

CONTENTS

BIOLOGY	1
Paper 0610/01 Multiple Choice	1
Paper 0610/02 Paper 2 (Core)	3
Paper 0610/03 Paper 3 (Extended)	7
Paper 0610/04 Coursework	11
Paper 0610/05 Practical Test	12
Paper 0610/06 Alternative to Practical	14

FOREWORD

This booklet contains reports written by Examiners on the work of candidates in certain papers. **Its contents are primarily for the information of the subject teachers concerned.**



BIOLOGY

<p>Paper 0610/01</p> <p>Multiple Choice</p>

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

General comments

The paper performed well in spreading candidates across the mark range with almost exactly the same percentage (0.5%) achieving maximum marks as scoring below the expected mark for guessing each answer. Although a few questions proved to be something of a challenge, no question was unacceptably difficult.

Comments on specific questions**Question 1**

This provided a welcoming introduction to the paper and was one of the easier questions. It was reassuring to note that, for a question with such a high facility (91%), it was still able to discriminate well between candidates of varying ability.

Question 3

This question proved a little more difficult, but it served to expose a degree of misunderstanding over the binomial system of classification. A few of the better candidates were unclear over the distinction between generic and specific names, while less able candidates thought that mammals form a species.

Question 13

Traditionally, graph interpretation poses problems for some. In this case, over a third of candidates, in effect, said that the enzyme had been denatured at the point at which it was responsible for the maximum rate of reaction.

Question 14

It had been intended that reference to hard work in the question would draw candidates' attentions to the need for strong muscles and therefore protein in the diet. It may be that some of the 33% who opted for **B** were thinking more of hard mental rather than physical work, in which case, their answer would have been understandable.

Question 17

Much was asked of candidates in this question, linking, as it did, information on white blood cells and capillary structure. Even some candidates, who otherwise, scored well on the paper, did not realise that white blood cells pass through capillary walls. Nevertheless, it was significant to see that over 40% erroneously believed that red blood cells do.

Question 20

It is surprising that, contrary to their own experiences, just over a third of the candidates should suggest that they do not breathe as deeply during physical exercise.

Question 22

It may have been the implausibility of the incorrect options that helped to make this question easy with 98% of candidates answering correctly.

Question 26

This question very successfully separated the good candidates from the rest, but with almost as many opting for **B**, there was the suggestion that phototropism was, perhaps, a more familiar term to some than phototaxis.

Question 30

With over a third of candidates opting for **D** there was a suggestion here that failure to read the information given in the question proved a handicap to some. There is a clear statement that the boiled water contains no oxygen – a point that did not escape the more able performers.

Paper 0610/02**Paper 2 (Core)****General comments**

The majority of candidates attempted all parts of every question and where this was not the case it seemed to be related to candidates who did not seem adequately prepared for the demands of this paper and consequently gained very low marks. In general, candidates appeared to have had sufficient time to respond to all questions. There were some questions or parts of questions that many candidates found rather demanding and for which they had limited knowledge and understanding. Also, there were a few situations in which more careful reading of the question would have assisted candidates in offering a more suitable and relevant response. References to these problems are made in the individual question comments. Some of the same misconceptions and misunderstandings have appeared again that have occurred in previous years and been commented on in the relevant reports.

Comments on specific questions**Question 1**

Although the majority of candidates were able to link the descriptions of the animals to the group names there were some regular errors. Many candidates muddled the descriptions of the crustacean and the mollusc, perhaps confusing the hard shell and the hard exoskeleton, but the reference to the many pairs of legs should have resolved this. A very large proportion of candidates were clearly unaware of the wormlike nature of nematodes as this was regularly given as the group for the fourth description, that of a mammal. Many failed to realise that the presence of fur is diagnostic of mammals.

Question 2

Knowledge and understanding of the nervous system seemed weak overall.

- (a) Most candidates identified at least one stimulus such as temperature differences, touch or pressure detected by the skin. However a small but significant number thought the skin detects light and a greater number did not seem to realise that pain is not a stimulus but a response of the body to an intense stimulation. There were also a significant number of responses that described actions rather than identifying stimuli.
- (b)(i)(ii) Far too few candidates realised that the retina detects the stimulus of increased light intensity and that the effector is the iris. Very many label lines were linked to the lens, suspensory ligaments and to the ciliary body. Also there were label lines for X that linked to the blind spot or even within the optic nerve.
- (c) Responses were often not given and some who knew the names of the three types of neurones muddled the sequence. A range of alternative names, regularly used in various texts were accepted for the relay neurone, in middle of the sequence .
- (d) There was very little understanding of the accommodation mechanism of the eye. Firstly, among those who recognised what focusing involved, many gave very general descriptions of the actions occurring and dealt with both far and near vision at the same time. It was expected that candidates would realise that reading an examination paper would involve near vision. Within the descriptions a common misconception was that the suspensory ligaments themselves contracted and relaxed rather than just transmitting the actions of the ciliary body to the lens. In some accounts it was stated that the lens also contracts and relaxes. Very many accounts dealt with the iris reflex with varying degrees of accuracy which ignored the list of structures given in the question.

Question 3

Responses in this question suggested that many candidates failed to read some parts of the question with sufficient care.

- (a)(i) Although virtually all candidates recognised that excretion involves the removal of waste from the body few knew that this applies to metabolic waste and many referred to faeces or undigested matter in this definition.
- (ii) There were many who did not understand that egestion is the removal of indigestible or undigested food materials. This definition was often linked to the removal of urine or urea. There were a significant number who muddled egestion and ingestion.
- (b)(i) Even with the clue in the stem of the question a large proportion of responses named the kidney rather than the liver.
- (ii) Following on from this many considered the source of urea to be salts and water rather than amino acids, perhaps muddling it with urine. Some listed the majority or all of the components given in Table 3.1.
- (c) Erroneous responses for **Q** and **R** frequently included pulmonary artery and vein. There was some confusion, probably arising from not carefully examining where these two label lines terminated, with pairs of responses such as renal artery and vein or aorta and vena cava.
- (d) The commonest error in completing the table was to suggest that the urine of a healthy person contained glucose.

Question 4

Many candidates' responses were weakened by the fact that they did not appreciate that carbon dioxide is an acidic gas with some even stating that it was an alkaline one.

- (a) On the whole there were sensible responses in completing Table 4.1 but too many did not recognise that the pond weed in the light respire as well as carrying out photosynthesis. There were candidates who seemed to think that any organism in the light carried out photosynthesis.
- (b)(i) Responses in Table 4.2 often did not follow a logical pattern. Many candidates who had identified that only respiration occurred in tubes A, C and D offered different end colours for these tubes, with some responses giving colours that matched that given for tube B.
- (ii) Explanations frequently seemed to ignore the responses in both tables and also revealed misunderstandings about the properties of both carbon dioxide and oxygen, the latter frequently described as either an acidic or as an alkaline gas. Additionally many candidates suggested that respiration removed carbon dioxide or added oxygen to the contents of the tubes and some suggested the reverse for photosynthesis revealing misunderstanding of the two processes. There were a small but significant number of responses that were complete explanations of all the events that were logically predicted. However, there were also explanations that made no reference to either respiration or photosynthesis.

Question 5

- (a)(i) Although the majority of candidates identified light as the form of energy utilised by plants there were a significant number whose responses did not name any form of energy and instead named structures such as leaves or chloroplasts. Responses such as "the sun" or "solar energy" were considered inadequate for any credit.
- (ii) Photosynthesis was recognised as the process that used the light energy by most candidates but some complicated their responses by trying to explain or describe the process.
- (b) The majority of candidates referred to the overall increase in carbon dioxide concentration over the 20 year period. Other changes identified correctly by candidates was the annual fall and rise in concentration and that after year 12 – 13 the rate of increase is greater than before this time. A number attempted to quantify the amount of the rise but should be aware that like for like comparisons should be made, such as the peak in year 1 with the peak in year 20 rather than the trough in year 1 with the peak in year 20. The fact that the question requested "changes" and that there were 2 marks was not observed by many candidates who only described one change.

- (c)(i)** The information given in the start of this question was apparently ignored by many candidates who suggested links to CFCs and damage to the ozone layer or acid rain and its consequences. It was expected that candidates would simply relate the rising levels of carbon dioxide to the atmosphere trapping more heat and thus a corresponding rise in the temperature of the atmosphere. Clearly some candidates were, from their general knowledge, aware of the concept of global warming and used this in their responses.
- (ii)** Because of the erroneous links to ozone layer damage or acid rain in **(c)(i)** the suggestions here were sometimes linked to these concerns. Candidates should not offer vague suggestions such as “reduce carbon dioxide in the atmosphere”. Most recognised that decreased deforestation and the development of new forest areas would help as well as reducing the use of fossil fuels in vehicles and power generation.

Question 6

The majority of candidates had good knowledge and understanding of the processes and mechanisms involved in the events leading up to fruit formation.

- (a)(i)** Most named pollination and many qualified this as either insect or cross pollination. There were a number who suggested that the “pollution” was the term to use.
- (ii)** Most descriptions gained full credit and many gave responses that were developed well beyond the standard required. A significant number however described the transfer of anthers and although this does occur within some species of flowering plants it is far less common than the transfer of pollen grains.
- (b)(i)** There was some confusion between the fertilisation and pollination in this response. A significant number of candidates extended their responses to describe fertilisation in some detail.
- (ii)** The commonest error was to identify the ovule as the part of the flower that developed into the fruit but most correctly identified the ovary.
- (c)** Although many responses touched on the principles involved very few gave any detail such as the fact that gametes formed by meiosis are rarely genetically identical, that both pollination and fertilisation are random processes and that in the in the case cited there is cross pollination. Most overlooked the fact that the environment can affect the phenotypes produced. Candidates muddled their use of the terms gene and allele. They should appreciate that flowers of the same species, noted in the introduction of the question, have identical genes but may have different alleles and thus genotypes for any gene. There were a significant number of responses that depended on the concept of inter species pollination as the cause of variation.

Question 7

- (a)(i)** Apart from a small number of candidates, who produced numerical responses totally unrelated to the data on the graph, this question seemed to present little difficulty. However candidates should always quote the units for the numerical answer unless, as in the case of **(a) (ii)** and **(iii)** they are printed in the answer space.
- (ii)(iii)** It was apparent that some candidates misread the information from the graph or failed to carry out subtractions correctly but this presented few difficulties to most candidates. There were a few who simply quoted the values at the relevant heart beat rates and left it for the Examiner to then work out the difference between them.

It should be brought to candidates’ attention that decimal points should be made very clear in their responses.
- (b)(i)** It was expected that candidates would name the chamber rather than just stating that it was a lower one or one on the left side of the heart. There were a lot of responses naming an atrium instead of a ventricle.
- (ii)** Although most candidates recognise that valves prevent backflow of blood there were a significant number who either thought that they actively push blood onwards or that their role is to separate deoxygenated from oxygenated blood.

Question 8

- (a)(i)** A large number of candidates did not appreciate that the most obvious adaptation of root hair cells is their lateral extension increasing their surface area for absorption.
- (ii)** There was the inevitable confusion between xylem and phloem.
- (b)** In the case of both types of ion the commonest problem was that their use was not specified but given in vague terms such as photosynthesis or growth. Candidates should be aware of the role of magnesium in chlorophyll formation and of nitrate in the formation of amino acids.
- (c)(i)** Very few commented on the fact that crops remove ions at each harvest and these must be replaced to maintain or improve crop yield. There were many references to better or healthy crops which were considered too vague for credit.
- (ii)** The responses in this part varied enormously in knowledge and understanding. Most linked the effects to eutrophication which was described with a varying range of details. Many of these went beyond the standard expected for full credit. However a number of responses highlighted some misunderstandings in relation to the effect of decreased penetration of light and the role of the decomposer bacteria. There were a smaller but significant number who simply believe that nitrates are toxic and kill all living organisms.

Question 9

- (a)(i)-(v)** The placement of the labels revealed some misunderstandings. The site of fertilisation was commonly thought to be the uterus as was the site of deposition of sperm. The vagina was regularly identified as a site for a surgical method of birth control. It was not uncommon for candidates not to attempt to identify where oestrogen was produced. There were a significant number of labels placed outside of the reproductive system in the urinary and digestive systems. Candidates should be encouraged to label such diagrams by placing the letters outside of the outline and linking them to the relevant position by a label line instead of writing letters directly onto the diagram as in the latter case the letters are sometimes so large they cross over a number of structures.
- (b)(i)** Candidates did, overall, seem to understand the problems that could arise if the maternal and fetal blood systems were linked and their bloods were allowed to mix. Most recognised the dangers of the bloods being of different blood groups or the risk of direct transfer of pathogens, toxins or drugs. However there were responses that were rather vague simply referring to the fact that this "could be harmful to the fetus". Fewer commented on the large difference in blood pressure between the two systems.
- (ii)** Too many responses were rather general and gave no specific detail. Candidates should name a waste material being transferred, such as urea or carbon dioxide. The question stem referred to the transfer of digested nutrients and thus when the question requests other roles candidates should not quote this transfer as one of their examples. Also when dealing with a mechanism that can occur in two directions candidates should indicate the direction of transfer for each of their examples.

<p>Paper 0610/03</p> <p>Paper 3 (Extended)</p>
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General comments

Candidates continue to cope well with this paper in its new format. Some Centres still need to select their candidates more appropriately for this paper: the weaker candidates should not be expected to study the extension material, which contains more difficult concepts. They can still gain up to a Grade C when entered for the Paper 2 route. While weaker candidates were able to make reasonable attempts at answering the more straightforward sections of the first three questions, they struggled with more challenging parts, particularly in **Questions 5 to 7**.

The paper discriminated well, with questions considered to be straightforward but not easy, and there was little evidence of candidates running out of time. Some showed impressive and accurate drawing skills in **Question 4**.

Spellings that were often wrong included the terms homeostasis, genus and pancreas. Handwriting and general presentation were mainly very good and the meaning of answers clear in all but a very few cases.

Few candidates appeared to have been aware of genetic engineering (**Question 5 (b)(ii)**), or the manufacture of enzymes (**Question 6 (c)**), topics which were both introduced in the 2005 syllabus. New topics and changes to the syllabus are identified with vertical black lines. Such topics are very likely to be examined. The protection against malaria afforded by being heterozygous for sickle cell anaemia (**Question 7 (b)(ii)**) was not understood well.

Comments on specific questions**Question 1**

Most candidates were able to attempt all sections of this question, with plenty of high scoring answers.

- (a) While most candidates were able to name one external feature that identifies an animal as an amphibian, some thought that this group has scales or dry skin. The commonest correct response was moist skin. *Webbed feet* was not accepted because it failed to distinguish between amphibians and some birds. The majority were able to name two other vertebrate groups, although some included invertebrates such as arachnids, annelids and crustaceans. Latin names are not needed, but were accepted. As stated in the syllabus, English terms should be used in preference to Latin or Greek terms.
- (b) Candidates needed to use the term *genus* in their answer: reference to both toads having the same name *Bufo* was not enough. There was some confusion between genus, gene and species.
- (c) Most candidates gained both marks here. Those who did not tended to be too vague and did not use the specific information given in the passage.
- (d) Answers needed to include two valid suggestions to gain the two marks available. Good responses included the protection of sand dunes by banning or restricting campsites, the formation of protected areas with suitable conditions and the protection of heathland by the removal of trees.
- (e)(i) A number of suitable answers were seen and accepted: secondary consumer, carnivore and third (or tertiary) level.
- (ii) This was generally answered well, although some candidates failed to study the food web carefully enough and only named one food in their answer, rather than insect larvae and adult insects.
- (iii) While most candidates answered correctly, some gave vague and inaccurate suggestions such as 'Common toads can eat all the foods'. They overlooked the fact that the producers named in the food web represent foods for primary consumers, but are not eaten by either species of toad.

Question 2

This was usually well answered.

- (a) Most candidates could complete the graph correctly. A few completely ignored the question, failed to shade the missing column, or forgot to include units for the x axis. Occasionally, the axes labels were reversed.
- (b)(i) A number of candidates thought the graph represented discontinuous variation, perhaps because the data was shown as a histogram rather than a curve.
- (ii) The most common mistake in answers was in failing to present variables as differences e.g. 'light' without qualification was not accepted, but 'differences in the amount of light the plants were exposed to' was a good answer.
- (c)(i) The majority of candidates had no difficulty stating two insect-attracting features of flowers. However, some responses were too vague, for example, colourful flower, instead of colourful petals. Examiners are looking for evidence of biological terms in addition to those used in the question.
- (ii) This was well answered. A few thought that an insect's role is to collect nectar, or to fertilise the flower.
- (d) Most candidates were aware that flowers may be self-pollinated. Only the best candidates went on to describe the need for fertilisation in the process of seed formation. Some answers indicated confusion between pollination and seed dispersal; others suggested that the plants could produce seeds by asexual reproduction.

Question 3

Again, candidates tended to answer the question well.

- (a) Useful substances supplied by the coronary arteries and a waste substance removed were known by the majority of candidates. Vague answers such as food, protein and blood were not accepted.
- (b)(i) Most candidates correctly named the tissue as muscle. Errors included cardiac tissue unqualified, nerve and pacemaker.
- (ii) Some candidates lost a mark because they stated the tissue would contract *and relax* when stimulated.
- (iii) Two marks were available for describing blood leaving the left ventricle through the aorta. Statements about an increase in pressure or a decrease in volume of the ventricle contents were also credited. Some candidates suggested the blood would go into the atrium or the pulmonary artery.
- (c)(i) The question was looking for how lifestyle can result in blockage of the arteries. It was usually answered well.
- (ii) While most candidates gained the marks, there was some careless shading of the artery below the label line or complete shading of the ventricle, even though the instruction in the question was to shade the parts of the artery affected by the blockage.
- (d) While many candidates could name two features of veins that enable them to function efficiently, fewer were able to give adequate explanations, particularly in relation to a wide lumen. The commonest correct answer was valves, to prevent backflow of blood. The term *lumen* was not well known.

Question 4

High marks on this question were rare, but the quality of drawing was often very good.

- (a) The pupil and iris were usually drawn correctly in the first diagram, but some made the pupil smaller in the second diagram or varied the overall diameter of the iris. Many were not aware that the sclera is the white part of the visible eye, tending to label the extreme right side, which is actually the remains of a third eyelid (nictitating membrane) and the point at which the lachrymal duct drains excess fluid from the eye. Candidates were instructed to label the parts on the first diagram: many put labels on the second, or on both, but this was not penalised.
- (b) Few candidates answered this correctly. Weak answers merely described the change in size of the pupil without explaining how this is achieved, or contained vague statements about the iris contracting and relaxing. There was also evidence of confusion between the role of the iris and accommodation: references to ciliary muscles instead of circular muscles were sometimes given.
- (c) Weaker candidates omitted any reference to rods and cones, or the intensity of light needed to stimulate them. Many lost marks for negative statements, such as 'in dim light cones cannot detect colour'. Answers need to clearly state the characteristics of cones, rather than inferring them. The statement 'cones detect colour and are only stimulated by bright light' gained two marks.

Question 5

Weaker candidates struggled with this question.

- (a)(i) Most were aware that a rise in concentration of glucose in the blood would be caused by a recent meal containing carbohydrate.
- (ii) While pancreas was the organ most frequently named, many thought that insulin was secreted by the liver. Pancreas was often incorrectly spelt as pancrease.
- (iii) While most candidates gained one mark for describing the conversion of glucose to glycogen, few stated that insulin stimulates the liver to absorb glucose from the blood, or that the respiratory rate of the liver increases, causing the breakdown of excess glucose. Inevitably, glycogen was sometimes confused with glucagon.
- (iv) Homeostasis and negative feedback were both accepted.
- (b)(i) Most gained one mark for recognising that insulin could be digested, but few went further to name an enzyme that would break it down, or to state that an injection would get the insulin to its site of action faster.
- (ii) Very few candidates had any knowledge or understanding of the process of genetic engineering. Many wrongly described bacteria as being altered in some vague way, fed on glucose and then injected into diabetics. Names of the enzymes involved, structure of bacteria and the way genes can be identified and extracted from human DNA, as well as the culture of modified bacteria need to be learned. Students should be aware that the syllabus does change from year to year.

Question 6

This question caused more difficulty than expected, with poor knowledge and understanding of enzyme action displayed in many scripts.

- (a) Most were able to define an enzyme as a biological catalyst and many stated their protein nature.
- (b)(i) Biological washing powders contain lipases to break down fat stains and proteases to digest protein stains. However, many candidates did not identify what the chemical nature of stains may be, name the relevant enzymes or state that the products of digestion are soluble.
- (ii) The question proved to be a good discriminator. Most candidates could state at least one relevant comment about the effect of temperature on enzymes: that they are denatured by high temperatures, work best at an optimum temperature and work slowly at low temperatures. Few gave biological reasons for the effects of high and low temperatures. Incorrect concepts included the denaturing of enzymes at low temperatures and the death of enzymes at high temperature.
- (iii) Most gave a suitable temperature and an appropriate explanation. However, units were not always stated.
- (c) Again, this was a new topic in the syllabus for 2005 and many candidates were not aware of the process of enzyme manufacture. Many answers showed confusion of this process with genetic engineering. Even basic terms such as *fermenter*, *feedstock* and the naming of enzyme sources were absent from most answers. Suitable conditions for the fermentation process were rarely stated.

Question 7

This was also answered less well by many candidates.

- (a) While the shape of cells was usually described adequately, a second mark relating to the effect of this shape (reduction in oxygen transported or the problem of getting stuck in capillaries) was often missed. Some candidates showed confusion between sickle cell anaemia and anaemia due to lack of dietary iron.
- (b)(i) Candidates are still missing marks by not labelling the stages in their genetic crosses adequately. Terms such as *genotype of parents*, *gametes* and the ability to distinguish between parents and gametes in the cross were often lacking. Presentation needs to be methodical to ensure success. Some candidates chose their own symbols for the alleles, although the question gave them. The prediction of probability proved to be difficult even when candidates got the rest of the question correct.
- (ii) Very few candidates are aware that people who are heterozygous for sickle cell anaemia gain protection from malaria, or understand why. Very few recognised that the term *homozygous* relates both to those with the genotype $I^N I^N$ and $I^S I^S$, failing to distinguish between them in terms of their vulnerability to death from malaria and sickle cell anaemia. The concept of codominance was not understood well.

<p>Paper 0610/04</p> <p>Coursework</p>
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General comments

The coursework submitted for moderation this year continued to show a pleasing standard achieved by many candidates.

Most Centres use between eight and twelve tasks. These were, in almost every case, well chosen and well constructed, ensuring that candidates were able to demonstrate their abilities in each strand of the criteria for the four skills. Open-ended tasks, presented as worksheets that do not provide too much help, are most useful in this respect. Some Centres use help sheets which they provide to candidates who are not working at the highest levels, in order to ensure that they can complete the task successfully.

While most candidates do well in Skill 1 and Skill 2, Skills 3 and 4 present more of a challenge and tend to provide a wider mark range within each Centre. In particular, evaluation is very demanding; not all candidates are able to assess the reliability of their results appropriately, and ability within this strand of Skill 3 often discriminates well between those performing at Level 5 or 6 and those who have not yet reached these levels. Planning (Skill 4) is also very demanding, but some excellent work is seen here, with candidates demonstrating a very sound grasp of the features that make for good experimental design, and the ability to look back on their experiment and to suggest how they could improve it.

While some types of task tend to be used by several Centres (for example, enzyme experiments, cooling curves, comparing structures of leaves or flowers), there are also some excellent and imaginative tasks that make good use of local circumstances, for example simple ecological investigations. These can bring out the best in candidates, and there was evidence of considerable enthusiasm amongst some.

One problem that continues to occur in some Centres is inadequate internal moderation. External moderation can only deal with each Centre as a whole, so it is essential that candidates within a Centre are all assessed to exactly the same standard. This does not necessarily mean that each teacher has to use exactly the same tasks, but it does undoubtedly help if they do, and also if they use the same mark schemes and apply them in the same way. Good internal moderation takes place well before the candidates actually undertake the tasks, in the planning of the task and the construction of the mark schemes, which all teachers should be involved in.

Marking of the assessed work should be made as explanatory as possible. A few Centres present work that has been word processed and bears no comments from the teacher. This makes it difficult for the External Moderators to understand how and why marks have been awarded, or to be certain that is the candidate's original piece of work rather than a re-formatted version done after marking has been done. Most teachers write careful and individual comments on each piece of work, usually addressed to the candidate, which not only provide good feedback to the candidate but also help the External Moderators to follow the thinking of the teacher in determining the level the candidate has reached.

<p>Paper 0610/05</p> <p>Practical Test</p>
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General comments

Some confusion arises with measurement, and time should be spent by candidates in making sure that they can measure and record accurately. Candidates should be able to tell the difference in interpreting ruler scales between 0.1 cm, 1 mm and 0.1 mm.

The last page of the Confidential Instructions now contains the Supervisor's Report, which should be cut from the booklet and enclosed with the candidates' scripts. A number of Centres failed to supply a report and seating plan but some did enclose a 'worked' script. The more information that a Centre can supply the greater the help to the Examiners, especially if some candidates appear to obtain unusual results.

Comments on specific questions**Question 1**

- (a)(i) This was well answered by most candidates, although it was evident that some waited until they had made their measurements to amend their expected outcome. As the potatoes were being placed in distilled water, they would have been expected to increase in length.
- (ii) The quality of the tables constructed was variable. Candidates should be encouraged to take a little time to plan exactly what is required in a table. It should be drawn neatly, using a ruler, headings should be clear and units stated. Some candidates did not gain full marks either because they did not make it clear that they were recording the final length of the potato chips or because they failed to provide suitable units.
- (iii) Measuring proved to be a problem for some candidates. 50.6 mm was recorded, for example, when it was clear from measurements made in **Question 2** that the intended measurement was 56 mm. The majority of candidates, however, gained the mark. It was also clear that some candidates had not carried out the instructions about cutting the potato chips accurately, with original measurements varying from 40 mm to 65 mm. In this case, the error was not of great importance but candidates should be encouraged to follow the instructions as accurately as possible.
- (iv) Some problems were encountered in this part of the question. Candidates were expected to calculate the mean of the three potato chips after they had been soaked in the distilled water for 30 minutes. A significant number calculated the mean of the original and final length for each potato chip. This would not provide meaningful information. Care should be taken when 'rounding' figures that this is done correctly. A mean of 52.666667 mm, for example, would be expected to be given as 52.7 mm rather than 52.6 mm. Several did not calculate a mean value at all.
- (v) In this part of the question, candidates were expected to explain *their own* results. Explanations that referred to different results were not credited. Neither were those that gave alternative explanations, unless a candidate had potato chips that had responded in different ways. Most understood that water moved by osmosis to change the length of the potato chip.
- (b)(i) This was not answered as well as had been expected. Candidates are expected to make comparative statements in the boxes, such as 'firm' and 'soft'. A statement such as 'hard' and 'smooth' was not credited as the descriptions did not make a comparison. Some candidates missed the reference to the "feel" of the pieces and mentioned colour and length, which were not credited.
- (ii) Those candidates who understood about water potential and osmosis were easily able to score maximum marks in this section. Some, however, referred to the movement of various sugars or starch into or out of a potato chip. Candidates were expected to refer to the potato cells when using the terms 'flaccid' or 'turgid'.

- (c)(i) This was answered well by many candidates. The numbers were frequently correct but some confusion was seen when it came to positive and negative. Some candidates appeared to manipulate the figures in odd ways, such as dividing the original length by the concentration.
- (ii) As consequential errors were allowed, most candidates gained the mark for plotting the figures. Those candidates who tried to plot figures of 40 were not credited as they could not fit them on the grid provided. Credit was given for joining the points with a clear line or a line of best fit. Candidates should make the line as neat as possible and, if joining the points, should do so with a series of straight lines or a smooth curve, as appropriate. Sketched lines or 'wobbly' lines are not appropriate. In this case, it was not appropriate to provide a dip between the last two points, indicating that if further data was available the line would start to move back upwards. When drawing graphs, lines should not automatically be extended so that they go through the origin (0,0). In this case, if the line was to be extended at all it should have continued upwards as the behaviour of the potato chips would not reverse simply so that the line could pass through (0,0).
- (iii) Candidates were asked to indicate the concentration at which there was no change in length. This would have been when the line crossed the x-axis. Of those who were able to work this out, some were unable to read the scale properly and therefore gave incorrect answers. Even some of those who had drawn the graph correctly suggested a concentration of 0, even though their line did not pass through it. This was a higher level skill.

Question 2

- (a)(i) Some good, clear diagrams were seen but many had sketched outlines. Candidates were expected to indicate the presence of the embryo in the drawing. Centres are reminded to instruct their candidates to put clear, ruled label lines that touch the structure being labelled. Some candidates made no attempt to label their diagram.
- (ii) The instruction to 'use a line to show where you made the measurement' was ignored by some candidates. If two short lines were used to indicate the limits of the drawing then a single line should be drawn between them so that the accuracy of measurement could be assessed. Candidates who do not show any working are disadvantaged as, if their answer is wrong, they cannot be awarded a mark for correct working. Some have noted previous reports in which it has been stated that answers for magnification should be given to one decimal place as the greatest degree of accuracy. Magnification should be indicated by 'times' or 'x' and should not have any units.
- (b)(i) This posed few problems for the candidates. Four marks were allocated to this part of the question, so some detail of volumes of reagent used or the idea of splitting the sample in order to carry out two different tests was also credited. Candidates should be made aware that the mark allocation indicates the amount of information that is required for a particular answer.
- (ii) This was generally answered well. It was pleasing to note that there were few problems with describing the colour change for iodine solution, as care needs to be taken not to confuse it with the colour of Benedict's solution or the result of the biuret test for protein. A few more problems arose when describing the expected colour change for a reducing sugar. Care needs to be taken, in this case, not to confuse the possible yellow/orange colour with the colour of iodine solution. It is suggested that candidates describe the result in terms of varying concentrations of reducing sugar, such as 'green to yellow to orange to brick red, depending on the amount of reducing sugar present'. This would overcome any confusion.
- (c) The majority of candidates scored well on this part of the question. A few had, presumably, confused their samples, as the conclusions were mixed up. As they had been asked about both starch and reducing sugar, the conclusions should have referred to both. A minority simply stated the observations, which was not required in this case.
- (d) This part of the question was the most testing and able candidates scored well, with clear and accurate descriptions. Weaker candidates simply restated the conclusions, stating that, for example, 'starch and reducing sugar are in cotyledons of a germinating seed'. Examiners were looking for the idea that starch is stored because it is insoluble and that, once a seed germinates, the starch is broken down into sugars that are then transported to the growing points where they are used for respiration to provide energy for growth. Some candidates relied on their theoretical knowledge, ignoring their own misleading conclusions in (c). As the seed was germinating rather than having emerged above the soil, credit was not given for production of sugars by photosynthesis (especially inappropriate for the cotyledon **W3**), even though a significant proportion of candidates based their answers around this fact.

Paper 0610/06
Alternative to Practical

General comments

The range of marks recorded was 0 to 38 out of a possible total 40.

The candidates entered for this paper showed a wide range of abilities. Many candidates scored high marks and showed a sound knowledge of practical skills with an ability to express their understanding and biological knowledge clearly and concisely. Overall, the standard of written English was high and there were comparatively few spelling errors. The drawing skills were generally well shown. The graphical part of **Question 1** was well answered by most candidates using data recorded from measurements and calculations which were recorded in Table 1.1. Most candidates correctly used a pencil to draw and to construct the line graph with an attempt at a line of best-fit in this examination session. The number of candidates attempting these parts of the paper using an ink pen or ball point is decreasing.

It is important that candidates read carefully through the introduction to the questions and follow the rubric exactly.

Question 3 was based on a topic which had been introduced into the Core Syllabus published for the examination for 2005. Most candidates were able to answer this question but not all candidates were familiar with the terminology involved in growth of populations.

It appeared that candidates had sufficient time to complete the paper.

Comments on specific questions

Question 1

This question was based on an investigation involving changes in lengths of cut pieces of potato immersed in glucose solutions of differing concentrations. It involved the candidate measuring the length of pieces of potato reproduced in a printed table and straightforward calculations to determine the mean change in length, plotting a line graph using a line of best fit for the change in length and some questions on interpretation and understanding of the investigation.

- (a)(i)** Most candidates carefully read the introduction to this question, heeded the units, millimetres, recorded in the column heading in Table 1.1 and correctly measured the six lengths. (There were nine measurements completed on the paper to save repetition of the same measurement skill.) Some candidates recorded the values incorrectly in centimetres. Weaker candidates were unable to carry out this skill and recorded values which deviated beyond those expected by variation between rulers.
- (ii)** This section required the calculation of a mean (average) length for the three potato pieces in two of the concentrations of glucose solution. Most candidates calculated the mean value correctly for these last two glucose solutions.
- (iii)** The more able candidates had no problem with this change between the mean and the original starting length of 60 mm and completed the table successfully. Some candidates calculated the change but omitted the signs, very occasionally reversing the sign. Weaker candidates did not understand how to calculate this, possibly because they had not taken note that the potato piece measured 60 mm at the beginning and the changes in length which were determined failed to relate to the mean. Other candidates incorrectly thought that the change in length might be found by adding all the different lengths together.
- (iv)** The use of three pieces of potato instead of just one was to increase the reliability of the data to overcome the variability between individual results as the pieces may be cut from different potatoes, perhaps of differing age or source. Few candidates used the word 'reliability' though many expressed the basic idea in other terms.

- (b)(i)** The rubric stated the plotting of data for the change in mean length of potato against concentration of glucose solution on the grid and to draw a line of best fit through the points. The axes were labelled to aid orientation of the data. A wide range of graphs was seen and candidates were choosing a scale to accommodate points so that the graph filled more than half the grid. More able candidates had no problem with this and even those who had no \pm signs were able to plot a reasonable graph for the results. There were very few column graphs or attempts where the axes were reversed. There were some candidates who incorrectly plotted the mean lengths 66 to 55 millimetres instead of change in mean length. Some candidates still use large circles for points which fill one mm^2 , a small cross is sufficient. Candidates did not, however, understand the line of best-fit. Many candidates tried but did not choose a line which went mid way between most of the points. It should be a line drawn to pass as close as possible to all the plotted points, it does not have to go through any of the points exactly but it can. Many lines just joined a couple of points or the first and last and missed any anomalous points. Quite a few candidates preferred to join point to point as they have been required to before and were given credit. Some candidates were drawing freehand lines and curves which has not been acceptable for a while. The line should extend from level with the first to the last point which is plotted and not be extrapolated to the axes.
- (ii)** The rubric stated the need to describe and to explain the changes in mean length of the potato pieces. Where candidates were familiar with the concept of osmosis, there were some excellent answers. Most candidates were able to gain two marks by knowing it was osmosis and that the movement of water was involved. Many candidates referred to the differences in glucose concentration rather than the water potential difference and did not give full explanations of water moving in or out of the potato pieces and linking this to the change in length. Weaker responses omitted reference to osmosis or water at all and gave only a description of their results, i.e. giving the length changes for each concentration but no explanation. A few candidates did not understand at all and tried to link the differences to glucose providing energy for growth of the potato.
- (c)(i)** Although many candidates correctly recorded the value from their graph for zero change, many failed to record the unit for the glucose concentration as printed on the axis. There were candidates who appeared to guess at a value instead of reading this from their plotted graph, usually 0.5 mol dm^{-3} .
- (ii)** Most candidates described some idea of a balanced state or equilibrium between the potato cell sap and the external glucose solution. Only a few able candidates realised the dynamic nature of the equilibrium in terms of equal movement of water into and out of the potato so there is no net change.

Question 2

This question was based on drawing and labelling skills from a photograph of a broad bean seed, a magnification calculation and a simple food test for protein.

- (a)(i)** For the majority of Centres, there has been an improvement in the standard of drawing, with the outline a clear continuous line, and very few sketchy or shaded diagrams were seen. The majority of drawings were larger than the photograph. There are still some candidates who do not pay enough attention to copying the photograph and trying to keep all parts in proportion. On the whole, most candidates gained marks for the drawing rather than the labelling. Many candidates did not even attempt to label anything. The usual correct labels included the testa or seed coat and the cotyledon. Some candidates incorrectly referred to the seed as having an endosperm. Many candidates were confused about the position of the plumule and radicle. Very weak candidates were labelling the diagram as a cell with cell membrane, vacuole and nucleus.
- (ii)** The majority of candidates had measured accurately but many failed to make any indication to show where they had measured their seed. The instruction was clear but ignored. Many candidates were able to show the correct working but some of them lost a mark by giving the answer with units and not with an 'x' or times.

- (b) This part of the question was based on a description of a food test for protein to compare the protein content of two different beans. It was surprising the number of candidates who failed to describe the biuret test even though it has been asked in many previous examinations. The more able of the candidates realised the importance of starting the comparison with equal masses of the beans, of using equal quantities of reagents and chopping or grinding their seeds to extract the protein. Some candidates added water but made no reference as to why. Many candidates named the correct individual reagents, referred to a resulting purple colour and compared the intensity of the colours as a qualitative indication. Some candidates incorrectly thought the colour might form faster if more protein was present. The colour was often linked to the wrong reagent e.g. Benedicts. Some candidates described other tests such as the use of Albustix or Millons reagents. Some candidates described incorrect tests such as bigger beans have more protein; burning the beans to calculate energy released, more energy = more protein; mixing with protease enzymes and testing for proteins; feeding beans to rats or humans and seeing which had better growth or more urea in their urine or growing the seeds to record the larger plant.

Question 3

This question was based on the growth of population of a microscopic one-celled fungus, yeast *Saccharomyces cerevisiae*. The growth of populations has been included in the core material for the first time in the syllabus for 2005. This fungus is mentioned in other parts of the syllabus and it appeared that some candidates found this confusing. Overall this question was badly answered by most candidates and it was not well known or understood.

- (a) This was obviously an experiment many candidates were not familiar with and the marks awarded were often only for reference to a microscope and counting the cells, without the candidate really understanding the constraints or difficulties of counting yeast cells. Even though the candidates probably meant 'count', too many candidates simply 'estimated' the numbers under the microscope and so were only repeating the question. A few candidates referred to high power magnification though many mentioned the electron microscope without understanding the difficulties involved. Some more able candidates realised the importance of sample size and then taking the flask volume into consideration, calculated the total number of cells. There were many completely different and incorrect experiments offered, many of which would give a comparison of numbers with time but which could not give numbers of yeast. Some of these included weighing the flask and observing change of mass with time; counting bubbles of carbon dioxide released; monitoring the loss of glucose, the more nutrients used the bigger the population.
- (b) Many candidates were not familiar with the growth curve presented in Fig. 3.1. It was clear that about half of the candidates had covered this topic and the terms 'lag' and 'log or exponential' growth stages were familiar. Of these candidates who did know the lag and log stages, many were struggling to correctly position Q, leaving the letter Q 'floating' on the graph, and so it was impossible to decide where it was located. Candidates must realise that a point like this, must be unambiguous and clearly marked.
- (c)(i) Even though the candidates may not have been familiar with the experiment in part (a) this part of the question was straightforward recall and many candidates gave one correct factor. Too often candidates gave vague answers like temperature instead of qualifying a suitable temperature to supply warmth, food instead of a specific substance such as sugars and moisture instead of water and the most common errors were oxygen, carbon dioxide, removing alcohol or humidity.
- (ii)(iii) Those candidates who were familiar with the growth curve usually also knew that the numbers of yeast cells would stop increasing or become constant. Many candidates suggested that the numbers would decrease either straight away or after slowing down a little. Usually, the answers were shown in the sketch for part (iii) although a small number of candidates did get a correct written answer but incorrectly sketched graph or vice versa. The extension of the curve on the graph in Fig. 3.1 was often ignored and candidates sketched a separate graph on the page below the last question. This took considerable time to construct the axes and to label them which candidates might have used elsewhere.