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BIOLOGY

Paper 0610/01
Multiple Choice

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19	**A**	39	**A**
20	**B**	40	**A**

General comments

This paper provided a good spread of marks with a very small percentage achieving the maximum. Only one question was not correctly answered by at least half the candidates.

Comments on specific questions

Question 3

This question was presented in a somewhat unfamiliar form and required candidates carefully to interpret the information provided before selecting their answer. The responses indicated that there is some confusion between the terms genus and species. A third of candidates felt that modern people are in the same species but not the same genus as their ancestors. Significantly, those who chose this option were generally not able performers on the rest of the test.

Question 7

There was some difficulty here in recognising a leaf as an organ. All options had a degree of support, particularly from 25% who believed that a leaf is a tissue. This was not, however, a belief held by able candidates.

Question 8

Over a quarter of the candidates opted for a diagram of a red blood cell in its normal form when asked to select one that has changed. The indications are that the concept of osmosis and red blood cells was, by some, not well understood.

Question 11

Candidates were struggling to differentiate between the graphs showing the effects of temperature and pH on enzymes with half of them not appreciating that the sudden decline in rate at 60 ^{o}C indicates destruction of the enzyme.

Question 12

A basic misunderstanding, both over the function of the phloem as well as over the properties of organic chemicals, was exposed by this question, namely that 38% of candidates believe that starch is a chemical that is translocated in the phloem.

Question 15

It was only the very good candidates who knew that fat is the highest energy food. It appears likely that carbohydrates rather than fats are linked with energy in the minds of most candidates with over 50% being attracted by a high-carbohydrate option.

Question 22

This question proved to be a snare for the unwary. Those who immediately linked alcohol with liver opted for the blood vessel leading blood from the liver, when they should have been reasoning that alcohol is first absorbed by the gut, then taken to the liver in vessel **C**.

Question 33

As might be expected, there were no problems at all with this question as it proved to be the easiest on the paper. Nevertheless, 2% did believe that a cow is a producer - of milk, no doubt!

Question 40

Superficially, this question appears straightforward and not particularly testing, with 79% choosing the correct option (**A**). However, several able candidates seemed not to carefully assimilate the information in the question. Some appeared to miss the arrows showing the direction of water flow, but, more worryingly, others hinted at the belief that pesticides affect the growth of water plants.

Paper 0610/02

Paper 2 (Core)

General comments

There was considerable evidence, much of it noted in comments about individual questions, of candidates not reading the questions carefully enough. Thus their responses, often biologically correct, failed to answer the questions set. There was overall evidence that the candidates tackled questions demanding application skills better than those requiring them to present knowledge and understanding. The candidates on the whole completed the paper and appeared to have sufficient time to achieve this.

Comments on specific questions

Question 1

(a)(i) Few candidates were able to identify the labelled phase as the log phase. It was confused with the lag phase. Many tried to describe what was occurring during this phase rather than naming it.

(ii) It would seem that in a very large number of cases candidates did not note that the graph related to a population of yeast and their responses suggested that various factors that affect humans or animals in the wild were the causes for the population not growing any further. It was expected that suggestions would include factors such as a lack of glucose or other nutrient and the build up of ethanol or other toxic waste.

(b) Although the majority of candidates did offer either a word or a symbol equation and not mixed ones, unfortunately their understanding of the process of fermentation by yeast was very weak. Some equations dealt with aerobic respiration or anaerobic respiration in mammals while others seemed to be attempts at a representation of photosynthesis.

(c) There would seem to be considerable misunderstanding about the long term effects of alcohol in the human body. Erroneously a range of types of cancer was quoted as well as various forms of damage to the kidneys and the heart. Many responses were very vague and did little more than repeat the stem of the question.

Question 2

(a) A significant proportion of the candidates were able to name the two structures but there was some confusion as to whether **A** was the cervix or the uterus.

(b) Understanding of where the three events occur was poor. Fertilisation was often thought to occur in either an ovary or the uterus while the production of oestrogen was attributed to most parts of the system shown in the diagram. A greater proportion of candidates were able to identify the ovaries as the site of gamete production.

(c) Again this year many candidates confused primary and secondary sexual characteristics. It was expected that candidates would be familiar with features such as widening of the hips, development of mammary glands, growth of pubic and axillary hair and the deposition of subcutaneous fat. A significant number quoted features that occur in males only.

(d) Although the question referred to changes in the ovaries and uterus a significant number of candidates discussed events occurring elsewhere, and gained no credit for this. The responses revealed considerable confusion in relation to what happens and the sequence of the events. Candidates should refer to the growth and shedding of the uterine lining and not to its wall or to the uterus as a whole. Both ovule and ovary were apparently substituted for ovum in many descriptions.

Question 3

(a) The vast majority of candidates solved the identification with little difficulty although where errors occurred it seemed to be between the two cereals with awns, **A** and **D**.

(b) A number of candidates seemed to have overlooked the fact that the question requested differences between insect and wind pollinated flowers and instead offered responses about leaves, whole plants, seeds and fruits and also methods of seed dispersal. Candidates should appreciate that when differences are requested then in their responses they should refer to both types of flower or in the event that they only make a statement about one only they should make it absolutely clear which type of flower is being dealt with.

(c)(i) Candidates should have linked the two ions with the formation of chlorophyll and with proteins. Far too many responses were very vague and mentioned the use of the ions in growth and photosynthesis.

(ii) There was some confusion over the effect of nitrate ions in water sources with many misconceptions. These ions are thought by some to have a direct toxic affect on both animals and plants. They are believed to directly cause anaerobic conditions in the water. Only a few candidates appreciated that the nitrate ions cause algae and other aquatic plant life to grow prolifically. This can lead submerged plants to die because of lack of light and this with the death of many algae leads to a massive increase in bacterial activity. It is this that results in anaerobic conditions and its consequences.

Question 4

(a) Candidates need to recognise that data of the type presented in the table should be plotted as a point graph and should not attempt to display it as a bar chart. Many candidates did not label the vertical axis and a significant number used a non-linear scale. Some candidates simply listed the values in the table, in the same order as they are printed, as the vertical scale. Many did not seem to appreciate that having plotted the points they should either join them or draw a line of best fit, a skill with which many seemed unfamiliar.

(b)(i) It was expected that candidates would realise that increased humidity would reduce the rate of water loss but most seemed to think that the reverse occurred.

(ii) Many candidates recognised that changes in temperature, wind speed or light intensity could affect the rate of water loss but it was very unusual for any of them to explain why it had an effect.

(c) Although a significant number identified xylem as the tissue involved, far fewer realised it had an additional function in providing support. Responses often reflected confusion with the role of the phloem.

Question 5

Responses varied reflecting varying degrees of confusion and misunderstanding. There was the inevitable muddling of haploid and diploid, gamete and zygote and the numbers of pairs and single chromosomes. More thought that the presence of an **X** chromosome was indicative of a male than the **Y** chromosome.

Question 6

Candidates seemed to have a better knowledge and understanding of the digestion of protein than that of either starch or fat. The most frequent error was not identifying the pancreas as a source of starch digesting enzyme. There was clearly confusion between the food materials and the end products of digestion.

Question 7

(a)(i) Although there were a variety of correct responses related to different food chains within the food web a large majority of candidates were able to quote a correct example.

(ii) It would seem that a large proportion of candidates failed to note the phrased 'Using examples from this food web …' as they regularly gave definitions or descriptions of both primary and secondary consumers but omitted to quote examples. There were a few who erroneously quoted examples that were not part of this web.

(b)(i) This aspect of the understanding of all ecosystems has been examined many times in the past and still large numbers of candidates do not appreciate that the source of energy for all food webs is the sun.

(ii) Many candidates did not seem to realise that by comparing the percentage of total energy transferred the factor of the animal's size is basically eliminated. Only a very few recognised a difference between the insect and a mammal is the need for the latter to maintain a constant body temperature, normally above that of the environment, and that this leads to a constant loss of heat energy and its need for replacement. Thus a smaller percentage of input energy is passed on to the next generation.

(c) There are two alternative explanations as to the effect of myxomatosis, in the rabbit population, on the kestrels. Either suggestion was accepted and credit given for taking the explanation step by step through the potential chain of events. A large proportion of the candidates gave clear logical responses.

Question 8

(a) It was expected that candidates would describe how additional activity during exercise would cause a greater rate of respiration in the relevant muscles, a greater demand for oxygen and glucose and consequently a need for the removal of more carbon dioxide and heat from the muscles. This would explain why the rate of blood flow was increased.

(b)(i) Many hormones and other chemical agents were offered in response to this question but relatively few identified adrenalin as the correct response.

(ii) A very large proportion of the responses suggested factors that would lead to the heart increasing blood flow rather than the ways in which the heart could achieve this. Only a very small number offered both correct responses, increased heart rate and increased stroke volume, but both were offered singly by many candidates, the former being the more common response.

Paper 0610/03

Paper 3 (Extended)

General comments

This was the first time that candidates had the opportunity to answer the paper in its new format. All the questions were compulsory (instead of previously choosing two from four ***Section B*** questions) and the mark allocation had increased from 70 to 80 marks. Centres were required to choose the most suitable option for each candidate, with Paper 3 being appropriate for those likely to gain a grade A to C, although the full range of grades was available. Many Centres opted appropriately, but some chose to enter weaker candidates who inevitably struggled with questions containing material from the extended curriculum and more challenging questions from the core of the syllabus. The change in structure appeared to work well, with a broader range of questions allowing candidates to demonstrate their knowledge and understanding across the curriculum content. Even weaker candidates were able to make good attempts at answering some of the questions, notably **Questions 1**, **2** and **3**. Having all the questions structured helped candidates to keep their answers focused more and parts of questions did not get overlooked, as has happened in the previous format. Indeed, Examiners marked very few scripts where parts of questions had not been attempted.

A very good standard of answers was seen, but the paper still discriminated well and there was no evidence of any candidates running out of time. Examiners felt strongly that the new structure was fairer to the candidates since, previously, success depended to a certain extent on the choice of ***Section B*** questions.

Spellings were variable, even when the correct terms were written in the question. For example, in **Question 3 (d)**, pancreas was often written as *pancrease.* The question rubrics were usually followed, although a sizeable number of candidates failed to follow the instructions given in **Question 5 (b)** – 'without further reference to carbon dioxide' - filling the available spaces in parts **(i)**, **(ii)** and **(iii)** with details that were irrelevant.

Explanatory questions proved to be the most difficult, with candidates failing to be sufficiently precise with their terminology. For example, comparative terms, qualifying words and linkages were often omitted.

Comments on specific questions

Question 1

The question was accessible to examinees of all abilities.

(a)(b) These were answered correctly by most candidates.

(c) The majority were able to construct the food chain correctly. A few tried to include all the organisms named in the question stem, while some placed the arrows in the wrong direction. Some began without a named producer (usually *plants* instead of grass).

(d) This was usually answered well. However, some gave an answer that was too general, such as '*they can get more food*'. The benefits of teamwork were often mentioned, but answers usually failed to state the increased chance of a kill that would result.

(e) Most candidates successfully extracted information from the question stem that jackals have alternative food sources. More imaginative answers stated that jackals would kill sheep in unprotected flocks. Weaker answers suggested that jackals have other food sources, without naming them.

(f) A range of acceptable answers was seen here, including trachea, oesophagus, spinal cord, arteries and veins. Some thought that the aorta or vena cava is present in the neck. The structures needed to be named, so vague responses such as *blood vessel* were not accepted. The term *vertebrate* was sometime confused with *vertebrae.*

(g) Most were aware that plastics tend to be non-biodegradable and gained a mark. Most went on to define the term, rather than give an explanation for the problem this would cause. The best answers referred to problems of visual pollution, scavengers choking on the plastic or the air pollution caused by burning the plastic collars. Some thought that toxic gases would be given off as the plastic decayed, or that animals would get trapped in the collars. Vague references to pollution were common.

Question 2

The question was generally understood and answered well, although part **(e)** proved to be more challenging.

(a) Most were able to give an accurate definition of the term *balanced diet.* Some candidates tried to list all the essential food classes, but usually omitted at least one, although they had been listed in the stem of part **(b)**. Many failed to use the terms *nutrients* or *foodstuffs* in their definition.

(b) Carbohydrates and fats were usually correctly selected. Occasionally, protein or fibre was chosen as a second answer.

(c)(i) While most candidates identified student Z as being obese, too many confused the other two. It was apparent that they had not used the chart, **Fig. 2.1**, in their identification.

(ii) This was generally answered well, with an increased chance of a heart attack and diabetes being the most common responses. A few described the causes of obesity instead of suggesting the health problems. There were occasional vague references to heart or breathing problems, without giving more detail.

(d) Most could name the units making up all three food molecules. A small minority only gave one answer for fats, although the value of the question indicated that, in total, four answers would be needed.

(e)(i) Most candidates correctly stated *enzyme* or *biological catalyst.* A few stated *catalyst* unqualified, or named a specific enzyme.

(ii) This was answered less well. Correct explanations involved the need for the molecules to be small and soluble to pass through the wall of the intestine or through capillary walls into the blood stream. Very few were aware of the use of the small molecules in synthesising new compounds. Some candidates tried to answer the question in terms of increasing surface area, which was not relevant here. Misconceptions included references to small molecules being easier to swallow or to be digested.

Question 3

Again, candidates tended to score well on this question. Weak candidates struggled with parts **(c)** and **(d)**.

(a) The calculation was well within the abilities of the majority of candidates.

(b) All parts were well answered. A few lost marks for identifying tissues such as alveoli and sweat glands instead of organs. A significant number thought that the liver is responsible for forming urine.

(c)(i) A surprising number of answers failed to state the change in volume of sweat and urine before explaining the change, so the explanation was not accepted without a correct volume statement. While an explanation for an increase in sweat was usually correct, fewer could relate a decrease in urine production to the increase in water lost through more sweat being lost, or to a need to maintain the water content of the blood. Occasional references to the effect of the secretion of ADH were accepted.

(ii) This was usually answered correctly, although many candidates struggled with the spelling.

(d) This was well answered: the better candidates all gained maximum marks. Where confusion did arise, it was generally between glucose and sucrose, excretion and secretion, glycogen and starch, or liver and pancreas.

Question 4

Only the best candidates could gain high marks on this question. It separated candidates who understood the topic from those who had learned statements by rote.

(a) Surprisingly, while most were aware of the increase in surface area that root hair cells create, few stated that the cells occur in large numbers, or that they contain large numbers of mitochondria to provide energy for active uptake of minerals.

(b)(i) Most candidates could give an accurate definition of active transport. A few got the gradient the wrong way round.

(ii) Candidates generally understand that active uptake requires energy, provided by respiration.

(c) Some candidates need to study this topic in more detail.

(i) This is in the core of the syllabus, but few answers displayed a sound knowledge of the modifications of xylem tissue for its function of transporting water and minerals. Where lignin was mentioned, many thought that it is present to withstand the pressure of water inside the xylem, rather than preventing the collapse of the vessels as water is drawn through them.

(ii) Better answers referred to transpiration and some of the mechanisms involved in achieving water movement. However, vague, irrelevant descriptions involving osmosis were common, with weak candidates offering only a definition of the process.

Question 5

This proved to be a more challenging question than expected, with few candidates gaining very high marks. It discriminated well between the more able and less able candidates. There were some very confused ideas concerning global warming, the ozone layer, CFCs and ultraviolet radiation.

(a) Although there were some good answers about the greenhouse effect and its possible consequences, there were also some very confused ones where carbon dioxide was described as a poisonous gas blamed for depleting the ozone layer and causing acid rain.

(b) A significant number of candidates ignored the instruction not to make further reference to carbon dioxide, giving near-repeat answers to those already credited in part **(a)**.

(i) Answers were equally acceptable if they related to a coal-fired or nuclear power station. Few candidates referred to the burning of fossil fuels, even though they were aware of the production of sulphur dioxide and its effects. Vague references to damage to buildings or plants or animals were common. Often, lists of gases (including carbon dioxide, carbon monoxide, oxides of nitrogen and sulphur dioxide) were given as waste products from the power station. These were then all linked with specific effects such as acid rain, making the answer biologically incorrect.

(ii) In this question, candidates were generally clearer about the effects of deforestation and were more precise about soil erosion, changes to the water cycle and habitat loss. However, very few were aware of the dangers to the lungs of particulates from wood smoke. Too often, carbon monoxide was identified as being produced when wood is burned, which is unlikely, particularly if the wood is burned outside. Again there was confusion about how the ozone layer can be damaged.

(iii) Lists of gases were also given in this part. Candidates need to be reminded that they will lose marks if they give lists of items containing some that are wrong. Motor vehicles tend to generate oxides of nitrogen rather than sulphur dioxide. Obvious details such as the formation of oxides of nitrogen being the result of the combustion of petrol (or diesel or gasoline) were frequently absent. Few candidates were aware of the presence of lead in some fuels, or of the harm that lead or particulates can do to humans when inhaled. Indeed, little knowledge was shown of the differences in polluting effects of petrol and diesel. Better answers highlighted the dangers of carbon monoxide to human health.

Question 6

(a) Candidates using punnett squares to illustrate their genetic crosses tended to make fewer errors than those drawing traditional genetic crosses. In the traditional format, the cross between the genotypes of the parents was often omitted and the labelling of parent line, gametes and F1 were rarely given. Candidates should be encouraged to draw clear lines to show how the F1 genotypes are derived from the gametes.

Most were able to complete the crosses. Marks were sometimes lost due to carelessness, while not all candidates stated the ratios produced. In part **(ii)**, the phenotype of the cat associated with the ratio was not always identified.

(b) The better candidates were able to apply their knowledge of co-dominance to this unfamiliar situation and suggested that the cat would have fur of an intermediate length. Many, however, suggested that the cat would have a mixture of fur length.

Question 7

(a) Almost all the candidates could state the differences between the composition of colostrum and normal breast milk.

(b) The calculation was usually completed correctly, with the working shown. This is important since, if the candidate makes an error in deriving the answer, a mark may still be awarded for working with the correct figures. Some candidates showed little understanding of how to work out the answer, while others used the figures for colostrum in their calculation.

(c)(i) Orange juice was a universal answer, with few alternatives seen.

(ii) A surprising number of answers showed a complete lack of knowledge about the relationship between sugar and bacteria on the teeth. Many thought that it was the sugar itself that causes cavities. Very few recognised that sucking the sugary drink through a teat prolonged the contact of sugar with the teeth.

(d) Good answers were seen here. However, the term *symptom* was not understood by all, with some responses describing the effect of an iron deficiency on the blood.

Answer: **(b)** 20 g.

Paper 0610/04

Coursework

General comments

An increasing number of Centres are entering candidates for this paper. The majority of Centres have assessed their candidates appropriately, and it is encouraging to find that few adjustments are now needed to bring the standards from different Centres into line with one another.

In most cases, around 6 to 12 tasks have been used. Some Centres prefer to assess only one or two skills with each task, whilst others assess three together. It is now rare to see attempts to assess C1 and C4 on the same task, although unfortunately a few instances of this did occur.

Most Centres use criterion-based, descriptive mark schemes, at least for skills C2, C3 and C4. Many, however, are using well-constructed tick list schemes for C1, and a few also use these for the other three skills. Tick lists are easy to apply, but great care is needed when constructing them. A few Centres are still attempting to arrive at a mark simply by adding up ticks, which is not acceptable as it does not relate the candidate's mark to the descriptors for each level of performance.

Paperwork is generally accurately completed. One or two Centres, however, appear to have taken insufficient care in ensuring that marks are correctly transcribed from the candidates' work to the various forms, and that addition is correct. It is important to build in some type of checking procedure, as it is easy to make mistakes and these are often detrimental to the candidates.

Comments on specific skills

Skill C1

Almost any practical task can be used for assessing Skill C1. Some Centres have chosen to use tick lists, while others use descriptive schemes. Not all Centres included evidence for their assessments of this Skill with their sample. It is very important to do this.

Skill C2

This Skill involves observation and recording. Many Centres have chosen to use some tasks involving drawing, and others involving taking numerical readings – for example of temperature, time or volume – and recording these in a results chart.

Skill C3

Assessment of this Skill can only be done effectively where an experiment produces numerical results. Many Centres assess it using the same tasks as C2. This Skill involves processing results, drawing conclusions and evaluating results. Processing is normally assessed by calculations and/or graph-drawing, and most candidates show good graphing skills. In some Centres, computer-drawn graphs are used. This is acceptable, so long as the candidate is in control of the graph's format, including choice of graph type, axes and of scales, and the way that the line is drawn. Evaluation is a high-level skill, and is a good discriminator between weaker and stronger candidates.

It is now rare to see Centres using paper-and-pencil exercises to try to assess this Skill. This is unacceptable; like all of these Skills, C3 must be assessed using results obtained either by the candidates themselves, or from a demonstration involving them.

Skill C4

This Skill, involving planning and carrying out an investigation, is more time-consuming than the others, and most Centres offer their candidates only two attempts, usually assessed towards the end of the course. Some use the same exercise for assessment of Skills C2 and C3. While this is certainly possible, it needs considerable experience and care if it is to work successfully. The tasks used here vary widely. They normally grow out of related work that the candidates have done, so that they have had experience of a suitable technique that they can adapt to a new situation.

Care needs to be taken that the plan, the actual method used and the evaluation are a candidate's own, individual work. In some cases, it appeared that candidates had worked together, which is unacceptable. If necessary, the writing of the plan should be done under controlled conditions in the classroom or laboratory, so that the teacher can guarantee that each candidate's plan is constructed with no outside help.

Paper 0610/05

Practical Test

General comments

It was pleasing to note that few candidates performed poorly on this paper and an encouraging number performed really well, demonstrating an ability to follow instructions, draw diagrams, analyse and make reasoned suggestions.

It was appreciated that some Centres experienced some difficulty with the materials in **Question 1** and in obtaining suitable specimens for **Question 2**. This was taken into account when the mark scheme was finalised. Every effort was made to credit candidates who had followed instructions and to use their observations and results to reward deductions made. The fact that most Centres supplied information concerning the problems and specimens was useful to the Examiners, as was the inclusion of pictures that were, in some cases, used. Centres are reminded that this aspect of the examination (adequate completion of the Supervisor's Report) is very important. Centres are also reminded that they can contact CIE with any queries that they may have. It is particularly important the Centres contact CIE if they are unable to supply a specimen or piece of apparatus as alternative solutions can be suggested to ensure that their candidates are not at a disadvantage. Centres are also advised to ensure that reagents work well, giving a clear result, and they should, preferably, be freshly prepared and tested before the examination.

Comments on specific questions

Question 1

(a) Most candidates gained both marks here. The most frequent error was to record 'no change' for adding water to iodine. This is ambiguous and so was not credited.

(b)(i) In order to gain these marks, 16 distinct drops should have been drawn and the two groups of 8 clearly separated, either with a 'gap' or labelled. Some candidates had misunderstood and put a large drop consisting of 8 drops in one corner of a tile and another large drop of 8 drops in the opposite corner. Pitted or smooth tiles could have been used, so the number of depressions available should not have posed a problem as long as enough space was available. Candidates are advised to read ahead a little in order to be clear about what is required.

(ii) Candidates who scored well in this question are those who followed good basic procedures in preparing a table. All lines should be neatly ruled. The table should be capable of being used to record the information required in a clear manner. Rows and/or columns should have suitable headings, including correct units if appropriate (the recognised abbreviation for minutes is 'min.' and not 'm.' which is used for 'metres'). Enough space should be available to record all the results that are required. Candidates are also expected to use lines to include the headings in the table. An example of a suitable table (but not the only correct answer) is shown below:

Time (mins)	Colour when added to iodine solution	
	A	B
1		
2		
3		
4		
5		
6		
7		
8		

(iii) The question asked candidates to record *observations*. Conclusions such as 'starch present' were not appropriate. Candidates should be encouraged to record what they see and not to enter comments such as 'nothing' or 'no result'.

(c) Candidates were marked on the basis of their individual results. There was no indication from the paper that sodium chloride would speed up the reaction, although many candidates assumed that this would be the case, even when their results did not support this fact. Clearly many candidates struggled to interpret their results and Examiners were sympathetic in looking for reasonable deductions to credit. Many results indicated that the sodium chloride produced no effect on the activity of the enzyme but candidates were reluctant to state this, even if their results clearly showed it. A typical example is that of the candidate who has results of 'yellow' for both A and B for all times. These results clearly show that the enzyme alone and the enzyme with sodium chloride both broke down the starch within 1 minute. There is no difference in the behaviour of A and B. However, the candidate confidently states that 'sodium chloride speeds up the reaction'. There is no evidence to support this and so this deduction cannot be made. Some confusion was seen concerning the role of the amylase, starch and iodine even though this information was given in the stem at the beginning of the question and in (a). Even candidates who had obtained and recorded correct colour changes for the presence and absence of starch in (a) would state that the enzyme had broken down the starch because a blue/black colour was present.

(d) It was disappointing to see how many candidates experienced difficulty with a basic scientific principle. While some commented on the need to dilute the amylase, few went on to explain that this was to make the concentrations or volumes equal. Some candidates appeared to think that it would alter the pH. Weaker candidates failed to gain any marks, not even one for indicating a fair test or control, while even good candidates did not express themselves clearly enough to gain both marks.

(e) This part of the question proved to be challenging for many candidates. Some simply had little idea of how to describe a controlled experiment and only made suggestions of how to alter pH or test for starch. There were some excellent descriptions that were clear to follow and would work well but many were confused and it was difficult to see precisely what the candidate was attempting to suggest. Confusion concerning the role of amylase, saliva, starch and iodine was evident. It was not unusual for candidates to forget to add either starch or amylase when they had described in detail how to get solutions of different pH. Many were unsure which chemicals would produce acidic or alkaline conditions. The candidates were not required to suggest possible results, but many did - and spent much of their answer doing so. Time and effort was wasted in this way.

Question 2

(a)(i) Clear, large diagrams were drawn by a large number of candidates. Some sketching of the outline was seen. Candidates should be encouraged to use a single line. While most diagrams were of a reasonable size, some were too small to see details clearly. Candidates should be advised to make drawings at least 5 cm. in length. Some detail of texture is also normally required, in this case some idea of venation on the wing. Although being asked to label two parts of the fruit, many candidates did not and therefore lost marks. Centres who provided, as asked, a labelled diagram of the fruit provided to their candidates, gave valuable assistance to the Examiners.

(ii) Candidates had been asked to draw a line to indicate where they were taking their measurements and this was not done in a significant proportion of cases. In these cases, it might not be clear where the measurement had come from. A significant number of candidates measured length very inaccurately, even when they had followed the instructions concerning drawing the line. Examiners do check the measurements and will not award the mark if outside a reasonable tolerance. Some candidates did not include units and therefore lost a mark. Magnification is a common calculation that would be expected on this paper, but many candidates seemed to have little idea of how to perform the calculation. No units should be given for magnification and it is considered that answers to more than 1 decimal place give a degree of accuracy that is not practical. Candidates should be advised to give results to the nearest whole number or to 1 decimal place.

(b) The question clearly instructs candidates to cut around the outline of the *Acer* fruit on page 6. It was surprising how many candidates did not do this and, as a result, were unable to draw accurately around it on the grid provided.

(i) Although this is not demanding mathematically, it proved to be a challenge to many candidates. They were expected to use the squares on the grid to provide an estimate of surface area. There are very many candidates who have little concept of size and units of measurement and consequently they do not realise that the answers that they give are improbable. One 'large' square had an area of 1 cm^2 but the 'small' square had an area of 4 mm^2 and not 1 mm^2. This was a common error. Although a range of answers was accepted, some answers were so approximate as to be meaningless.

(ii) Some excellent explanations were seen but many were poorly expressed. Many candidates simply stated that they had multiplied length by width, which was credited with one mark. It was pleasing to see a significant number of candidates who appreciated that the fruit had two surfaces.

(c) The key words in this question were 'describe' and 'environmental'. Answers such as 'wind affects the distance travelled' did not contain enough detail to be awarded a mark. Candidates were expected to make statements such as 'on a windy day the fruit will travel further'. This actually described the effect that the wind would have. Some candidates simply described modifications of the plant while others wrote about pollination, which was not relevant.

Paper 0610/06
Alternative to Practical

General comments

The paper included a range of differentiated questions for candidates to answer to show their experimental skills and ability C1 to C4, as outlined in the syllabus booklet page 17-19.

In most Examiners' allocations there were Centres with good candidates of high ability and all Examiners reported that candidates appeared to have adequate time to complete the paper. Many candidates managed to achieve high scores and all of the points on the paper were achieved by different candidates.

The standard of English seen on the scripts was high and the drawing and line graph were generally constructed using a pencil.

Range of marks noted 0 to 40.

Comments on specific questions

Question 1

This question was based on the passage of water molecules into or out of onion epidermal cells when placed in sugar solutions of different concentrations.

(a) The width measurement of four different cells was required. The line to be measured was clearly printed on the drawings. Most candidates correctly recorded the same measurement for Fig. 1.1 and used SI units either cm or mm. Unfortunately, there were a significant number of candidates who failed to record which unit of measurement was used. The line in Fig. 1.3 was shorter, as the cell was plasmolysed and in Fig. 1.4 the line was longer as this cell was turgid and the cell contents had increased.

(b) The identification of the solution, in which each of the cells had been placed, was considered separately to the explanation.

Candidates who had carried out this type of practical were able to identify the solution and offer an explanation involving osmosis and the diffusion of water either into the cell (Fig. 1.4) or out of the cell (Fig. 1.3). In the case of the cell in Fig. 1.2 this diffusion was balanced and so there was no net movement of water. Some candidates answered with reference to the 'passage of water molecules from a region of their higher concentration to a region of their lower concentration', as given in the core syllabus, or some referred to the concept of water potential gradient as in the supplement. The direction of movement needed to be clearly expressed either into or out of the cell as relevant.

Although there were many excellent answers, some candidates need to be clear about these concepts and to identify the direction of movement of the water molecules and not the sugar molecules. Candidates are often confused over terms such as osmotic potentials, concentration of solutions and solvents.

Question 2

The question was based on a series of recorded results for an enzyme, amylase on the breakdown of starch using iodine solution to test for any starch which may still be present in the reaction mixtures.

(a)(i) Table 2.1 recorded the colour changes of a sample of the reaction mixture in three test tubes A, B and C. The third sentence in the introduction clearly stated that the starch had been completely digested when the orange brown iodine solution does not change colour.

Most candidates recorded the times for tubes A and C correctly but others recorded the change from black to dark brown where the starch was only partially broken down.

(ii) Tube C had 1 cm^3 of 0.5% sodium chloride added instead of water. This made the breakdown of the starch faster by at least 7 minutes. An explanation for this was not required as it is beyond the syllabus. Enzymes are defined as proteins that function as biological catalysts. Sodium chloride is an inorganic compound it speeds up the reaction it does not affect pH as some candidates described.

(iii) The role for tube B in this investigation was to act as a control for tube A so the colour changes might be compared. Most candidates realised this point but there were some candidates who thought that tube B 'controlled the reaction' and did not appreciate the comparison aspect. Other candidates described the effect of denaturing the enzyme by boiling but did not continue to describe the role of this to the overall investigation.

(b) This section was based on planning a different investigation, namely, to show the effect of pH on the activity of amylase. (Skill C4). If candidates had carried out this investigation or practised planning an investigation then by including experimental details the full marks were gained readily. The plan should involve controlling the concentrations and volumes of reactants (starch and amylase), the conditions such as the temperature and using similar apparatus and testing methods, so there is only one variable, that of pH. Many of the details were given in the introduction to the first experiment.

The method for controlling pH by the use of buffers or addition of diluted acids or alkaline substances was credited as also the idea of repeating the experiment to verify the results. Some candidates expressed confused ideas concerning pH and thought sodium chloride (see **(a)(ii)**) controlled pH.

Many of the candidates did follow the details given and their plans could be easily followed. However, other candidates gave a description of digestion of starch (as well as other foods) in the alimentary canal and failed to refer to any experimental details. A few candidates misread the instructions and incorrectly described details of an experiment to follow changes in pH as the breakdown of starch took place.

Question 3

The third question was the longest and was based on the structure of wind dispersed fruits and the handling of a set of data, and short questions concerning the dispersal of these fruits.

(a)(i) The candidates were required to make a large drawing of one of the two joined fruits shown in Fig. 3.1. Candidates could choose which fruit to draw. Although many candidates did follow this rubric and drew a single fruit, there were a significant number of candidates who drew both fruits joined together. A few candidates drew fruits which were completely different resembling lemons or tomatoes.

The standard of drawing varied from the accurate, large, well-proportioned version using a sharpened pencil for the outline to the small, rough and sketchy outlined one showing poor proportions which was difficult to recognise as one of the fruits.

The label to mark the position of the seed should be in the upper portion of the fruit above the lighter line with the wing-like extension below. The seed is not located at the junction line between the fruits and not along the wing-like extension. The position of the seed was the only label requested.

(ii) Most candidates correctly measured the length of the fruit in Fig. 3.1 and on their drawing and calculated the magnification. For those candidates who had drawn two fruits and therefore measured both fruits the calculation was credited. Magnification does not have a unit. This was a common error.

A few candidates expressed the magnification as a ratio.

(iii) Two methods of calculating surface area were recognised. Some candidates meticulously counted squares and included half squares covered by the fruits (sometimes it was the whole area minus the squares surrounding the fruit). Others measured the length and width of the fruit and calculated the surface area mathematically. The method chosen was clear from the measurements on the Fig. 3.1.

The units, mm^2 or cm^2, were often confused or not given.

Consideration was given to those candidates who based the drawing, magnification and determination of surface area on two fruits instead of a single fruit.

(b)(i) This part involved the calculation of five mean distances to complete the final column in Table 3.1.

Most candidates carried out the calculations correctly. Unfortunately, some candidates only recorded totals, failing to divide these totals by the number of results, five. There was plenty of spare space at the end of the question for rough calculations but some candidates used the Examiner's margin.

(ii) Most candidates attempted to plot an accurate line graph with the values for the surface area of the model fruit in cm^3 on the x-axis and the distance travelled/cm on the y- axis. Some candidates used a ruled line point to point and others a line of best fit. Either of these methods was acceptable providing that the line was accurately drawn. The scale caused problems for candidates. The range of values for the surface area of fruit increased by 32 cm^2 for each set of repeated values of distance travelled and an even scale was required. If this range started from 30 cm^2 (instead of 0 cm^2) and used one mm square to represent 2 cm^2 an even scale filled the printed grid. The vertical scale for the mean distance travelled in cms for a value of 0 or 25 to 50 cm an even scale could be used to fill the printed grid.

Common errors noted included the incorrect orientation of axes; incomplete labelling of the axes or not labelling the axes; use of scales which were not even; incorrect plotting; extrapolation of the line for the graph beyond the plotted points. A few candidates inappropriately plotted a histogram when the question requested a line graph.

(iii) Many candidates described the relationship between the surface area and the mean distance travelled by the fruit as almost linear where the increase in surface area of the wing-like extension of the fruit carried the fruit further from the parent plant. The data showed an almost a linear relationship and gave the opportunity for candidates to express this by referring to the gradient of the line plotted on the graph.

(iv) The importance of seed dispersal away from the parent plant was discussed by most candidates with reference to reducing over-crowding of the seeds on germination thereby reducing also the competition between seedlings for space, water or light. Some candidates inappropriately discussed pollination, increasing variability, natural selection or avoiding disease.