# BIOLOGY

**Paper 0610/11**
**Multiple Choice (Core)**

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

## General comments

The questions on this paper proved challenging to some candidates. The interpretation of graphs is an area where some candidates need further practice.

## Comments on specific questions

### Question 2

The ability to follow a simple key, though often not especially demanding, is never-the-less an important ability at this level. It was reassuring to see so many successfully doing so.

**Question 8**

This question tested candidates' knowledge that it is the solvent only that moves by osmosis. The reference here was to the movement of the solute – the red dye. Even so, many believed that the dye would be moving by osmosis rather than by simple diffusion.

**Question 9**

Many candidates knew that glycerol is a basic unit of oils. It may be that the term 'oils' rather than 'fats' was a source of confusion for some.

**Question 10**

This proved to be one of the more challenging questions on the paper, with some candidates failing to appreciate the significant difference in the appearance of graphs that show the effect of increased temperature and increased pH on enzymes and their activity.

**Question 16**

It was expected that candidates would appreciate that a diet lacking in meat would contain plant material which is a source of dietary fibre. This was not well known to all.

**Question 17**

As with **Question 10**, the interpretation of graphs proved challenging. Apart from the relatively unlikely option, C, the alternatives proved almost equally popular. Many candidates chose graphs that indicated an increase in humidity will increase the rate of transpiration.

**Question 21**

This question proved challenging for some and many appeared unsure of the differences in the composition of inspire and expired air.

**Question 27**

Candidates were required to identify the neurone as motor, and then know that its cell body would lie in the central nervous system. A significant proportion of candidates erroneously indicated that the cell body would be in the leg.

**Question 29**

The link between alcohol consumption and liver damage was well known by almost all candidates.

**Question 32**

Many candidates seemed unfamiliar with the different forms of contraception.

**Question 38**

The concept of food chains is well understood by candidates.

# BIOLOGY

**Paper 0610/12**
**Multiple Choice (Core)**

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

## General comments

The paper exposed a few areas for further development of candidates' knowledge. These were in addition to the traditional problems of interpreting information presented graphically. Overall the paper proved to be a good test of candidates' knowledge and ability.

## Comments on specific questions

### Question 3

The use of a key to identify species is a skill that most candidates have mastered.

**Question 4**

Although the levels of organisation are fairly well known, applying those definitions to examples proved to be challenging for some candidates.

**Question 9**

Many candidates knew that glycerol is a basic unit of oils. It may be that the term ‘oils’ rather than ’fats’ was a source of confusion for some.

**Question 11**

This proved to be one of the more challenging questions on the paper, with some candidates failing to appreciate the significant difference in the appearance of graphs that show the effect of increased temperature and increased pH on enzymes and their activity.

**Question 15**

This was a testing question for candidates. It appeared that some candidates were perhaps thinking of the possible consequences of food poisoning, such as vomiting, rather than where absorption occurs. Careful reading of questions set in a context is an important skill to develop.

**Question 18**

As with **Question 10**, the interpretation of graphs proved challenging. Apart from the relatively unlikely option, C, the alternatives proved almost equally popular. Many candidates chose graphs that indicated an increase in humidity will increase the rate of transpiration.

**Question 20**

Many candidates appeared to believe that haemoglobin is dissolved in blood plasma.

**Question 24**

Many candidates did not appear to realise that respiration is a metabolic reaction under the control of enzymes.

**Question 31**

Candidates need to have a clear understanding of the difference between the terms asexual and sexual reproduction. Many suggested that fusion of nuclei is involved in asexual reproduction, and some also indicated that asexual reproduction would lead to genetic variety in offspring.

**Question 37**

Some candidates were not comfortable with applying the term ‘population’ to the number of ‘living’ organisms within the natural world. Many did not consider that in a 100 year period many of the individual humans would have died and would therefore no longer be part of the population.

# BIOLOGY

**Paper 0610/13**
**Multiple Choice (Core)**

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

## General comments

The paper proved to be well-matched to the ability of the candidates. Interpreting graphical data is an area that requires further development for some candidates.

## Comments on specific questions

### Question 2

It was, perhaps, surprising that many candidates believed that phototropism is more to do with nutrition than with sensitivity.

**Question 4**

Candidates showed a good understand of the levels of organisation tested in this question.

**Question 8**

Many candidates seemed to believe that support for a plant came from water movement in the xylem or phloem. The importance of water in the cells as a means of support should be emphasised to candidates.

**Question 9**

Many candidates knew that glycerol is a basic unit of oils. It may be that the term ‘oils’ rather than ’fats’ was a source of confusion for some.

**Question 10**

This question involved knowledge and understanding of a relatively complex subject. Candidates did well to tackle it so successfully.

**Question 11**

This proved to be one of the more challenging questions on the paper, with some candidates failing to appreciate the significant difference in the appearance of graphs that show the effect of increased temperature and increased pH on enzymes and their activity.

**Question 14**

Many candidates thought that the liver or gall bladder produced amylase rather than the pancreas.

**Question 16**

It was surprising that many of the candidates thought that carbohydrates, fats and proteins do not need to be digested before they are absorbed.

**Question 17**

As with **Question 10**, the interpretation of graphs proved challenging. Apart from the relatively unlikely option, C, the alternatives proved almost equally popular. Many candidates chose graphs that indicated an increase in humidity will increase the rate of transpiration.

**Question 19**

Although the correct answer was the most popular, it was evident that candidates were not confident in their knowledge of function of blood vessels associated with the heart.

**Question 20**

Many candidates appeared to believe that haemoglobin is dissolved in blood plasma.

**Question 24**

Candidates need to understand that egestion is not an example of excretion.

**Question 37**

Whilst candidates usually have a very good understanding of food chains the interpretation of pyramids of numbers proved more challenging and is an area for further development for some.

**Question 38**

The water cycle is well understood by nearly all candidates.

# BIOLOGY

**Paper 0610/21**
**Multiple Choice (Extended)**

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

## General comments

The paper proved to be an effective instrument of discrimination. With the majority of candidates showing a good understanding of most of the areas tested.

## Comments on specific questions

### Question 3

Following a simple dichotomous key is a skill that nearly all candidates have mastered.

**Question 4**

It was, perhaps, a little surprising that some candidates believed that the cells that manufacture insulin would contain a large number of nuclei.

**Question 10**

Some candidates appeared unfamiliar with the difference in the shape of graphs showing the effect of temperature and the effect of pH on enzyme action. The sudden drop to zero by the enzyme that is denatured by heat rather than pH was appreciated by relatively few candidates.

**Question 12**

The use of a hydrogen carbonate indicator is specified in the syllabus, but those who had problems with remembering the colour change or who might have been more familiar with limewater as a test for carbon dioxide, were challenged by this question.

**Question 13**

A significant number of candidates seemed either unfamiliar with the structure of a villus, or with the vessels that a villus contains. Many thought that the lacteal transports its contents directly to the liver.

**Question 15**

Many candidates were uncertain about the function of bile. Significantly, most of those who were confused were of the opinion that it contains digestive enzymes.

**Question 18**

It appeared that the term ‘atrioventricular’ was not familiar to some candidates. After successfully navigating the common left side right side confusion, many failed to appreciate that the valve would lie between the atrium and the ventricle.

**Question 22**

The action of the intercostal muscles and the diaphragm during the process of breathing needs careful thought before being accurately described. This topic is an area for further development for many candidates.

**Question 28**

The link between alcohol consumption and liver damage was well known by almost all candidates.

**Question 34**

This question demanded a deep level of understanding. Some candidates were able to correctly identify that less genetic variety in the bees would mean that adaptation to environmental change would be slow.

**Question 35**

This question required candidates to think simultaneously in terms of both pyramids of numbers and pyramids of biomass. Most were able to eliminate option D, but fewer were able identify the correct answer. Many did not realise that each tree would have many insects and each bird would have many fleas.

# BIOLOGY

**Paper 0610/22**
**Multiple Choice (Extended)**

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

## General comments

The paper produced an effective range of marks from candidates. This indicated that there was a comfortable match between the facility of the paper and the ability of the candidates offering it. One or two questions exposed some are for further development of knowledge; enzymes in metabolism, the cause of stomatal opening and the effect of temperature and pH on enzyme action and herbicides. In general, there were many extremely competent performances.

## Comments on specific questions

### Question 1

The process of respiration in yeast was well known in the context of this question.

**Question 2**

Of the four flowers illustrated, three of them possessed five petals. The distinguishing feature of petals and sepals being arranged in threes was shown only by the flower that provided the correct answer. It was a little surprising, therefore, that flower A was selected by many candidates.

**Question 6**

It was appreciated by most candidates that potassium ions move into cells by active transport, but less well appreciated that it is turgidity rather than flaccidity in guard cells that results in the opening of a stoma.

**Question 10**

Some candidates appeared unfamiliar with the difference in the shape of graphs showing the effect of temperature and the effect of pH on enzyme action. The sudden drop to zero by the enzyme that is denatured by heat rather than pH was appreciated by relatively few candidates.

**Question 20**

Many candidates did not appear to realise that respiration is a metabolic reaction under the control of enzymes.

**Question 27**

The conditions required for seed germination posed very few problems for candidates.

**Question 33**

Care reading of the information provided in the diagram guided candidates to the correct answer. However, some did not refer to the diagram and many erroneously selected features of xerophytes and land plants. This is an area for further development.

**Question 35**

This question required candidates to think simultaneously in terms of both pyramids of numbers and pyramids of biomass. Most were able to eliminate option D, but fewer were able identify the correct answer. Many did not realise that each tree would have many insects and each bird would have many fleas.

**Question 40**

It seemed that some candidates were unfamiliar with the term ‘herbicide’. Many indicated that it would have the effect of encouraging the growth of plants either on land, or in the contaminated water or both.

# BIOLOGY

**Paper 0610/23**
**Multiple Choice (Extended)**

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

## General comments

Marks were spread out across the entire range of abilities indicating that the candidates and the paper were well matched. Some areas where knowledge was less secure involved topics that were new to the syllabus and are therefore areas for further development.

## Comments on specific questions

### Question 4

Candidates showed a good understand of the levels of organisation tested in this question.

**Question 5**

The calculation of a magnification factor proved challenging for some candidates.

**Question 6**

Many candidates seemed to believe that support for a plant came from water movement in the xylem or phloem. The importance of water in the cells as a means of support should be emphasised to candidates.

**Question 11**

The key features of xerophytes proved challenging for some candidates and is an area of for further development as many erroneously selected features of hydrophytes.

**Question 13**

In general the cause of cholera was not well understood and many candidates indicated that the cholera pathogen is a virus.

**Question 19**

This was a challenging question which accurately discriminated between the abilities of candidates. Some were able to recall the features of passive immunity. The majority, however, indicated that the process involves memory cells.

**Question 21**

The results of the action of the intercostal muscles is an area for further development as many were unclear as about the relationship between muscle contraction and relaxation and its subsequent effect on the pressure in the thorax.

**Question 23**

Candidates need to understand that egestion is not an example of excretion.

**Question 35**

This question required candidates to think simultaneously in terms of both pyramids of numbers and pyramids of biomass. Most were able to eliminate option D, but fewer were able identify the correct answer. Many did not realise that each tree would have many insects and each bird would have many fleas.

**Question 36**

This question was well understood by nearly all candidates.

**Question 37**

The nitrogen cycle is traditionally a challenging topic. Many candidates indicated that root nodule bacteria are involved in nitrification rather than nitrogen fixation.

# BIOLOGY

**Paper 0610/31**
**Theory (Core)**

## Key messages

Candidates need to read each question carefully and consider their answers before starting to write. In some cases marks cannot be awarded but because the response given by the candidate does not answer the question asked.

Candidates should also check the number of marks available for the question and try to make one point for each mark.

## General comments

Many candidates performed very well on this paper and some scripts were excellent. There was no evidence that candidates had been short of time. There are some areas where specific improvements could be made and these will be clarified in the relevant sections. In particular, the topics that are new to the syllabus were unfamiliar to some candidates and so these will be an area for future development.

### Question 1

**(a) (i)** Most candidates could identify the two parts of an animal cell correctly. The most common error was to label the cell membrane as the cell wall.

**(ii)** Many candidates of all abilities were unable to name DNA as the chemical used in genetic material. The most frequently given answers were protein, chromosome and gene. Obviously, this is an area that needs emphasising.

**(b)** The majority of candidates answered correctly. Only a few erroneously stated that carbon dioxide diffused in and oxygen diffused out.

**(c)** One difference between diffusion and active transport was stated clearly by most candidates. Some only quoted the definition for diffusion and made no mention of active transport.

**(d) (i)** Candidates labelled the two parts of a plant cell more accurately than they labelled the animal cell in **1(a)(i)**. The most common error was to give the name of the cell wall as the cell membrane.

**(ii)** The majority of candidates named the process correctly as photosynthesis and gained marks by outlining this process. Fewer candidates could explain clearly why all animal life was dependant on photosynthesis. Of those who attempted an explanation, a significant number stated that animals need oxygen for breathing (and not for respiration). There were some excellent explanations from some candidates. Those who found the topic challenging were unable to identify photosynthesis as the process, instead identifying it as excretion, homeostasis or respiration.

### Question 2

**(a) (i)** The majority selected the possession of fur or hair. It should be noted that mammary glands are visible in the photograph, but that breast-feeding is not.

**(ii)** Stating two mammalian characteristics that were not visible in the photograph proved more challenging for candidates of all abilities. Some stated ears (which are visible). Many appeared to be stating the characteristics of living organism or those of vertebrates.

**(b) (i)** Accurately answered by almost all candidates.

**(ii)** Well answered.

**(iii)** Also well answered.

**(iv)** The relationship between body mass and average life span was correctly stated by many candidates. Less confident candidates confused average life span with individual age and produced statement such as “the more you weigh the longer you will live”.

**(c)** Most candidates were able to give at least two items that would contribute towards a longer life span. Many who did not gain three marks gave answers with insufficient explanation.

**Question 3**

**(a)** The structure of the skin was not well known and few candidates scored well on this question. It is an area of the syllabus that needs greater emphasis.

**(b) (i)** The majority of candidates obtained the correct figures from the graph, but very few could manipulate these to calculate the required percentage. Many calculated a percentage, but not the one required.

**(ii)** Well answered.

**(c)** Many candidates could not explain how sweating cools the body. Only a few understood what was involved and explained the mechanism. Others referred to homeostatic mechanisms in general. Although the cooling effect of sweating may be a difficult concept for candidates to understand, nevertheless, it is an area that requires greater emphasis.

**Question 4**

Fairly well answered. The term “target organ” was unfamiliar to many.

**Question 5**

**(a)** The majority correctly stated xylem. Only a few candidates stated phloem.

**(b) (i)** Most candidates said that as the temperature increases, so does the rate of transpiration. Some candidates did not access the mark as they stated that an increase in the rate of transpiration would result in an increase in temperature.

**(ii)** This question proved challenging to candidates. Many only gave one reason when two were required. The answer most commonly given was that enzymes would be denatured at 60 °C.

**(c) (i)** Answered reasonably well.

**(ii)** Although candidates were instructed to give two reasons for the difference in results, the majority gave one reason only, and so could not access all the marks.

**(d)** The majority of candidates gave a correct answer, usually humidity or light intensity. A few incorrectly stated temperature.

**Question 6**

**(a)** The definition of genetic engineering was not known by many candidates.

**(b)** This was the most challenging question on the paper. Although several examples of the use of genetic engineering are given in the syllabus, candidates had very scant knowledge of them. The majority gave examples involving either selective breeding or some type of fertility treatment for humans. This area of the syllabus needs much greater emphasis.

**Question 7**

As might be expected from the format of the question, most candidates scored several marks and many gained full marks. The areas that need reinforcing are the meanings of assimilation and homeostasis.

**Question 8**

**(a) (i)** This question was challenging for many candidates, with few able to identify the structures involved.

**(ii)** Many candidates knew that the liver produced urea. Fewer could state that it is transferred by the blood, with many thinking that there was transfer along some unspecified tube.

**(b)** The majority of candidates pinpointed lower water intake as a reason for the decrease in urine volume.

**(c)** The treatment of sewage is another area of the syllabus that needs a more rigorous approach. Filtration was the most common process described and frequently the only process described. Some misconceptions included the idea that sewage could be boiled and the water condensed. Some candidates erroneously discussed methods of keeping water supplies fit for drinking.

**Question 9**

**(a) (i)** Well answered.

**(ii)** Also well answered.

**(b)** Fairly well answered. The majority of candidates gave two appropriate examples of the use of modern technology. Fewer candidates gained the marks for the explanations. There was a tendency to state what the example chosen did, without explaining how that increased the amount grown. For example, to say that an insecticide killed insects was insufficient without saying that this would stop insects eating the plant, and thus increase the amount grown.

**(c)** Many candidates gave disadvantages inherent in monocultures, rather than their impact on the wider environment which did not answer the question.

# BIOLOGY

**Paper 0610/32**

**Theory (Core)**

## Key messages

Read the questions carefully and answer the question asked.

Candidates should know the difference between command words e.g. state, describe, explain, calculate and suggest and the expected response for each command word.

## General comments

Candidates were prepared well for the examination. The marks covered the whole range of abilities.

It is essential that candidates read questions carefully and make sure they are following all the instructions given. As many candidates showed a good knowledge and understanding of the topic, but the question asked was not answered. It should also be emphasised that marks are never awarded for simply restating the question.

The paper asked for a number of definitions for words and processes. Candidates should learn these definitions and have an understanding of what they mean.

Most candidates were able to complete all sections and there was no indication that the time allowed was insufficient.

## Comments on specific questions

### Question 1

**(a) (i)** Many candidates looked at the pictures and stated the feature that the four reptiles had in common, rather than the feature that all vertebrates have in common.

**(ii)** Most candidates were able to give at least one characteristic of reptiles. The presence of scales or dry skin being common answers.

**(iii)** Nearly all candidates were able to correctly indentify a suitable feature.

**(b) (i)** Many candidates correctly identified the newt as an amphibian. However, a significant number thought it was a fish.

**(ii)** Some candidates although identifying the role of skin, then referred to breathing rather than gas exchange.

**(c)** There was a good understanding of the importance of keeping eggs within the female's body.

**Question 2**

This question covered many parts of the syllabus including the water cycle, pathogens and sustainable resources. Candidates were able to use the diagram of the glasshouse to answer the questions.

**(a)** While some candidates were able to identify precipitation, many seemed not to have considered the water cycle in their response.

**(b)** Transpiration and excretion were common correct answers here.

**(c) (i)** Animals that feed on plants are herbivores; most candidates knew this although there was a wide range of spellings and candidates should learn the correct spellings for the different biological names.

**(ii)** Many candidates had difficulty with the definition of the term *pathogen*. A disease-causing organism was the required response.

**(d)** There were many good answers in this section although some candidates did not identify what the question was asking.

**(e) (i)** Many candidates confused sustainable with renewable.

**(ii)** Candidates did not link the prevention of extinction with stocks of fish in the wild.

**Question 3**

**(a)** Candidates had a good knowledge of the reproductive structures of a plant. They were asked to draw only five lines. Those who drew seven, eight or more lines could not score full marks.

**(b)** Some candidates wrote correctly and in detail of the events leading up to the sperm being deposited, unfortunately this information was given in the question. Most candidates understood fusion of gametes and fertilisation. Some candidates were uncertain regarding the correct sequence of events that lead to an embryo being formed. This led to a number of statements being biologically incorrect.

**(c)** The differences between meiosis and mitosis were not clearly understood by some candidates who used the terms interchangeably. Candidates should be certain as to whether they are referring to sexual or asexual reproduction.

**Question 4**

**(a) (i)** Many candidates label the parts of a root hair cell, although a few confused them with human hair.

**(ii)** Few candidates knew that cellulose was made from glucose units.

**(iii)** The absorption of water was well know as a function of a root hair cell but absorption of mineral salts was less well known.

**(iv)** Although most candidates were aware of the importance of the extension, they did link not this to the idea of increased surface area.

**(b)** The first thing the candidates had to do was to identify the structures present in the palisade cell but not present in the root hair cell. These are the chloroplasts. Then they had to explain what the chloroplasts do. A simple description of photosynthesis met all the required criteria.

**Question 5**

In general a good knowledge and understanding of CHD was shown.

**(a) (i)** Candidates were very good at extracting data from the graph.

**(ii)(iii)** Describing the parts of the graph proved more challenging for some candidates. Some responses described the causes instead of the risks for CHD. A few candidates read the wrong bars, so had risk for men decreasing while risk for women increased. Although most understood the risk factors they often failed to explain the risk.

**(b)** The risk factors need to be qualified. Diet alone could mean high or low fat for example.

**(c)** Some candidates could correctly identify the coronary artery.

**(d)** Many candidates were uncertain as to how monitoring was carried out. However, apart from this the questions on heart activity were well answered.

**Question 6**

This question proved challenging for many.

**(a)** Many candidates did not write a definition but instead gave examples of the uses of genetic engineering instead.

**(b) (i)** Many framed the response in terms of 'uses' rather than 'useful' and so did not answer the question.

**(ii)** Many candidates could identify the statements which use genetic engineering.

**(c) (i)(ii)** Many candidates did not know what a herbicide is or does, although they understood how plants could be resistant.

**Question 7**

**(a) (i)** Deforestation was the correct answer given by many.

**(ii)** Candidates showed an understanding of the problems associated with the removal of rainforests with habitat destruction and soil erosion being popular answers..

**(b)** Some candidates gave their answers in the context of plants rather than orang-utans.

**(i)** The calculation proved challenging for some candidates and they should be reminded to always show working even if they are unsure of the final answer.

**(ii)** This question was successfully answered by many candidates.

**(c)** Some candidates seemed to have missed the words 'to the environment' and so did not answer the question.

**Question 8**

The topic of the reflex arc is one for future development as some candidates did not have a secure level of understanding in this part of the syllabus.

# BIOLOGY

**Paper 0610/33**

**Theory (Core)**

## Key messages

Read the questions carefully and answer the question asked.

Candidates should know the difference between command words e.g. state, describe, explain, calculate and suggest and the expected response for each command word.

## General comments

Candidates were prepared well for the examination. The marks covered the whole range of abilities.

It is essential that candidates read questions carefully and make sure they are following all the instructions given. As many candidates showed a good knowledge and understanding of the topic, but the question asked was not answered. It should also be emphasised that marks are never awarded for simply restating the question.

The paper asked for a number of definitions for words and processes. Candidates should learn these definitions and have an understanding of what they mean.

Most candidates were able to complete all sections and there was no indication that the time allowed was insufficient.

## Comments on specific questions

### Question 1

**(a)** Few candidates could state a feature common to all arthropods. Many gave feature particular to one arthropod group such as antennae or six legs.

**(b) (i)** Insects was a common correct answer. A common incorrect answer was myriapods.

**(ii)** The features chosen must be visible in Fig. 1.1. This was not appreciated by some candidates. Antennae and wings were common correct responses.

### Question 2

**(a) (i)** Very few candidates read the words ‘in structure’ and consequently many gave incorrect answers that referred to the type of blood and which way the blood was travelling.

**(ii)** Blood in vessel D is low pressure and oxygenated. The most frequent wrong answer was high pressure, oxygenated.

**(iii)** All four boxes had to be correct to score the three marks. Most candidates were able to select one correct box but few could select all four.

**Question 3**

**(a) (i)** A correct answer of transpiration or evaporation was given by most candidates.

**(ii)** This question proved challenging for many and while all candidates were able to select one correct box few managed to correctly sequence all four. There was no consistent pattern to the wrong responses given.

**(b) (i)** Candidates were asked to use the data in Fig. 3.2 to answer this question about how the volume of water in jar H had changed and suggest an explanation for the change. They were not asked about any other jar or for a comparison with other jars. Therefore responses about the number of leaves and size of flower did not answer the question. The description should have been about the shape of the graph and the explanation is that water is absorbed because it is used by the plant or lost so needs replacing. There was also credit for data usage.

**(ii)** This was a simple calculation using figures extracted from the graph of G and H at midday but surprisingly few got the correct answer of 45.

**(iii)** Many candidates were able to answer this question correctly.

**Question 4**

**(a)** This was the first definition on the paper. Many candidates found this challenging and could not define what a balanced diet is. While some knew what a 'diet' was they were unable to further qualify their responses sufficiently to state what a balance diet was.

**(b) (i)** Many candidates realised that the foods listed were rich in carbohydrates and that they were needed for energy.

**(ii)** At least two foods high in protein should have been named and many candidates wrote all six categories. Some also went on to say that they were needed for growth or repair of cells or named body parts. A common misconception was that they were needed for energy.

**(iii)** Diabetes, obesity and heart problems were popular correct answers

**(iv)** This question was misinterpreted by some candidates. The factors affecting a person's dietary needs are age, gender, activity, pregnancy and others. Two of these should have been stated and then an explanation offered as to how this factor affected the person's needs.

**Question 5**

This question proved to a challenging area of the syllabus for many.

**(a)** Many candidates did not write a definition but instead gave examples of the uses of genetic engineering instead.

**(b) (i)** Some candidates were able to recall the definition of a gene but many gave responses that discussed traits or characteristics being passed from one generation to another rather than a length of DNA that codes for a protein.

**(ii)** A few candidates were able to correctly identify that the maize would kill insects which would lead to a higher crop yield.

**(c) (i)** A few candidates were able to correctly describe pollination.

**(ii)** The idea of fewer pollinators/insects was realised by many candidates. Alternatively they wrote about the trees not being pollinated.

**(d)** Some candidates gave good examples of genetic engineering. A common error was to give a description of selective breeding or how to create new genes.

**Question 6**

**(a)** A few candidates were able to give a correct definition. Some knew it was a chemical and some knew it was carried in the blood. Most wrote about the effects of hormones especially the sex hormones.

**(b) (i)** Most candidates were able to identify the reproductive organs and state corresponding hormones. Fewer could identify the adrenal glands, pancreas and their associated hormones.

**(ii)** The majority of candidates understood the stimuli that trigger the release of adrenaline and proved correct responses to this question.

**Question 7**

**(a)** Some candidate responses gave 'uses' rather referring to why bacteria are 'useful' and this did not answer the question. A few candidates were able to identify valid reasons such as a fast reproductive rate and the ability to make complex molecules.

**(b) (i)** Some candidates were able to provide the correct response many found this question challenging.

**(ii)** Candidates knew that above 60 °C the enzymes do not function and many knew the term denatured. They did not fully answer the question by explaining why the recommended temperature is 30 °C.

**(c)** Very few candidates correctly answered lipase. Most wrote amylase.

**Question 8**

**(a) (i)(ii)** The position and the names of parts of the eye were not known by most candidates.

**(b) (i)** Inherited is the transmission of genetic information from generation to generation. Few candidates were able to state what was passed from generation to generation in sufficient detail. Common responses discussed passing of traits and characteristics but made no reference to genetic information.

**(ii)** The terms recessive and allele were known to only a few candidates.

**(c)** Some candidates did very well in this question. The key was to realise that those who suffer from glaucoma must be gg (double recessive), then in order for there to be non-sufferers the others must be heterozygous (Gg).

**Question 9**

**(a) (i)** Nearly all candidates gave a good definition of the term *herbivore*.

**(ii)** Many candidates could name the organisms that break down dead or decaying matter as decomposers.

**(iii)** Most candidates copied out the statements from Fig. 9.1 which was insufficient. The ideas that nutrients and water are recycled and it is a self-contained system were some of the reasons expected.

**(b)** Many candidates were uncertain of the differences between sustainable and renewable.

**Question 10**

This question was well done with the majority of candidates showing a high level of knowledge and understanding of this topic which was pleasing.

**(a)** Many candidates knew that the amniotic fluid was for protection.

**(b)** Many candidates sequenced all the stages correctly.

# BIOLOGY

**Paper 0610/41**
**Theory (Extended)**

**Key messages**

- Candidates should be encouraged to use correct scientific terminology and always use units when giving numerical answers.
- There were several questions in this paper that dealt with topics new to the syllabus, such as maintenance of fish stocks and sustainable resources in **Question 5** and the control of plant growth by auxins in **Question 2**. Many candidates wrote biologically correct statements about genes and mutations, but these often lacked the precise detail of the definitions that are now required by the syllabus. Candidates should be very careful that they distinguish between the genetic code (triplets of bases that signify specific amino acids) and base sequences that code for different proteins.
- Candidates should read questions very carefully paying particular attention to the focus of each question. They should take special note of command words, such as describe and explain and know how to respond in each case. These two terms were used in every question except **Question 3**.
- There is never any credit for repeating information that is provided in the question stems. In data response questions there are often marks for calculating, describing or selecting such information, but never for simply repeating the information unchanged.
- Candidates should look carefully at the mark allocations avoiding writing six points for a two-mark question and too few points for a six-mark question.
- The six-mark question is new to these papers. These questions are designed to test candidates' ability to provide a discursive answer written in continuous prose, not in bullet points. Although there are no marks for the quality of the writing candidates who use other ways to present their answers risk gaining little credit for not giving sufficient information. Lists and phrases that show no demonstration to link ideas to the appropriate scientific concept do not gain credit. Examiners notice that candidates who answer these questions in bullet points rarely write enough to gain credit in each point that they make. Candidates may wish to plan an answer in point form and then write their extended answer in continuous prose. When finished, they should check their answers to make sure that they have covered enough issues and/or used sufficient detail.
- Candidates should take care over the spelling of words that are similar to other biological terms. Mitosis and meiosis, urea and urine, aorta and artery, glycogen and glucagon are all examples. Candidates can be helped to avoid making mistakes by various learning and revision exercises.
- Candidates should not use thick felt tip pens. The ink can affect the clarity of answers written on the reverse side of the pages in the scripts.
- Changes on scripts should be made by crossing out first answers and rewriting them. Candidates should not try to alter an answer by writing over it as in changing an F to an E or a D to a B. They should also avoid writing initial answers in pencil and then overwriting in pen. Any feint pencil markings that were missed during this process are unlikely to be sufficiently clear to gain credit.

## General comments

When answering questions, candidates should be reminded to use the correct scientific terminology and ensure it is spelt correctly.

Many candidates showed good factual knowledge and the ability to write extended answers. Candidates should be reminded that they need to read the stimulus material provided for each question and complete all the instructions contained within each part question to help maximise their success.

Most candidates were able to describe the pattern of a simple graph such as that in **Question 1 (b)**; many struggled with the more complex example where they had to be selective over the choice of material as in **Question 5 (b)**. The analysis of data from Table **6.1** proved to be challenging for some.

Questions on the topics new to the syllabus were answered well by the best prepared candidates.

## Comments on specific questions

### Question 1

**(a)** Many candidates answered this question well. Some of the errors seen included selection of the incorrect valves in the second and fifth rows, uncertainty about which blood vessel carries deoxygenated blood and the difference between atria and ventricles. The term septum was spelt in a variety of different ways. Many descriptions were offered instead and cardiac muscle was a good attempt for those who did not know the term, but since that applies to almost all of the heart it could not be accepted as an alternative. Many candidates chose correct chambers and matching letters for the last two rows of the table. Encouragingly, most candidates did not mistake the left and right sides of the heart. A minority of candidates listed either just the letters, or just the statements. In some cases, these answers were all or partially correct, suggesting that they had not considered the requirements of the question.

**(b) (i)** The rapid increase in pulse rate and the maximum rate achieved at 4 minutes were often not noticed. Many answers did not use the figures from the graph as instructed. If candidates used figures sometimes they were not accompanied by the full unit – beats per minute or b p m. Some candidates described the whole of the graph. In describing the rapid rise in heart rate, many candidates used terms related to magnitude, such as ‘significant,’ ‘large,’ or ‘high,’ which could not be accepted. Many described in detail the shape of the whole graph before the race had begun, or the falling heart rate after the race had ended.

**(ii)** Good responses explained that there is an increased demand for oxygen by muscles and that the heart beats faster to supply these with more oxygen and glucose and remove the carbon dioxide and any lactic acid that they produced.

Very few candidates stated that there will also be an increased flow of blood to the lungs. Some candidates stated that adrenaline is responsible for the increase in heart rate and a few described how this is coordinated by detection of an increase in carbon dioxide concentration in the blood and impulses sent along nerves from the brain to increase heart rate.

Some candidates tried to explain the whole of the graph. They discussed the onset of anaerobic respiration and stated that extra oxygen is required for the oxygen debt, even though the exercise had only just begun. They also stated that oxygen breaks down lactic acid in muscles. The concept of the oxygen debt has been asked many times in the past, so they were appeared to be relying on a past mark scheme for their answers. Candidates should know that lactic acid is removed from muscles and broken down (or converted into other compounds) in the liver. Many candidates seemed unsure of the relationship between the chemical reactions or respiration and the release of energy; for example, some wrote: ‘the muscles needed more energy to undertake respiration’. Candidates should be reminded that energy is released not produced or made.

**Question 2**

The control of tropisms is a topic new to the syllabus and was tested in part **(c)**. Some candidates wrote excellent answers to part **(c)(iv)** on the role of auxins, but many were less confident in their knowledge and understanding of this topic.

**(a)** Most candidates were successful in completing at least two of the missing terms in the diagram showing the organisation of the nervous system in mammals. Most knew the central nervous system and the spinal cord, but many did not know the peripheral nervous system. Some gave central for both of the top two boxes.

**(b)** In part **(i)**, many candidates knew that the missing structure in the flow chart in Fig. 2.2 was a sensory neurone. While many gave 'reflex', 'reflex action' or 'reflex arc' in part **(ii)** many candidates gave examples of simple reflexes, such as 'moving hand away from a hot object' or simply 'pain'. The question did not ask for an example so these answers were not accepted. 'Reflex arc' was accepted, despite it describing a nerve pathway rather than a response. Candidates gave a good range of answers to part **(iii)** stating two differences between voluntary and involuntary actions. Many reversed the question giving ways in which involuntary actions differ from voluntary actions. Misconceptions seen included the idea that involuntary actions are 'not controlled', or that the brain is not involved in involuntary actions. Candidates should know the pupil reflex which is coordinated by neurones that pass from the eye to the brain and back. Again, it was fairly common for candidates to provide examples of voluntary and involuntary actions in their answers to this question.

**(c)(i)** There were quite a few suggestions as to the conditions in which pots **P** and **Q** were kept. Candidates often suggested a string of different conditions of light, water, minerals, temperature and humidity. The correct answer given most frequently was: **P** in the light and **Q** in the dark. Some candidates erroneously stated 'low light,' 'dim light' or 'shade' for **Q**.

**(ii)** Many candidates stated that the response of the seedlings in pot **R** was a phototropism, but few qualified this with the word 'positive'. It should be emphasised that care needs to be taken when using terms with similar spellings but different means as the use of the word trophic rather than tropic was not appropriate in this response. A number of candidates gave geotropism or gravitropism.

**(iii)** The advantage of a positive phototropic response is that a larger surface area of the leaves is exposed to light than if the plants continued to grow straight upwards. This change in direction of growth allows the plants to absorb more light energy for photosynthesis. Answers to this question often implied these ideas.

**(iv)** Whilst there were some very good answers, some candidates were less confident in their understanding of the role of auxins. Many thought that auxins become concentrated on the side exposed to light to cause growth, rather than in the shaded side; very few stated that auxins are produced in the tip of the shoot and diffuse, or 'spread', downwards through the stem and few stated that they stimulate greater elongation growth on the shaded side, relative to the illuminated side. Many candidates referred to auxins being 'found,' 'grown', or 'destroyed' at various points in the stem. Others referred to the 'left hand side' or the 'right hand side' of the stem rather than stating which side was in the shade and which side was illuminated. Very few wrote about the detail of elongation of cells including water absorption. There was some confusion with geotropism and roots.

**Question 3**

Many candidates gave very confident answers to this question on genetics. However, fewer candidates gave definitions of *gene* and *gene mutations* based securely on the detail now given in the syllabus. Very few knew that the genetic cross involving dogs 4 and 5 from the pedigree diagram in Fig. 3.1 is a test cross.

**(a)** Many definitions of a gene were given in the context of a 'unit of inheritance' and did not state that a gene is a length of DNA that codes for a protein. Quite a number of responses mentioned that a gene codes for a characteristic, which is not specific enough. Similarly, gene mutations were often defined in terms of a 'spontaneous change in a gene' rather than a change in the *base sequence* of DNA within a gene. Many included information about chromosome mutations in their answer. Others referred to mutagens and the causes of mutation in their answer. Some candidates wrote that a gene mutation is 'a change in the genetic code', which is not correct.

**(b) (i)** Many candidates gave the three genotypes in the correct format, although the sex chromosomes or the symbol used for the ABO blood group gene (**I**) were often included as well. Many thought that at least one of the dogs had to be homozygous dominant and sometimes both **1** and **3** were given this genotype (BB). Common errors include the use of terms rather than letters, and these were rarely all correct as 'homozygous' was not qualified by 'recessive' in the case of dog 2. There were also some candidates who wrote down the phenotypes rather than genotypes.

**(ii)** The genetic diagram was completed successfully by many candidates who often used a Punnett square to derive the offspring genotypes, although many completed their answers without using one. It was only necessary to show two fusions; B + b and b + b to give offspring which would either have the normal phenotype (Bb) or show the disorder acatalasia (bb). Many referred to the dogs with the heterozygous genotype as carriers and this was accepted as an alternative to 'normal'. Candidates often make errors at different stages in their diagrams. Those who chose the incorrect genotype or genotypes for the parents, often by choosing BB instead of Bb, could still gain credit. Many candidates incorrectly listed the female's gamete as diploid, by inserting the genotype bb into the circle. Others drew a second circle and entered a single b allele. This is not incorrect, but is unnecessary.

**(iii)** This question proved challenging for many with very few identifying that this was a test cross. This was understandable if they had not chosen Bb and bb as the genotypes of the parents.

**Question 4**

Surprisingly, part **(c)** proved to be more of a challenge than part **(b)** in which the candidates had to explain the results shown in the bar chart in Fig. 4.2. Some candidates seemed uncertain about the role of the cell wall. In answering these questions some candidates used the terms isotonic, hypotonic and hypertonic thinking that they had offered explanations of the movement of water. These three terms describe the behaviour of animal cells in solutions of different water potential and do not explain the movement of water in to and out of cells.

**(a)** This question was well answered by nearly all candidates. Many candidates wrote 'gas exchange by diffusion', which was obviously accepted, but 'gas exchange' unqualified by 'diffusion' was not. Excretion was accepted as an alternative, but 'exhaled', 'expired' or 'breathed out' were not, as the organism concerned is single-celled. Some erroneously stated 'oxygen' and 'photosynthesis' for the first two answers.

**(b)** This question was more challenging for some. Many had the water potential gradient going the wrong way (leaving the organism rather than entering it). Some thought that the contractile vacuole was important to the answer and referred to the contractile vacuole bursting when filled with water, which it does after a fashion, rather than the whole organism bursting if the contractile vacuole was not present to remove the excess water. However, many candidates did give a correct and full definition of osmosis in their responses which partly answered the question.

**(c)** Most candidates were able to state the relationship between the concentration of sea water and the rate at which water is excreted by *Rhabdostyla*, but fewer were able to explain that the 'difference in water potential' between them, decreases as the concentration increases. Some stated that the water potential of the organism is about the same as the 12% solution of sea water, which was a good observation. Fewer then went on to say that less water enters the organism and so less water needs to be removed by the contractile vacuoles.

**(d)** This proved to be a challenging question for many as the role and properties of the cell wall was seemed not to be well understood. Many stated that cell walls prevent the cell from bursting but did not develop their answers further. Candidates rarely stated that cell walls are made from rigid materials that do not stretch and so keep these single-celled organisms in a constant size and shape. Candidates sometimes stated that cells walls withstand or counteract the pressure of the cell contents and prevent the entry of yet more water. The terms 'turgor pressure' and 'turgid' appeared quite often and were used in the correct contexts. Many contrasted cell walls with cell membranes erroneously describing cell walls as being impermeable to water.

**Question 5**

This question tested knowledge of population growth (syllabus section 19.4) and conservation in the context of fish stocks (21.4). Parts **(b)**, **(c)** and **(d)** tested material new to the syllabus, namely maintenance of fish stocks and sustainable resources.

**(a) (i)** It was essential to read the question carefully before answering. Many candidates saw this as a question asking for the standard population growth curve showing lag, log (exponential), stationary and death phases. The response required was a line showing exponential growth. Common errors included drawing all the phases but not identifying the exponential phase, labelling the *y*-axis with 'population growth' and showed a phase of deceleration.

**(a) (ii)** There were many excellent answers that explained why the population of fish in the farm increased exponentially. The less successful answers dwelt for too long on one issue, often the availability of food or absence of predators. Some candidates wrote at length about the reproduction of fish and the fact that once there is a new generation of fish there are more males and females to reproduce. These responses did not answer the question. It was good to see candidates identifying factors that are normally given in answers to questions that ask why a population does not grow. A significant number referred to the removal of waste and the lower degree of pollution in the fish farm.

**(b)** Candidates who simply stated the fish catches at certain years between 1950 and 2012 were of insufficient detail as they did not describe the changes. Many stated that there was an overall increase and qualified with correct data quotes for 1950 and 2012. Some also quoted the maximum catch in 1996 as 94 million tonnes and then stated that the catch fluctuated describing one or more of the periods when these fluctuations occurred. However, in the absence of the term 'fluctuation,' many candidates simply described how the graph decreased and increased or vice versa, which was insufficient. Errors included quoting incorrect figures from the graph and comparing wild fish with farmed fish.

**(c)** The syllabus states that candidates should know that fish stocks can be maintained by the use of quotas, re-stocking and education. There were many well-written and detailed answers to this question that went further and described the use of marine reserves where fishing is prohibited and bans on fishing at particular times of the year, usually during the spawning season. Some referred to fines, or punishments, but did not explain that these would be imposed on fishermen who overfished or fished in restricted areas or at restricted times. Fewer answers dealt with regulations on methods of fishing, such as mesh size and bans on using certain types of net or the use of explosives. Captive breeding and release (re-stocking) were often included as well. Many candidates dealt with the idea of increasing taxation, or applying subsidies, to encourage the reduction of wild fishing and/or promote fish farming. A point that was rarely seen was the idea of agreements between governments of different countries for the conservation of fish stocks. Some candidates thought that the question was about fish stocks in rivers or small lakes and discussed controls on people who fish for a hobby. One of the main errors in response to this question was to stray into ideas about water pollution, eutrophication, and 'run off' fertilisers. A few candidates confused this question with fish farming and therefore suggested some unrealistic ways of increasing the wild fish stocks.

**(d)** Some candidates were able to describe what is meant by the term *sustainable resource*. Those who could, related the idea to timber, or lumber, production explaining that trees are a renewable resource and that if conserved properly they will not run out. Methods of conservation such as replanting and allowing natural regeneration from seeds were given. Some candidates mentioned management techniques such as coppicing, a method that can be applied to trees such as sweet chestnut, hazel, eucalyptus, and in India, the sal tree. Those who did not know the term often confused it with non-renewable resources, such as fossil fuels. Others cited that the resource is obtained from areas that are rich in species diversity. These candidates had seemingly confused the term 'sustainable' with aspects of habitat maintenance and environmental ethics. Some candidates made reference to the benefits that forests can bring namely removal of carbon dioxide from the atmosphere and production of oxygen, so missing the point.

**Question 6**

Part **(b)** in this question was not answered as well as the description of the graph in **Question 5 (b)**. Candidates appeared to be less adept at describing data given in a table than in graphs. Sketching the data in Table 6.1 on a pair of axes to give a U-shaped curve would have helped many candidates see the pattern.

**(a)** The balanced chemical equation for photosynthesis was given correctly by many candidates. Errors included giving the word equation, writing an equation that was not balanced, for example by including a '6' before glucose, and giving the equation for aerobic respiration.

**(b)** Table 6.1 showed results for an investigation into the effect of different wavelengths of light on the rate of photosynthesis of *Cabomba*. This was rarely well answered. Very few realised that the colour of light depended on the wavelength but treated them separately. Many candidates could not detect a pattern in the data and instead just wrote down the results from the table without any form of description. There were in fact quite a number of candidates who thought that some of the results were anomalous and stated that the rate increases when the wavelength increases. Good responses provided a description of the decrease and then increase of the rate of photosynthesis as wavelength increased (the U-shape described above); the high rates in blue, violet and red regions of the spectrum; the low rates in green and yellow light and either the maximum rate or the minimum rate with appropriate figures.

**(c)** Numerous different approaches to the calculation were seen. Some of these involved the use of the figures for wavelengths rather than either the volume of gas or the time. Formulae for the calculation often involved multiplication rather than division. A few candidates saw this as an opportunity to describe how the volume of gas could be collected and measured.

**(d) (i)** Candidates should know that light intensity is one of the major limiting factors of photosynthesis and keeping the lamp at the same distance during the whole investigation keeps the light intensity constant. There were some very good answers that explained the need to keep light intensity the same, but many had not grasped this point. 'To make sure there is a fair test' was not an acceptable answer and it should be stressed that 'amount of light' or 'concentration of light' are not acceptable terms for 'light intensity'.

**(d) (ii)** Many candidates thought that sodium hydrogencarbonate was sodium hydrogencarbonate *indicator solution*. As a result they wrote about detecting changes in pH and carbon dioxide concentration and measuring how much carbon dioxide is used in photosynthesis by *Cabomba*. Some candidates thought that the solution was to measure the oxygen produced or to absorb any carbon dioxide evolved by the plant. Some were able to identify that it would prevent the carbon dioxide from becoming a limiting factor.

**(e)** Candidates were asked to state three uses of carbohydrate produced in photosynthesis. Many gave 'for respiration' and 'for energy' which were considered to be two ways of saying the same thing. Many wrote about the conversion to starch for storage and conversion to other biochemicals, such as sucrose, cellulose, amino acids and fats. General ideas such as 'for food' and 'growth' were insufficiently detailed. 'Making nectar' and 'making fruits' showed that some candidates were able to apply their knowledge of other areas of the syllabus which was pleasing.

# BIOLOGY

**Paper 0610/42**
**Theory (Extended)**

## Key messages

- Candidates should be encouraged to use correct scientific terminology and always use units when giving numerical answers.
- There were several questions in this paper that dealt with topics new to the syllabus, such as cholera in **Question 2** and pollution of waters by hormones in **Question 5**.
- Candidates should read questions very carefully paying particular attention to the focus of each question. They should take special note of command words, such as describe and explain and know how to respond in each case.
- There is never any credit for repeating information that is provided in the question stems. In data response questions there are often marks for calculating, describing or selecting such information, but never for simply repeating the information unchanged.
- Candidates should look carefully at the mark allocations avoiding writing six points for a two-mark question and too few points for a six-mark question.
- The six-mark question is new to these papers. These questions are designed to test candidates' ability to provide a discursive answer written in continuous prose, not in bullet points. Although there are no marks for the quality of the writing candidates who use other ways to present their answers risk gaining little credit for not giving sufficient information. Lists and phrases that show no demonstration to link ideas to the appropriate scientific concept do not gain credit. Examiners notice that candidates who answer these questions in bullet points rarely write enough to gain credit in each point that they make. Candidates may wish to plan an answer in point form and then write their extended answer in continuous prose. When finished, they should check their answers to make sure that they have covered enough issues and/or used sufficient detail.
- Candidates should take care over the spelling of words that are similar to other biological terms. Mitosis and meiosis, urea and urine, aorta and artery, glycogen and glucagon are all examples. Candidates can be helped to avoid making mistakes by various learning and revision exercises.
- Candidates should not use thick felt tip pens. The ink can affect the clarity of answers written on the reverse side of the pages in the scripts.
- Changes on scripts should be made by crossing out first answers and rewriting them. Candidates should not try to alter an answer by writing over it as in changing an F to an E or a D to a B. They should also avoid writing initial answers in pencil and then overwriting in pen. Any feint pencil markings that were missed during this process are unlikely to be sufficiently clear to gain credit.

## General comments

All questions were attempted by most candidates and a full range of responses and full coverage of the mark scheme were seen. Few, if any, questions were omitted by noticeable numbers of candidates and thus there was no evidence that shortage of time was an issue.

Candidates should avoid using the term 'water concentration' when describing the movement of water by osmosis. The appropriate term in the syllabus is water potential.

**Comments on specific questions**

**Question 1**

Most candidates were well prepared and able to answer all aspects of this question, including a few concepts that are new to the syllabus.

**(a)** Most candidates knew that the muscular wall that separates the sides of the heart is called the septum. There was a wide variety of spelling for the word septum. Nevertheless, answers like cardiac muscles, heart muscles and ventricular wall were spotted quite a number of times and a few candidates left this blank.

**(b) (i)** Although many candidates found it difficult to express their understanding, most were familiar with the concept of a double circulatory system. A common error was to omit that the blood completes a circuit each time it flows through the heart. Other errors included the implication that there were two independent circulatory systems or that blood flowed twice through the body in a single circulation.

**(ii)** A range of suitable suggestions as to the value of a double circulatory system were seen. The ideas of double circulation enabling high metabolic rates and increased size were rare. Some answers relating to blood pressure were negated by the suggestion that high pressure would be maintained in both loops. A number of candidates suggested a more efficient exchange of gases, which occurs between alveoli and capillaries and between respiring cells and capillaries, rather than a more efficient or faster delivery of oxygenated blood or removal of waste products.

**(c)** This question required the candidates to identify the functions and name the parts of the circulatory system from a diagram. Candidates that found this challenging tended to give the correct answers for left ventricle and pulmonary vein, but gave renal artery or hepatic portal vein instead of renal vein.

**(d)** Many candidates made use of the diagram to describe the pathway of blood from the vena cava to the lungs. Many candidates obtained full marks on this question with only a minority describing the sequence incorrectly. A common omission was to make no reference to the valves and the contraction of the atria and ventricles; a common error was to confuse the atrium for the ventricle. However, many candidates also knew far more detail than is required by the syllabus and described the phases of the cardiac cycle: diastole, atrial systole and ventricular systole. There were some candidates who correctly used the names of the heart chambers and the vessels, but then contradicted themselves by using the wrong letters from the diagram.

**(e) (i)** The most common lifestyle improvements to reduce the risk of coronary heart disease were to exercise more and to stop smoking. A significant minority of candidates failed to notice that as diet was in the question, the answer should not refer to aspects of an improved diet.

**(ii)** There was a wide range in the depth of understanding regarding the various surgical options to treat coronary heart disease. The most common misconceptions included suggesting heart transplants and pacemakers. For example, candidates described some sort of surgery where the artery was opened and the blockage scraped out. Candidates were often too vague in their explanation of the named surgical option. For example, when describing bypass surgery they failed to show that the new vessel was a replacement. A number of candidates suggested using a vein or capillary to replace the artery and stated that it is the aorta that has to be replaced rather than the coronary artery. Some candidates named appropriate procedures but then described a different one resulting only in partial credit. A number of candidates knew the idea of opening or widening the artery, but failed to name the correct tool to do it, with some suggesting the use of rings or wires. A number of candidates referred to one named procedure, e.g. bypass and then described a different procedure, such as the insertion of a stent or balloon.

**Question 2**

This question tested a wide range of skills from knowledge recall to data interpretation and the identification of known phenomena in an unfamiliar context. Although many candidates were able to draw together their knowledge others found it challenging to link their ideas together. The question was based on the action of cholera toxin on the carrier proteins in the epithelial cells lining the small intestine. The toxin interferes with the movement through these carrier proteins leading to an increased loss of chloride ions and osmotic movement of water into the gut lumen.

**(a) (i)** Most candidates were familiar with the distinguishing features of prokaryotes. Many candidates incorrectly named features found in some but not all prokaryotes, like flagella. 'No cell wall' was another commonly seen incorrect response, often after a candidate had already written 'no nucleus'.

**(ii)** Even though flagella would have been taught in the context of sperm, it was pleasing that almost all candidates were able to apply their understanding of their function to the bacterium that causes cholera. Some candidates seemed to know far more than what is required by the syllabus and this often lead to confusion. For example, pilus is not on the syllabus, but many confused the function of a flagellum with that of a pilus.

**(b)** Some very confident descriptions of how vaccination controls diseases were seen. However, many candidates also found it challenging to write a clear description, outlining the key facts stated in the syllabus. Common errors and omissions included:

- the misconception that a small amount of the antigen was used, rather than a weakened or harmless form
- a confusion between the terms antigen and antibody
- memory cells being formed by antibodies
- vaccines containing antibodies rather than antigens
- vague references to antibody production without mentioning lymphocytes
- the idea of memory cells being ready of future infections without any reference to the increase speed of a second immune response.

Other answers included too many details not required by the syllabus, such as neutralisation and agglutination, at the expense of the key points. Some candidates who tried to give very detailed answers also tended to write confused and sometimes contradictory answers. Another consequence seen frequently by candidates who knew considerable detail beyond the syllabus was that their knowledge was imprecise. For example, plasma cells were encountered a number of times, but were mistaken as carrying out phagocytosis.

**(c)(i)** The vast majority of candidates identified the appropriate data from the graphs and calculate the difference in the flow of chloride ions with and without the toxin produced by *Vibrio cholerae*. However many omitted the units which was a requirement on this question. Some candidates added compound units, for example arbitrary units per second.

**(ii)** Although most candidates described the main features of the flow of ions from cells caused by the toxin, some candidates either did not use data from the graph or described the differences between the two lines on the graph. However, a significant minority of candidates failed to highlight the main features of the graph such as the rapid increase, the peak and levelling off. Instead they merely quoted any figure at a random time point without any description of the shape of the curve.

**(iii)** Even though candidates would not have been familiar with this scenario, most applied their knowledge and realised that ions would travel across membranes by active transport. The need for energy and the movement of ions against a concentration gradient were identified by many candidates. Fewer responses included reference to the protein molecules involved in the transport, but very few noted that these proteins are in the cell membrane. A few able candidates mentioned that these proteins are specific for chloride ions. A significant minority of candidates referred incorrectly to osmosis as a means of chloride ion transport.

**(d) (i)** The effects of cholera are new to the syllabus, so it was pleasing that many candidates knew that the small intestine was the organ affected by the cholera toxin. The liver, kidney and stomach were incorrect answers that were seen occasionally.

**(ii)** A full range of treatments for cholera were described. Most candidates were aware of the need for water and ions; however, fewer mentioned the need for glucose. Credit for antibiotics was gained by a large number of candidates, although some referred to giving antibodies or to vaccinations. Candidates should know that vaccines are not used to *treat* an infectious disease.

**Question 3**

Most candidates predicted the outcome of the genetic cross involving co-dominance, but many found it difficult to describe meiosis and selective breeding in sufficient detail.

**(a) (i)** Well-prepared candidates gave clear, detailed descriptions of selective breeding. However, many found this challenging and the steps involved in selective breeding was not well understood by all. Many responses dealt only with the choice of parents, without progressing to the choices to be made in the second and subsequent generations of breeding programmes. Some candidates described choosing genes or alleles rather than choosing phenotypic features. Some described methods of asexual reproduction here yet still gave correct answers in **(a)(ii)** on the disadvantages of sexual reproduction. Some used most of the available space to describe the transfer of pollen from one plant to another and whilst this often gained credit, they missed the other points available. There were a significant number of responses that described genetic engineering, and a few that referred to cloning, rather than to selective breeding.

**(a) (ii)** The most common correct disadvantage of using sexual reproduction in plant breeding was the idea that it took a long time. This idea was expressed in many different ways. Many candidates also understood the consequences of variation negatively affecting the desired outcome of selective breeding. Some candidates incorrectly focused on the idea that variation in the population would be reduced. For candidates who had revised the disadvantages these were very accessible marks; however, some did not relate their answers to plant breeding.

**(b)** Only very few candidates defined meiosis correctly. Many candidates confused meiosis with fertilisation, some confused it with mitosis and a minority even gave definitions of osmosis. Another common error was to describe the ‘offspring’ rather than the gametes as being genetically different, suggesting that the sequence of meiosis in gamete production followed by fertilisation had become confused.

**(c) (i)** The vast majority of candidates were able to give the genotype of a heterozygous carnation using the notation for the alleles that was provided to them. An occasional error was to give $\mathbf{F^{AN}}$.

**(ii)** Most candidates realised that since flower colour in these carnations showed co-dominance, a heterozygous plant would produce pink flowers. A significant minority suggested other colours such as orange, yellow or purple. A few who used red and white did not make it clear that they are found in the same flower. Some candidates confused the terms genotype and phenotype.

**(iii)** A large proportion of the candidates were able to construct a genetic diagram and predict the correct proportion of pure breeding carnations in a genetic cross. The best responses organised the answers carefully so that the correct phenotype was written under the genotype to show that they were clearly linked and ensured that genotypes in the Punnett squares were copied correctly onto the answer line. Some candidates seemed unfamiliar with the term ‘pure breeds’.

**Question 4**

Many candidates applied their knowledge and demonstrated a confident ability to use appropriate terminology.

**(a)** Almost all candidates knew that osmosis involved the movement of water. Many correctly described the movement of water molecules from a high water potential to a low water potential and then contradicted themselves by stating that it was down a water *concentration* gradient. Some candidates were confused about the term 'gradient' referring to water movement from a 'high water potential gradient' to a 'low water potential gradient'.

**(b) (i)** Many candidates predicted correctly that 1.0 mol per $dm^3$ salt solution would cause the greatest decrease in mass of the potato sticks, although other incorrect answers were seen.

**(ii)** Many candidates explained why it was necessary to blot the potato sticks before reweighing them at the end of the experiment. However, a number of candidates mentioned the determination of dry mass possibly as a result of confusion with a potato stick that had been dried.

**(c)** A wide range of responses were given to explain why the potato stick that had lost mass would become soft and floppy. Candidates often explained that the potato stick had lost water, and used the terms plasmolysed, flaccid and turgid in their explanations. Some candidates failed to give details that linked the loss of water to the stick becoming soft and floppy. Some candidates erroneously suggested that water had moved into the potato stick so making it soft.

**(d)** Only the most able candidates applied their knowledge to explain that membrane damage caused by heat would mean that no osmosis would occur in boiled potato sticks. Many who included the idea of denaturation in their answers did not link this to proteins saying instead that the 'cell' or 'enzymes' were denatured. A misconception was that the damage to the membrane would make it impermeable. Other incorrect responses included the idea that there would be no water left in the tissue due to evaporation, that the cooked starch would form a barrier to water movement, and that cell walls act as barriers to water movement.

**Question 5**

Many candidates had a sound knowledge of the functions of reproductive hormones, but were less able to interpret data on pollution of lakes by these hormones, a new syllabus point in section 21.3. Nevertheless, many excellent extended responses describing the effects of sewage pollution in aquatic ecosystems were seen.

**(a) (i)** Most candidates knew that the testes secrete testosterone. Some did not seem to know that the testes are glands and altered their original answers to pituitary gland and prostate gland in order to include the word 'gland'.

**(ii)** Slightly fewer candidates were able to describe how testosterone might improve sporting performance. Candidates generally gave increased muscle mass as their most common answer. There were many incorrect responses that referred to increasing adrenaline secretion with effects on heart and breathing rates. Others suggested the development of male secondary sexual characteristics, but were not specific as to which of these would be relevant to sporting performance.

**(iii)** Maintenance of the uterine lining was the most commonly seen correct answer for the role of progesterone in the menstrual cycle. Quite a number of candidates used the term uterine *wall* when they meant the lining. The idea of progesterone thickening the lining was often given, which on its own was insufficient for credit. Few candidates gave progesterone's role inhibiting FSH and/or LH.

**(iv)** Many candidates knew that oestrogen was also found in many oral contraceptives. Candidates occasionally blended the words oestrogen and progesterone which was not accepted. However, answers like FSH, LH and testosterone were encountered quite a number of times. A considerable number of candidates wrote multiple responses, though only their first answer was considered by the examiners.

**(b)** Many candidates realised that lake A was the most polluted with hormones but found it more challenging to support their answer with suitable evidence from the data table. Often these candidates gave vague references to amounts or numbers rather than using the correct term, concentration. Some candidates did not read the question carefully and wrote about the difference between before and after treatment instead of comparing the two lakes before treatment. Several stated incorrect figures or did not giving any units. Many candidates simply listed the figures from the table without any comparison or explanation.

**(c) (i)** Only the most able candidates described the effects of chlorine treatment on hormones in the sewage water. Commonly effects on lake A were described without mentioning that the treatment of this lake was due to the inclusion of ozone in addition to chlorine. Others did not mention specific hormones in their answers.

**(ii)** Many candidates stated correctly that the main purpose of chlorine in sewage treatment is to kill bacteria.

**(d)** A wide range of responses were seen to describe the consequences of untreated sewage on lake ecosystems. Descriptions of eutrophication were commonly seen. A few candidates were familiar with the processes involved, but were unable to sequence them in an appropriate context. However, some managed to give superficial answers without much explanation; for example, 'sewage pollutes the lake and kills fishes' was a typical response. Others used generalised descriptions like sewage affecting lakes or having 'bad effects' on the ecosystem. Decreased pH was mentioned rarely and usually in the wrong context. Many references to decay by bacteria lacked the necessary detail. Some responses were limited because they focused only on the effect of the hormones in the sewage. The terms 'marine' and 'land' or 'soil' were used in a substantial number of responses suggesting that those candidates had not considered their responses in terms of the lake ecosystem, as stated in the question.

**Question 6**

Many candidates gave thorough answers to this question and showed a sound understanding of this topic.

**(a)** Homeostasis and negative feedback were given as answers to this question. A surprisingly frequent error was osmoregulation.

**(b) (i)** Almost all candidates stated that insulin is the hormone that would be secreted in response to the increasing blood glucose concentration shown in Fig. 6.1. Glucagon was a common error.

**(ii)** All three organs involved in the regulation of blood glucose concentration were given in responses to this question; muscle did not appear as often as liver or pancreas.

**(iii)** Many candidates knew that glycogen was the product of glucose storage. Some gave incorrect spellings that were too similar to glucagon and so were not accepted.

**(c)** A wide range of symptoms and treatments for type 1 diabetes were given. Quite a number of candidates mentioned weight gain as a symptom instead of weight loss. A few even further suggested that this weight gain is due to the high concentration of glucose in the blood. Most candidates knew that part of the treatment included the injection of insulin. Some contradicted this by adding that insulin could also be given orally. The expected answer 'regular blood glucose test' was rarely seen. However, in answers where 'glucose testing' was mentioned the word 'blood' was very often omitted. This meant that the testing could involve monitoring the glucose content of meals or its presence in urine. Common errors were to describe the cause of type 1 diabetes and to give lengthy descriptions of the production of insulin by genetic engineering. Candidates, however, often went on to describe the symptoms and treatment as well. A common error for treatment was to describe dialysis.

# BIOLOGY

**Paper 0610/43**
**Theory (Extended)**

## Key messages

- Candidates should be encouraged to use correct scientific terminology and always use units when giving numerical answers.
- There were several questions in this paper that dealt with topics new to the syllabus, such as cartilage in **Question 1(b)** and the control of plant growth by auxins in **Question 2**.
- Candidates should read questions very carefully paying particular attention to the focus of each question. They should take special note of command words, such as describe and explain and know how to respond in each case.
- There is never any credit for repeating information that is provided in the question stems. In data response questions there are often marks for calculating, describing or selecting such information, but never for simply repeating the information unchanged.
- Candidates should look carefully at the mark allocations avoiding writing six points for a two-mark question and too few points for a six-mark question.
- The six-mark question is new to these papers. These questions are designed to test candidates' ability to provide a discursive answer written in continuous prose, not in bullet points. Although there are no marks for the quality of the writing candidates who use other ways to present their answers risk gaining little credit for not giving sufficient information. Lists and phrases that show no demonstration to link ideas to the appropriate scientific concept do not gain credit. Examiners notice that candidates who answer these questions in bullet points rarely write enough to gain credit in each point that they make. Candidates may wish to plan an answer in point form and then write their extended answer in continuous prose. When finished, they should check their answers to make sure that they have covered enough issues and/or used sufficient detail.
- Candidates should take care over the spelling of words that are similar to other biological terms. Mitosis and meiosis, urea and urine, aorta and artery, glycogen and glucagon are all examples. Candidates can be helped to avoid making mistakes by various learning and revision exercises.
- Candidates should not use thick felt tip pens. The ink can affect the clarity of answers written on the reverse side of the pages in the scripts.
- Changes on scripts should be made by crossing out first answers and rewriting them. Candidates should not try to alter an answer by writing over it as in changing an F to an E or a D to a B. They should also avoid writing initial answers in pencil and then overwriting in pen. Any feint pencil markings that were missed during this process are unlikely to be sufficiently clear to gain credit.

## General comments

The vast majority of candidates were well prepared and showed a detailed knowledge and understanding of the theory examined. A few candidates were unable to answer some of the straightforward theory questions suggesting that some sections of the 2016–2018 syllabus were not well known by candidates. **Question 1(b)** on cartilage was an example. It was rare to find questions that were left blank and there was no evidence that shortage of time was an issue.

**Comments on specific questions**

**Question 1**

**(a)** Most candidates identified and named at least some of the parts of the gas exchange system. The most well-known structures were the alveoli and the ribs, but many candidates did not distinguish between the internal and external intercostal muscles. A number of candidates also confused the terms bronchi and bronchioles.

**(b)** Although most candidates offered suggestions as to the function of cartilage in the gas exchange system, it was evident that few were confident in their knowledge. The most common misconceptions were that cartilage offers protection to the gas exchange system, or increases surface area for gas exchange.

**(c) (i)** Most candidates knew that respiration is the process inside cells that releases carbon dioxide. It was pleasing to notice that most candidates qualified their answer by stating aerobic respiration even though this was not required for the one mark available. Anaerobic respiration was an occasional incorrect response.

**(ii)** Most candidates understood that an increase in carbon dioxide in the blood would increase the rate and/or depth of breathing. Some candidates stated that breathing would increase without qualifying their answer by giving an indication of either speed or depth.

**(iii)** Most candidates found it challenging to explain how the increased breathing rate would be co-ordinated with many not aware of the role of the nervous system in this process. Many candidates discussed the heart beating faster rather than how the diaphragm and/or intercostal muscles were co-ordinated by the brain to contract more rapidly.

**Question 2**

Most candidates were confident in their knowledge of the structure and function of the eye, but few were familiar with the concept of gravitropism and its control by auxin.

**(a) (i)** This was a well-answered question with the majority of candidates able to identify the retina from the flow diagram. The most common incorrect response was pupil.

**(ii)** Almost all candidates named the optic nerve. Occasionally sensory neurone was seen. Although these neurones transmit impulses to the brain this response was not credited as the question specifically asked for the *nerve* involved.

**(iii)** Fewer candidates were aware that light rays refract as they enter the cornea and lens. Many erroneously referred to reflection instead. Although many well-prepared candidates described how the light rays would focus on the retina, some only mentioned that the image that would form would be upside down.

**(iv)** Many candidates described the role of the rod cells correctly. A number of candidates confused the roles of rod and cone cells and described colour vision. Many candidates also simply repeated that light was absorbed in the rod cells, as stated in the flow diagram. Candidates always need reminding that no credit can be gained for restating information provided in the question.

**(b) (i)** Many responses identified the stimulus as light rather than gravity. The stem of the question stated clearly that the plant was in the dark and there is no light source drawn in the diagram. This emphasises the importance of careful reading of the question.

**(ii)** Those candidates who had identified the stimulus in **(b)(i)** as gravity were generally able to name this response. However, many responses lacked sufficient detail. The plant grows in a direction opposite to the pull of gravity and so shows *negative gravitropism*. Many only gave gravitropism, or geotropism unqualified. The allocation of marks should have prompted candidates to further qualify their answers.

**(iii)** Some very well-considered advantages of gravitropism were explained in detail. It was evident that the more able candidates had given this question some thought and suggested a wide range of valid reasons both in terms of downwards growth of roots and upward growth of shoots.

**(iv)** Although some candidates described confidently the role of auxin in controlling gravitropism, many references to increased growth were seen, rather than elongation of cells. Although many candidates described an uneven distribution of auxin in the root, few knew that auxin is produced in the shoot tips and diffuses to the lower side of the stem in the plant shown in Fig. 2.2.

**Question 3**

This topic was generally well understood and described by most candidates.

**(a)** Most candidates completed the genetic diagram to show how sex is determined in cats. Some seemed to work backwards from the ratio that they knew would be 50:50. A small minority seemed unfamiliar with the existence of the Y chromosome and hence did not distinguish between the two sex chromosomes, using X throughout.

**(b) (i)** Although most candidates determined the genotypes of the individual cats from the pedigree diagram in Fig. 3.1, some seemed unfamiliar with the term genotype and simply stated the phenotypes. It is important to remind candidates that the Y chromosome should still be shown in a genotype even if the gene for the specific feature is not located on that chromosome. This shows that the Y chromosome does **not** contain either the normal allele or the mutant allele for this sex-linked characteristic.

**(ii)** Many candidates found it challenging to explain clearly why coat colour was an example of discontinuous variation. A common mistake was to state that discontinuous meant a phenotype was not always present or could skip generations. Only some were able to describe the three coat colours in cats as distinct categories without intermediates.

**Question 4**

Although most candidates were familiar with the terms diffusion, osmosis and active transport, many seemed to confuse these phenomena and interchanged the terms within an answer as if they were synonyms.

**(a) (i)** Many confident descriptions of the classic experiment showing the diffusion of iodine through Visking tubing were seen. Most candidates correctly realised that starch molecules were too big to pass through the membrane, but fewer candidates referred to the iodine being small enough to pass through. Some candidates focused their responses on describing the process of osmosis perhaps because of other experiments using Visking tubing that they may have done in practical classes.

**(ii)** Many factors that influence the movement of molecules across membranes were suggested. Common examples included concentration gradient, temperature and molecule size. A noticeable minority wrote ‘diffusion’, ‘active transport’ and ‘osmosis’ as their three answers.

**(b) (i)** Most candidates recognised the structures in the electron micrograph and were able to describe the pathway followed by carbon dioxide molecules produced in muscle cells. Very few candidates began their answers by mentioning that the mitochondria were the site of carbon dioxide production, but most candidates went on to discuss carbon dioxide entering the capillary and being carried by the red blood cells or plasma.

**(ii)** Most candidates described the features of capillaries, but fewer were able to go on and describe how these features were useful to the function of the capillary. The two most common features given were the thin walls of the capillary and the fact that these vessels are very small. It was pleasing to notice that very few candidates wrote ‘thin cell walls’, but rather worded their answers carefully to avoid confusion with plant cells. However, a few candidates did confuse capillaries with arteries and described their features instead.

**(c)** This question asked candidates to explain how a molecule of carbon dioxide from the atmosphere reaches the site of photosynthesis in a leaf. Although most candidates knew that carbon dioxide enters through stomata, fewer candidates were able to go on to describe the pathway which carbon dioxide takes through the leaf. Many candidates mentioned that carbon dioxide diffuses, but did not go on to discuss the difference in concentrations between the atmosphere and the leaf. Other candidates described the entry of carbon dioxide through the stomata, but then went on to describe movement up the xylem suggesting they had a very limited understanding of the structure of a plant.

**Question 5**

Many candidates handled the data confidently and discussed the impact of deforestation on the land.

**(a)** Almost all candidates explained why forests are felled. The most common answers were for wood products and to provide space for housing. Some candidates gave several uses for wood as a raw material without considering a broad a range of reasons.

**(b) (i)** The vast majority of candidates selected the correct data from Table 5.1 and calculated the percentage loss of natural forests in Indonesia. A few candidates failed to express their answers to the nearest whole number as required by the question. Candidates should be reminded to always show their working, even if they are unsure of the final answer.

**(ii)** This question required candidates to consider all the data in the table and compare the loss of natural forests in Indonesia and Malaysia. The most common error was not including thousands of hectares as the appropriate unit when quoting comparative figures.

**(iii)** Many candidates found it challenging to apply their knowledge of conservation to suggest why replanted forests were less useful to natural ecosystems. Habitat loss was a common correct answer and those candidates who were familiar with the new syllabus statement on monocultures developed this idea to answer the question more fully.

**(c)** This question required an extended response. Candidates had to discuss the impacts of deforestation on the land. Many gave confident and thorough answers, but some candidates failed to notice that the question asked for the impact of deforestation *on the land*. For example, increases in carbon dioxide concentration and reductions in oxygen concentration were commonly discussed.

**Question 6**

This topic was well understood by most candidates.

**(a)** Although most candidates identified the stomach in two unfamiliar mammalian digestive systems, some found it more difficult to recognise the large intestine.

**(b)** Most candidates described the role of mechanical digestion. It was well known that although enzymes are not part of mechanical digestion, increasing the surface area of the food to be digested facilitates faster chemical digestion. Some candidates simply described the process of digestion generally, rather than focusing on mechanical digestion.

**(c)** Fig. 6.2 showed the results of investigations into the transit time of small plastic beads in the intestines of mammals of different body masses. The question required candidates to discuss the pros and cons of a conclusion using information from the scatter graph to support their answers. Some very well considered arguments were seen with most candidates considering both evidence for and against. Unfortunately, many forgot to include correct units when writing about body mass. A number of very able candidates took their answers further describing aspects of the experimental design that would prevent a conclusive decision to be made.

# BIOLOGY

**Paper 0610/51**
**Practical Test**

## Key messages

Candidates need to be familiar with practical procedures outlined in the syllabus. It is important that candidates read through the questions carefully before starting.

- The units specified in the questions will always be SI units and candidates should check if they are converting units, that they have changed the figures appropriately to match the selected unit.
- A sharp pencil should be used for drawings and constructing graphs.

## General comments

The quality of work showed that candidates were well prepared for this paper as there were many examples of clear well-presented answers. The marks seen covered the entire range of abilities.

The Supervisor's Report is very important in ensuring that candidates are credited appropriately when materials have to be substituted for those specified in the confidential instructions. Supervisors should trial practical materials as required in the confidential instructions, in advance of the actual examination. This gives time if any difficulties arise to seek advice about alternative materials from Cambridge Assessment, using the contact information on the Confidential Instructions. In cases where a substitution is made the Supervisor's Report should include as much detail as possible to allow examiners to assess the candidates' answers appropriately.

## Comments on specific questions

### Question 1

**(a) (i)** Most candidates were able to correctly follow instructions but some candidates used centimetres without changing the unit in the table and some used imperial units.

**(ii)** Most candidates prepared a single suitable table with ruled lines and units shown only in the heading. Not all of the tables seen reached this standard. Less well constructed tables showed too few columns and / or boxes to record the data.

Supervisor's Reports are important to inform about any difficulties that were encountered in providing materials and guidance for the activity of the enzyme in the potato samples.

The numbers of bubbles varied both between the candidate's two sets for each sample; variation was seen between candidates' results and their peers within the same Centre. A few candidates were not able to count any bubbles. It is important to record zero in the appropriate box in the table.

**(b)** Most candidates understood the reason why the stopper needed to be fixed firmly before starting to prevent leakage.

**(c) (i)** Candidates were able to link their observed numbers of bubbles with activity of catalase. Some candidates also linked this to the pre-treatment soaking in the specified alcohol concentration.

**(ii)** Based on their own results, most candidates were able to compare the counts for the two samples A and B.

**(iii)** The prediction for expected numbers of bubbles in a higher concentration of alcohol needed to follow the trend given by the candidates own results as recorded in their results table (a)(ii). This was not always the case and the opposite trend was suggested.

**(d) (i)** Most candidates were able to identify a suitable controlled variable and this question was answered competently by many candidates. Some candidates were imprecise about how the variable was controlled.

**(ii)** An error in counting of number of bubbles released in three minutes was identified by most candidates and how this could be rectified successfully. The error given was based on the candidates' own observations and varied accordingly. Many described the difficulties in setting up apparatus as in **(b)** not the why the method of counting was a source of error.

**(iii)** To name a second source of error proved more challenging for some candidates. Some candidates gave an improvement rather than a reason for the error which did not answer the question.

**(iv)** It is essential when describing a control, to state that the procedure is carried out in exactly the same way apart from the one variation that constitutes the control experiment. Frequently candidates who correctly stated that the potato piece would not be soaked in alcohol omitted the former point. Other frequently suggested, but unacceptable controls, were to use boiled potato or to replace the hydrogen peroxide with water. Some candidates did not appreciate the nature of a control experiment and discussed controlled variables instead.

**(v)** This prediction for the expected number of bubbles for the control experiment was related to the trend established in the candidates' own results for samples **A** and **B** in relation to the pre-treatment soaking for the control. The lower alcohol soaking for sample **B** had to be considered.

**(e)** Most candidates were able to name a safety precaution required when using alcohol.

**(f) (i)** Most candidates correctly calculated the mean for the data provided.

**(ii)** The two column bar chart needed to be presented neatly and accurately on the printed grid, with labelled axes with units, using an even scale. The bar chart needed to occupy at least half of the grid area. If the scale starts from zero and there is break, a suitable discontinuity mark must be shown on the axis. Ruled lines for columns with a key or labels to identify columns must be clear. The bars should not touch and there is no requirement for shading the bars.

**(iii)** The range of reactions times after consuming alcohol was correctly identified by most candidates.

**Question 2**

**(a) (i)** A plan diagram was required which accurately showed the different regions of the vascular bundle. Careful observation skills were needed as well as an accurate representation of the proportions for the various regions in relation to the image. No individual cells should be shown in such a drawing as clearly stated in the instructions. Candidates would benefit from more practice of drawing plan diagrams of unfamiliar structures.

Better drawings had a clear outline, drawn with a sharp pencil without any shading and with clearly drawn details of the inside without shading to indicate more than two regions of tissue.

Candidates should be encouraged to use most of the space provided, but not to overlap into the print. Label lines should not have arrow heads and should make contact with the intended structure.

**(ii)** Measurements were usually accurate. The units in which the measurement was carried out was sometimes not stated, or stated incorrectly. Most candidates calculated the magnification accurately. Some candidates failed to draw a line on their diagram or drew one in a random position.

**(iii)** Most candidates were able to state one visible difference between the two labelled cells.

**(b)** In general, candidates planned the procedure for locating a vascular bundle clearly and accurately. A few did not make use of the information given about lignin and staining it with a red dye. Most used all the information given. The points most frequently omitted were giving time for the dye to be absorbed and linking the stained xylem with the position of a vascular bundle.

# BIOLOGY

**Paper 0610/52**

**Practical Test**

## Key messages

The changes in emphasis of the syllabus criteria for this paper make it critical for candidates to have an understanding of scientific method gained by the experience of carrying out practical activities. They should be familiar with laboratory equipment and understand which apparatus is appropriate to use in different circumstances. The experience of practical activity will be invaluable in helping candidates to recognise errors and to plan experiments.

To achieve high marks candidates should:

- follow the instructions on the examination paper about recording results
- know which SI units to use for measurements, in particular time
- record results in tables with headings that include units using the correct abbreviations
- recognise sources of error in an experiment that are important in obtaining reliable results and know how to make improvements
- be able to observe carefully and draw recognisable image from photographs or specimens.

## General comments

There were many examples of answers that followed the instructions given and gave well-presented concise answers. These candidates were able to make reasoned suggestions for sources of error and appropriate improvements and to give a coherent plan for an experiment. Less well executed answers did not identify errors that were part of the given procedure, but wrote about error in using apparatus. Well prepared candidates were able to complete the tables provided as instructed. Less well executed answers often put units in the body of the table, even though they were included in the table heading, and recorded in minutes and seconds despite the given table heading stating seconds. For results obtained using a timer, candidates should be encouraged to record time to the nearest whole second.

Candidates should be aware which type of graph to use for different types of data. In this examination the data is categoric and so a bar chart is most appropriate. While many candidates did select a bar chart, many did not gain maximum credit as the bars were adjacent instead of being separated by from each other by the same distance. Good answers used suitable scales that could be plotted accurately; poorer answers used scales that were too small or were uneven on the y axis.

The description of how to use the apparatus illustrated in the question paper, was another case where many candidates ignored the instruction to draw a diagram of the apparatus set-up. Candidates should be aware that one of the skills tested is that of ‘following instructions’, so if they do not do so, full credit cannot be given.

There were some good examples of drawings, made with a sharp pencil and occupying over half of the space provided. Better drawings showed correct proportions and good observation of the layers of the stem section and the shape of the vascular tissue layer. Less well executed drawings were drawn with thick lines, sometimes in ink and included cells, in spite of the instruction not to draw any cells.

The Supervisor’s Report is very important in ensuring that candidates are credited appropriately when materials have to be substituted for those specified in the confidential instructions. Supervisors should trial practical materials, as required in the confidential instructions, as far in advance of the actual examination as possible. This gives time, if any difficulties arise, to seek advice about alternative materials from Cambridge Assessment, using the contact information on the confidential instructions. In cases, where a substitution is

made the Supervisors report should include as much detail as possible to allow Examiners to assess the candidates answers appropriately.

## Comments on specific questions

### Question 1

This question was a practical activity that involved analysing some food supplements for their vitamin C, reducing sugar and protein content. The practical skills tested were observation, measurement using SI units, recording results, identifying sources of error and suggesting improvements, plotting a bar chart and using ratios to calculate a mass of food containing 20 g protein.

**(a) (i)** Most candidates were able to complete the table correctly. Some candidates, limited manipulation skills resulting in large drops, added a very small number of drops in comparison to the Supervisor's Report.

**(ii)** Better answers showed the understanding that the main source of error was the inconsistent size of 'a drop'. Some answers showed a misunderstanding of the question and thought that the method should be changed so that more than 20 drops of iodine were added or that shaking should be replaced by stirring.

**(b) (i)** Most candidates completed the table correctly in line with the Supervisor's Report. The most common errors were to put units in the body of the table or to write 'did not change colour' instead of following the instruction to write 'more than 180'.

**(ii)** Almost all candidates gave a correct answer.

**(c)** Better answers showed an understanding that observing either the time of colour change, or the actual colour change, in three tubes in the same container was a major problem. These candidates gave acceptable improvements, commonly testing each tube separately. Some answers were related either to the lack of repeats or to the temperature of the water bath. Candidates need to understand that repeating a method that is flawed in unlikely to improve the reliability of the results. Candidates also need to be aware that for reactions that happen in a very short time, the fall in temperature in that time is so small it is unlikely to have any effect on the results. Unacceptable answers were related to human error or using 'better' stop clocks.

**(d) (i)** Most candidates gave a correct answer, although the spelling of biuret was often incorrect, and in some cases confused with burette. Candidates should be able to spell the names of food test reagents correctly.

**(ii)** Almost all candidates completed the table correctly. Candidates were expected to give the colours of biuret reagent at the start and at the end, but as the solution being tested were colourless or transparent, credit was awarded for candidates who gave this as the start colour. Some candidates confused the colour at the end with that given by Benedict's solution. A few candidates confused the colour with those of the iodine test.

**(e) (i)** The majority of candidates gained maximum credit for this question. The most common error was to omit a gap between the bars of the graph. Poor answers also missed out the units from the *y*-axis or shaded the bars carelessly so too much extended outside the bars. Bars do not need to be shaded. There were relatively few examples of errors in plotting. A number of candidates drew a line graph, illustrating the importance of candidates being aware of the type of graph suited to the data.

**(ii)** Most candidates used a simple proportion method to gain the correct answer. A minority of candidates with the correct working did not follow the instruction to give their answer to the nearest whole number. The most common errors were to divide 20 by 11.3, but not multiply by 100, or to divide 11.3 by 100 and multiply by 20.

**Question 2**

This question tested the practical skills of using apparatus, identifying variables, processing results, planning an experiment, observing, drawing and calculating magnification from a photograph of a stem.

**(a)** Answers to this question varied greatly. Candidates who had experience of this or similar apparatus were able to give good descriptions of how to use a potometer. Some candidates who had clearly used a potometer were confused about what is actually measured by the ruler. These candidates tended to describe measuring 'the amount or volume of water lost', rather than the distance moved by the water or air, which can be converted to a volume. Some answers described the movement of water or air into the capillary. Candidates were not expected to know a specific time for which the potometer would be left, so knowing that a potometer is left set period of time was accepted. There were many candidates who did not appear to be familiar with a potometer and gave answers that were descriptions of what they could see, for example, 'the ruler measures the water' and 'the timer measures the time'. Candidates should be familiar with this technique and understand how to use a potometer.

**(b)** The majority of candidates gave a correct answer, commonly a fan. A few candidates gave apparatus used to measure air speed. Candidates unfamiliar with a potometer gave a wide range of inappropriate apparatus, such as ruler, gas syringe and flag.

**(c)** Most candidates were able to give at least one correct answer**,** commonly leaf area, temperature, humidity or light intensity. These candidates recognised that what matters are the factors, other than air movement that might change the transpiration from the leaves. The most common incorrect answers were 'amount of water' and 'time'. As the rate is calculated by dividing distance moved by air or water in a fixed time, neither of these factors needs to be constant.

**(d)** There were relatively few correct answers to this question. Candidates did not seem to realise that a potometer does not work unless it is watertight and airtight. The majority of candidates thought that the petroleum jelly prevented evaporation from the capillary tube or from the rubber tubing.

**(e)** Almost all candidates gave the correct readings from the bar chart and gave a correct answer. Some candidates, carrying out the correct calculation, unfortunately did not follow the instruction to answer to one decimal place. The only common error was to subtract 0.8 from 2.3 instead of dividing 2.3 by 0.8.

**(f)** Candidates who had used a potometer gave a correct answer. Unacceptable answers included, 'measures the loss of water by the stem and leaves' and 'does not include the water lost by evaporation from the apparatus'.

**(g)** There were some excellent well organised answers to this question. Less confident answers tended to omit critical stages or to be in an incorrect sequence. The best answers included a diagram showing leaves suspended by string, a description of putting petroleum jelly on the upper and lower surfaces of leaves, using controls without petroleum jelly, weighing the leaves, leaving the leaves suspended for a specified time in standard temperature, light and humidity and then reweighing. A fully annotated diagram often gained many of the available marks. Common errors included, weighing the leaves before applying petroleum jelly, removing petroleum jelly before re-weighing, not using control leaves and not standardising environmental factors. In general, the quality of the drawings could be improved, often scribbled and including copied diagrams from Fig. 2.3. A great many candidates omitted a drawing despite the instruction to do so in the question. Some answers showed little understanding of how the apparatus should be used, for example wrapping leaves in a known mass of string and weighing the mass of the string, using petroleum jelly to hold the leaves on the clamps, using scissors to cut the leaves into small pieces or into upper and lower surfaces, weighing the entire clamp stand and leaves on the balance, and suspending the leaves resting onto the balance. A common misconception was that holding one leaf with the upper surface exposed to the sun and another leaf with the lower surface exposed to the sun was a method of carrying out the experiment.

**(h) (i)** Candidates were expected to observe and record a plan of the organisation of the tissues in the stem. They were not expected to be familiar with this type of stem structure as they were being tested on their observation skills. The instruction clearly stated that only the part within the enclosed part of Fig. 2.4 should be drawn and that individual cells should not be drawn. In fact, many candidates did draw cells and a large number drew complete transverse sections. As already stated, it is critical that candidates follow the instructions given.

Overall there were relatively few drawings that met all of the expected criteria. Better answers had clear, continuous, lines drawn with a sharp pencil, without any shading and occupying at least half of the space available. The best answers also showed distinct epidermis and cortex layers, a band of vascular tissue with an irregular or finger shaped inner surface and a relatively large central medulla region. Less well executed drawings had outlines with breaks and overlaps, sometimes drawn in ink, with cells drawn or sometimes cross-hatching or shading. Some candidates appeared to have ignored the photograph in the question paper and drawn a memorised text-book diagram of transverse section of a stem. Candidates should be encouraged to draw using a sharp pencil and pay attention to the relative proportion of different parts of a specimen.

**(i) (i)** Many candidates gave a correct measurement in mm. There were some answers in centimetres and others with inappropriate millimetre accuracy. Candidates should know how to measure in mm and to be aware that with a standard ruler, it is not possible to measure more accurately than 0.5 mm. Some candidates appeared to misread the question and measured their own drawing.

**(ii)** The majority of candidates were able to use their measurement to give an acceptable answer. Again, many candidates did not follow the instruction in the question to round to the nearest whole number. Candidates should also know that magnifications do not have units.

# BIOLOGY

**Paper 0610/53**
**Practical Test**

## Key messages

- Candidates must be familiar with the practical procedures indicated by the syllabus. This means that candidates are expected to be able to carry out these procedures safely, but also that they should be able to work safely and with competence on practical procedures that derive from learned methods.
- When asked about safety considerations, candidates should identify a risk, but also identify a method of reducing that risk.
- Mathematical calculations form an important part of the practical assessment. It is essential that candidates check all of their working carefully and take time to consider whether the resulting answer is realistic.
- Candidates must ensure that they read the questions carefully before starting to answer. This is particularly important for any planning exercise that is required. Identification of the dependent and independent variables is vital before a plan is completed.

## General comments

The examination paper consisted of three questions testing candidate's skills in a variety of areas. The setting up and carrying out of practical work on cooling was required, where safe and well-organised methods were essential if candidates were to obtain meaningful results.

Candidates were required to construct a table and record results, consider safety aspects and evaluate the methods used by suggesting improvements. A drawing was required, together with calculations of magnification and the production of a graph.

Candidates were also required to construct a plan for an experiment to test an independent variable, based on the experiment already described in the examination paper, and one which should already have been familiar to candidates.

Generally candidates did well throughout the paper, but certain areas proved more challenging than others. The production of a table in which to record data was pleasing, as was the plotting of a graph from the data given. Areas such as the biological drawing and planning activity were less well done however and may require more practice.

**Comments on specific questions**

**Question 1**

Question 1 required candidates to carry out practical work to investigate the effect of 'ears' on the cooling of 'blood' in a body. The candidates were required to measure the change in temperature in two beakers, one with pipettes and one without. The regular squeezing of the pipettes represented blood flow through the ears.

**(a)** Space was provided for a table of results to be constructed. Most candidates did this reasonably well. Examples of common errors seen included:

- Failure to actually draw a table. A few candidates presented their results simply as a list of numbers. A table should be draw, preferably using ruled lines. No units should be written in the body of the table.
- Incorrect headings. The top of each column of data should have an appropriate heading. The most common error missing information from the heading; either an incorrect variable was named or units were missing or incorrect. A significant number of candidates used 'm' instead of 'min' to represent minutes.
- Starting time missing. A small number of candidates forgot to include the initial starting temperature. This should have been included in the body of the table as time '0'.

**(b)** Safety considerations were generally well thought through with some sensible suggestions. To 'take care' when doing the experiment is insufficient.

**(c) (i)** This question asked candidates why the change in temperature was calculated (instead of just looking at the final temperature). Very few suggested the correct answer, which was that the starting temperatures may have been different. A very small number of candidates did understand that by measuring the time taken it was possible to calculate the rate of change.

**(ii)** It is essential that candidates read the questions very carefully before answering. In this case some candidates incorrectly assumed that the question was asking them to calculate the rate taken form their own results, rather than the results given in the stem of the question.

Only some candidates were able to give their answer to two significant figures.

**(d) (i)** This question asked candidates to identify sources of error in the experiment and explain why they were potential errors. Most candidates could identify errors but found it more challenging to explain their choices. Common answers included problems with the lids not fitting or getting wet, while others recognised that squeezing the pipettes wasn't standardised. Far fewer candidates were able to go on and explain how these problems may have caused errors in the experiment (from uneven heat loss for example).

**(ii)** Once possible errors had been identified in **1(d)(i)**, most candidates were able to go on and suggest suitable improvements (such as making lids that fitted or didn't get wet).

**(e) (i)** Almost all candidates were able to correctly identify the difference between the two animals. Some however provided insufficient detail for example by stating that size was a difference rather than saying which was bigger or smaller.

**(ii)** Similarly, nearly all candidates were able to deduce that the animal with larger ears lived in a hotter climate. A significant number of candidates misread the question and answered in terms of body temperature, stating that the animal with larger ears would have a cooler temperature.

**Question 2**

Question 2 asked candidates to draw a section through a celery stem, calculate its magnification and then plan an experiment that could be carried out to investigate the effect of leaf area on water uptake.

**(a)** Most candidates complete the drawing task well. The quality of drawings was good, with all being drawn to a good size with an appropriate level of detail and accurately labelled. In most cases however the drawing did not have a continuous clear outline, and was drawn with either feathered lines or with shading. Candidates should always use a sharp pencil when drawing.

**(b)** The magnification calculation was carried out very well with most candidates providing correct answers. A few candidates incorrectly measured the image while a few more used incorrect units; measuring in **cm** rather than **mm**. Some candidates, however, forgot to round their answer to the nearest whole number, as required by the question.

**(c) (i)** Almost all candidates were able to calculate the movement of dye up the stem of the celery.

**(ii)** This question asked candidates to plan an experiment in which they investigated the effect of leaf area on water uptake. Many candidates found this question challenging with few able to identify the independent variable of leaf area or provide a workable method for changing this.

A suitable plan should include:

- The dependent variable; in this case movement of dye but other reasonable suggestions were considered.
- Some reference to time. In this investigation the rate was required, so time was an important aspect that needed to be recorded.
- The independent variable. Here the number of leaves could be changed or even better, a measurement made of leaf surface area.
- At least two controlled variables need to be identified.
- The investigation should be repeated.

**Question 3**

**(a)** Most candidates produced very good graphs which was pleasing. Care needs to be taken with the labelling of the *x* and *y*-axis, which must include units and a suitable scale needs to be chosen.

**(b)** Most candidates were able to describe the trend seen on the graph, although a significant number related the heart rate to the age of an organism rather than to life expectancy. A surprising number of candidates did not refer to any of the data points when answering the question despite being asked to ‘use the data’.

**(c)** In this question candidates were asked to use the graph they had drawn to predict the life expectancy at 60 heart beats per minute. Most candidates managed to do this well, indicating on their graph how they achieved an answer. Only a few chose the wrong axis to measure ‘60’ while others found the task difficult as they had not added a line of best fit.

# BIOLOGY

**Paper 0610/61**
**Theory (Core)**

## Key messages

Candidates should read questions carefully before starting to write their answer. It is also essential that they follow the instructions given. It would be helpful for the candidates to be guided by the mark allowance for an answer and by the space provided. Some candidates only make one point where two marks are available.

## General comments

The quality of the work showed that candidates were well prepared for this paper; there were many excellent scripts where the answers were accurate, informed, well-reasoned and clearly presented.

## Comments on specific questions

### Question 1

**(a) (i)** The majority of candidates measured the dimensions of the potato pieces accurately. The main error was to state the measurements in centimetres and not millimetres as given in the table headings. Candidates of all abilities need to note the importance of checking for the units that are required.

**(ii)** Having read the description of the experiment carried out, candidates were asked to prepare a table in which to record the results. They then had to complete this table using results given to then in the form of a tally chart.

The majority of candidates knew what was meant by a table, although a few attempted to draw a bar chart or a line graph. Many candidates produced good quality tables, showing all the information required and represented the tally chart results accurately in figures. The area where improvement most needs to be made is in the headings of the table. Frequently the units were omitted or the headings arranged illogically. Some candidates misunderstood what was meant by the mean and calculated the mean for all potato pieces.

**(b) (i)** Some candidates were more concerned about gases entering the apparatus rather than the escape of gas from it. Preventing the escape of gas was the correct answer most frequently given, with few mentioning that the reaction could be observed as soon as it started.

**(ii)** Many candidates stated that gas would escape if the bung did not fit tightly in the test-tube. Relatively few went on to explain that if this happened, the experimental results would be inaccurate, unreliable or invalid.

**(c) (i)** This question was answered quite well, with many candidates stating that more bubbles meant greater activity of the catalase. Some were also able to link the catalase activity to the concentration of alcohol in which the potato had previously been soaked. Candidates should use the terms concentration or volume rather than ‘amount’ so that their meaning is clear.

**(ii)** Many candidates gave accurate, succinct answers. A few lacked detail as they only compared two test-tubes. Re-stating the experimental results i.e. quoting how many bubbles each tube produced did not answer the question.

**(iii)** Many candidates gave an accurate prediction. Some candidates who had misunderstood the experiment predicted a large number of bubbles.

**(d) (i)** This was answered competently by many candidates. The majority identified a suitable variable. Some candidates were imprecise about how the variable could be controlled. They stated that the potato or hydrogen peroxide were measured and not that the measurement had to be the same for each sample. A few candidates erroneously identified the alcohol concentration as a variable to be controlled.

**(ii)** Very few candidates selected the timing as a source of error. Most candidates identified the size of bubble or the speed of bubble production as possible errors in the experimental design. Gas syringes were often quoted for reducing the error of varying bubble size. The error arising from speed of bubble production was sometimes dealt with by repeat experiments, or, quite frequently, by taking video recordings (and counting at a later stage).This question proved difficult for some candidates.

**(iii)** Many candidates appreciated that cutting the potato pieces into similar slices was imprecise. Few candidates scored more than this marking point. Some candidates gave reasons associated with the need for having sharp knives, and accurate rulers. Few were able to give a reason involving the surface area of the potato or the quantity of available catalase.

**(iv)** It is essential when describing a control, to state that the procedure is carried out in exactly the same way apart from the one variation that constitutes the control experiment. Frequently candidates who correctly stated that the potato piece would not be soaked in alcohol omitted the former point. Other frequently suggested, but unacceptable controls, were to use boiled potato or to replace the hydrogen peroxide with water. Some candidates did not appreciate the nature of a control experiment and confused it with controlling variables.

**(v)** Those candidates who gave an incorrect control experiment were given credit if the predicted results were stated logically. The majority of those who gave the correct control experiment in **1(d)(iv)** accessed a mark for the correct predicted result.

**(e)** Most candidates could give a relevant safety precaution when using ethanol in an experiment.

**(f) (i)** Many calculated the mean accurately.

**(ii)** The most frequent reasons for loss of marks were not labelling the y-axis fully, using an irregular scale, and drawing bars that were touching. Those who had miscalculated in part **1(f)(i)** were given credit if they used that information for the dimension of the bar. Some candidates drew excellent bar charts.

**(iii)** Most could follow the principle for quoting a range, but a number of candidates selected the incorrect numbers.

**Question 2**

**(a)** Candidates were asked to draw the regions visible in a photograph of a section through a vascular bundle. Despite clear instructions not to draw individual cells, the majority of candidates proceeded to draw them. This hampered them, not only in terms of extra time spent, but also from the point of view that they were highly unlikely to gain the line mark when there were so many opportunities for mistakes to be made. Few candidates appeared to have spent time looking for areas of different cell types, as usually only the areas of xylem and phloem were represented on the diagram. The great majority of diagrams were sufficiently large. The position of the xylem vessel was often imprecise. Candidates would benefit from more practice of drawing plan diagrams of unfamiliar structures.

**(ii)** Measurements were usually accurate. The units in which the measurement was carried out was sometimes not stated, or stated incorrectly. Most candidates calculated the magnification accurately. Some candidates failed to draw a line on their diagram or drew one in a random position.

**(iii)** The majority could say that the xylem vessel was in some way larger than the phloem tube. Errors occurred when candidates did not follow instructions and compared the xylem and phloem tissues.

**(b)** In general, candidates planned the procedure for locating a vascular bundle clearly and accurately. A few did not make use of the information given about lignin and staining it with a red dye. Most used all the information given. The points most frequently omitted were giving time for the dye to be absorbed and linking the stained xylem with the position of a vascular bundle.

# BIOLOGY

**Paper 0610/62**
**Alternative to Practical**

## Key messages

Candidates should have experience of practical procedures as outlined in the syllabus so that they are familiar with experimental methods and are suitably prepared for this paper.

## General comments

Overall, candidates were well prepared for the examination and answered the questions well. The marks covered the whole range of abilities. To do well, candidates must read questions carefully to make sure they are following all the instructions given. They must also take time to read experimental methodology and results carefully so that they can interpret data and information given.

It is important that candidates use a sharp HB pencil and an eraser for drawings. Drawings should be drawn with clear, continuous lines and have no shading.

When drawing a graph, candidates should label the axes, with units, and use even scales. Candidates need to recognise when it is appropriate to draw a bar chart and when it is better to choose a line graph or histogram.

## Comments on specific questions

### Question 1

**(a) (i)** The majority of candidates were able to correctly name test for protein. A wide range of spellings for Biuret was seen and it is encouraged that candidates learn the correct spellings for the names of the different food tests.

**(ii)** Candidates needed to recall the staring colour of Biuret reagent and the colour it changes to if protein is present. Most candidates were able to correctly identify the colour changes. The most common incorrect answer was to give the colour at the start as blue-black or colourless.

**(b)** The majority of candidates were able to do this correctly. Some however, did not use Table 1.2 to help them to interpret the results given.

**(c) (i)** Generally well answered.

**(ii)** Most candidates were familiar with common safety precautions such as wearing goggles and lab coats and some also described safety with heating the solutions, e.g. handling test tubes with tongs and using a water bath.

**(d)** Most candidates were able to complete the table correctly. It was important to read the information given carefully. For food supplement P, the result of 1 minute and 15 seconds should have been converted into seconds and recorded as 75 (s). For food supplement Q, there was no colour change, so the result should have been recorded as more than 180 (s). Common errors were to suggest the time for P to be 60 s and that Q was 180, rather than 'more than 180'.

**(e) (i)** Many candidates recognised that the volume of each food supplement should have been the same. Some had not realised that the food supplement was a solution and thought that it should have been crushed.

**(ii)** Most candidates were able to give a correct suggestion, e.g. using a measuring cylinder or a balance. As precision was important a graduated pipette was a more acceptable alternative than a pipette or dropper.

**(f)** This proved to be a challenging question for many candidates and a wide range of answers were given. We accepted answers relating to the difficulty in identifying the end point of the reaction, or about the fact that it was difficult to monitor three tubes at the same time. Many candidates thought the absence of repeats was an error, or that there was a problem with the temperature of the solutions. Many different answers were given and some confused sources of error with improvements.

**(g) (i)** Most graphs were well drawn, of a suitable size, with evenly scaled axes showing the independent variable (food type) on the *x*-axis and the dependent variable (protein content of food) on the *y*-axis. The majority of candidates labelled the axes and included appropriate. The most common error was to draw a line graph instead of a bar chart or to draw touching bars. For categoric data candidates should draw a bar chart and not a line graph.

**(ii)** Some candidates found this question challenging and some forgot to round their answer to the nearest whole number.

**Question 2**

**(a)** A range of answers were given and some candidates found it difficult to articulate their answers clearly. Candidates should be familiar with this experimental technique and should be able to describe how this apparatus can be used to calculate rate of transpiration. Some were unsure of what was being measured.

**(b)** Most candidates were able to suggest that a fan could be used for this. A common mistake was to suggest a piece of apparatus that could be used to measure air speed.

**(c)** The majority of candidates answered this question well. Light (intensity), temperature and humidity were the most common answers. Those that were less confident thought that the amount of water in the capillary needed to be controlled. As it is just the distance that the water moves that is being measured, the amount of water does not need to be controlled.

**(d)** This was a high level question and candidates had to say that the petroleum jelly prevented water loss, or that it stopped air getting in, rather than preventing evaporation, which was commonly seen.

**(e)** Most candidates correctly read the two data points off the graph, but fewer correctly divided 2.3 by 0.8 and rounded the answer to the nearest whole number (as asked for). A common error was to subtract the figures.

**(f)** Candidates had to suggest why the apparatus does not measure water loss. Although a range of answers were given, the majority were able to deduce that the apparatus actually measures water uptake or that not all of the water taken in will be lost, some of it will be used for cellular processes such as photosynthesis.

**(g)** Although candidates were asked to include a drawing in their answer, some left the space blank. Candidates must be careful to follow all instructions. Most described the correct treatment of the leaves, that one leaf should have the lower surface covered with petroleum jelly and one should have the upper surface covered with petroleum jelly. The majority of candidates were unsure as to whether to weigh the leaves before adding the petroleum jelly or after with many opting for before. However, most were able to discuss weighing or reweighing the leaves after a period of time correctly. Further detail of the experiment, e.g. use of a control, a description of controlled variable or mention that the experiment should be repeated was required. It is important that candidates have experience with a range of practical techniques in order to have the skills and knowledge necessary to answer questions such as this. Some candidates found it challenging to describe the use of the apparatus in a meaningful way.

**(h)** Most candidates produced drawings of a suitable size. Candidates are reminded to read the instructions carefully. Many drew the whole section rather than the part asked for, and many drawings included cells when they were instructed not to. Drawing cells also made it much hard to achieve a clean outline. Candidates should be encouraged to practice drawing plan diagrams which are freehand and to draw what they see rather than trying to reproduce stylised textbook illustrations.

**(ii)** Well answered.

**(iii)** Most candidates were able to do this although some forgot to round their answer to the nearest whole number as instructed.

# BIOLOGY

**Paper 0610/63**
**Alternative to Practical**

## Key messages

- It is essential that candidates are familiar with the practical procedures indicated by the syllabus. This means that candidates are expected to be able to identify safety issues with practical procedures and should be familiar with the methods that could be provided in a range of different contexts.
- When asked about safety considerations, candidates should identify a risk, but also identify a method of reducing that risk.
- Mathematical calculations form an important part of the practical assessment. It is essential that candidates check all of their working carefully and take time to consider whether the resulting answer is realistic.
- Candidates must ensure that they read the questions carefully before starting to answer. This is particularly important for any planning exercise that is required. Identification of the dependent and independent variables is vital before a plan is completed.

## General comments

This examination paper is an alternative to the 0610/53 Practical Test run in parallel and consisted of three equivalent questions. These tested candidates' skills in a variety of areas including the tabulation of data that were provided.

Candidates were required to construct a table and record data, consider safety aspects and evaluate methods by suggesting improvements. A drawing was required, together with calculations of magnification and the production of a graph.

Candidates were also required to construct a plan for an experiment to test an independent variable, based on the experiment already described in the examination paper, and one which should already have been familiar to candidates.

Generally candidates did well throughout the paper, but certain areas proved more challenging than others. The production of a table in which to record data was pleasing, as was the plotting of a graph from the data given. Areas such as the biological drawing and the planning activity were less well done, however, and may require more practice.

**Comments on specific questions**

**Question 1**

Question 1 required candidates to consider practical work that investigated the effect of 'ears' on the cooling of 'blood' in a body. The candidates were required to work with data provided that showed the temperature change in two beakers, one with pipettes and one without. The regular squeezing of the pipettes represented blood flow through the ears.

**(a)** Two thermometer scales were shown and candidates were required read off the temperature from the scales. Nearly all candidates managed to do this successfully. The majority of candidates remembered to include the units.

**(b)** Space was provided for a table of results to be constructed. Most candidates did this reasonably well. Examples of common errors seen included:

- Failure to actually draw a table. A few candidates presented their results simply as a list of numbers. A table should be draw, preferably using ruled lines. No units should be written in the body of the table.
- Incorrect headings. The top of each column of data should have an appropriate heading. The most common error missing information from the heading; either an incorrect variable was named or units were missing or incorrect. A significant number of candidates used 'm' instead of 'min' to represent minutes.
- Starting time missing. A small number of candidates forgot to include the initial starting temperature. This should have been included in the body of the table as time '0'.

**(c)** Safety considerations were generally well thought through with some sensible suggestions. To 'take care' when doing the experiment is insufficient.

**(d) (i)** This question asked candidates why the change in temperature was calculated (instead of just looking at the final temperature). Very few suggested the correct answer, which was that the starting temperatures may have been different. A very small number of candidates did understand that by measuring the time taken it was possible to calculate the rate of change.

**(ii)** It is essential that candidates read the questions very carefully before answering. In this case some candidates assumed the question was asking them to calculate the rate from the first experiment, rather than the results given in the stem of the question (which was a repeated experiment).

Only some candidates were able to give their answer to two significant figures.

**(e) (i)** Most candidates were able to suggest a good reason for using cardboard lids on top of the beakers. The use of lids to prevent heat loss (or act as insulators) was accepted, as well as a method for keeping the thermometer and pipettes upright.

**(ii)** This part of the question was also very well answered with most candidates identifying at least one source of error that would affect heat loss, for example different numbers of holes in the lids or lids disintegrating when they got wet.

**(iii)** Many candidates found this challenging and were only able to describe one improvement. Some responses did not relate to the question as they described changes to the cardboard lids, while others gave the same answer twice, for example by using two methods for insulating the beaker and preventing heat loss. Some candidates did well and came up with a range of improvements including a standardisation of the rate of squeezing of the pipettes, using constant volumes of water and starting the temperatures at the same time.

Candidates should always try to use terms such as 'volume' and 'mass' rather than stating 'amount'.

**(f) (i)** Almost all candidates were able to correctly identify the difference between the two animals. Some however provided insufficient detail for example by stating that size was a difference rather than saying which was bigger or smaller.

**(ii)** Similarly, nearly all candidates were able to deduce that the animal with larger ears lived in a hotter climate. A significant number of candidates misread the question and answered in terms of body temperature, stating that the animal with larger ears would have a cooler temperature.

**Question 2**

Question 2 asked candidates to draw a section through a celery stem, calculate its magnification and then plan an experiment that could be carried out to investigate the effect of leaf area on water uptake.

**(a)** Most candidates complete the drawing task well. The quality of drawings was good, with all being drawn to a good size with an appropriate level of detail and accurately labelled. In most cases however the drawing did not have a continuous clear outline, and was drawn with either feathered lines or with shading. Candidates should always use a sharp pencil when drawing.

**(b)** The magnification calculation was carried out very well with most candidates providing correct answers. A few candidates incorrectly measured the image while a few more used incorrect units; measuring in **cm** rather than **mm**. Some candidates, however, forgot to round their answer to the nearest whole number, as required by the question.

**(c) (i)** Almost all candidates were able to calculate the movement of dye up the stem of the celery.

**(ii)** This question asked candidates to plan an experiment in which they investigated the effect of leaf area on water uptake. Many candidates found this question challenging with few able to identify the independent variable of leaf area or provide a workable method for changing this.

A suitable plan should include:

- The dependent variable; in this case movement of dye but other reasonable suggestions were considered.
- Some reference to time. In this investigation the rate was required, so time was an important aspect that needed to be recorded.
- The independent variable. Here the number of leaves could be changed or even better, a measurement made of leaf surface area.
- At least two controlled variables need to be identified.
- The investigation should be repeated.

**Question 3**

**(a)** Most candidates produced very good graphs which was pleasing. Care needs to be taken with the labelling of the *x* and *y*-axis, which must include units and a suitable scale needs to be chosen.

**(b)** Most candidates were able to describe the trend seen on the graph, although a significant number related the heart rate to the age of an organism rather than to life expectancy. A surprising number of candidates did not refer to any of the data points when answering the question despite being asked to ‘use the data’.

**(c)** In this question candidates were asked to use the graph they had drawn to predict the life expectancy at 60 heart beats per minute. Most candidates managed to do this well, indicating on their graph how they achieved an answer. Only a few chose the wrong axis to measure ‘60’ while others found the task difficult as they did not add a line of best fit.