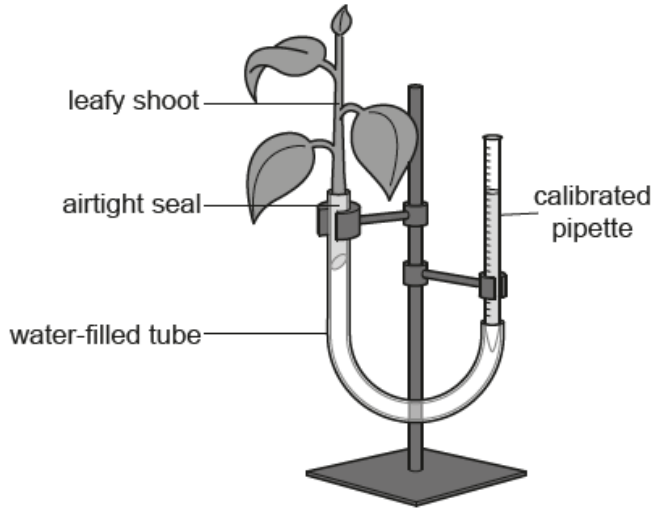


Fig. 4.2

The student stated that this apparatus would be an improvement on the apparatus shown in **Fig. 4.1** because the volume of water taken up could be measured directly.

Suggest why it might be considered better to use a capillary tube rather than a calibrated pipette to measure water uptake.

.....

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

Candidates struggled to express a reason why the capillary tube was better. Correct ideas mostly focused on the greater degree of measuring precision allowed. It was not correct to relate the different apparatus to greater accuracy.

	AfL	Terms used by OCR relating to practical measurements can be found in the Practical Skills Handbook, Appendix 4: https://www.ocr.org.uk/Images/294468-biology-practical-skills-handbook.pdf

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		These are also available in the Nuffield Foundation and Association for Advancement of Science 'Language of Measurement' handbook available here: http://www.gettingpractical.org.uk/Books.php

Question 4 (d)

(d) The student wanted to compare the rates of transpiration of the two leafy shoots shown in Fig. 4.3.

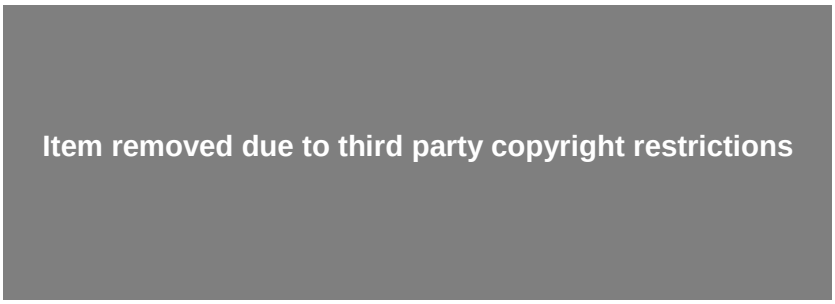


Fig. 4.3

Describe how the student could ensure that a valid comparison could be made between the two leafy shoots.

.....

.....

.....

.....

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

Many candidates wrote about a selection of variables that should be controlled but did not address the crucial one of leaf surface area.

i	**OCR support**	Useful resources for teaching about the use of the potometer are given in the OCR 'Transport in Plants' delivery guide and the Practical Skills Handbook: https://www.ocr.org.uk/qualifications/as-a-level-gce-biology-a-h020-h420-from-2015/delivery-guide/module-ba03-module-3-exchange-and-transport/delivery-guide-badg009-transport-in-plants-313#231117 http://www.saps.org.uk/secondary/teaching-resources/1263-investigating-transpiration-with-a-potometer There is also a link within the delivery guide to estimating leaf surface area. https://www.ocr.org.uk/qualifications/as-a-level-gce-biology-a-h020-h420-from-2015/delivery-guide/module-ba03-module-3-exchange-and-transport/delivery-guide-badg009-transport-in-plants-313#231115

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Question 5 (a)

5 *Paramecium caudatum* is a protoctist. The structure of this organism is shown in Fig. 5.

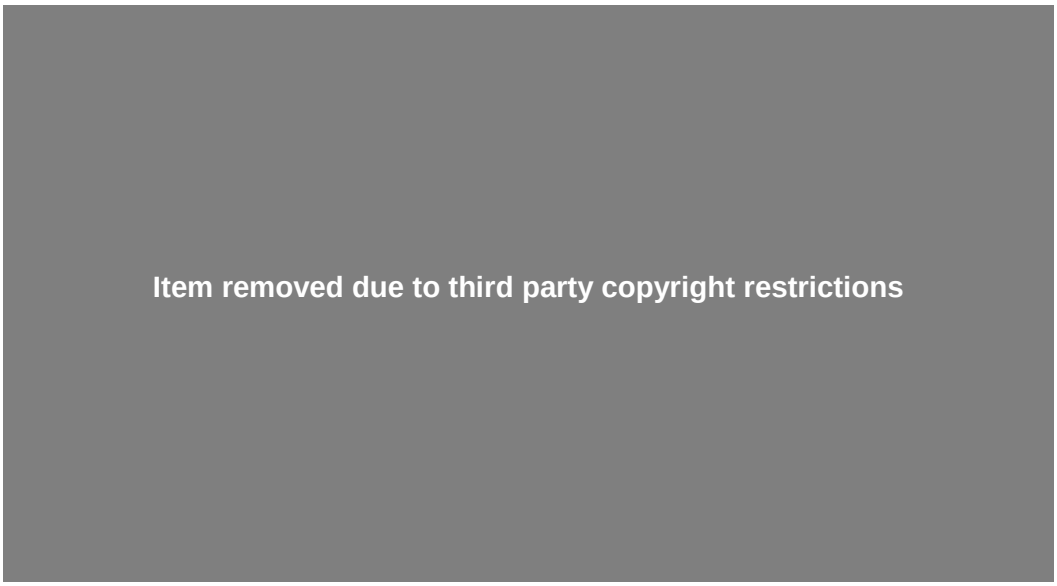


Fig. 5

Most species of *Paramecium* are freshwater organisms. Over a period of time water from the cytoplasm is collected by the collecting channels. They pass the water into the contractile vacuole. Once the contractile vacuole is full, it contracts, expelling the contents from the cell.

(a) Explain why *Paramecium* needs to expel water when in fresh water.

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

Many candidates showed an understanding of osmosis and water potential to reason that water would enter the *Paramecium* with a risk of the cell bursting. Some candidates incorrectly referred to plasmolysis. Others seemed to think the water had to enter so the contractile vacuole could continue to operate, not that the contractile vacuole was a response to the problem of too much water entering the cell.

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Question 5 (b) (i)

(b) An experiment was carried out in which the frequency of vacuole contraction was observed when *Paramecium* was bathed in different concentrations of sodium chloride solution. The results are shown in Table 5.

Concentration of sodium chloride solution ($mol\,dm^{-3}$)	Mean number of contractions (min^{-1})
0.00	6.5
0.01	6.2
0.03	5.7
0.05	4.9
0.10	4.4
0.15	3.9
0.20	1.2

Table 5

(i) Calculate the percentage decrease in the mean number of contractions as the concentration of sodium chloride solution increases from 0.00 $mol\,dm^{-3}$ to 0.15 $mol\,dm^{-3}$.

percentage decrease = ... % **[2]**

Many candidates correctly calculated a 40% decrease. A few candidates did not notice that the concentration range asked about was from 0.00 to 0.15 (not the 0.20 figure at the end of the table). Some candidates found the difference between the figures for the two concentrations but divided by the final figure (3.9) not the initial figure (6.5), gaining one mark only for error carried forward in their calculation.

Question 5 (b) (ii)

(ii) Explain why there is a decrease in the activity of the contractile vacuole as the concentration of sodium chloride increases.

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

This provided a good test of candidates' ability to describe and explain parallel trends as two parameters change. Answers needed to consider the dynamic trend produced in the dependent variable as the concentration of sodium chloride increased (going down the table). There is a trend of decrease in the external water potential, leading to less water uptake by *Paramecium* and less need to expel water. Practical work on osmosis should provide candidates with a background idea that cytoplasm has a solute concentration greater than 0.20 mol dm^{-3}, therefore there will not be water movement from the cytoplasm into the external solution in this case.

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Question 5 (b) (iii)

(iii) The cytoplasm of *Paramecium* contains salt crystals. These salt crystals can be used to alter the water potential of the cytoplasm.

Suggest and explain how the water potential can be altered **and** how this could benefit the *Paramecium* living in freshwater.

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

This question caused widespread confusion. Alteration of the water potential would have to involve either making more solid crystals or allowing some to dissolve. Generally candidates thought that more crystals meant a lower water potential, whereas more crystallisation would remove ions from solution and allow water potential to increase. Those who described crystals dissolving, reducing the water potential in the cell, ran into the problem that this would not be a benefit to the *Paramecium*, but would make its osmoregulation problem worse. Candidates can be assured that in a novel context like this, an initial error does not mean they lose all the marks, so long as they use correct logic to follow through their argument.

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Question 5 (b) (iv)

(iv) The experiment described in **Table 5** was extended to find out the effect of reducing the dissolved oxygen concentration on the mean number of contractions at each concentration of sodium chloride.

When the dissolved oxygen concentration of the solution was reduced, the mean number of contractions was lower at each concentration of sodium chloride.

Suggest an explanation for these findings.

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

Some candidates continued to pursue an osmosis line of thought. Those who considered respiration often did not qualify it as aerobic (i.e. less aerobic respiration can occur if less oxygen is available). Only a few candidates realised that contraction of the vacuole is an active, energy-requiring process.

Question 6 (a) (i)

6 The sweet potato is a plant that is a staple food in countries such as China. The sweet potato is susceptible to a group of viruses known as potyviruses.

(a) (i) It is difficult for the virus to enter the sweet potato cell.

Suggest a barrier that makes it difficult for potyviruses to enter the sweet potato cell.

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

Many candidates correctly stated cell wall while others wrote 'skin'. The question was clear that entry to an individual cell was the issue.

Question 6 (a) (ii)

(ii) Suggest how the potyviruses enter the sweet potato cell.

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

Even candidates who had focused on the cell wall for Q6 (a)(i) often veered off into histological territory with wrong answers like 'through the roots' or 'through stomata'. Candidates need to note the level of detail depicted in the question, for example whether the question context deals with organs, tissues, individual cells or with organelles or molecules within cells.

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Question 6 (b) (i)

(b) Sweet potato cells have a mechanism that recognises and destroys incorrectly formed mRNA or non-functional mRNA.

(i) The nucleic acid in potyviruses is RNA.

Suggest why this mechanism in sweet potato cells is able to counteract infection by a potyvirus.

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

In this type of question candidates need to use the information given but add some insight to it to make a deduction. Hence just repeating the question stem information ('they recognise and destroy mRNA') will not score marks. Candidates needed to make the link that the viral RNA will be recognised by this mechanism as different to the cell's correct mRNA, so this viral RNA (not the whole virus) will be destroyed.

Question 6 (b) (ii)

(ii) An enzyme is involved in this process.

Name the bond that is broken by this enzyme.

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

Wrong bond names included peptide and hydrogen as frequently as the correct answer, phosphodiester.

Question 6 (b) (iii)

(iii) Suggest an advantage to a **non-infected** cell of having this process.

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

Many candidates did not read the question carefully enough and missed the point that the cell was a non- infected cell. They wrote about a cell resisting re-infection. Only a few candidates referred to the idea that this mechanism removes faulty proteins produced as a result of mutations.

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