BIOLOGY

Paper 0610/12
Multiple Choice (Core)

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

General comments

There was a good understanding of osmosis, fertilisation and location and functions of organs in the digestive system.

There was some uncertainty about the structure of blood vessels and breathing system, the function of ECGs and how to calculate the percentage of offspring with a particular characteristic in a monohybrid cross.

Candidates need to carefully read the question, for example **Question 2** and **Question 38**, and interpret graphs precisely, for example **Question 11**.

Comments on specific questions

Question 6

Few candidates could identify how to increase the rate of diffusion. Some candidates chose decreasing the surface area or decreasing the concentration gradient.

Questions 9 and 10

Many candidates correctly answered these questions about testing for biological molecules. Some were unable to identify the positive result for the DCPIP test and some incorrectly thought that Benedict's solution is used to test for protein.

Question 12

A significant number of candidates incorrectly thought that plants were unable to respire.

Question 25

Most candidates identified the correct statements about pathogens but some thought that all pathogens are bacteria.

Questions 27 and 28

Most candidates correctly identified the products of aerobic respiration and the products of anaerobic respiration in yeast. Some candidates were confused between the two types of respiration and between anaerobic respiration in yeast and muscles.

Question 29

Some candidates were unaware that the kidneys excrete excess ions.

Question 31

Most candidates could identify the lens as the structure that focuses light on the retina, but common incorrect responses were the cornea and the iris.

Question 32

Many candidates could identify the correct statements about adrenaline, but some were confused about the effect of adrenaline on breathing rate and pupil size.

Question 33

Some candidates were unable to identify antibiotics as a type of drug and others incorrectly believed that antibiotics can be used to kill viruses.

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Paper 0610/22
Multiple Choice (Extended)

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

General comments

There was a good understanding of the binomial scientific naming system, cell structure, translocation, respiration, synaptic transmission and IVF.

The was some uncertainty about biological molecules, limiting factors in photosynthesis, digestion and absorption, the response to exercise and examples of variation.

Candidates need to carefully look at diagrams and graphs, for example **Questions 22**, **24**, **30** and **34**, and it is important for candidates to work methodically through information provided in questions, for example **Questions 19**, **20**, **32**, **36** and **38**.

Comments on specific questions

Question 3

There was some confusion about the characteristics of arthropods with some candidates believing that arachnids have three pairs of legs.

Question 9

Most candidates understood active transport, but some did not realise that it requires a protein carrier in the cell membrane.

Question 11

Most candidates correctly linked the large molecule with the small molecule it is made from, but a few incorrectly thought that fat is made from glycogen.

Question 18

Some candidates incorrectly believed that bile is produced in the gall bladder rather than stored there.

Question 19

Some candidates incorrectly selected option **A**, perhaps not reading the question thoroughly. Option **A** were correct features of villi but not all important for glucose absorption.

Question 24

A number of candidates incorrectly thought that a decrease in oxygen in the blood is the stimulus for an increase in breathing rate during exercise, rather than an increase in carbon dioxide in the blood.

Question 29

Most candidates understood the function of the cornea, but some incorrectly thought that the pupil refracts light entering the eye.

Question 34

A few candidates confused FSH and LH and so incorrectly selected option **A**.

Question 37

This question was demanding for many students. Candidates should be able to identify the examples of variation described in the syllabus. A number of candidates incorrectly believed that seed colour in peas is an example of continuous variation.

Question 38

Some candidates were unsure about the nitrogen cycle with some incorrectly believing that nitrogen fixation produces nitrogen gas from nitrate ions.

BIOLOGY

Paper 0610/32
Theory (Core)

Key messages

Command words such as 'describe' and 'explain' require different responses from candidates. If a description is required, including a reference to a graph or table, then it will be expected that data will be used in the description given. Many candidates can do this effectively. An explanation requires more than just a description and candidates should be encouraged to practise the difference between 'explain' and 'describe'.

General comments

Many candidates were well prepared for the exam and had obviously referred to past papers and mark schemes when preparing. This type of preparation allows candidates to express themselves clearly. Candidates generally were more successful on short objective questions than longer questions requiring a more detailed answer.

Comments on specific questions

Question 1

(a) (i) The functions of blood components were fairly well known. Some candidates only drew three lines and so limited the maximum mark they could achieve. Usually, these candidates linked only one function to white blood cells, often antibody production.

(ii) Those candidates who stated that plasma functions as a transport vehicle usually gained both marks as a transported chemical was also mentioned. Many candidates gave its function as being the liquid part of the blood or thought that plasma was responsible for blood clotting.

(b) (i) A large number of candidates mis-identified the cell as a red blood cell.

(ii) Some candidates found identification of cellular structures demanding. Many could identify the cell membrane but did not attempt to name structures **B** and **C**. The nucleus was often identified as a vacuole and the mitochondrion as the nucleus.

(iii) Candidates who gained a mark for stating a function of the cytoplasm were those who had specifically learnt a precise wording. A large number had difficulty expressing their ideas clearly and succinctly.

Question 2

(a) This question was well answered. The main reason for candidates not gaining three marks was confusion of genus and species.

(b) Many candidates had learnt the definition of a species and so gained two marks. Others responded by stating the definition of a population.

(c) The use of a dichotomous key was well understood with most candidates gaining at least three marks.

Question 3

(a) Very few candidates gained credit here. Many responses stated that the carbon dioxide in apparatus **A** had been absorbed by the soda lime and the potassium hydroxide. This was insufficient as that information had been given in the question. It was necessary to state that carbon dioxide is required for photosynthesis.

(b) The explanations for why iodine solution could be used to show the occurrence of photosynthesis were very variable in quality. Only the strongest candidates made the link between photosynthesis producing glucose and the conversion of glucose into starch for storage. Many gave the positive result for a test using iodine without stating that it was a test for the presence of starch.

(c) (i) The majority of candidates could read the graph accurately to state the highest rate of photosynthesis.

(ii) The difference in photosynthetic rate was calculated fairly well.

(iii) The figure for the lowest light intensity at which maximum rate of photosynthesis occurred was read with considerably less accuracy than the reading in part **(i)**.

(iv) Candidates found it difficult to explain why an increase in light intensity caused the line on the graph to rise. A sound answer was to state that light is needed for photosynthesis as it is the energy source. The vast majority of candidates merely stated that the rate of photosynthesis rises as the light intensity increases. The latter is not an explanation.

(d) Many students knew that the other raw material needed for photosynthesis is water. Sunlight was not accepted as it is not a raw material.

(e) This question asked candidates to name the cell structure where photosynthesis occurs. Frequent incorrect answers were chlorophyll and palisade mesophyll.

(f) (i) Stronger candidates knew the formula for calculating percentage increase. Many of these omitted to convert their answer to three significant figures as requested. Other candidates selected the correct figures from the table but performed an inappropriate calculation. These candidates gained some credit if their answer was converted to the correct number of significant figures.

(ii) The majority of students selected the correct conclusion that could be drawn from the data.

Question 4

(a) The majority of candidates inserted the missing words correctly.

(b) (i) Most candidates could not identify the position of the blind spot. Some identified the retina but not the blind spot itself or placed their cross in the vitreous humour near to the blind spot.

(ii) Some candidate struggled to identify the cornea and the iris. The retina and the optic nerve were better known.

(iii) The functions of the iris and the lens were either not well known or the answers lacked detail. Many said that the function of the iris was to prevent too much light entering the pupil, whereas its function is to control the amount of light that enters. The function of the lens is to focus light onto the retina.

Question 5

(a) The majority of candidates identified a herbivore and also an animal which is both a secondary and a tertiary consumer. Identification of a quaternary consumer and of an organism at trophic level one proved much more difficult, and the answers suggested that candidates were guessing here.

(b) (i) There were many good responses for drawing the pyramid of numbers and for naming the organisms in it. Some candidates drew the pyramid with the widest box at the top and others drew a correctly shaped pyramid but labelled it with the producer at the top.

(ii) Weaker candidates often stated that the source of energy for food webs was the producers. It should be noted that light is not an acceptable response as there are other sources of light which do not originate from the Sun directly.

(iii) Very few candidates gained full marks. It appeared that the word 'overharvesting' was misinterpreted. Many candidates appeared to think that overharvesting rabbits would result in the presence of a very large number of rabbits. Some candidates did not understand the relationships represented by a food web as there were references to road runners eating rabbits and hawks eating road runners and road runners eating grass. Those candidates who did understand the task often omitted explanatory steps in their reasoning.

(c) (i) Most candidates knew that insecticides kill insects. This response is insufficient as an explanation and to complete the answer and gain both marks it was necessary for a candidate to say, for example, that if left untreated, insects will eat or damage the crops or that killing the insects will result in a higher crop yield.

(ii) There is a wide range of ways in which human activity can reduce a population of birds and many candidates could suggest three of these ways. Others did not gain full marks as they suggested variations of the same reason e.g., three different methods of habitat destruction.

Question 6

(a)(i) This question was worth two marks which should indicate to candidates that two distinct pieces of information are required in the answer. The majority of candidates stated that the total mass of plastic waste increased but did not differentiate between the change in rate of production. Most did not quote figures from the graph, or, where they did, neglected to give the units. Weaker candidates often mis-read the question and referred to the methods of dealing with plastic waste.

(ii) Many candidates selected 50%.

(iii) What is meant by a sustainable resource was not well known even by the stronger candidates. A common misconception was that a sustainable resource means that it can be re-used or recycled or that it does not harm the environment.

(iv) Few candidates gained three marks as their answers contained either too little detail or inaccurate information. Many weaker candidates thought that an increase in atmospheric carbon dioxide concentrations would result in acid rain or holes in the ozone layer. Most candidates knew that the increased concentrations would result in global warming but did not develop this idea by giving examples of the adverse effects of global warming. A misconception was that an increase in carbon dioxide concentrations would result in severe breathing problems. It needs to be remembered that the relatively small increase in carbon dioxide concentrations will have a large effect in terms of global warming, but that the resultant small decrease in oxygen levels would not affect breathing and respiration in organisms to any significant degree.

(b) Stronger candidates gave thorough answers on the effect of plastic pollution in the oceans. Other candidates tended to say that the oceans would become polluted and that the water would become dirty and unhygienic.

Question 7

(a) (i) Those candidates who had learnt the definition of a gene gained both marks. The majority who tried to explain what the term meant in their own words usually gained no credit.

(ii) Although the majority of candidates knew that insulin is connected with blood glucose concentration, many merely stated that this concentration was controlled by insulin rather than that insulin lowered the concentration.

(iii) Few candidates could describe another use of genetically modified organisms. The example most commonly known was the production of biofuels.

(iv) The advantages of using bacteria in genetic modifications were unknown and misunderstood by the majority of candidates.

(b) Most candidates gained at least one mark for knowing one difference between bacterial cells and plant cells. The mark for a second difference was awarded less frequently. A common misconception is that bacterial cells do not possess cell walls.

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Paper 0610/42
Theory (Extended)

Key messages

There are several skills that it would benefit candidates to practise to access the maximum credit available.

It is very important for candidates to understand what is expected by the command words 'describe' and 'explain'. These command words require different responses and understanding these were critical for answering **Questions 1(b)**, **2(b)**, **2(c)(i)**, **6(a)(iv)** and **6(b)(ii)**.

Candidates would benefit from practising mathematical skills. When completing any mathematical calculation, the workings should be laid out clearly, rounded appropriately, displayed to the correct number of significant figures and the units stated. These were useful skills required in answering **Questions 3(c)** and **5(b)(i)**.

Candidates should read all stimulus material carefully and follow all the instructions given in the question. Important information was present in the stimulus material for **Question (3)(a)**, and it was missed by some candidates.

General comments

There was a high standard of scientific knowledge and understanding seen with many candidates providing detailed and accurate responses. Most candidates attempted all the questions on the paper.

Whilst many candidates had a broad knowledge of the syllabus, it was evident that some areas of the syllabus were better known than others. The syllabus can be used as a guide of what content needs to be covered and can provide an excellent revision tool for candidates, ensuring that they have covered each learning objective in their revision.

Comments on specific questions

Question 1

(a) (i) Some candidates were not precise enough in their responses, simply referring to catalysts as affecting or changing the rate of reaction rather than increasing it. Candidates also needed to describe a catalyst as being unchanged or not being used up in the reaction rather than not taking part in the reaction.

(ii) Many candidates could name the required chemical elements. Some candidates did not read the question carefully and gave amino acids instead of the chemical elements. Occasionally other incorrect elements or compounds were seen, including carbon dioxide.

(b) There were some excellent responses seen. Areas for improvement include the explanation of enzyme action at the optimum pH. Few candidates explained this in terms of more successful collisions, or more enzyme-substrate complexes being formed. The explanation of denaturation was far more successful. Most candidates identified the optimum pH of 7 and referred to the enzyme becoming denatured away from the optimum. Some described the active site changing when becoming denatured but did not refer to the shape changing. This question required candidates to describe and explain the results shown. Often descriptions were limited or imprecise. When reading values from a graph, candidates should be reminded to take readings accurately and ensure the correct units are used. It was evident that some candidates confused the effect of

temperature on enzyme action with pH, referring to increased kinetic energy and frequency of collisions.

(c) (i) This question was generally well answered. Fats or oils as the reactant was frequently seen. Occasionally incorrect answers included substances such as glucose or glycogen.

(ii) Some good explanations of the effect of bile on the neutralisation of gastric juice were commonly seen. Some candidates stated that the pancreas was the organ responsible for the production of bile. On occasion there was some confusion between high pH and acidity.

Question 2

(a) (i) Candidates should read and complete all the instructions in the question paper. This question was often omitted by candidates. Candidates that did attempt this question generally achieved credit and were able to choose the correct side of the heart.

(ii) Candidates should use the terms for parts of the body as stated in the syllabus. The valves were often referred to by other names. These were accepted if correct, however, syllabus terms should be used.

(iii) This question was generally well answered. Some candidates confused the sides of the heart, stating that blood was either coming from or going to the lungs. The best responses referred specifically to the left ventricle as the part of the heart that blood vessel **C** transports blood from.

(b) Candidates generally identified that deoxygenated and oxygenated blood would mix. Fewer were able to give the name of the part that was compromised. Again, some imprecision was seen in the responses with references to affecting the transport of oxygen throughout the body rather than specifying that a hole in the septum would decrease the transport of oxygen. Some incorrectly stated that oxygen transportation would be completely stopped or that blood flow would decrease in speed.

(b) (i) It is very important for candidates to pay attention to the command words used as the type and level of response required is dependent on the command word used. This question required a description of the graphical data provided. Many candidates attempted to explain the data, giving very little in the way of a description. Those that did recognise the need for a description generally scored highly, giving accurate descriptions, referring to the changes in rate of release of energy from respiration and including units. One common misconception was that when the line levelled off on the graph, this meant that the energy release had stopped instead of becoming constant.

(ii) A small number of candidates gave the balanced equation for anaerobic respiration, whilst some tried to include carbon dioxide as one of the reactants. A few had problems balancing the equation.

(iii) The correct answer of lactic acid was commonly seen. The most common incorrect response being carbon dioxide.

Question 3

(a) (i) The stimulus material required careful reading as it stated that the plant was kept in the dark, therefore light had no bearing on the growth response seen in the plant. Missing this piece of information may have resulted in giving the commonly seen incorrect response of phototropism.

(ii) Auxin was well known as the hormone responsible for the response. Fewer candidates were able to explain the action of auxin in terms of accumulation in areas of the shoot facing towards where gravity is acting. The area of production and method of movement by diffusion was well known by candidates. The action of auxin on the cells is cell elongation. References to cell growth or division were ignored. Those that did not reference auxin commonly described factors needed for plant growth such as nutrients and water.

(b) Uses of water in a plant was well known by the majority of candidates. Transpiration is a consequence rather than a use of water in plants and so was ignored.

(c) Many clear calculations were seen. Common errors included incorrect rounding to 177.77%, inaccurate reading from the graph, indicating a percentage decrease and subtracting their value from 100 to give a value of 77.78.

Question 4

(a) The correct hormones of oestrogen and LH were frequently seen. Several candidates confused the hormones giving LH as hormone **R** and oestrogen as hormone **S**. Some incorrectly identified LH as LSH.

(b) The most likely day for ovulation was commonly seen. The shedding of the uterus lining required a range of dates. A wide variety of incorrect responses were seen including giving single days and ranges from other parts of the menstrual cycle. It may be that candidates did not recognise that shedding of the uterus lining is the same as menstruation.

(c) Many candidates knew the role of progesterone in maintaining the lining of the uterus during pregnancy. Fewer were able to articulate that the level of progesterone release remains high. There were some vague responses referring to progesterone levels increasing but the key here was that progesterone levels increased and then remained high.

(d) Many candidates could identify the sites of progesterone production for both examples. Incorrect responses included the pituitary gland, uterus, and uterus lining.

(e) There were some inaccurate responses given. Responses referring to the growth or production of eggs or follicles were ignored, as were responses referring to ovulation. The best responses described the maturation of eggs in the ovary.

Question 5

(a) (i) The key for this question was to identify visible pieces of evidence. Any references to evidence not visible such as sticky pollen or colourful petals were ignored. The best responses generally referred to large petals and the presence of a spotted pattern on petals to attract insects.

(ii) There were some excellent responses detailing the advantages and disadvantages of sexual reproduction. Occasionally candidates were vague in their responses, referring to an increase in survival in the environment rather than increased survival in new or changing environments. Sometimes candidates required more detail when explaining that increased genetic variation decreased susceptibility to disease. It was evident there was some confusion between transmissible diseases and genetic diseases. The disadvantages of sexual reproduction were well known with the need for two parents and the additional time and energy requirement commonly given.

(b) (i) The majority of candidates gave the correct value. Very occasionally incorrect units of cm^3 were given or units omitted altogether.

(ii) Very occasionally candidates were too vague in their responses. Candidates needed to specifically refer to leaf area rather than leaf size for this question.

(iii) Candidates that recognised this question was about natural selection, generally scored highly. Some candidates tried unsuccessfully to explain this in terms of genetic modification or selective breeding. A common misconception is that genes, rather than alleles, are inherited from parents. Another area for improvement is for candidates to recognise that this process is repeated over many generations. Many candidates simply explained this happening over a long time, which is not precise enough for credit.

Question 6

(a) (i) Most candidates were able to relate the presence of chlorophyll with the ability to photosynthesise and so use carbon dioxide for this process. A few candidates suggested that carbon dioxide was used for respiration.

(ii) Many candidates recognised the role of zooplankton as decomposers. A number of candidates simply reiterated information that was given to them in the stimulus material and provided no additional information. Responses such as these were ignored.

(iii) Two correct processes were often given. Incorrect processes included evaporation and photosynthesis.

(iv) Some candidates did not appreciate that this question was related to global warming and tried to give the effects of carbon dioxide on the human body. Those that recognised that carbon dioxide was a greenhouse gas generally scored highly and a wide variety of effects on the environment were seen. Some candidates went into detail about the mechanism of carbon dioxide being able to cause global warming. This question simply required a description of the effects rather than an explanation, so whilst correct, this information was ignored. Some incorrectly thought that carbon dioxide reduces the ozone layer.

(b) (i) This question required linking the knowledge that herbivores are primary consumers with the position of primary consumers in a pyramid of energy. Only the strongest candidates were able to do this, and several candidates labelled the 1st, 3rd, or 4th trophic levels.

(ii) This question relied on the understanding that energy is lost between trophic levels. The command word for this question was ‘explain’. The best responses saw candidates describing the energy loss but explaining this by giving examples of how energy is lost and so leaving insufficient energy for another trophic level.

(iii) This question proved demanding for all but the most able candidates. The best responses appreciated that time is taken into account when using a pyramid of energy, thus making them more reliable than pyramids of biomass.

(c) (i) A variety of descriptions of the meaning of the term sustainable resource were seen. It was clear than a number of candidates did not understand the meaning and often referred vaguely to a sustainable resource being environmentally friendly. Often candidates understood that a sustainable resource is produced as rapidly as it is used but fewer went on to say that it does not run out.

(ii) Many candidates were able to describe different methods to conserve fish stocks. Fewer were able to provide more detail on how their stated method was able to conserve fish stocks. The best responses often related to allowing young fish to survive in order to breed to replenish the population.

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Paper 0610/52
Practical Test

Key messages

Candidates should ensure that they read the questions carefully before starting to answer. This is particularly important for any planning exercise that is required. Description of the dependent and independent variables is vital before a plan is completed. Controlled variables must also be considered and included in a plan.

Data should be presented in a table using the appropriate SI units. Tables must be bordered with appropriate headings. Appropriate SI units or suitable abbreviations should be used. Units must not be used in the body of the table.

Candidates are advised to show their working in calculations. This ensures that partial credit can be awarded even if a mistake is made during the calculation.

General comments

Many candidates performed well on this paper, with good answers seen in many cases. It is essential that all questions are attempted, even if the candidate is unsure of the answer as they may gain partial credit even if full marks are not awarded.

The drawing of the graph was done well by most candidates, but care should be taken with labels and scales on the axes.

Comments on specific questions

Question 1

(a) (i) Many candidates were awarded full marks for drawing the table. In some cases, candidates recorded their values in both minutes and seconds. The instructions were for them to record the values in seconds. A common error was not providing enough detail in the headings. Simply writing 'test-tubes' is not enough for a mark to be awarded. Candidates should be more specific.

(ii) Candidates were required to state a valid conclusion based on the data they collected. The vast majority of candidates produced a suitable conclusion.

(iii) In general, this was answered well. Candidates were able to correctly identify glucose concentration as the independent variable.

(iv) Most candidates were able to identify a variable that was kept constant in the investigation. Many candidates correctly identified temperature or volume of yeast. Candidates are reminded to be specific in their answers. Yeast unqualified is insufficient to gain credit.

(v) Identifying why it is important to stir the yeast suspension proved demanding for many candidates. As there was no glucose present in this step, stirring the yeast to ensure a reaction happened, would have no effect. The stirring was to allow even distribution of the yeast cells.

(b) (i) Many candidates struggled to identify two improvements to the method. However, many correctly identified the need to repeat the investigation at each concentration.

(ii) Although many candidates were able to describe how to make 5.0 cm^3 of 0.25% glucose from water and a 0.50% glucose solution, many others were not able to determine the dilution, or make a solution of the specified volume.

(iii) It was clear that candidates had learned the test for reducing sugars or glucose. A small number omitted the need to provide a high temperature for the reaction to happen.

(c) (i) Using a gas syringe was the most common correct answer. Some candidates stated that a measuring cylinder could be used, but failed to qualify this with any details of a displacement method or of collecting over water which should have been described.

(ii) The best answers to this question were those that identified an anomalous result as not fitting the trend in the data or that fell outside the line of best fit.

(iii) The majority of candidates correctly recognised that the anomalous result would be excluded when calculating the mean, but a few incorrectly then went on to mention dividing by three, when it would have to be divided by two.

(iv) This question proved demanding for many candidates. Some candidates were able to correctly state that more carbon dioxide was produced at higher temperatures. Stronger candidates were then able to manipulate the figures to support this statement. Candidates should be reminded that comparisons are different to explanations and do not require theoretical knowledge.

(v) Many candidates were able to draw a suitable graph with a key. Some candidates made plotting difficult by choosing a difficult scale. The most common error was not providing suitable units for the axes or drawing incorrect lines of best fit. It is important that lines of best fit are not extrapolated beyond the plotted points and accurately represent the trend in the data.

(vi) In order to gain both marking points, candidates were required to estimate the value and show their working on the graph. It is important to follow all instructions in a question.

(d) Very few candidates correctly identified the colour change that would occur when carbon dioxide is bubbled through hydrogencarbonate indicator solution.

Question 2

(a) (i) This question assessed the ability to produce a standard biological drawing, following all necessary conventions. Candidates must be able to produce a drawing using a sharp pencil that has clear and continuous lines. It is important that candidates do not use shading or feathery lines. Candidates were required to draw a diagram of cell **X**, although many drew more cells than required. The expected drawing accurately showed the shape of the cell and contained appropriate details, such as a cell wall and extensions to the cytoplasm.

(ii) This calculation was attempted well by most candidates. They were asked to calculate the actual length of the cell. The most common error was not taking enough care to note that the question asked for the answer to be expressed to three significant figures. Candidates should be reminded to show all working, so that partial credit can be awarded even if a mistake is made in the calculation.

(b) Some candidates answered this question very well and gave an impressive level of detail. They clearly understood how the effect of sodium chloride solution could be measured on plant tissue. Almost all candidates were able to identify at least two suitable control variables. Correctly identifying the dependent variable was more challenging. The most commonly awarded marks were for those who measured the length or mass of the plant tissue before submerging it into the sodium chloride solution and compared this with the final length or mass. It is important that candidates consider the relevant safety precautions for an experiment. Using gloves to handle sodium chloride solution is not appropriate. Gloves should only be used in the case of having an allergy to the plant tissue itself. However, a more commonly awarded response discussed the importance of using a knife to cut away from the body or on a flat surface.

BIOLOGY

Paper 0610/62
Alternative to Practical

Key messages

Candidates should ensure that they read the questions carefully before starting to answer. Candidates are advised that variables need to be described in context as part of a planned method.

Candidates are reminded to identify the independent and dependant variables before plotting a graph so that this information can be used to decide on the correct orientation of the axes.

Candidates are encouraged to use sharp pencils for graphs and drawings and that whereas rulers may be required to draw lines on a graph, it would be incorrect to use a ruler for a biological drawing.

General comments

The majority of candidates were well prepared for the practical component of the course and were familiar with some common techniques, apparatus and tests. However, many were less secure in their understanding of concentration and volume, highlighted in **Question 1(a)(iii)**, **Question 1(b)(ii)** and **Question 2(b)**, or the use of hydrogencarbonate indicator (**Question 1(c)(vii)**). Most candidates could draw suitable tables, draw graphs and make careful observations. Suggesting improvements in **Question 1(b)(i)** and designing plans in **Question 2(b)** highlighted other areas where further practice in a laboratory would be helpful.

Question 1

(a) (i) Almost all tables prepared by candidates were suitable to record the data. Some candidates used the vague heading of test-tube instead of the more specific heading of glucose concentration. Most candidates correctly converted the times on the stop-clocks into seconds. However, a significant number of candidates included the units in the body of the table. This meant that they were not able to gain full credit.

(ii) Although many candidates were able to state a suitable conclusion, a significant number described the trend instead. Candidates should refer back to the stated aim of the investigation when considering their conclusion.

(iii) Most candidates identified the independent variable as the concentration of glucose. Some referred to volume rather than concentration of glucose. Volume of glucose was too vague on its own because the final volume of glucose was standardised.

(iv) Almost all candidates stated one of the variables that was kept constant, with temperature being the most common. Some answers lacked detail, for instance stating that yeast was kept constant was insufficient and required clarification. In this case, stating that the volume of yeast was kept constant would have gained a mark.

(v) Few candidates gave correct explanations about why the yeast suspension was stirred in step 5. Candidates should always refer to the appropriate step in the method to avoid making incorrect assumptions. Many incorrectly stated that stirring increased yeast activity, but at step 5 no glucose was present. Others incorrectly suggested that the mixing would help dissolve the yeast. Since yeast is a living organism, it cannot dissolve.

(b) (i) A wide range of suggestions to improve the investigation were seen, with repetition of the experiment being the most common. Many candidates made suggestions to steps that did not need

any improvement. For example, the method described that the samples were kept at 40°C in a water-bath and so no improvements to the maintenance of temperature were required. Others unfortunately suggested alternative investigations to test the impact of other variables, rather than improvements to the investigation in the question.

(ii) Although many candidates were able to describe how to make 5.0 cm^3 of 0.25% glucose from water and a 0.50% glucose solution, many others were not able to determine the dilution, or make a solution of the specified volume.

(iii) Almost all candidates knew that Benedict's solution is used to test for the presence of glucose and most also knew that the solution needs to be heated. A few candidates did describe how a test-tube with the solution needs to be placed in a water-bath but did not indicate that this should be a hot water-bath. Others confused the iodine test for starch with the Benedict's test for glucose.

(c) (i) The use of a gas syringe was the most common correct apparatus for collecting and measuring the volume of carbon dioxide produced. Simply stating that a measuring cylinder could be used was insufficient and detail of a displacement method or collecting over water should have been described.

(ii) The most common correct description of an anomalous result was that it is a measurement that does not fit the expected pattern. A few candidates incorrectly thought that anomalous results would be inaccurate.

(iii) Most candidates knew the anomalous result would be excluded when calculating the mean, but a few incorrectly then went on to mention dividing by three, rather than two.

(iv) Some very detailed comparisons of the mean volumes of carbon dioxide produced at 25°C and 35°C were seen. Some candidates were able to correctly manipulate the data. Some candidates provided explanations for their comparison, but this was not required by the question.

(v) In most cases, graphs were drawn neatly with correctly labelled axes, plots and lines. There were a few graphs where the line of best fit had been extrapolated, often to the origin. A few candidates did not plot the points on their graphs when values were zero and others incorrectly recorded the unit for time as seconds. A few candidates chose a scale that meant the plotted points occupied less than half the graph paper. Candidates should identify the independent variable and put it on the *x*-axis. When a key is required, using different point markers (crosses and small dots) is preferrable to dashed lines.

(vi) Most candidates correctly estimated the time taken to produce 3.0 cm^3 of carbon dioxide at 35°C and indicated this on their graphs. Some candidates made very small indications on their graphs that did not clearly show how the result was obtained.

(d) Few candidates knew the colour change that would occur when carbon dioxide is bubbled through hydrogencarbonate indicator solution.

Question 2

(a) (i) Almost all candidates drew the cell labelled **X**, although a few did not read the question carefully and drew all the cells. Most candidates used a sharp pencil and drew continuous lines without any shading. There were many examples of careful, detailed observations.

(ii) Many candidates calculated the actual length of the cell and gave their answers to three significant figures.

(b) Some detailed and carefully planned investigations to determine the effect of the concentration of sodium chloride solution on osmosis in plant tissue were described. Most candidates included clear detail in their method about the use of different concentrations of sodium chloride, but others confused concentration with volume and described immersing the plant material in different volumes of solution of the same concentration. This should have been one of the variables that they standardised. A few candidates chose to describe a method to measure percentage plasmolysis using tissue samples on microscope slides but most elected to describe one of the common methods of measuring either the mass or length of the plant tissue before and after immersion in the solutions, for a suitable period of time. However, some plans were seen with an

incorrect method of measuring osmosis where the candidates described recording the volume of immersion solution before and after the plant tissue had been placed in it. A small number of candidates planned investigations using dialysis tubing with no reference to plant material, or confused osmosis with transpiration and described the use of a potometer or movement of dye in xylem tissue. It was very common to see mentions of the need for goggles, lab coats and gloves with many references to sodium chloride being a hazardous chemical. The safety precautions were not necessary as sodium chloride is a common substance in many foods. The most common correct safety precaution was safe use of a knife such as cutting away from the body or cutting on a hard flat surface.