

BIOLOGY

Paper 0970/11
Multiple Choice (Core)

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

General comments

The paper provided a balance of questions and sufficient challenge for candidates working at this level. Common misconceptions were identified and are detailed against individual questions. The sources of vitamin C and birth control were topics that candidates knew well. Interpreting graphs proved to be more challenging.

Comments on specific questions

Question 3

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

Question 5

Most candidates correctly identified the chloroplast as the site where sugar is made, although some believed that sugar is made in the vacuole.

Questions 6

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

Question 8

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

Question 10

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

Question 11

This was a well-answered question.

Questions 12 and 31

These were well-answered by the majority.

Question 13

While many candidates correctly identified that a young, active woman requires more iron than a young, active man, some believed that the woman requires more protein.

Question 15

Some candidates were able to correctly identify tissue **C** (the xylem) as transporting water.

Question 18

Although many candidates correctly identified blood component '**D**' (platelets) as being responsible for clotting, many opted for an incorrect blood component.

Question 19

Most candidates correctly identified a transmissible disease as a disease caused when a pathogen passes from one host to another. Some wrongly believed that a transmissible disease is caused when a pathogen passes to the host's body only by direct contact.

Question 20

While many candidates were able to identify the correct response, others were unable to use their knowledge to problem solve and derive the answer.

Question 21

Few were able to select the correct option. Some were not aware that only a little energy is released from anaerobic respiration.

Question 23

Many candidates correctly opted for muscles and glands as effectors. A common incorrect response was the brain and spinal cord.

Question 25

While many candidates appreciated that shivering involves the action of muscles, some wrongly believed that sweating requires the action of muscles.

Question 26

Most candidates responded correctly to this question, a few believed that antibiotics are effective against scurvy.

Question 27

This proved to be a challenging question with few able to derive the correct answer.

Question 29

Many candidates opted for the correct answer, although some incorrectly believed that menstruation is the release of an egg.

Question 33

While some candidates opted for the correct answer, the majority did not seem to appreciate that meiosis produces gametes (sperm cells).

Question 34

Only some candidates appreciated that ionising radiation increases the rate of mutation.

Question 36

While many candidates identified the correct option, some believed that the hazel trees, and even the soil, are the principal sources of energy for the food chain.

Question 37

The majority of candidates opted for a wrong answer, suggesting that this topic is not well understood.

Question 39

While many candidates opted for the correct answer, some incorrectly opted for selective breeding as an example of genetic engineering.

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Paper 0970/21
Multiple Choice (Extended)

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

General comments

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

Comments on specific questions

Question 1

Many candidates appreciated that all plants and animals carry out the characteristics of living things. Some believed that only animals carry out these characteristics.

Question 3

Although this question was well answered by the majority of candidates, some believed that amphibian skin possesses scales.

Questions 6, 7, 8, 9, 10, 11, 12, 14, 16, 23, 24, 25, 26, 27, 28, 29, 30, 36 and 39

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

Question 13

While many candidates correctly identified that a young, active woman requires more iron than a young, active man, some believed that the woman requires more protein.

Question 18

This question was well understood by many candidates, although some were uncertain whether fibrin is converted to fibrinogen (incorrect) or fibrinogen to fibrin (correct).

Question 19

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

Question 20

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

Question 21

While many candidates gave the correct response, many were uncertain of the differences between aerobic and anaerobic respiration in yeast.

Question 22

This was well-answered. One common misconception was that glucose would not be found in the fluid entering the kidney tubule.

Question 33

Many candidates opted for the correct answer. The commonest wrong response was option A. While it is true that heterozygous individuals do suffer from symptoms, the question asked for benefits of being heterozygous so this ruled out option A as it is not beneficial to be symptomatic.

Question 38

Only some candidates chose the correct option. Many candidates appeared uncertain as to what is required to grow *Penicillium* in a fermenter.

BIOLOGY

Paper 0970/31
Theory (Core)

Key messages

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

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

General comments

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

Comments on specific questions

Question 1

- (a) Most candidates performed well on the question. The two processes that some found challenging were phagocytosis and blood clotting. Some candidates only drew five lines rather than the required six often the missing line was the second line going to the white blood cell.
- (b) (i) Generally well-answered.
- (ii) The function of stomata was not universally known. Some responses lacked sufficient detail, such as citing a gas but omitting the direction in which it travelled. One misconception was that water would enter the plant through the stomata.

Question 2

- (a) This question proved challenging for some candidates. Many definitions were incomplete as they did not make reference to the production of genetically different offspring. Some incorrectly referred to sexual intercourse.
- (b) (i) A common error was to state 'anus'; the point of exit of faeces rather than where it is transport. Sperm duct was better known. While many responses correctly distinguished between the urethra and the ureter this was a common source of error. Due to the similarity of these words only precise spelling was accepted.
- (ii) The prostate gland was often confused with the seminal vesicle. Significant numbers did not attempt to label the prostate gland at all.
- (c) Some responses confused the scrotum with the testes. The most common incorrect responses were producing sperm or carrying sperm. Some did refer to temperature but did not state that the testes require a lower temperature than the rest of the body.

Question 3

Nearly all candidates knew that neurones are cells that are part of the nervous system. Most named the motor neurone as the third type neurone. Sometimes the option 'stimuli' was chosen in error for 'impulses'. Not all were aware that the junctions between neurones are called synapses. Most were aware that reflex actions are fast.

Question 4

- (a) This proved challenging with few able to recall the correct word equation.
- (b)(i) Most candidates gave the correct value from the graph.
 - (ii) Most candidates were able to give one effect but few gave two correct effects of a reduction in energy.
- (c) Some responses lacked sufficient detail to meet the requirements of the marking points. Others compared males and females in the same age group which unfortunately did not answer the question.
- (d) Surprisingly few scored both marks. The most common correct responses were baking and brewing.

Question 5

- (a)(i) Most candidates did well on the question. A common error was to draw a pyramid instead of a food chain but very few of these had the correct shape. Most candidates remembered to put in arrows and most were the correct way round.
 - (ii) The majority of candidates gave the correct response.
 - (iii) Most candidates gave the correct response.
- (b)(i) The most frequent correct responses were habitat destruction, hunting, lack of food, no mates, more predators and disease.
 - (ii) Most candidates gave a suitable response.

Question 6

- (a) Many found this question challenging.
- (b)(i) A common misconception was that teeth break down molecules rather than food. The question required two functions, where more than two were given only the first two were considered.
 - (ii) Some responses again made reference to the break down of molecules which was incorrect. Many referred to swallowing but few made reference to the increased surface area of the broken down food.

Question 7

- (a)(i) Most candidates could identify a petal but fewer could identify an ovule. A common error was to label the ovary rather than an ovule.
 - (ii) The most frequent error was to put petals instead of sepals.
- (b) Most candidates drew the correct line from the anther of a flower to the stigma of another. A common error was to connect two stigmas. Another common error was to draw a line instead of an arrow.

- (c) Most candidates gave two correct visible features. The commonest error was to refer to structures that were not visible such as scent or nectar.
- (d) Most candidates were able to recall some of the structures involved in the pathway; the most well-known being the root hairs and xylem. Many also made reference to osmosis but not always in the correct context i.e. osmosis occurring the xylem vessels. Few mentioned the cortex or mesophyll. Many went on to discuss water exiting the leaves and transpiration which was not required. Common misconceptions included making reference to the phloem as being part of the pathway or water entering the stomata and travelling to the roots.

Question 8

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

Question 9

- (a) (i) Some candidates found reading values accurately off the graph challenging but most gave two correct times.
 - (ii) Most candidates answered this correctly.
 - (iii) Many candidates successfully linked availability of light to photosynthesis and thus absorption of carbon dioxide. Some only wrote about sunrise and photosynthesis or photosynthesis and carbon dioxide absorption. A few seemed unaware that respiration is still going on alongside photosynthesis, or thought they were alternative processes. A few thought that carbon dioxide was decreasing as the light intensity was decreasing.
- (b) Most candidates were able to state one environmental factor but fewer could give two.

Question 10

- (a) Candidates did well on this question. Many correctly identified the Merino and gave a satisfactory reason for their choice.
- (b) It was pleasing to see that most candidates gave correct responses for this question and showed a good understanding of the process of selective breeding and were able to apply their knowledge in this context. Common errors included stating that the process (of mating and selecting offspring with the desirable features) would be repeated but not that it would need to be repeated for a number of generations or making reference to genetic engineering techniques that did not take into account the context of the question.

BIOLOGY

Paper 0970/41
Theory (Extended)

Key messages

- Consider all the information provided in a question when formulating a response to the question.
- There is no need to write out the question at the beginning of a response.
- Candidates often use blank pages and spaces to continue their responses. Instead of using asterisks or arrows it is better to state on the question the page number on which the continuation has been written.

General comments

There were some exceptionally good scripts and candidates were well-prepared for the exam. Time spent on thinking and planning would have aided responses to unfamiliar material, especially questions **3(b)** and **4(b)(iv)**. Information given in question **5(c)** was often more appropriate for question **5(d)**.

Candidates showed a good understanding of the requirements for each command word. In particular it was good to see that very few explained concepts when asked to describe them; when asked to suggest many made a logical extrapolation of their knowledge to apply it to an unfamiliar situation. Many also gave concise answers in response to the command word 'state'.

Comments on specific questions

Question 1

- (a) Many candidates identified the molecules shown in Fig. 1.1 correctly. The enzyme-substrate complex (**C**) was the least well-known term. Some candidates identified the active site (**B**) as the enzyme even though that term was given in diagram. 'Substance' was a common incorrect response for 'substrate'.
- (b) Many candidates gave a correct response to this question. A common error was to omit the term molecule; for example, some responses discussed the breakdown of 'particles' and 'substances' and others described the role of mechanical digestion. Some responses did not clearly distinguish between the two types of digestion.
- (c) Many candidates completing Table 1.1 correctly. Common errors were to give the stomach as the site of maltose digestion, the pancreas as the organ that secretes bile and the salivary glands as the site of starch digestion, possibly they were thinking about the source of amylase rather than the site of digestion.

Question 2

- (a) Few responses gave the full definition of the term *fitness*. Many referred simply to survival of an organism in its environment or habitat and did not refer to the increased probability of reproduction as well. Others stated that fitness is to do with having a balanced diet or with physical attributes, such as strength. Some thought fitness referred to an organism's ability to adapt to an environment.
- (b)(i) Many candidates gave two suitable features. Common responses referred to 'thin legs', 'large ears' and some candidates gave 'small size' which on its own was insufficient; some gave large surface area: volume ratio which was more appropriate. A few referred to behavioural adaptations such as seeking shade in the daytime or living in a burrow.

- (ii) Many suitable features were given. Good responses included the large number of rods in the eyes and the presence of whiskers.
- (c) (i) Candidates often drew two extra blocks representing detritivores and carnivores on the pyramid of biomass in Fig. 2.2, even though the labelling indicates that the biomass of the herbivores and detritivores had been combined to form the second block. Most of the blocks were carefully centred. Many responses did not consider the scale and drew blocks that were too large. Many also did not label the drawn block.
 - (ii) Many responses explained that the detritivores in this desert ecosystem feed on plant matter or are primary consumers like the herbivores. The fact that they are eaten by carnivores was not a reason for placing detritivores in the same block as herbivores.
 - (iii) There were many good responses that referred to energy flow as the reason for the limit to four or five trophic levels in ecosystems. Many stated that only 10 per cent of the energy entering a trophic level is available to the next trophic level and gave suitable reasons to account for this. The idea that not enough energy reaches higher trophic levels was less well appreciated. Many, however, explained that no animals exist that can prey on top consumers.
 - (iv) Candidates found it challenging to explain the advantages of a pyramid of biomass over a pyramid of numbers. Many simply stated what is shown by each type of pyramid. However, others stated that pyramids of numbers do not take into account the size or mass of organisms, often giving an example such as large numbers of caterpillars that can feed on a single tree. Many only gave partial responses to this question by stating that producers may be very large and have greater biomass. Some considered biomass to be the same as energy, but these were often accepted if they stated that a pyramid of biomass gives an indication of the energy available in each trophic level. One misconception was to state that pyramids of biomass show the transfer of energy, which they do not. Simple sketches would have supported less confident responses about the shapes of the pyramids.

Question 3

- (a) (i) Many candidates labelled the central star-like region of the cross-section of the root as the xylem. Common errors were to label the cortex or the phloem. Some label lines to the xylem only just reached the outer line of the 'star' rather than ending clearly within the area of xylem. Some used arrow heads which sometimes made it difficult to interpret which area they were pointing at.
 - (ii) Many candidates were able to give a suitable response but some were not familiar with the definition of the term tissue.
- (b) Some candidates found this question challenging. Some responses described how water is transported in the xylem and how the structure of a leaf is adapted for photosynthesis which did not answer the question. Most stated that the spongy mesophyll has air spaces, but few described the large internal surface area of the mesophyll cells and the evaporation of water from these surfaces. Although most understood that water moves out through stomata, many did not state that it is water vapour that diffuses out. There were also incorrect references to 'water evaporating out of the stomata'. Few linked the guard cells to the stomata and guard cells were often described as opening rather than the stomata opening.

Question 4

- (a) (i) Many candidates gave the correct response.
 - (ii) Few candidates identified all three blood vessels correctly. Most identified the capillary (T), but most identified Q as a vein instead of a venule and S as an artery instead of arteriole.
 - (iii) The majority of candidates gave the correct response. Incorrect responses included myelin and myelin sheath.

- (b)(i) There were many excellent descriptions of the effect of increasing the temperature of the skin surface on blood flow to the skin without capsaicin. Most of these responses used the units from Fig. 4.2 correctly. However, some responses compared the effects of the two treatments or explained these differences rather than describing the effects on the blood flow in the untreated volunteers. Some responses gave data quotes with no further description. Some responses gave correct readings of values from the graph. A common error was to read 41°C on the graph as 40°C or 42°C. Many responses described an overall increase with no reference to the constant blood flow at the lower temperatures shown on Fig. 4.2.
- (ii) There were few detailed responses to this question. Most knew that vasodilation is involved in the skin's response to increased temperature and some knew that it is arterioles that dilate to increase blood flow through the capillaries near the surface of the skin. A common error was reference to 'capillaries dilating'. Few responses explained the roles of arterioles and shunt vessels. Many referred to the role of receptors and sensory neurones, the best responses went on to discuss impulses travelling along motor neurones to the rings of muscle on the blood vessels. Only some responses described an increase in blood flow in capillaries near the surface of the skin (as shown in Fig. 4.1). A common error was to describe blood vessels 'moving up towards the surface of the skin'.
- (iii) The majority of candidates gave the correct response.
- (iv) This was a challenging question for some candidates. The best responses made correct reference to diffusion of capsaicin down a concentration gradient. Some good responses made full use of all the information provided in the question and referred to the structures through which capsaicin had to pass in order to reach the receptors.
- (c) Some responses to this question explained how the body temperature is controlled rather than explaining its importance. Most recognised the effect of deviations in optimal body temperature on enzyme activity. Good responses linked the effects of temperature changes on enzymes to the rate of metabolic processes, such as respiration and chemical digestion. The best responses referred to other effects including; dehydration, heat stroke and the effect of high temperature on sperm production.
- (d) This was answered well by the majority of candidates. Less well-executed responses described the features of the nervous system and made little or no reference to hormones. Others gave a description of the reflex arc, which was not relevant.

Question 5

- (a) The vast majority of candidates were familiar with the chemical equation for aerobic respiration. A few wrote the equation for photosynthesis and not all were able to correctly balance the equation. Some gave an equation for anaerobic respiration.
- (b) There were some correct calculations. Many calculated the correct difference between walking and trotting but then chose the wrong value as the denominator. In some cases partial credit could be awarded because the response showed the correct working despite arriving at an incorrect final value. This highlights the importance of showing working when prompted to do so.
- (c) Many explanations of the oxygen debt stated that 'the horse' or 'the body' respire anaerobically instead of making it clear that the change from aerobic to anaerobic respiration occurs in muscles. Many stated correctly that lactic acid is produced. Common errors included confusing respiration with breathing and stating that the 'body produces oxygen'. Some also wrote in general terms about carbon dioxide and sometimes about its effect on blood pH, which was not relevant to the question.
- (d) Many responses stated that the horses would continue to breathe faster and/or deeper and would have a fast heart rate in order to recover from the oxygen debt. A common error was to state that lactic acid is broken down within muscle tissue rather than diffusing into the blood to be transported to the liver where it is oxidised. The role of oxygen in this process was not well-understood. Others misinterpreted the question and described how the horses should be provided with rest and water to recover from the exercise.

Question 6

- (a) (i) There were many correct responses. The most common incorrect response was **T** (uterus) as the site of fertilisation.
- (ii) The majority of candidates gave the correct response. Ovary was the most common incorrect response.
- (b) (i) The majority of candidates gave the correct response. Some incorrect responses gave the size of the image as a percentage of the actual image which was not what was required.
- (ii) There were many incorrect responses to this question ranging from $5.5\mu\text{m}$ to $0.5 \times 10^{-8}\mu\text{m}$.
- (c) Most candidates stated that sperm cells are haploid or that they contain 23 chromosomes. However, very few went on to give an *explanation*, either in terms of the production of sperm cells by meiosis, or that this ensures the number of chromosomes remains constant from generation to generation. Some candidates stated incorrectly that sperm cells are haploid because they divide by meiosis.
- (d) There were many excellent explanations of the roles of the three parts of the sperm cell. Most stated that the flagellum propels the sperm towards the oviduct or towards the egg. Fewer stated that mitochondria are the site of aerobic respiration and provide energy for this movement. Several misconceptions were seen. Fewer knew the role of the acrosome as a store of enzymes, although many stated that the role of the acrosome is to ensure that sperm and egg nuclei can fuse together. Common errors seen included; stating that the acrosome is an enzyme rather than it contains enzymes, suggesting that the acrosome is used as a navigation tool to find the egg, stating that the enzymes digest the egg cell membrane so that the whole sperm can enter the egg and describing digestion of the cell wall rather than the jelly coat.
- (e) There were many good accounts of the role of the father in sex determination. Errors included stating that X and Y are genes or alleles rather than chromosomes and not making clear the difference between the sex chromosomes in diploid cells and in gametes. Another misconception was that the Y chromosome is 'dominant' to the X, and/or that the X chromosome is 'recessive'.

BIOLOGY

Paper 0970/51
Practical Test

Key messages

Candidates should be able to:

- recognise variables in an experiment and describe how to change the independent variable, measure a dependent variable and describe how to keep any other important variables constant
- use correct scientific terminology and units for quantities for volume, mass and concentration
- know the difference between a bar chart and a histogram
- know how to work out ratios.

General comments

Many excellent scripts were seen with clearly written responses that were precise and direct. If candidates need to cross out an answer, it is better to write the revised answer on a blank part of the question paper if there is not enough space left in the answer lines. Writing over the top of the crossed-out section, particularly over changed numbers, is often difficult to read.

It is important that candidates follow the instructions in the question paper carefully. There were examples in both question 1 and question 2 where candidates appeared to have misread the question, for example in question 1(a) candidates recorded results at intervals of five minutes, rather than intervals of one minute for five minutes. In question 2(b)(i) a great many did not follow the instruction 'label the abdomen' on their drawing.

The supervisor's report is very important in ensuring that candidates are credited appropriately when the results of the experiment do not fit the expected pattern. Chemicals should be new as deterioration can give false results. 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, 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' responses appropriately.

Comments on specific questions

Question 1

- (a) The majority of candidates were able to draw a suitable table, but in many cases were not able to use suitable headings that included appropriate units. A common error was to put units in the body of the table.

Candidates need to know that it is good practice for the independent variable to be the first column or row of a table and the dependent variables should be the next column(s) or row(s). In this question the independent variable was the pH of the tubes A, B and C and the dependent variable the stage of clotting at minute intervals. Candidates should know how to construct tables when a column heading may be further sub-divided. In this question, if candidates made their first column the type of test-tube, the second column would be time / minutes subdivided into columns numbered 1, 2, 3, 4, and 5.

Good responses showed that candidates followed the instruction to record the stage of clotting in each test-tube at one-minute intervals, using the letters given in the question paper, so their tables had fifteen results recorded. Less clear responses often did not use the letters given in the question paper and used other symbols or words without providing a key.

The table was also expected to show a correct trend. The supervisor's results were critical if the candidate's results did not follow the expected pattern.

Some misinterpreted this question in one of two ways. In some cases, results were recorded candidates every five minutes. Credit was given if the table matched the expected criteria. In other cases 'stages of clotting' were used as column headings in the table and the number of minutes taken to reach this stage for each of the test-tubes, P, Q and R was recorded. In these cases the supervisor's results were taken into consideration.

- (b) Good responses usually noted that rennin works best in low pH or acid conditions. The best responses also noted that rennin was inhibited at higher pH or basic conditions. Some responses were unclear about the difference between low pH and high pH; a common error was to state that 'the optimum pH for rennin is acid conditions giving a high pH'. Less well-executed responses omitted any mention of rennin and variously answered in terms milk clotting with acid and being unaffected by alkali. A great many simply described their results.
- (c) (i) Many candidates gave a correct response, but a large number assumed that 37°C was the optimum temperature of the enzyme or that the enzymes would be activated by the temperature.
- (ii) The commonest correct responses were the volume of rennin and the volume of milk. Less well-executed responses simply stated time without any further qualification, others listed equipment such as size of test-tubes and beakers. Candidates need to be able to identify which of the variables in an experiment must be kept constant in order to obtain valid results.
- (d) The best responses gave at least three acceptable suggestions. The most common were; the temperature of the water bath not being maintained, contamination from using the same dropping pipette, the difference in volume of drops and not having any repeats. A common mistake was to state an improvement instead of identifying an error or to list human errors such as not carrying out the method correctly.
- (e) Almost all candidates gave a correct response, commonly the use of acid.
- (f) The majority of candidates gave the correct response. The most common error was to confuse biuret reagent with Benedict's solution. A minority did not appear to know how to test for protein and added more rennin so that extra protein would form clots.
- (g) Responses to this question were very variable. Some candidates gave concise answers that described a suitable sequence for testing the effect of temperature on a protease enzyme. They chose a suitable range of temperatures, standardised the pH and volume of enzyme, described how they identify the end point and included a safety precaution. A common error was to state that the experiment should be repeated, but to omit how many times it should be repeated. Some response lacked detail as to how the procedure would be performed. Some responses did not seem to have considered the information in the question and just described how to do the original experiment at different temperatures. The best responses identified the independent variable and how it would be changed, how the dependent variable would be measured and which variables would be kept constant. They also gave a range of values for the independent variable and stated how many times the procedure would be repeated.

Question 2

- (a) Most candidates gave correct responses to parts (i) (ii) and (iii). The most common error in part (i) was to miscount either web B or web E. In these cases, error carried forward was allowed in parts (ii) and (iii). In part (iii) the most common errors were to divide 102 by 6 or to add 6 to 102.
- (a) (iv) This proved to be challenging for some candidates. The best responses showed a clear understanding of what is meant by an estimate or the purpose of an average. Good responses showed an understanding that the sample counted was relatively small for the total number of webs or that the sample did not represent the situation in the whole garden. The majority of responses discussed the different size of webs, the variation in the number of insects caught or the unreliability of the estimate.

- (b) (i)** The quality of drawings varied greatly. There were some excellent examples drawn with a sharp pencil with clear outlines that accurately observed the specimen and made good use of the space provided. Good responses also did not use shading or other artistic edging of lines.

Less well-executed drawings had three body segments instead of two, lacked detail of the segmentation of the legs or extended into the text of the question. Some were also drawn in pen or with a blunt pencil that gave thick sketchy lines.

Good responses showed the relative size of the body in correct proportion to the legs. Measuring the specimen can be helpful when determining the correct proportions of structures. Those who labelled the abdomen usually labelled it correctly, but many omitted this step or drew a label line that did not actually touch the abdomen.

- (ii)** The majority of candidates measured the line on Fig. 2.2 correctly. Better responses also showed a line drawn on their drawing and a correct measurement for this line. Common errors included omitting the line or the units for the line measurement. Most candidates correctly calculated the magnification from their measurements, although some incorrectly stated the unit for magnification in cm or mm.

- (c) (i)** Most candidates correctly labelled the axes of the bar chart and used a suitable scale. Candidates were also able to accurately plot data. The commonest error was to draw a histogram (bars touching) instead of a bar chart.

- (ii)** Most candidates could find the correct total for the number of plants and animals. Many gave a correct ratio, although some did not express it in its simplest form. A common error was to give the ratio of plants to animals instead of animals to plants.

BIOLOGY

Paper 0970/61
Alternative to Practical

Key messages

There were many excellent scripts where the answers were accurate, informed, clearly reasoned and well presented.

General comments

Candidates must read a question carefully before starting to write their answer. They must also follow the instructions precisely. Credit cannot be given for correct biology that is irrelevant to the answer required. It would be helpful for the candidates to look at both the mark allowance for an answer and at the space provided for it. Often only one piece of information is provided in an answer when there are two marks available. Similarly, if one line is provided and only one mark is available, it is inappropriate to write a paragraph.

When drawing a diagram, a soft pencil should be used and an eraser if necessary. Thus, any errors can be rectified easily. Lines need to be continuous, with no breaks and no overlaps. Shading and artistic additions should not appear.

When drawing a graph, candidates should use a sharp pencil. Axes need to be fully labelled with units stated. The scale must be even but need not necessarily start at zero. The completed graph should occupy more than half of the grid provided. The size of the printed grid is chosen to help candidates to choose an easy scale. Candidates need to recognise when it is appropriate to draw a line graph, a bar chart or a histogram. (Line graphs are for continuous data, bar charts for discontinuous data and histograms are used for displaying data frequency.)

The construction of a table should be done with ruled lines, preferably with an outer border. Units need to appear in the headings and not in the cells of the table. Each item of information needs to be in a discrete cell. Candidates need more practice in constructing a table where there is an over-arching heading with sub-headings beneath, as was required in this paper.

When planning an investigation it is good practice to repeat the measurements of each value in the range chosen for the independent variable at least twice (i.e. three or more measurements in total for each independent variable value). If measurements are only taken twice and the results are different, then it is not possible to know which result is the true value one.

Comments on specific questions

Question 1

- (a) Almost all candidates could draw a table with at least three columns with a line separating the headings from the data. Many candidates also entered the data correctly. Stating the correct headings for the table proved to be more challenging. Some thought that the results referred to the length of the clotting process, rather than the state of clotting that had been reached after a period.
- (b) Most candidates were able to state a reasonable conclusion for the results provided. The best responses made the connection between the pH of the test-tube contents and the amount of clotting produced. A common mistake was to state that clotting occurred more slowly in alkaline conditions, a fact that could not be determined from the results given.
- (c) (i) The reason for keeping the separate test-tubes at 40°C for three minutes before mixing the content was not widely appreciated. Many thought that the reason was to provide optimum conditions for enzyme activity, whereas the over-riding reason was to ensure that all the reactants were at the same temperature prior to being mixed.

- (ii) This was well-answered, with most candidates being able to state two factors that were kept constant during the investigation. Some gave answers that were imprecise: for example, 'time' needs to be qualified by stating the time for which part of the investigation and 'volume' needs to be qualified by the name of the chemical.
- (d) This proved to be a challenging question for some candidates. They were asked to identify four sources of error in the investigation and some responses instead stated improvements to the method or listed human errors such as not carrying out the stated method correctly.
- (e) A significant proportion of candidates identified the use of an acid or an alkali as a hazard.
- (f) The majority of candidates could name the biuret test as a test for the presence of proteins and knew the required colour change. Common errors included heating the reagents or performing the Benedict's test for reducing sugars.
- (g) Many candidates correctly identified the test for fats as the ethanol emulsion test.
- (h) There were some excellent descriptions given for testing the hypothesis stated in the question. Less detailed responses wrote about enzymes in general which did not meet all the criteria required. Others gained marks for general points such as repeating (the investigation) at least twice and wearing safety equipment such as goggles. Apart from these, the most frequently awarded marks were for using a thermostatically controlled water-bath, using the same volumes of reactants and keeping the pH the same.

Question 2

- (a) (i) Almost all candidates performed this task accurately.
- (ii) The average number of spiders per web was calculated correctly by nearly all candidates.
- (iii) The calculation of the average number of insects in the whole garden was carried out correctly by the many candidates. A common error was to carry out a division instead of a multiplication.
- (iv) Some candidates found this question challenging. The majority referred (incorrectly) to differences in web size, or the fact that the figures used were averages. Many candidates did not appear to appreciate the nature of an average. Relatively few identified the fact that the sample size was too small or that environments could vary within the garden.
- (b) (i) Some candidates produced an excellent drawing of the spider. Most drawings had clear unbroken outline which were of an appropriate size. Less well executed drawings divided the body into three sections with legs that did not give any indication of having joints. Those who labelled the abdomen usually labelled it correctly, but many omitted this step.
- (ii) The measurement and calculation of magnification were usually carried out accurately. The most common errors were not inserting the measurement line on their drawing and stating the magnification with a unit.
- (c) (i) Candidates were given information which they had to represent in a bar chart. Many were awarded full marks for this. The most common errors were not labelling the axes and drawing a histogram (with no space between the bars) instead of a bar chart.
- (ii) A minority of candidates did not seem to recognise the term 'ratio'. Most performed the calculation correctly but a significant number wrote down the ratio of plants to animals instead of what had been requested: animals to plants.