CONTENTS

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

GCE Advanced Level and GCE Advanced Subsidiary Level

Paper 9700/01
Multiple Choice

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

General comments

The standard achieved by candidates was very good, the mean being 28.8 (72%). The spread of scores was high, with a standard deviation of 6.2. Eleven questions were answered correctly by 80% or more of candidates - **Questions 1**, **2**, **6**, **11**, **18**, **20**, **27**, **29**, **33**, **34** and **38**. Only one question, **Question 30** was found to be difficult. The great majority of questions discriminated well between candidates of different abilities. Only in **Questions 4**, **7**, **10**, **30** and **31** did stronger candidates perform less well than expected.

Comments on specific questions

Question 4

The resolution of a light microscope was well known but there was a degree of guesswork, even amongst the more able, as to the resolution of an electron microscope.

Question 7

The low discrimination shows that more able candidates were little more secure in their understanding of plant water relations than the less able. After one hour, the water potential of the cell would be the same as the water potential of the solution, making the pressure potential zero.

Question 10

Too many of the more able were attracted to option **D**, resulting in poor discrimination. The iron atoms in haemoglobin form a loose association with oxygen; they are not oxidised.

Question 30

The characteristics of a bronchiole were not well known; weaker candidates guessed at the answer while too many of the more able chose option **A**.

Question 39

The ecology questions were answered well; only the weakest confused community with population.

Paper 9700/02

Paper 2

General comments

There were many extremely encouraging answers to all six questions especially **Questions 1**, **3** and **5** from the well prepared candidates, though disappointingly there were some very low scores, and even the more able candidates had some difficulty with **Questions 2 (c)** and **(d)**, **4 (b)** and **6 (a)** and **(c)**.

Candidates often lost marks by not using their biological knowledge to answer the question set. For example, in **Question 1 (c)**, where candidates were asked to describe the effect of *tar* from cigarettes on the *lining* of the gaseous exchange system, many inappropriately described the effect of smoking on the lungs and even the heart with mention of bronchitis, emphysema and heart disease.

Again, in answer to **Question 4 (b)**, many candidates spent far too much valuable time giving a theoretical explanation of the hydrolysis of starch, involving enzyme action, with no experimental details of how the rate of hydrolysis would be determined.

Other candidates were far too imprecise in their answers. For example, in **Question 2 (d)**, candidates were asked to explain the role of decomposers in the cycling of carbon and nitrogen in ecosystems, but gave generalised accounts involving aspects of both cycles which did not involve decomposers and even mentioned the uptake of carbon dioxide in photosynthesis.

There were sufficient marking points to allow candidates to demonstrate their knowledge and understanding and most candidates appeared to have had sufficient time.

Comments on specific questions

Section A

Question 1

There were some high scoring answers to this question.

The vast majority of candidates stated three correct ways, visible in Fig. 1.1, in which the artery differed from the vein. Most responses included reference to one or more of the following: a thicker wall, narrower lumen, more muscle and a round versus irregular shape. Few referred to the 'crinkly' lining of the artery and rarely to the wall to diameter ratio.

Weaker candidates inappropriately mentioned arteries containing oxygenated blood and blood under high pressure, neither being visible differences. For the majority of candidates this was a chance to pick up the maximum marks and there were some excellent comparative sentences.

Candidates were required to explain the *role* of capillaries in the lungs. Weaker candidates merely referred to the uptake of oxygen and release of carbon dioxide. Only the most able explained that the capillary network provided a large surface area for gas exchange, with the one cell thick capillary wall/endothelium and the intimate relationship with the alveoli maximising the efficiency of gas exchange by diffusion. Weaker candidates wrote at length on gas exchange, were not precise enough about the direction of movement of carbon dioxide and oxygen and referred to the capillary being one cell thick with no mention of the actual wall.

The key word here was *lining*, candidates being asked to describe the effect of tar from cigarettes on the lining of the gaseous exchange system. Far too many candidates at this level, as mentioned earlier, answered in terms of emphysema, chronic bronchitis, phlegm production, blockage of airways, even coughing blood, which are all consequences of damage to the lining, when what was required was reference to the destruction of cilia, the production of excess mucus by goblet cells/mucus glands and the effect of carcinogens causing mutation with lining cells becoming cancerous.

Very weak candidates referred to tar coating the lining and preventing gas exchange.

Question 2

Overall a sound level of response.

(a) A significant number of candidates were able to calculate how much energy is available to the primary consumers in Fig. 2.1, which showed the flow of energy through an ecosystem, the correct Figure being 14147 (kJ m^{-2} $year^{-1}$).

(b) Again, many candidates were able to use the formula given to calculate the efficiency of energy transfer between the secondary consumer and tertiary consumers in this ecosystem. The correct Figure was 3.74%. A significant number of candidates did not express themselves to 3 significant Figures i.e. gave 3.7, 3.739 and often omitted %.

(c) Here candidates were asked to explain an advantage of individual consumer species feeding at different trophic levels in food webs. Only the most able understood what was required, appreciating that the species did not have to rely on one food source and therefore there was less chance of starvation. Exceptionally good candidates understood that more energy was available at *lower* trophic levels and often quoted comparative Figures from Fig. 3.1 to substantiate their response. Weaker candidates failed to link energy availability with trophic level and were confused as to *lower* and *higher* trophic levels. For many detritus was a species. Few candidates made reference to such consumer species being able to sustain a larger population.

(d) In explaining the role of decomposers in the cycling of carbon and nitrogen in ecosystems, the best candidates referred initially to the breakdown/decay of organic material with occasional mention of starch/cellulose being hydrolysed to sugars, which were respired with the release of carbon dioxide. Similarly proteins could be converted to amino acids, deaminated with the release of ammonia which became available for nitrification to nitrites and nitrates. Weaker candidates confined their response to the carbon cycle with the release of carbon dioxide and/or inappropriately referred to aspects of the carbon and nitrogen cycle which did not involve decomposers, believing that *all* micro-organisms involved in the nitrogen cycle including denitrifying and nitrogen fixing bacteria are decomposers. "Decomposers decompose and release carbon and nitrogen back into the soil/air" was as much as many could write.

Question 3

There were many excellent answers to this question in which candidates had to complete a passage on cholera.

Even the most able occasionally had difficulty with the spelling of the name of the bacterium which causes cholera, *Vibrio cholerae*/*V*. *cholerae*, as well as with the required reference to an 'immune response', the consequence of the vaccine stimulating the lymphocytes lining the gut. There were a range of answers for the immune response including active acquired immunity and humoral response.

Most appreciated that cholera bacteria are transmitted by contaminated 'food/water', although faeces occurred quite frequently. There were many different spellings of 'diarrhoea' in describing the symptoms that can quickly lead to dehydration and death. Some candidates had the β lymphocytes producing antitoxins, antibiotics or even antigens rather than 'antibodies'.

Question 4

The standard of response in **(a)** was generally good though answers to **(b)** were frequently very disappointing.

(a) Candidates were required to complete a table to show which of the five statements given applied to each of the polysaccharides, starch, glycogen and cellulose. The most knowledgeable candidates had no difficulty in correctly completing the table. The vast majority of candidates understood that all the carbohydrates possessed glycosidic bonds between monomers and that starch was the only polysaccharide stored within chloroplasts.

Weaker candidates did not appear to appreciate that only starch can exist in two forms - a branched and an unbranched chain or that the monomer in cellulose is β glucose.

(b) Candidates were required to determine the rate of hydrolysis where the enzyme amylase was added to a solution of starch at 25°C. The Examiners were looking for some reference to taking samples at timed intervals, either testing with iodine solution to determine the end point/no blue black colour/starch remaining, or with Benedicts to measure the amount of glucose/reducing sugar produced, noting the time to reach these end points, and a suitable explanation of the rate calculation/initial rate determination.

Many candidates were often able to describe how they could investigate the action of amylase on starch (although they insisted on adding iodine solution or Benedicts initially to the mixture), but gave no indication of how they would measure the rate of hydrolysis. Only the most able of candidates appreciated that the rate could be calculated over, for example, the first 30 seconds or as the initial rate with the shape of the tangent to the curve as close to 0 as possible or as ^{1}/time. Several candidates surprisingly determined rate by counting bubbles.

Exceptionally, candidates made reference to a colorimeter providing more precise results or that the production of reducing sugar was more precise than the end point measurement with no starch remaining.

Unfortunately many weaker candidates simply described the hydrolysis of starch. They wrote generally about enzyme action including reference to active sites, activation energy, the effect of altering temperature, enzyme and starch concentrations as well as pH, even designing their own experiments around these variables.

Question 5

For many weaker candidates this was challenging question with imprecise answers. However for able candidates it was often a high scoring question.

(a) Many able candidates correctly distinguished and stated the roles of glycoproteins, carrier proteins and cholesterol in the cell surface membrane. Weaker candidates were unable to refer to glycoproteins acting as receptors for hormones/neurotransmitters or acting as antigens, and the distinction between receptors and cell recognition markers was not always clear. The best candidates understood that carrier proteins were involved in the active transport, using ATP, of polar substances against a concentration gradient. There are still candidates who think that facilitated diffusion requires ATP. The role of cholesterol remains a mystery for some but many candidates did refer to the maintenance or regulation of the fluidity of membranes or preventing the leakage of ions/polar molecules.

(b) Fig. 5.1 showed the concentrations and directions of movement of an ion **(A)** and a non-polar molecule **(B)** on either side of the cell surface membrane. Many candidates did not appreciate that **A** was moving against a concentration gradient and therefore a carrier protein and ATP would be required, or that **B** was moving with the concentration gradient, being a non-polar substance, and could do so passively by simple diffusion through the lipid bilayer.

Weaker candidates did not appear to comprehend the difference between an ion and a non-polar molecule and that their movement would be influenced by the chemical make up of the lipo-protein cell surface membrane. Some seemed to regard molecule **B** as water and wrote of osmosis or that **B** crossed the membrane through the carrier proteins by facilitated diffusion.

(c) In describing how particles, such as bacteria, are taken up by phagocytosis, few candidates referred to pseudopodia or extensions of cytoplasm, many referred to the enveloping/engulfing of the bacteria but omitted to mention the formation of a vacuole/vesicle. Only rarely did a candidate make reference to receptors on the surface of the cell or bacteria being marked by antibodies.

(d) Good candidates referred to hydrolytic enzymes in the lysosome of phagocytes being involved in the digestion of bacteria. Weaker candidates were not sure about the contents of a lysosome - toxins/antitoxins being incorrectly mentioned. Several referred to the lysosome as an enzyme or out of context referred to lysosomes destroying worn out organelles.

Question 6

There were few good quality answers to this question.

(a) Very few candidates explained why the athlete's oxygen consumption increased between two and six minutes as indicated on Fig. 6.1 in terms of an increased demand for energy by the muscles and the need for aerobic respiration. Many answered in terms of the need for more oxygen, cells (other than muscle) and respiration. The biological information given was often correct but did not answer the question.

(b) Many more candidates were able to explain why the athlete's oxygen consumption took more than four minutes to decrease to resting values after the end of exercise. They made suitable reference to an oxygen debt which needed to be repaid in order for the liver to breakdown lactic acid, converting it to glucose/pyruvate before respiration. Others referred to the increased rate of metabolism after exercise and the (re)oxygenation of both haemoglobin and myoglobin. Weaker responses included references to oxygen deficit and the reoxidising of myoglobin/haemoglobin.

(c) In stating two reasons why heart transplants are much less common than coronary by-pass surgery in treating heart disease, many responses were not well presented. Good candidates did refer to a shortage of donors and rejection by the immune system. Most responses involved comparative risk and cost. Other acceptable though infrequent responses given included reference to aftercare costs being prohibitive and the shortage of trained personnel to carry out the transplants. Many candidates' responses however were too vague, referring to matching blood types, people not being willing to donate hearts when they were alive and even discussing the pros and cons of heart transplants rather than answering the question.

Paper 9700/03

Practical 1

General comments

The quality of answers was high from many Centres with several candidates scoring well in excess of 20 marks out of a possible 25.

The Paper appeared to discriminate well between candidates but allowed all candidates to demonstrate their knowledge and practical skills.

As always, Supervisor's reports proved most helpful. There was some evidence that some of the solutions provided had been incorrectly made up. It was possible to allow for this when details of their preparation had been provided.

Some fruit substitutions were made by Centres and concentrations of glucose contained within the fruits sometimes varied from the expected, as indicated by the Supervisor's Report. When this happened, the mark scheme for those candidates was modified accordingly.

There was no evidence of a lack of time.

Comments on specific questions

Question 1

(a)(i) This was answered well by most candidates.

Most candidates correctly identified the standard solutions and obtained a good colour range from blue to brick red. However, making an incorrect dilution in **(ii)** or leaving the solutions to boil for too long sometimes produced incorrect colours. This question proved to be a good test of practical ability.

(ii) Most candidates managed to correctly dilute the solutions. However some candidates used wrong volumes and failed to produce an accurate solution.

(iii) This part was not well answered. More able candidates noticed that the question was worth 3 marks and produced three good points such as using the same volumes of solutions; leaving for the same time; or heating all at the same temperature. All too often however candidates gained only one of these marking points.

(iv) This section was well answered with candidates showing good understanding of using the solutions as a comparison. Only a few candidates referred to them incorrectly as a control.

(b) This section showed the widest variety of responses. More able candidates were able to list the fruits in order of reducing sugar concentration and went on to identify the range of sugar in each of the fruits by comparing them with the standard solution. All too often however, answers were vague and failed to relate their results to the standard solutions.

(c) This section was attempted by most candidates but good quality answers were not often present. Vague references to comparing colour did not score. What was required was an understanding that this is not a quantitative test, or that reducing-sugars may also be present in the fruits.

Question 2

(a) The quality of drawings varied considerably. Many failed to realise that a plan drawing had been asked for and details of individual cells, was not required. Credit was given for a clearly drawn plan.

Many candidates scored full marks and produced labelled plans, clearly showing the different tissues and their arrangements.

(b) This section was not answered so well. Again, more able candidates realised that four marking points were required. Clear comparisons such as the cells in the palisade layer are rectangular but the cells in the spongy mesophyll are irregularly shaped, scored marks. Single, non comparative statements, such as palisade cells are rectangular, failed to score. Credit was also given for comparing the number of chloroplasts, the closeness of packing and the size of the cells.

Paper 9700/04

Paper 4

General comments

The Paper showed a large range of marks and there were a large number of high scoring candidates. However there were a number of low scoring candidates whom did not appear to be prepared for this examination.

Comments on specific Question

Question 1

This proved to be a difficult question for many candidates. A large number of candidates made general statements which did not apply to the whole of the graph.

(a) Here the candidates made no reference to low or high light intensity nor to the increase in light intensity and their general statements therefore gained them no marks.

The Examiners were looking for reference to the difference in the carbon dioxide production at low light intensity, the different compensation points, and the effect of higher light intensity on the sun and shade leaves.

(b) A large number of candidates incorrectly referred to light being the limiting factor. However some candidates realised that light was no longer a limiting factor and question quoted temperature or carbon dioxide as the limiting factor.

(c) General statements were given with reference to the effect of temperature on enzyme reactions. However few candidates realised that at low light intensity light would be the limiting factor and therefore an increase in temperature would not have an effect.

Question 2

This question was generally well answered.

(a) A large number of candidates made reference to the cytoplasm and to the matrix of the mitochondria. However a number of incorrect answers referred to the stroma of the mitochondria and to the chloroplasts.

(b) The majority of candidates had a good understanding of the role of this coenzyme but very few referred to it as a coenzyme. A large number of candidates made reference to it being a hydrogen carrier from glycolysis/the link reaction/or krebs cycle to the electron transport chain. Few referred to its role in the oxidation of triose phosphate to pyruvate in glycolysis nor to its role in anaerobic respiration.

(c) Very few candidates scored three marks. A number seemed to think that reduced NAD passes its hydrogen directly to oxygen to form water. Good candidates realised that oxygen is the final acceptor at the end of the electron transport chain and that without oxygen the chain will not work, therefore reduced NAD cannot be oxidised.

(d) It was well known that aerobic respiration produces more ATP than anaerobic. A number of candidates went on to state, “therefore to produce the same amount of ATP more glucose would have to be broken down in glycolysis”.

Question 3

(a) This was generally well answered. However a number of candidates failed to quote figures for the glucose concentration and the time. Few noted that the level of glucose fell below the original level before recovering after 240 minutes.

(b)(i) A number of candidates did not explain how the changes in blood glucose caused an increase in the concentration of insulin in the plasma but described the graphs and related sets of figures across the two graphs. Few referred to the hypothalamus as being the receptor for the high glucose. The role of the alpha and the beta cells was often confused. The Examiners were looking for reference to the high glucose level stimulating the alpha cells in the islets of Langerhans/the pancreas to secrete insulin.

(ii) It was generally understood that when the glucose level dropped the beta cells were no longer stimulated and the secretion of insulin stopped. Few made reference to the insulin being broken down.

(c) This question was well answered. However some candidates confused glucagon with glycogen and had the glucagon being converted to glucose. Few made reference to the glucagon being secreted by the alpha cells nor to the fact that glucagon has the opposite effect to insulin.

Question 4

(a) Most candidates were able to answer this section but there were some blank pages. The majority crossed two heterozygous parents to give ¼ homozygous recessive. A number of marks were lost by not reading the question properly i.e. "show how warfarin resistant rats can produce warfarin susceptible offspring," a small number used crosses which only gave warfarin resistant rats. Once again not all candidates are clearly linking the genotype of the offspring to their phenotype. There were a few attempts to make the question sex linked.

(b) The majority of candidates correctly made reference to the large amount of vitamin K required by the homozygous dominant rats and that this may not be available in the wild. Some answers referred to the rats being eaten by predators.

(c) This section was not very well answered. Vague references were made to survival of the fittest with no mention being made of the rats. The Examiners were looking for the fact that the homozygous dominant rats would die through lack of vitamin K, the homozygous recessive rats would be killed by the warfarin, leaving the heterozygous dominant rats to reproduce. This would result in 50% being heterozygous.

(d) Most candidates offered Sickle cell anaemia as the example of which there was generally excellent knowledge. Some candidates correctly identified the change in the codon/triplet, the change in an amino acid resulting in a different primary protein structure and hence the probability of a change in protein function. However a number of candidates gave examples which were not the result of a single base substitution or were chromosome mutations.

Question 5

(a) This was a good discriminator and an opportunity to gain good marks for thoughtful, well structured answers. The Examiners were looking for reference to the globin being hydrolysed to amino acids, the iron being removed from the haem and reused and the remaining part of the molecule forming bile pigments. Some candidates had the globin being converted to pigments and the haem to amino acids. There were many odd answers including reference to the ink particles being involved in the breakdown of the haemoglobin, the candidates obviously did not understand the stem of the question.

(b) This section was well answered, reference was made to the removal of the amino group, its conversion to ammonia which was then converted to urea. Only a small number referred to the formation of the keto acid/oxo acid.

(c) This section was not very well done. A number of toxic compounds were acceptable to the Examiners e.g. alcohol, ammonia, lactate and hydrogen peroxide. The most common answer was alcohol, however not many candidates referred to it being oxidised to ethanal/acetaldehyde. There were some confused answers such as "ammonia reacting with carbon dioxide in the ornithine cycle to produce energy", "alcohol being deaminated to ammonia" and "the hydrogen peroxide of urea being transaminated".

Paper 9700/05

Practical 2

General comments

The quality of answers was very high from many Centres with several candidates scoring well in excess of 25 marks out of a possible 30.

The Paper appeared to discriminate well between candidates but allowed all candidates to demonstrate their knowledge and practical skills.

As a general principle, some candidates are failing to realise that a four mark question requires a four mark answer. The number in square brackets is a very useful piece of information. Candidates would be well advised to take this information into account when writing their answer.

There was no evidence of a lack of time.

Comments on specific questions

Question 1

(a) The quality of tables produced by candidates in this part varied considerably. Good tables had the units only at the heads of the columns and did not repeat them after every recording. Many candidates failed to realise that a total of five readings was required and only completed four. More able candidates reset the apparatus after each reading but if the bubble was moving slowly, it was just possible to complete all five readings without resetting the apparatus.

(b)(i) Credit was given for correct calculation and also using the correct units. Candidates who used the less accurate cm for measuring in part **(a)** were required to convert them into mm in part **(b)(i)**.

(ii) This was well done by most candidates. Credit was given for stating that the seeds absorbed oxygen, released carbon dioxide, and that the carbon dioxide was absorbed by the soda lime. Credit was also given for correct reference to pressure and temperature changes.

(c)(i) This was also well done with most candidates realising that the volume of carbon dioxide released was greater than the volume of oxygen absorbed. This indicated a clear understanding of the process taking place.

(ii) Not surprisingly, this was only completed successfully by the most able candidates. However many candidates did score full marks on this section demonstrating excellent understanding of respiratory quotients.

Question 2

(a) This discriminated well between more able and weaker candidates. There was evidence of some excellent diagrams that were clearly produced from what was seen under the microscope. Good scale and good labelling all scored marks. Good candidates scored full marks on this part. All too often however, candidates drew textbook diagrams from memory. Candidates should be encouraged not to do this as it inevitably costs them marks.

(b) This question produced a range of answers and it was clear that some candidates had never used an eyepiece graticule. This is a simple skill and it is suggested Centres should ensure that all their candidates are capable of using graticules accurately. This skill is sure to be re-tested again, some time in the future. Most candidates however did score one of the two marks by using the correct units. This is to their credit.

Question 3

This question proved to be a good indicator of testing a candidate's scientific method. Most candidates scored at least five to six marks on this question. However marks were often lost for not specifying timings and precise volumes used. Also very few candidates planned to repeat the experiment and take an average for more accurate results. These are all skills that would have scored them marks. More able candidates identified a clear end point, explained how they would use the data and went on to give scientific knowledge on the effect of high temperatures on the structure of the enzymes. This was a question where good candidates were able to really show what they could do and were given credit accordingly.

Paper 9700/06

Options

General comments

The standard was similar to that of recent years. Examiners were pleased to find scripts spanning most of the mark range, with candidates being well prepared by their Centres.

Many candidates quoted figures in the data response sections. It has often been a past criticism that candidates did not make sufficient use of figures, so this was a welcome feature.

In general, the interpretation of data from tables and graphs was adequately carried out. However, a significant number of candidates appeared to only gain marks where they could exhibit a knowledge of factual material, with weak responses where asked to apply knowledge or analyse data. These are vital skills at this level. Candidates need to take every opportunity to attempt questions of this type, to gain confidence in applying their factual knowledge.

Once again the most commonly preferred option was Growth, Development and Reproduction, with Genetics also chosen by a significant number of candidates. Very few candidates made the mistake of answering more than one option, although some attempted both free-response questions from a single option, resulting in Examiners marking both in order to award the higher mark.

Comments on specific questions

Option 1

Biodiversity

Question 1

(a)(i) Most candidates correctly identified the parts.

(ii) A surprising number of answers confused these two.

(iii) The presence of rhizoids was commonly noted. The absence of true leaves, roots or stems would also have scored.

(b)(i) The majority of candidates gave two correct factors, although candidates did not seem to appreciate that the growth medium or CO_2 were relevant here.

(ii) Candidates found difficulty in making general statements. Some did appreciate that *R. loreus* grows more slowly than *D. majus* in most conditions and that both grow faster in high humidity, but few could go beyond this by noting that the effect was always greater for *D. majus*. Many candidates quoted figures but in many cases it was impossible to tell precisely to which treatment these referred.

(c) Structural deficiencies of Bryophytes were understood, such as lack of cuticle, vascular tissue or true roots. Few answers related this to increased water loss or reduction in efficiency of water absorption.

Question 2

(a)(i) Better prepared candidates were able to score well but many did not clearly show a cell wall or membrane. Overall this question was poorly answered.

(ii) Very few attempts were made here. Most candidates did not seem to know the size of *Chlorella*. It was expected that a scale line/bar would have been drawn with 1µm represented as between 2mm and 15mm.

(b)(i) Cilia, cytostome or 2 nuclei (macro- and micro-) were frequently stated here.

(ii) Candidates were aware of mutual benefits. Most realised that *Vorticella* gained photosynthetic products from *Chlorella* but were less aware of the movement of a nitrogen source or CO_2 in the opposite direction.

(c)(i) Some incorrect references were made to CO_2 but the presence of light for photosynthesis was usually noted.

(ii) The aerobic reference usually led to the idea of oxygen release.

(d) Animal feed and fertiliser for the land were both given but possible production of biogas/methane was not appreciated.

Question 3

Fewer candidates chose this free-response question.

(a)(i) Most candidates gained marks by discussing the importance of high biodiversity. There was less awareness shown of effects on soil erosion, climate or the balance of CO_2.

(ii) The need for extra space for an expanding population, agriculture, towns and roads was understood, together with the use of forest for fuel and logging.

(iii) This proved the most difficult of the sections, with many rambling responses. A few references to reserves and the encouragement of ecotourism were made, but measures such as banning trade, educating consumers, providing aid and finding ways of sustainably using the forest, were less well known.

(b)(i) Good accounts of structure were provided, with many scoring maximum marks.

(ii) Responses tended to concentrate on the capture of the prey, with good descriptions of the roles of nematocysts. Few noted that the animal was a carnivore or named a food source. The process of digestion was understood, with references to the use of enzymes and both extra- and intra-cellular digestion.

(iii) This section proved more taxing. General points scored, such as the relatively large surface area to volume ratio in cnidarians and their small size. A few candidates appreciated that every cell would be in contact with water, explaining how this would aid gaseous exchange. Few references were seen to diffusion or the gases involved; surprising, in a question about gas exchange surfaces. The fish being more active was noted, along with its impermeable body surface. These ideas should have been extended; gills creating a larger area to provide the necessary oxygen supply.

Option 2

Biotechnology

Question 1

(a) Responses were poor, with few suggestions beyond the prevention of disease. Reduction of pollution or eutrophication, along with improved taste or smell would have scored.

(b)(i) Candidates needed to clearly indicate to which process they were referring in order to gain credit for aerobic v. anaerobic.

(ii) The process was not described satisfactorily. Few references were made to the organisms involved or the process of respiration but the removal of organic matter was occasionally noted.

(iii) Well-prepared candidates referred to methanobacteria respiring, producing methane and CO_2.

(c)(i) The need for light in photosynthesis was widely recognised.

(ii) The aerobic reference usually led to oxygen release.

(d) The production of animal feed or use as fertiliser often gained credit, while production of biogas was rarely suggested.

Question 2

(a) Given that the question was to discuss advantages, answers surprisingly lacked any degree of depth. Only a few responses mentioned increasing production to feed the world's hungry or being easier to grow in difficult situations or cheapness making them more affordable. Marks were usually only gained for the production of new crops with desirable features. A few candidates referred to potential long-term health effects. Other disadvantages such as might be caused by pesticides, herbicides or growth hormone use were unappreciated.

(b) Demonstrating that the product is safe was occasionally noted but ideas did not extend beyond this.

(c) Surprisingly few candidates could clearly explain this in terms of a lack of genetically engineered ingredients, inorganic fertilisers or pesticides.

(d) Candidates found it hard to express their ideas. Very few of the available marks were awarded, such as the possibility of only spraying once or the production of a higher yield. Credit would have been given for the reduction of glyphosate use and the resulting environmental benefits, together with savings in terms of energy, man power or machinery use.

Question 3

(a)(i) Some candidates realised that there would be a genetic link to the child but few other suggestions were made. A few responses incorrectly side-tracked into discussion of artificial insemination and progeny testing in livestock.

(ii) Candidates failed to gain relatively easy marks here. Opposition to the procedure by particular groups, the idea that it is naturally wrong or feelings of guilt are just some of the points that would have scored.

(iii) Generally candidates fared better on this section. However even here detail was lacking, such as the initial collection of seed, a suitable storage, moisture content or temperature, or monitoring for viability.

(b)(i) Although candidates understood the principles of these techniques, answers were poorly written. Most realised that this involved the attachment of enzyme to insoluble material but detail of physical and chemical methods were sketchy. Easy marks were often not gained e.g. a simple description of the production of alginate beads and their use being omitted.

(ii) There was some understanding of advantages, such as the potential re-use of the enzyme and the product being easily freed from enzyme. However, their long shelf life, protection from pH or temperature denaturation or the similarity to the way they act in cells appeared unfamiliar to candidates.

(iii) This was another disappointing section with candidates' answers lacking detail. A simple description of an experiment using alginate beads, either in a column or as solutions in a beaker and retrieval of the product, along with testing for the initial substrate and its product would have been credited here.

Option 3

Growth, development and reproduction

Question 1

(a)(i) These presented few problems except for **C**, which was often incorrectly identified as generative nucleus, despite the fact that it had obviously divided to give two male gametes.

(ii) Candidates provided excellent descriptions of the process of double fertilisation. It should be noted however that the diploid or triploid status of the products should be included to avoid loss of marks.

(iii) The spiky, rough nature of the exine was noted by the majority of candidates but a surprising number of comments on possible size or other features that could not be determined from the diagram were not credited.

(b)(i) Good candidates clearly explained that this was so no stigma secretion was present; the word *control* unqualified did not suffice.

(ii) Many responses merely quoted results from the table and drew conclusions from them, without indicating the reasoning behind the experimental method.

(iii) The role played by lipids, in particular the unsaturated triglyceride 2, was appreciated by good candidates. The numbers for the unsaturated triglycerides however, were misunderstood by many candidates as being numbers of double bonds present, resulting in nonsensical statements being made.

Question 2

(a) In both **(i)** and **(ii)** the role of the anterior pituitary gland was known. More errors occurred in **(iii)** where the answers were at times imprecise or incorrect.

(b) Good answers were seen in both parts. It should be stressed however that the rise in FSH and LH triggers puberty; many seem to think the reverse is true. A common error was to link both LH and FSH with either spermatogenesis or stimulation of testosterone instead of clearly stating their separate roles. The graphs were generally well described but care must be taken to quote exact figures and use the correct vertical axis. A few instances occurred where the hormones were described as decreasing when an increase was simply becoming less steep (e.g. testosterone 14-18y).

(c)(i) Well prepared candidates were able to calculate this correctly as 5g per year.

(ii) Surprisingly few were able to calculate this as 0.625 (0.63 s.f.), often forgetting to divide by the initial mean mass.

Question 3

This was the least popular of the free response questions.

(a)(i) Surprisingly few candidates were able to correctly name a Prokaryote. A common error was to think that binary fission somehow involved mitosis. DNA replication was recognised as integral to the process but few were able to describe the role of mesosomes or the formation of a cross-wall to produce two cells.

(ii) More details could have been provided of how the organism was grown. Most realised that sampling at intervals was needed but methods of assessing growth were often unclear. Descriptions of use of a haemocytometer, colorimeter or measurement of dry mass, colony diameter or number were all attempted but many were confused and generally lacked detail.

(iii) A few responses featured techniques not described in **(ii)**. The need for sterility and the problems of dead cells being present were generally understood but discussion rarely went beyond this.

(b)(i) The majority of responses lacked detail. Although most used suitable apparatus and attempted to set up experiments with only one factor missing, frequently no satisfactory method was described. Many candidates assumed that adding a cork to a test tube would eliminate oxygen, while detail of how unsuitable temperatures could be maintained was often omitted. The use of a control was likewise not clearly described. It appeared unlikely that many candidates had set up this experiment or seen it demonstrated.

(ii) Candidates often confused this with **(iii)**. Reasons why seed dormancy is occurring should be described in terms of the physical and chemical status of the seed.

(iii) Many candidates had unfortunately already discussed these in **(ii)** so did not always repeat the advantages here.

Option 4

Applications of genetics

Question 1

(a) This produced many very good responses, with use of correct terminology.

(b) This had been studied well. Few mentioned that the DNA should be extracted from a suitable cell or explained why the fragments separated on the gel but a good understanding of the process overall was shown.

(c) It was rare for a candidate to clearly state that close relationships were indicated by similar banding patterns or that choosing the right birds to breed would maintain heterozygosity. The majority of candidates however understood that it enabled relationships to be seen, so the most diverse could be bred.

(d)(i) Many good responses were seen.

(ii) It was understood that in selective breeding parents are chosen for particular features while genetic diversity becomes reduced. Ideas about the captive group were less well expressed, although a few candidates realised the need to maintain maximum diversity and that parents are not chosen for any particular feature.

Question 2

(a)(i) Very few candidates realised this would waste materials or energy.

(ii) Many good answers were seen describing random mutation, different enzyme production and the survival of resistant forms that then reproduce. The passage of resistant alleles to the offspring had also been well learnt.

(b) It was not realised here that the products of gene activity should be measured, namely mRNA or protein production.

(c) Good responses were made; many candidates achieving full marks in both sections.

(d) Generally a poor response was given. Some candidates showed a general understanding of linkage but failed to apply it to this situation. The importance of whether plants were heterozygous or not was unappreciated although some awareness was shown that resistance alleles would stay together.

Question 3

Similar numbers of candidates attempted the free response questions.

(a)(i) Candidates had prepared well for this; many scored maximum marks. A few responses confused this with crossing over in meiosis 1.

(ii) Candidates were similarly well prepared here. The genetic cause and symptoms of the disease were known along with its pattern of inheritance.

(iii) This proved more difficult. Some appreciated that it would be advantageous to know before having children, but few suggestions were made of steps that could then be taken to ensure an HD free child. The disadvantage of knowing someone will suffer from an incurable disease was recognised but the implications for another related person, in terms of their probable genotype, was not.

(b)(i) On the whole this was answered well. Some candidates lost marks by describing the genetic basis in **(i)** and then not including these points in **(ii)**. Candidates should be reminded to give examples which include both the feature and the species in which it is found.

(ii) This was well taught.

(iii) While candidates knew some suitable examples, insufficient detail of how the effect occurred was given. Again examples need to state both the phenotypic character and the specific organism.

Paper 9700/08

Practical 3 (Mauritius Only)

General comments

Overall, the Paper seemed to discriminate a wide range. The maximum mark for the Paper was 25 and the marks awarded ranged from 22 to 3. No Centres reported problems concerning the preparation or procedures and the practical work involved appeared to be carried out without any major difficulties.

More candidates failed to gain half of the available marks for **Question 2** than they did for **Question 1**.

Comments on specific questions

Question 1

(a)(i) All candidates completed this by following the instructions to measure the length of the potato strips, but marks were lost when candidates stated the measurements in cm, or if they used fractions of mm which could not possibly be measured accurately using rulers.

(ii) More candidates lost marks here than in part **(i)** because they often failed to calculate means or they failed to indicate whether there was an increase or decrease in length. Usually, the percentage change in length was calculated accurately and a double penalty was avoided because the calculation of the means were marked independently of the calculation of the percentages.

(iii) The correct trend was expected as the answer. This was marked objectively because of the known molar concentrations that were supplied to the candidates.

(iv) As usual, the marks awarded for the graph were given for the correct position of the *x* and *y* axes and for the accuracy of the plots. The axes were often not labelled and this resulted in the loss of one mark. Again, the plotting was marked independently of the marks awarded for the axes.

(v) Credit was given for the correct answer based on the graph constructed in **(iv)**. Often the graph was incorrectly plotted and therefore could not be used to determine the water potential. Some candidates ignored the instruction and gave an answer as molarity.

(b) Marks were obtained for giving sensible suggestions for improvements to the method which included, use of replicates, a larger range of molar solutions, and a more standardised way of preparing the tissue samples.

(c) More marks were lost in this part than were lost on the rest of the question because candidates did not address the part relating to the *shape* of the graph. Many candidates failed to gain the mark for the reason for the change. They did not recognise that a soluble carbohydrate is needed to lower the water potential of the solution.

Question 2

(a) Very rarely did candidates obtain full marks for this question. It was disappointing to see so many answers that listed xerophytic features which could not be observed on the specimen. It was expected that candidates should observe three of the following: a thick cuticle, sunken stomata in pits, a thick epidermal wall, and the fact that there are two outer layers (epidermis and hypodermic).

(b)(i) Drawings often gained full marks. Such drawings showed the resin canal surrounded by two layers of cells, the outermost having thicker walls than the innermost and both layers having contents in their cells. No labels were expected.

(ii) The cells of the mesophyll in this type of xerophytic leaf are almost unique in having an irregular shape. It was expected that candidates should note this in their drawings together with an indication of darkly stained contents and the fact that the cells fitted neatly together without air spaces.