BIOLOGY (US)

Paper 0438/13
Multiple Choice (Core)

Question Number	Key	Question Number	Key
1	A	21	A
2	B	22	A
3	C	23	D
4	D	24	B
5	B	25	A
6	B	26	C
7	A	27	B
8	B	28	A
9	C	29	A
10	A	30	B
11	B	31	C
12	B	32	A
13	A	33	B
14	A	34	B
15	A	35	B
16	C	36	C
17	B	37	D
18	D	38	B
19	C	39	B
20	D	40	B

General comments

The paper provided a balance of questions and sufficient challenge for candidates working at this level. A number of misconceptions and areas of knowledge that are less well understood are detailed against individual questions. The questions on the structure of the leaf; the use of calcium in a pregnant woman; the names of parts of the alimentary canal; identifying the bladder; the role of insulin; the role of the liver; parts of the human reproductive system, and the water cycle were well understood.

Comments on specific questions

Question 1

Although many candidates appreciated that all animals and plants carry out the characteristics of living things, many also incorrectly believed that only animals carry out these characteristics.

Question 3

While many candidates understood that amphibians have moist skin without scales, some believed that amphibian skin possesses scales.

Question 4

Most candidates were able to use the key to derive the correct answer, although some identified the plant wrongly by not observing carefully the appearance of the leaves.

Question 5

While most candidates correctly identified the chloroplast as the site where sugar is made, some incorrectly believed that sugar is made in the vacuole.

Question 6

Most candidates understood that root hairs increase the surface area of root cells. Some wrongly believed that root hairs are used for the maintenance of the temperature of the cell sap.

Question 8

While some candidates correctly identified that it is the surface membrane that is partially permeable, many incorrectly opted for the cell wall.

Question 9

Although some candidates correctly identified that the fruit contained protein and reducing sugar, many showed a less secure knowledge of food test results.

Question 10

Many candidates understood how the axes should be labelled; some, though, were uncertain which axis represents the 'pH' and which represents the 'rate of reaction.'

Question 13, 14, 24 and 37

These were well-answered by most candidates.

Question 16

Many candidates correctly opted for the rate of respiration not affecting the rate of transpiration, although some incorrectly believed that the number of open stomata does not affect transpiration.

Question 18

While some candidates correctly identified blood component 'D' (platelets) as being responsible for blood clotting, the majority of candidates opted for an incorrect blood component.

Question 21

The question proved to be challenging with few showing a good understanding of anaerobic respiration.

Question 23

This question was well-answered by many candidates, although some wrongly believed that the sequence of the reflex action commenced with a receptor, which generates the stimulus.

Question 25

This proved to be a challenging question with only some candidates opting for the correct answer.

Question 28 and 29

Only some candidates understood the features of asexual and sexual reproduction.

Question 31

The fact that oestrogen is responsible for the development of secondary sexual characteristics was not well known.

Question 32

There is some confusion about the name of the length of DNA that codes for a protein. The commonest incorrect responses were gene and amino acid.

Question 34

This was a challenging question with many choosing one of the first three options.

Question 39

While many candidates correctly identified methane as a source of air pollution, some opted for herbicides.

BIOLOGY (US)

> **Paper 0438/23**
> **Multiple Choice (Extended)**

Question Number	Key	Question Number	Key
1	A	21	A
2	B	22	D
3	C	23	D
4	D	24	B
5	B	25	B
6	B	26	C
7	A	27	C
8	B	28	D
9	C	29	B
10	A	30	B
11	B	31	B
12	B	32	B
13	A	33	C
14	A	34	A
15	A	35	C
16	C	36	C
17	B	37	A
18	D	38	B
19	A	39	C
20	A	40	D

General comments

The paper provided a balance of questions and sufficient challenge for candidates working at this level. Common misconceptions were identified and are detailed against individual questions. Good knowledge of many areas of the syllabus was demonstrated by the majority of candidates.

Comments on specific questions

Question 1

Although many candidates appreciated that all animals and plants carry out the characteristics of living things, some also believed that only animals carry out these characteristics.

Cambridge Assessment
International Education

Questions 3, 4, 5, 6, 7, 9, 11, 12, 13, 14, 15, 23, 25, 27, 33, 35, 38 and 40

These questions were well-answered by the majority of candidates.

Question 8

While many candidates correctly identified that it is the surface membrane that is partially permeable, some incorrectly opted for the cell wall.

Question 17

While many candidates were able to identify the correct graph which shows the results of the experiment, many opted for an incorrect graph. It is important that candidates work methodically through the information given.

Question 18

The question was well answered by many candidates, although a similar number chose an incorrect option. There was some uncertainty whether fibrin is converted to fibrinogen (incorrect) or fibrinogen to fibrin (correct).

Question 19

Many candidates chose the correct option. Incorrect responses suggested that the term 'passive' was not understood by all.

Question 20

While most candidates understood what muscle action is required for inspiration, some were uncertain as to which way round the external and internal intercostal muscles work.

Question 22

Many candidates correctly identified the renal vein. The renal artery was a common incorrect response.

Question 24

Most candidates were able recall the activities of the structures involved in viewing a near object. However, this proved to be a challenging question for many.

Question 26

Many candidates were uncertain about which region of the shoot would show the greatest rate of growth.

Question 28

While many candidates chose the correct option, some were less secure in their knowledge of these reproductive techniques.

Question 29

Some candidates selected the correct response but many could not identify the curve representing progesterone.

Question 30

Most candidates were able to work through the information given and derive the correct answer. However, many found this challenging.

Question 31

Most candidates were able to work systematically through the information and derive the correct answer.

Question 34

While many candidates chose the correct option, some believed that xerophytes have a thin cuticle and many stomata.

Question 36

Some candidates were able to recognise the definition of a community. Many were unsure of the definitions of a community, an ecosystem and a population.

Question 37

While many candidates appreciated that the presence of plasmids makes it possible for bacteria to produce human insulin, some wrongly believed that bacteria possess genes for insulin.

Question 39

This proved to be a challenging question for many who did not recall that decomposer bacteria lower the oxygen concentration of water during eutrophication.

BIOLOGY (US)

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| **Paper 0438/33** |
| **Theory (Core)** |
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Key messages

The space provided and the number of marks available indicates the length and type of response required. Where extra space is required candidates should ensure that they have noted in the question where on the script they have written the continuation of their response. It is important that all of the instructions in a question are followed.

Candidates should know the difference between command words, e.g. state, describe, explain, calculate and suggest so that they can respond to the question appropriately.

General comments

Most candidates were well-prepared for the exam. A good knowledge and understanding of many areas of the syllabus was shown.

Comments on specific questions

Question 1

(a)   Most candidates gave a correct feature.

(b)(i)   Generally well-answered. One misconception was that crocodiles were amphibians.

(ii)   Again, generally well-answered.

(iii)   Most candidates gave a correct response.

(c)   While most candidates gave correct responses a common error was name individual organisms rather than the group to which they belong.

Question 2

(a)(i)   This proved to be a challenging question with few able to state the correct word equation for photosynthesis.

(ii)   A common error was to state chloroplast, which is the structure containing the pigment.

(b)(i)   Most candidates gave the correct response.

(ii)   Most candidates gave two correct values.

(iii)   Some candidates calculated the correct value and some gain only the mark for workings.

(c)   Many responses gave the marking point about rising and falling and some went on to state that there were no bubbles at 40(°C). Very few gained all three marks.

(d)   Many candidates stated a correct factor. Where the response gave more than one factor, only the first in the list was considered.

Question 3

(a) Most candidates gave suitable suggestions and this question was well-answered.

(a)(ii) Again this question was well-answered by the majority of candidates.

(b) Many candidates gave five correct responses. Although thought that oranges and lemons are a good source of Vitamin D instead of Vitamin C.

(c) This was proved challenging for some candidates. It required an explanation and often a list of requirements was given with no reason as to why they were needed which was insufficient.

Question 4

(a)(i) Some candidates were able to define the term but many could not.

(ii) This question was well-answered by the majority of candidates.

(b)(i) Most correctly identified the skin. The commonest incorrect responses included; cell wall, mesoderm, fat and antibodies.

(ii) This proved to be a challenging question. Few responses completed the whole table correctly, suggesting that the roles of the components of blood were not well-understood by all.

(c) A few candidates could recall the chemical barriers but many could not.

Question 5

(a) Despite candidates being given the words to choose from, some still included words not on the list However this was generally well-answered. A common mistake was to give decomposition for process C.

(b)(i) and (ii)
Here, not all candidates followed the instructions given. Common errors included; drawing a line instead of an arrow therefore not indicating the direction, drawing the arrow in the opposite direction, not labelling the arrow with a letter.

(c)(i) Although this is a topic of worldwide importance, relatively few could give two possible reasons for the increase in carbon dioxide concentration in the atmosphere.

(ii) This question was challenging for many. Some referred to the ozone layer, lack of oxygen and general references to pollution. Many referred to the greenhouse effect rather than the enhanced greenhouse effect which was insufficient.

(iii) Only a few could name another greenhouse gas.

Question 6

(a)(i) Some candidates could recall the correct type of cell division.

(ii) Some gave the correct response but many were unable to recall it and common wrong answers included; embryo, foetus, baby and gene.

(b)(i) Some candidates gave the correct definition for the term.

(ii) Many responses gave the phenotype rather than the dominant allele.

(c) This was a challenging question and only a few responses provided a suitable description.

(d) Some candidates successfully completed this question but a significant number found it challenging.

(e) While some candidates were able to successfully describe the stages many described techniques involved in genetic engineering. There were many of descriptions of mating and the subsequent births of offspring. Many responses just stopped once the parents had been chosen and bred or suggested that all of the offspring would have the desired characteristics. Some wrote that the process needs to be repeated but not that the repetition was done for many generations.

Question 7

This topic (sewage treatment) was not well-understood by all.

(a) The answer looked for sources of water pollution not what the pollutant was.

(b) Most candidates knew that sewage is filtered but fewer could provide further detail of how sewage is treated.

(c) Few could define this term correctly.

Question 8

(a) Most candidates could identify the parts of the female reproductive system.

(b) Most candidates could identify the ovaries. The commonest incorrect structures given were the oviduct or the uterus.

(c) Many candidates gave the correct response. The commonest incorrect structures given were the ovary, cervix, uterus and uterine wall.

BIOLOGY (US)

Paper 0438/43
Theory (Extended)

Key messages

- Some questions require candidates to give descriptions or explanations. The best responses identify the relevant points and link them together logically to give a clear account.
- Candidates often use blank pages and spaces to continue their responses. Instead of using asterisks or arrows it is better to state on the question the page number on which the continuation has been written.

General comments

There was a full range of responses which demonstrated all the points required by the mark scheme. Although many candidates were well-prepared to answer questions on the entire syllabus, there was some evidence that not all were familiar with some of the aspects relating to plants, such as the use of 2, 4-D in agriculture (question **4(e)(ii)**), the changes taking place in cells when a leaf wilts (question **3(b)(ii)**) and the adaptations of a leaf (questions **3(a)(ii)** and **3(a)(iii)**).

Comments on specific questions

Question 1

(a)   Almost all candidates knew that mechanical digestion starts in the mouth, but only the best responses gave a detailed description. Many descriptions focused on chemical digestion. Very few gave details of the roles of the different types of teeth.

(b)   Many were familiar with at least some of the digestive enzymes and the products of chemical digestion. Amylase was the most well-known enzyme although some responses did not state the products of starch digestion. The location of fat digestion was the least well-known.

(c) (i)   Some candidates knew the storage carbohydrate in the liver. A common error was glucagon. Correct spelling of glycogen was important to differentiate it from glucagon.

   (ii)   Many candidates knew the correct response.

   (iii)   Almost all candidates suggested a suitable function for the fat layer beneath the skin. The most common misconception was that the fat layer would produce heat rather than provide insulation.

Question 2

(a) (i)   Many candidates knew that fur is one visible feature of mammals, but only a few suggested a correct second feature. Where more than two features were given in a response, only the first two were considered. Features which were not visible or were not distinguishing were often seen. A considerable number suggested that having four legs and a backbone were unique to mammals.

   (ii)   Many good explanations of the term adaptive feature were seen. Almost all candidates explained that adaptive features increase chances of survival. Less well-executed responses just described the adaptive features of wolves. Some did not extend their explanations to cover all aspects of an adaptive feature; the genetic link in the context of natural selection and reference to fitness were the most common omissions.

(b)   Almost all candidates knew some conditions that limit plant growth. Responses that used very general terms such as 'weather' or 'environment' were rare.

(c)   There were many good responses to this question. The most common points made were the lack of food and the low reproductive rates, but a broad range of valid points were made. Less well-executed responses tended to state the same point multiple times or lacked sufficient scientific detail.

Question 3

(a) (i)   Even though the three-dimensional image of the broad bean leaf was likely to be unfamiliar, many candidates identified successfully the two labelled tissues in the photomicrograph. A common error was to state that the epidermis (**A**) was the cuticle.

(ii)   Good responses were able to explain why the mesophyll tissues have a large surface area or considered the optimisation of either light absorption or gas exchange. Only the best responses considered both aspects.

(iii)   The best responses provided a detailed account of why there are interconnecting air spaces in a leaf. Many realised that it would be related to diffusion and the processes that occur in a leaf, but were not able to construct a response in sufficient detail.

(b) (i)   Many suggested one correct condition that could increase the chances of wilting, but only a few gave two correct conditions. A significant number of candidates stated an abiotic factor without qualifying it; for example, many gave humidity without stating *low* humidity. A common misconception was that the absence of light would cause wilting.

(ii)   Explaining what happens to leaf cells to cause wilting proved to be challenging. There were some very good responses, but many gave lacked sufficient detail stating only that cells loose turgor or become flaccid but offering no further explanation.

(iii)   The most common correct advantage of wilting suggested was to reduce herbivory, but many other plausible suggestions were also given.

Question 4

(a)   Many candidates gave part of the definition of a hormone, but only some gave a detailed, precise response. Many did not state that hormones are transported in the blood.

(b) (i)   The majority of candidates stated that the retina converts light energy into nerve impulses.

(ii)   Fewer candidates knew that the fovea has the highest concentration of light sensitive cells in the eye. The most common wrong answer was the retina.

(iii)   Many candidates knew that sensory neurones conduct impulses from the eye to the brain. The most common wrong response was the optic nerve, suggesting that some were unsure of the difference between nerve tissue and nerve cells or neurones.

(iv)   Almost all candidates knew that the optic nerve contains the neurones that conduct impulses from the eye to the brain.

(v)   The majority of candidates identified the spinal cord from the diagram. References to the spine, rather than spinal cord were rare, suggesting that most candidates knew the difference between these two terms.

(vi)   A few correctly identified the adrenal gland but it was not widely known.

(c)   Most candidates completed at least part of Table 4.1 to describe the effect of adrenaline on different parts of the body. The effects on the liver were the least well-known. Many responses made general statements about the *eyes* dilating rather than stating that it is the *pupils* that dilate.

(d)   The best responses gave a full explanation. Many referred correctly to the increased speed of the nervous system as well as the long-lasting effects of the endocrine system. Some responses did not make it clear as to whether they were referring to the nervous system or to the endocrine system.

(e) (i) A reasonable number of responses named a plant hormone, but many gave the names of animal hormones.

(ii) Very few candidates knew how 2, 4-D is used in agriculture. Most suggested that it is used to promote the growth of crops without specific mention of its role as a weedkiller.

Question 5

(a) The vast majority of candidates were familiar with the chemical equation for aerobic respiration. A few wrote the equation for photosynthesis and not all were able to correctly balance the equation.

(b) Many candidates calculated the rate of carbon dioxide production and most also went on to give their answer to the correct number of significant figures, however, some found this challenging. Similarly, correct rounding of the calculated value proved to be a challenge for some.

(c) Many excellent explanations were seen, both in terms of concern for the welfare of the crickets and good experimental design.

(d) A similar number of candidates also explained why the temperature in the jar would increase. A broad range of correct points were made with many extending their responses to cover many valid reasons.

(e) Most candidates stated two conclusions from the data in the figure, but fewer were able to support their conclusions with appropriate data quotations. Often where data was quoted there were no comparative figures or units were missing.

Question 6

(a) Many candidates were able to identify at least some parts of the flower, but fewer could correctly identify their functions. The least well-known function was the protection given by sepals to the flower bud.

(b) (i) Many candidates knew the formula to calculate the actual size of a pollen grain from a magnified image.

(ii) Many candidates converted millimeters to micrometers successfully with only a few using something other than a factor of a thousand.

(iii) Almost all candidates suggested that the spikes on the pollen grains would hook on to the bodies of insects to aid pollination.

(c) (i) A reasonable number of candidates knew that the ovule contains the female gamete in flowers.

(ii) Some candidates gave a correct definition. Good responses approximated the definition given in the syllabus. A common error was to state that the chromosome number was 23 without further explanation.

(iii) Some candidates explained in detail why it is important that gametes are haploid with many referring to the restoration of the diploid number at fertilisation. Less well-executed responses seemed to be familiar with the terminology, but were not able to use it in the correct context.

BIOLOGY (US)

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│      Paper 0438/07          │
│       Coursework            │
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Key messages

In general, centres have been steadily improving the standard of their assessment exercises, mark schemes and moderation procedures, in line with recommendations from the external moderator. These improvements have allowed many candidates to achieve good marks in their coursework. There are still further improvements that can be made in these respects, and in the organisation of paperwork for the external moderation process.

General comments

Organisation of documents

In order to facilitate the handling of documents, each candidate's work should be fixed together with string, or with paper fasteners other than simple paper clips, to prevent separation of pages.

Choice of assessment activities

As was made clear by the moderator in 2017, it is the responsibility of a centre to ensure that every candidate is assessed to the same standard, as the external moderator cannot moderate each teaching group separately. It would be preferable if a centre could use a single set of experiments for coursework assessment.

In skills C2 and C3, some candidates could be given further opportunities. For example, in some osmosis tasks, only three different solutions are used, but if five were used, better line graphs could be plotted. In addition, repeats could be used, allowing for the calculation of mean averages.

One problem in using an assessment exercise for skill C4 alone, is that candidates tend not to display the data that they have collected, thinking that such display is needed only if skills C2 and C3 are also being assessed. However, this hampers the marking and moderation processes, as it is difficult to see how effectively the candidates have carried out the whole experiment.

Accuracy of readings

Centres are reminded of the rule which states: 'the mean should usually be given to the same number of decimal places as the individual readings'. In some instances, candidates try to impose a higher level of accuracy on means, than is warranted by the data.

Use of appropriate charts and graphs

Candidates should be encouraged to use appropriate bar charts or graphs, to fit the contexts of particular tasks.

Graph paper

As was mentioned in previous years, it is strongly recommended that centres should supply candidates with paper which has a 2 mm grid. It appears that it is sometimes difficult to obtain this, but samples can be found on the Internet, which can be downloaded and printed off as required. Using this type of graph paper, rather than grids made up of relatively large squares, encourages precise and careful plotting.

Candidates' work

The tidiness and layout of candidates' work varied widely. It is important to encourage the production of work that is well-presented and is easy to read, especially as it may be moderated externally.

Apparatus does not necessarily have to be illustrated as part of assessments, but in many cases, diagrams drawn by the candidates would have been useful, in order to show how equipment was set up and used. This would have been especially helpful for work which was assessing skill C4, if candidates designed or modified apparatus in some way.

Candidates need to be more specific about giving details of variables, especially those which are controlled. Also, they should mention variables which have not been controlled in a practical assessment.

Mark schemes

When constructing mark schemes for specific practical exercises, it is important to cover each aspect from the generic schemes which are provided in the syllabus. It was quite common for a centre to miss one key instruction in an otherwise good mark scheme. In some cases, it seemed that centres did incorporate missing points in the schemes when carrying out marking, but it was not always easy to ascertain this fact.

At the score levels below six, teachers should not just be judging candidates on errors or negative points, but assessing positive achievements which have been met when assistance has been given. So, they should provide a 'detailed format' (score 2) or an 'outline format' (score 4), and not leave candidates entirely on their own, or penalise them when axes are not labelled correctly, if they have not been shown what to do.

One technique which has proved very useful in some centres, is for teachers to design the mark schemes as personalised 'check lists', which are then included with the candidates' work.

Quality of marking

It is not always possible to ascertain what points were taken into account when work was being marked, and more annotations on candidates' work would clarify this issue.

What is difficult to know in some cases, is how much help has been given to candidates, how much observation has taken place (especially with relation to skill C1), and whether verbal input from candidates has been of significance: only the teachers know these facts, and it would be helpful if they could be explained for the benefit of the external moderator.

Teachers are urged to annotate candidates' work clearly, to show how and where marks have been awarded. Useful techniques would include:
- the inclusion of individual marking sheets with the written work
- the use of check-list mark schemes
- the inclusion of explanatory comments on Individual Candidate Record Cards.

Properly-marked work not only provides valuable feedback to candidates, but also facilitates both internal and external moderation.

Internal moderation

Changes to candidates' marks which are made during the moderation process should be indicated on individual pieces of coursework.

It would be very helpful to the external moderator if any apparent mismatch between a candidate's original total mark, and the moderated total mark could be explained.

Accuracy of adding and transferring marks, and provision of correct paperwork

Many instances of inaccuracies were found this year. Centres are urged to take particular care, and to have everything checked by more than one person.

Samples for external moderation

Centres are reminded of this instruction: 'The sample should include a candidate with the highest mark and a candidate with the lowest mark with the remaining candidates spread evenly across the mark range. You should also include any candidates with a mark of 0 in the sample. All work which contributed to the candidates' final mark must be included.'

In a few cases, candidates' work, from which marks had been used, was incomplete in the moderation sample. This may have been due to the fact that candidates were partially assessed verbally, but if that is the case, then it should be made clear to the external moderator by annotating the work.