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

General comments

Scores showed a very good spread around the mean of 27.1 (67.8%), the standard deviation being 6.1. Eleven items were answered correctly by 80% or more of candidates, **Questions 2**, **4**, **6**, **10**, **11**, **17**, **18**, **22**, **25**, **33**, and **39**. The most difficult ones, answered correctly by 40% or fewer were **Questions 8**, **26**, **34**, and **35**.

Comments on specific questions

Question 5

The relative difficulty of this item reveals a poor understanding of the function of mitochondria. It was not surprising that option **A** was popular as only this option mentioned energy. Option **C** attracted a high proportion of weaker candidates, indicating their confusion between respiration and gas exchange.

Question 8

This was a difficult item even for the most able. Option **D** was far more popular than the correct o because candidates did not take into account the loss of water molecules in the condensation rea during polymerisation.

Question 19

Weaker candidates had little idea of the answer, while the more able found this an easy item, making it a very good discriminator.

Question 24

The high discrimination was due to the large proportion of weaker candidates who thought that the diagram represented sieve tubes in phloem. Better candidates had little difficulty in making the correct identification.

Question 26

This was a difficult item for all levels of ability. It appears that candidates knew the effects of carbon dioxide concentration and the frequency of impulses in the vagus nerve, but few were aware of the role of pressure receptors in the aorta.

Question 30

Weaker candidates had little idea of how to tackle this problem, while it was not difficult for the more able.

Question 34

More candidates chose option **A** than chose the correct option, **C**. This was true even of the most able. Many candidates probably failed to take notice of the word 'least' in the question. Malaria is not passed directly from parent to child because it requires an intermediate host.

Question 35

This item reveals a poor understanding of the biology of the infectious agents responsible for diseases mentioned in section K of the syllabus. It is evidently not generally appreciated that viruses, prokaryotic cells and eukaryotic cells all contain genes, and that viruses are not cells.

Paper 9700/02

Paper 2

General comments

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

Candidates often lost marks by not using their knowledge to answer the question set. For example, in **Question 3 (a)**, where candidates were asked to explain why transpiration is the inevitable consequence of gaseous exchange in land plants, more than a few simply described the process of transpiration. Again, in answer to **Question 4 (a)**, many candidates described in detail enzyme action, the reduction of activation energy and even the factors affecting enzyme activity rather than restricting their answer to explaining how enzymes catalyse specific reactions. Other candidates were far too imprecise in their answers. For example, in **Question 1 (b)**, statements such as "triglycerides release/store more energy than starch" were far too common, where a more detailed and extended answer was required.

There were sufficient marking points to allow candidates to demonstrate their ability and most (candidates) appeared to have had sufficient time.

Comments on specific questions

Question 1

Overall a sound level of response.

(a) A significant number of candidates used the most efficient route and correctly measured the scale bar as the basis for finding the magnification of Figure 1.1, a drawing of an electron micrograph showing a cross-section of an alveolus and two adjacent capillaries. Many candidates however used a rather more time consuming method and additionally measured Figure 1.1 as part of their calculation, not realising that only the length of the scale bar needed to be measured to calculate the magnification e.g. $\frac{18\text{mm} \times 1000\mu\text{m}}{10\mu\text{m}} = \times 1800$.

There were a few who failed to give sufficient working as requested and it was not always obvious to see where the values came from.

(b) Many candidates correctly described the process of gaseous exchange between the alveolus and the blood, referring to concentration gradients, diffusion and oxygen being exchanged for carbon dioxide. Only occasionally did candidates make reference to the squamous epithelium of the alveolus, the endothelium of the capillary and the significance of the short diffusion distance into the capillary. There were many vague statements about the thinness of the layers. A significant number of candidates inappropriately described how the lungs were adapted for efficient gas exchange, referring to a large surface area and rich blood supply without describing the process of gas exchange as required in the question. Others described ventilation and even blood flow around the body. Surprisingly at this level some candidates had oxygen and carbon dioxide incorrectly diffusing out of and into the blood respectively at the alveolar surface.

(c) Only the best candidates were able to precisely name B lymphocytes/B cells/plasma cell as the name of the cells of the immune system that secrete antibodies. Many more generally referred to lymphocytes, several incorrectly gave T-lymphocytes whilst weaker candidates mentioned white blood cells or phagocytes.

(d) Candidates were required to describe the changes that occur in the airways/bronchioles during an asthma attack. Weaker candidates simply repeated the information given in the question in terms of antibody formation, histamine secretion and inflammation, and incorrectly stated that these, along with lymphocytes and pus, were responsible for the blockages in and narrowing of the bronchioles. A few candidates confused asthma with emphysema and described the wrong changes. Only the most able answered the question referring to secretion of excess mucus by goblet cells, the contraction of muscle, occasionally mentioning the leakage of fluid from the capillaries, all leading to congestion of the bronchioles and resistance to air flow.

Question 2

There were few maximum scores to this question, largely due to imprecise responses in **(b)** and **(c)**.

(a)(i) By far the majority of candidates correctly named the molecules labelled **A** and **B** as glycerol and fatty acid respectively. Weaker candidates occasionally confused the two molecules or stated glucose and carboxylic acid.

(ii) Condensation was the usual correct answer when stating the name of the reaction shown in Figure 2.1. Very good candidates exceptionally referred to esterification/ester bond formation. Weaker candidates often stated hydrolysis.

(b) This part of the question proved difficult for many. Candidates were asked to explain the advantages of storing triglycerides, as energy reserves, rather than carbohydrates such as starch. Weaker candidates generally stated that triglycerides released more energy. Few quoted appropriate comparative values and units to support this statement in terms of kJ/g or per unit mass, and only the most able made correct reference to the significance of the hydrogen/oxygen content of both reserves. There was some confusion about the bonds involved, a number mentioning C-C bonds, and more oxygen rather than less in triglycerides. Many candidates did not respond in terms of energy reserves but made inappropriate reference to triglycerides providing insulation and buoyancy.

(c) A considerable number of candidates could not precisely state how it is determin… person is sufficiently overweight to be classed as obese. There were many vague state… regard to being 20% overweight or having 20% more fat. Several confused BMI (Bo… Index) with BMR (Basal Metabolic Rate) or made vague statements about mass and h… Several gave the correct formula for the BMI but were unable to give the correct figure of >… Alternatively, others correctly quoted a figure of 20% or more above the recommended mass fo… height as determining obesity.

(d) Coronary heart disease, stroke, diabetes and occasionally cancer were most frequently quoted in outlining two risks of being obese. This was well answered. Most candidates had a very good knowledge of the risks. Vague reference to cholesterol, heart and mobility problems characterised weaker responses.

Question 3

There were some good quality answers to the question but many had difficulty with **(a)** and **(c)(i)**.

(a) Many candidates did not address the question which asked why transpiration is the inevitable consequence of gas exchange in land plants. Some reference to the stomata being open for gas exchange (as part of photosynthesis/respiration) and the consequential evaporation of water from the surfaces of the spongy mesophyll cells, with the loss of the water vapour by diffusion, via stomata to the atmosphere, was required. Many candidates simply defined or described transpiration, including details of the environmental conditions that affect the rate of transpiration, gave long descriptions of the uptake of water by roots or the whole transpiration stream, without referring to gaseous exchange and stomata. Others incorrectly stated that gases passed out/in because the stomata were open to let out excess water.

(b) In explaining how water moves from the xylem vessel to cell **B** in Figure 3.1, the vast majority of candidates mentioned osmosis and water potential gradients, occasionally referring to a partially permeable membrane (in the context of cell **B**). Many still refer incorrectly to the membrane being semi-permeable. The most able made additional reference to the apoplast pathway through the freely permeable cell wall. Several candidates simply listed apoplast, symplast and vacuolar pathways. It was exceptional to find any candidate referring to cohesion/tension and hydrogen bonding in their explanation.

(c)(i) Candidates were asked to indicate the direction in which water flows between cells **A**, **B** and **C**. Almost all candidates indicated the flow from **B** to **A** and **A** to **C** but many did not appreciate that water would also flow from **B** to **C** and lost marks accordingly. Some candidates' arrows indicated flow in the opposite direction, for example **A** to **B**, not appreciating that water flows from a less negative to a more negative water potential. Weaker candidates still refer to concentration gradients.

(ii) Most candidates correctly indicated the direction in which water vapour diffuses, with an arrow through the stomatal opening.

It is worth noting that candidates were asked in **(c)(i)** and **(c)(ii)** to draw *labelled* arrows. Very few candidates fulfilled this instruction.

(d) In stating two features of xerophytic plants that help to reduce the loss of water by transpiration from their leaves, the commonest answers involved reference to the reduction of leaf surface area, sunken stomata, hairs that trap moisture and a waxy cuticle. Common errors included inappropriate reference to spines, thorns and needles, folded leaves, shiny leaves, fewer stomata and even reference to root systems.

Question 4

There were some clear and precise answers to this question, though a considerable number had difficulty with **(c)** where the responses were often vague and general in character indicating the lack of detailed knowledge of genetic engineering.

(a) Good candidates answered the question which referred to the specificity of enzyme[illegible] specific reactions. These candidates restricted their answers to specifically shaped a[illegible] complementary to the substrate, moulding around the substrate (induced fit), combining [illegible] temporary bonds to form an enzyme substrate complex. Weaker responses included refere[illegible] substrates having the same or similar shape to the active site, some failed to mention the ac[illegible] site at all and others had the enzyme and substrate the wrong way round. The Lock and Key and Induced Fit theories were often given without appropriate qualification. As mentioned under 'General Comments' earlier, a considerable number of candidates gave biologically correct but inappropriate information on enzymes and did not address the question asked.

(b)(i) Most candidates correctly identified the restriction enzyme that cut the section of DNA shown in Figure 4.1 as EcoRI.

(ii) Not all candidates stated 'sticky ends', several referred to complementary bases, anti-codons, even introns and nucleotides in naming the unpaired base sequences that remain after the DNA had been cut by the three restriction enzymes shown in Figure 4.1.

(c) In explaining how lengths of DNA, cut by restriction enzymes, are inserted into plasmids, many did not appreciate the plasmid DNA would need to be cut with the *same* restriction enzyme/endonuclease. Where candidates referred to ligase, the vast majority incorrectly stated that this enzyme is used to promote the binding of DNA and plasmid 'sticky ends' rather than forming bonds between sugar and phosphate/phosphodiester bonds. A high proportion of candidates made no mention of complementary base pairing with hydrogen bonds between the 'sticky ends' or the pairing of C and G where 'sticky ends' are introduced as in the production of human insulin from genetically engineered bacteria. Imprecise responses made reference to "complementary sticky ends" (but no pairing) and ligase "sealing the backbone". Very weak candidates simply re-worded the question.

Question 5

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

(a) The most knowledgeable candidates made detailed reference to the female, *Anopheles*, mosquito sucking blood (from an infected person) and injecting saliva with parasites/plasmodia into an uninfected person. Weaker candidates simply referred to the mosquito 'biting' both the infected and uninfected individual. Occasionally candidates referred to the mosquito as the malarial parasite or referred to the mosquito transmitting the disease rather than the parasite. Quite a few thought that malaria is caused by a virus or bacterium and transmitted by poor hygiene, blood transfusions and contaminated needles. Able candidates did on some occasions make reference to reproduction of the parasite in the mosquito.

(b) The majority of candidates made appropriate reference to the presence of the nucleus/nuclear membrane, mitochondria and membranous organelles in stating two features visible in Figure 5.1 that indicated that the malarial parasite is eukaryotic. Common mistakes included the presence of ribosomes, cell membranes or descriptions of prokaryotic features.

(c) A considerable number of candidates in describing the effects on the body of the presence of malarial parasites in red blood cells concentrated on giving a list of symptoms and made little reference to the destruction/bursting of the red blood cells, resulting in the reduction in their number, to less haemoglobin and reduced oxygen transport. Weaker candidates referred to parasites using up oxygen in their respiration or filling up the space inside red blood cells. Few made any reference to the excretion of waste products/toxins by the parasites. As mentioned above most were aware of the symptoms of the disease and from a long list gained the mark available, the commonest correct responses given being fever and anaemia.

Question 6

There were many excellent answers to this question, but even the most able occasionally had difficulty with 'aerobic' to describe the exercise which uses the cardiovascular and gaseous exchange systems, and 'resting' to describe the pulse rate, measurement of which is used to indicate improvements in the fitness of the cardiovascular system. Many candidates gave 'strenuous' for 'aerobic' and a variety of unacceptable alternatives for 'resting', including heart, systolic and cardiovascular. A considerable number of candidates gave 'muscle' for liver, inappropriately referred to oxygen '*dept*' rather than oxygen '*debt*' and sometimes referred to 'inaerobic/unaerobic' when referring to 'anaerobic' respiration at the beginning of the passage.

Paper 9700/03

Practical 1

General comments

In general, the Paper was well answered by most candidates. The Paper proved to be accessible, allowing candidates to demonstrate knowledge, while at the same time discriminating between weaker and more able candidates. There was no evidence that any candidate was penalised due to a lack of time to complete the Paper.

Comments on specific questions

Question 1

(a) was well answered by almost all candidates. It proved to be an easy confidence gaining start to the examination. Only very weak candidates failed to score the full three marks on this section.

The second table in **(b)(i)** proved to be a little more difficult but most candidates were able to complete it and score the full five marks. Credit was awarded for correctly identifying that some potato sticks would gain mass while others in more concentrated sugar solutions would lose it. Marks were also awarded for correctly performing the calculations and using + and - signs appropriately.

Part **(b)(ii)** proved to be varied in terms of quality of answer. The graph should have been drawn accurately, with the correct orientation and labels in order to score the first mark. The mark was sometimes not awarded because candidates had failed to label the axes with units, or had not orientated the axes correctly. The second mark was awarded for correctly plotting the points. All too often candidates made plotting very difficult for themselves by choosing an inappropriate scale. Candidates would be well advised to look carefully at the units before determining the scale of the axes. The third mark was awarded for drawing a line of best fit. This should have been a straight line drawn between all of the points plotted. It should be noted that candidates who failed to score this point were not penalised a second time when marking part **(iv)**.

In part **(iii)**, most candidates were able to give an accurate description of what was happening. However, those candidates who failed to read the question and answered in terms of osmosis were restricted to a maximum of three marks. More able candidates gave a clear and precise description of water movement due to water potential and demonstrated a clear understanding of what was meant by negative water potential.

Part **(iv)** was often poorly answered. Candidates correctly determined the original molarity from their graph but failed to give a clear reason for their answer. More able candidates referred to the net flow of water being equal therefore there was no gain or loss in mass. Weaker candidates often stated that osmosis had stopped and thus failed to score the mark.

Part **(c)** was usually answered well with candidates realising that accuracy was what this question was all about. Good answers scored by referring to accuracy and then going on to explain why their suggestion would be more accurate. Marks were also credited if the candidate explained why not using a more accurate method would lead to inaccuracies. For example, candidates who said that the potato chip was bent and therefore it was difficult to correctly measure the length were awarded a mark.

Part **(d)** discriminated well between weaker and more able candidates. Most candidates treated the question very simply and wrote about looking at the cells under a microscope. Marks were awarded for a correct explanation of how the cells were obtained and how long they should be left in the different solutions. Although most candidates referred to plasmolysis, more able candidates gave clear descriptions of what they meant by insipient plasmolysis and how they would determine when 50% of a large sample of cells had plasmolysed.

Paper 9700/04

Paper 4

General comments

This Paper produced discrimination between candidates, they were spread across the whole mark range of the Paper. There were sufficient marking points to allow candidates to demonstrate their ability and all candidates appeared to have sufficient time to complete the Paper. There were many excellent scores and disappointingly there were some low scores. In many instances marks were lost through lack of precision or by the candidates not reading the question carefully and therefore giving information in the wrong section of the question. Once again a number of candidates were not able to cope with the "Genetics" question and therefore lost a number of marks.

Comments on specific questions

Question 1

A number of candidates in part **(a)** described what happens after the light source was turned off but in this section also gave an explanation as to why this happened. As a result they had great difficulty in answering part **(b)**.

(a) The majority of candidates recognised that the concentration of GP increased rapidly and then decreased and that the concentration of RuBP was reduced to zero.

(b)(i) The most common answer as to why the concentration of GP changed was that it increased because RuBP was being converted to GP. Very few candidates referred to the decrease being due to the conversion of GP to TP or hexose sugars.

(ii) The majority of candidates realised that the concentration of RuBP decreased because it was being converted to GP and it was not being regenerated. Few candidates made reference to the fact that ATP and reduced NADP from the light stage were required for the regeneration of RuBP.

(c) The majority of candidates gave ATP as a product of photophosphorylation. Fewer referred to reduced NADP. Common errors were water ADP, NAD, CO_2, glucose and oxygen.

Question 2

In general this question was well answered. The majority of candidates appeared to be familiar with the structure of the mitochondria and the stages of respiration.

(a) This was generally well answered, however a number of candidates confused structures **A** and **B**. A small number of candidates referred to structures in the chloroplast, such as stroma, grana and cisternae. Some candidates did not realise that the stages required were stated in the stem of the question.

(b) The majority of candidates referred to the cristae providing a large surface area but only a number made reference to the ordered arrangement of the carriers in the respiratory chain. Very few referred to the matrix containing the enzymes for Kreb's cycle or to the fact that the membranes allowed differences in pH between the cytoplasm and the matrix. A number of candidates referred to the large surface area being available for gaseous exchange, which did not receive any credit.

(c) In describing the role of NAD in respiration the majority of candidates made reference to it being an H carrier from Kreb's cycle to the electron transfer chain. Very few candidates made reference to it being a coenzyme and to its role in Glycolysis.

(d) Very few candidates were able to describe concisely how photophosphorylation differs from oxidative phosphorylation. Those who scored marks made reference to photophosphorylation occurring in the thylakoid membranes in the chloroplasts/chlorophyll and requiring light. Very few candidates mentioned the photolysis of water or the production of oxygen.

Question 3

This was a low scoring question for a large number of candidates. Most candidates attempted all with reference to the role of insulin and glucagon and to the formation of urea via the ornithine cycle.

(a) In describing the role of the Kupffer cells in the homeostatic function of the liver many candidates referred to all the functions of the liver and not just those of the Kupffer cells. The Examiners were looking mainly for the destruction of old red blood cells and their further breakdown to their components. Credit was given for the removal of toxic substances.

(b) The candidates were asked to state how the liver cells are involved in fat metabolism. Relatively few confined their answer to fat metabolism but referred to the conversion of glucose to glycogen or to the role of bile in the emulsification of lipids in the intestines. Therefore they did not score. The Examiners were looking for reference to the formation of lipoproteins, cholesterol and bile salts as well as the interconversion of fats and glucose. Few candidates mentioned the storage of fats in the liver but made reference to its storage elsewhere in the body.

(c) Many candidates failed to read the question properly and confined their answer to the formation of urea and the ornithine cycle. Of those who concentrated on the transport of urea from the liver to the kidneys there were some very good answers giving details of the blood vessels between the two organs. However there were some very confused answers with blood being removed from the liver in the hepatic portal vein or the hepatic artery and being taken to the kidneys in the renal vein. Very few answers mentioned diffusion into the sinusoids.

(d) Failure to read the question carefully proved costly to some candidates. Credit could not be given where candidates took in **(i)** the hepatic portal vein and in **(ii)** the hepatic artery as their “base line”, unless they made this perfectly clear. The Examiners were looking for reference to the fact that the hepatic vein would contain less glucose, amino acids etc. and more urea than the hepatic portal vein and it would contain less oxygen and more carbon dioxide than the hepatic artery.

Question 4

This was a relatively high scoring question, the majority of candidates having a good knowledge and understanding of meiosis.

(a) In most instances Metaphase was given as the correct answer. Very few answers incorrectly referred to other stages.

(b) There were some well worded answers here, including the correct use of chromatid/chromosome and spindle/spindle fibres. The majority of candidates made reference to the centromeres dividing, the sister chromatids separating and moving to opposite poles. Fewer mentioned the mechanism of movement.

(c)(i)(ii) Most answers mentioned the breakdown of the nuclear membrane, the division of the centrioles and their movement to opposite poles of the spindle.

(d) Most candidates correctly named the two stages in which meiosis can lead to variation making reference to crossing over/chiasma formation between non-sister chromatids of homologous chromosomes and to the random alignment/independent assortment of chromosomes. However few were able to gain the extra marks for an explanation of each.

Question 5

This question caused problems for many candidates. Many were confused by the fact that multiple alleles were involved and did not appreciate that the scallops were hermaphrodite and able to fertilise themselves.

(a) Better candidates did score full marks on this part. They stated that orange was dominant to black and give full genetic diagrams showing the crosses resulting from the self fertilisation of the heterozygous orange scallops and the self fertilisation of the homozygous black scallops. Credit was given to those candidates who did not draw genetic diagrams but gave a written explanation. The inclusion of the yellow scallops caused confusion for some, they often gave unnecessary details of a yellow cross, others gave unspecified crosses e.g. orange x black. Some candidates thought that the scallops were triploid.

(b) This part was not very well answered. In an attempt to produce a pure-breeding [illegible] scallops many candidates did not appreciate that it is impossible to select homozygous [illegible] merely on appearance and that some sort of investigation must be carried out. Very few [illegible] that one would have to continue breeding generations of orange scallops until some indiv[illegible] produced only orange offspring. Weaker candidates suggested genetic engineering with [illegible] removal of the black gene.

Paper 9700/05

Practical 2

General comments

In general, the Paper was well answered by most candidates. The Paper proved to be accessible, allowing candidates to demonstrate knowledge, while at the same time discriminating between weaker and more able candidates. There was no evidence that any candidate was penalised due to a lack of time to complete the Paper. It was evident in this Paper that candidates are still drawing the cellular tissue that they see under the microscope as if it were taken straight from a text book. It is most important that candidates draw what they see, if they wish to score marks.

Comments on specific questions

Question 1

(a)(i) required candidates to draw a cell during interphase. Most candidates were able to score all four marks for this section by correctly drawing and labelling the cell. However weaker candidates drew chromosomes and other structures that were not visible in cells during interphase.

Part **(ii)** discriminated well between those candidates who were practiced at using a microscope and those who were not. Marks were awarded for correctly drawing a labelled stage of mitosis and labelling the chromosomes or chromatids appropriately. All too often candidates were labelling structures such as spindle fibres that were not visible at this magnification. Credit was given to those candidates who made a good attempt to draw and explain with good labelling, what they saw.

In part **(iii)**, candidates who paid particular attention to detail, were rewarded. Drawings that were elongated and had a nucleus of the correct relative size, were credited. All too often, candidates saw a nucleus in the cell and then proceeded to draw the nucleus much larger than it should have been. Credit was also given for correctly identifying that these cells also contained a vacuole.

Question 2

This was generally well answered and demonstrated that most candidates had a good understanding of how enzymes worked.

Part **(a)** was well done with most candidates obtaining correct results.

In part **(b)**, good candidates did not just describe the reaction, but went on to point out that it was less vigorous than S7.

Part **(c)** gave candidates the opportunity to show that they understood what the experiment was all about. Good answers referred to an explanation of denaturing in enzymes and how this worked, why a control was used, and why dilution had an effect on the rate of reaction.

Part **(d)** proved to be more problematic with many candidates failing to understand the importance of the question. Candidates often wrote about extending the experiment rather than improving it. Answers that included using a larger range of temperatures did not score. However candidates who said use a constant temperature did score. The same rule applied to other variables, such as pH. Candidates who also said that the experiment should be repeated, did not score unless they also went on to say the results should then be averaged.

Part **(e)** proved to be quite difficult. Credit was given to those candidates who said that is was ... used to prevent pressure changes affecting the experiment. However, all too often, these statem... not found in the answer.

In part **(f)**, candidates tended to score two out of the three marks. There were many marking points, a... credit was given to candidates who correctly explained how the apparatus would be used. Good answers ... included reference to the screw clip and syringe and explained how the readings would be taken over a period of time.

Good answers to part **(g)** were rare. Candidates who realised the NaOH should be removed and replaced with water, scored both marks. It was also clear that some had performed a similar experiment using pyrogallol but all to often the candidates did not realise the implication of replacing the NaOH with pyrogallol.

Paper 9700/06

Options

General comments

Candidates' marks were well spread. A few candidates attempted options not selected by the rest of their Centre. Presumably this was a spur of the moment mistake by the candidate, which invariably resulted in a low mark. By far the most popular option was *Growth, Development and Reproduction*. The remaining options were selected by relatively few candidates, *Biotechnology* proving to be the least popular.

There were a few cases of rubric infringement, where some candidates had completed two options instead of one or had attempted both free-response questions in their chosen option.

The majority of candidates made some attempt to answer all sub-sections of the structured questions. They should read the question stem and the questions carefully to be sure of expressing the correct information in the relevant sub-section.

Many candidates found the data response questions particularly difficult. They need to experience a wide range of graphical and tabulated material to be confident of correct interpretation of new material. A common reason for loss of easily accessible marks in the data response was the lack of figures. Figures should be quoted wherever relevant and must be accompanied by the correct units.

It is essential in the structured questions that candidates distinguish between key words. All too frequently 'explain' led to a response which simply repeated the data provided.

Free-response questions were clearly answered in the appropriate sub-sections by the majority of the candidates. Here again the need to answer the relevant question still applies, with 'discuss' or 'explain' requiring more than simple factual recall.

Comments on specific questions

Option 1

Biodiversity

Question 1

(a)(i) Sensible references were made to the greater weight of the elephant but no awareness was shown that the body weight increases in proportion to the volume or cube of the linear dimensions.

(ii) Answers often lacked detail. Good references to streamlined shape and water support were made. Many incorrect references to fins were made, with tail or limb references rarely noting the increased surface area to aid movement. Some responses correctly linked elephant ear size to temperature regulation.

(b)(i) Candidates seemed to expect a direct relationship here, stating incorrectly that [illegible] increase at low human population. The variable relationship below 15 humans km^{-2} w[illegible] as were explanations such as the high mobility or need for food of elephants.

(ii) Good responses were frequently seen here.

(c)(i) Only better prepared candidates were able to explain the idea of maintaining a population approximately the same in number. Some recognised the need for enough breeding animals but did not appreciate the long time period involved.

(ii) Good answers recognised the need to record birth and death rate and age structure of the population. Rarely was the frequency with which females give birth mentioned.

Question 2

(a)(i) The presence of flowers was almost universally noted.

(ii) Most answers included reference to parallel venation but few recognised that the flower parts were in threes.

(iii) The adventitious or fibrous root system was well known.

(iv) Scattered vascular bundles were shown correctly by most, although a few attempts were made to draw monocotyledonous roots or dicotyledonous stems.

(b) While most of the table was usually correct, the most common error related to the xylem vessels.

(c) Some candidates failed to score here by referring only to general structural aspects of the dominant generation. Features of the life cycle were required such as fertilisation being internal or not dependent on water, embryo development within a seed or male gamete formation inside pollen grains. Fertilisation references most commonly scored.

Question 3

(a) This was the more popular of the two free-response questions in this section.

(i) Good responses were produced by the well prepared candidates. Most diagrams were pleasingly well labelled. Weaker answers showed confusion of terms such as conidia, conidiophore and sterigma.

(ii) Answers generally indicated a reasonable level of understanding but tended to lack detail such as a named food material or detail of named food groups and their digested products. Enzyme secretion, extracellular digestion and absorption of the products were well known.

(iii) Many but not all remembered to include some discussion of the living or non-living idea. Better responses described many viral features, although some became unwieldy with detailed descriptions of replication at the expense of the many other valid points.

(b)(i) With the exception of a few well prepared candidates, answers were vague or confused. Very few stated what the problems of gas exchange were or clearly stated that the exchange surface was the gill lamellae. Ventilation and countercurrent flow were often described but answers showed little understanding of how these contributed to overcoming the problems.

(ii) Many terms were confused here, with bronchioles, tracheids and alveoli all appearing! The pathway taken by the air to the tissues needed to be clearly described, along with fluid movement from the tracheole tips when active. Problems of water loss and closure of spiracles could also have gained credit.

(iii) This was surprisingly poorly done, with few details provided of the six jointed legs, the chitinous exoskeleton being flexible at the joints or the role of antagonistic muscles. The idea of a tripod arrangement for walking was mostly appreciated, with occasional references to large hind legs for jumping, adhesive pads and claws for grip. Candidates referring to flying had not understood the question!

Option 2

Biotechnology

Question 1

(a)(i) Both the lactic acid production and increase in pH were recognised.

(ii) The curve was described rather than explained by many candidates. Frequently only a mark for figures could be awarded.

(b) It was recognised that carbon dioxide is produced by the yeast but the link with respiration was omitted.

(c) Candidates failed to understand that differences such as lactose, fat or protein content or different products would cause this.

(d) Very few suggestions were forthcoming.

(e)(i) Some responses appreciated that lactose was fermented, with milk as the substrate, using bacteria in both cases.

(ii) It was recognised that bacteria on their own were used in yoghurt production, but not the idea of different products being formed.

Question 2

(a) Few named plant examples were seen. Candidates needed to state the source material e.g. apical or embryonic explants or protoplasts, together with reasons, such as disease-free plant production or to allow genetic manipulation.

(b)(i) Answers were generally poorly expressed. Some recognised the problem of microbe contamination but frequently failed to link this to the availability of nutrients for their growth.

(ii) Few candidates could name a suitable tissue.

(c) Candidates found it difficult to draw conclusions from this table. They should be encouraged to quote figures. The role of cytokinin promoting shoot growth, increasing numbers of shoots and inhibiting root growth might then be appreciated.

(d) Possible ingredients were often quoted but few candidates could describe their use.

Question 3

(a) Insufficient responses were seen to comment on this question.

(b)(i) Outline definitions were forthcoming but few responses included the detail needed at this level. Attempts to describe a biosensor were on the whole the more successful of the two.

(ii) Candidates were aware of their use for pathogen or cancer diagnosis and cancer treatment as ‘magic bullets’ but further detail was sketchy and their use in the purification of interferon and preparation of vaccines unknown.

(iii) The basic operation and principles behind the biosensor were generally understood. Finer detail such as the use of a protective cellophane acetate gel for the enzyme or the products formed in the process was not given.

Option 3

Growth, Development and Reproduction

Question 1

(a)(i) The term 'parturition' was less well known than 'conception' but many candidates correctly defined both.

(ii) Mis-interpretation of the graph was common by weaker candidates. Some answers only gave a figure for one type of cell.

(iii) While some candidates recognised the fetus' need for oxygen or that rapid growth was occurring, others incorrectly linked the increase to nutrient supply.

(b) A surprising number of candidates failed to gain both marks. Many correctly noted the lack of nuclei or the biconcave shape. A common error was to repeat the size difference, while others compared oxygen affinity.

(c)(i) Candidates found this difficult. Most answered by comparing fetal and maternal haemoglobin so not addressing the question. The emphasis should have been on the link between small changes in oxygen partial pressure leading to large changes in % saturation of the fetal haemoglobin i.e. loading and unloading. Some candidates noted the high oxygen affinity and referred to the ability to unload at the tissues but figures were rarely quoted or relevant (many compared fetal with maternal).

(ii) Some good comparisons were seen noting the steeper curve, shifted left. Many candidates correctly quoted figures. A few excellent responses noted the higher fetal % saturation at all oxygen partial pressures and that maximum saturation was higher and occurred at a lower oxygen partial pressure compared to maternal.

(iii) Most appreciated the higher fetal affinity for oxygen while some also explained the need for oxygen transfer from maternal to fetal blood.

(iv) Rarely did candidates recognise that the embryonic blood system would be poorly developed or that it must hold on to the oxygen at low oxygen levels.

Question 2

(a) A minority confused the terms 'hypogeal' and 'epigeal', while some confused lateral roots with adventitious/fibrous/root hairs. Many responses correctly described differences in hypocotyl or epicotyl growth or positions of testa or cotyledons.

(b)(i) Good descriptions were given by many candidates. Some references to cooling in a desiccator were made but in some cases the whole plant was dried rather than the beans.

(ii) Failure to refer to the mean or average dry mass deprived many candidates of marks, as did the omission of units. Able candidates easily scored maximum marks here.

(iii) Few scored marks for nitrate, failing to realise that the leguminous beans could fix nitrogen or that the soil might already have sufficient nitrogen. Nitrogen as a growth inhibitor or being toxic were common errors. Phosphate effects were slightly better known, linking it to increased growth, or ATP/DNA production. That the soil might have been deficient was not recognised.

Question 3

(a) This was by far the more popular of the two free-response questions.

(i) Some candidates lost marks due to mis-interpretation of the question, with general descriptions of growth, growth measurement and reproduction. Many, however, produced good detailed responses when confined to the relevant material.

(ii) Answers too frequently described the whole process of multiple hormonal control of [illegible] cycle instead of concentrating on the question asked. Poor use of terminology was ev[illegible] repeated use of 'wall' instead of 'endometrium' or 'myometrium'. The idea of repair was kn[illegible] detail such as vascularisation or glandular formation was lacking. A link between oest[illegible] secretion and follicle development was often stated but timing of this in the cycle was ra[illegible] mentioned.

(iii) While some candidates realised that this thickened and maintained the endometrium, with increased glandular activity, few answers went beyond this. Some did mention changes in cervical mucus, together with the relaxation of the myometrium and the loss of the endometrium as progesterone decreased. The development of coiled arteries and glands was not appreciated and further marks could have been gained by references to the timing of progesterone's influence.

(b)(i) Good logical accounts of the control of flowering in SDP were given by many well prepared candidates, although few named plant examples were seen. Unfortunately some candidates had not grasped the more basic ideas, proceeding to use forms of phytochrome and light as interchangeable terms or describing the Pr as active rather than the idea that the inhibition by Pfr was critical. Responses could have been expanded, giving more detail of the events in the plant following the removal of the Pfr.

(ii) Candidates were aware of the actions of GA and ABA in the control of dormancy. Further detail of the roles of cytokinins and ethene and their interactions with GA or ABA were rarely given.

(iii) Some confusion was evident at times between the idea of fruiting and ripening but many appreciated the role of auxin in fruit development and correct references were often made to parthenocarpy. The role of ethene in ripening was likewise well known. A few well prepared candidates made reference to the control of fruit drop by auxin.

Option 4

Applications of Genetics

Question 1

(a) Candidates frequently identified the major factors.

(b)(i) While the selection for breeding of organisms with particular features was known, few responses clearly stated that the traits were chosen specifically for the benefit of man. Similarly, the idea that this is *artificial selection* or that it takes place over several generations was rarely appreciated.

(ii) An increase in homozygosity and the idea that this was inbreeding were known but few referred to *alleles* in discarded traits being lost, leaving selected individuals with a restricted number of alleles. Too often the general term 'gene' was used instead of 'allele'.

(c) Basic principles were well known but this could have been expanded by the idea of collecting seed from many sources or providing detail of the effect of conditions on the success of storage.

(d)(i) Most agreed that diversity was reduced. Few figures were given to support the statement. The idea that only one gene was being considered was not appreciated.

(ii) Few candidates could explain that greater selection was occurring in the regulatory region, indicating that whether genes were switched on was more important than the product produced.

Question 2

(a)(i) Good responses were seen, describing random mutation. Worryingly some candidates think this occurs as a result of antibiotic exposure rather than as a random event.

(ii) Very few answers mentioned natural selection, although most successfully described various methods of reproduction causing the spread.

(b)(i) Candidates tended to simply describe the evidence in the table rather than offering an explanation.

(ii) Good answers concentrated on the idea that there might have been less contact with [illegible] or that species 1 was not closely related to the rest. The possibility that this would [illegible] horizontal transmission or that it might be more easily killed by the antibiotic was not appre[illegible]

(iii) Some answers referred to the possibility of this being a new antibiotic, while a few suggested [illegible] an important pathway was involved. None realised that this probably required a large mutation or [illegible] series of mutations.

(c) Some comments were made to the effect that the bacteria supposedly not in contact with the antibiotics showed up to 100% resistance. A few also realised that B supported the idea, but reasoning beyond this was very muddled.

Question 3

(a)(i) Candidates were generally well prepared, providing suitable detailed answers.

(ii) Many candidates were able to describe the events accurately, although weaker accounts lacked detail or confused the sequence of events. The role of different hormones to control cell division or differentiation was the least well known aspect of the process.

(iii) This was generally less well answered. Few advantages of the processes were known, apart from the speeding up of selective breeding.

(b)(i) Trisomy 21 was usually well known and explained clearly. Translocation was less frequently described. A few accounts included irrelevant material such as a description of Down's syndrome symptoms.

(ii) Well prepared candidates were able to describe detail of many features of amniocentesis, chorionic villus sampling or DNA profiling. Disappointingly, many weaker responses were submitted which appeared unable to name the techniques or describe them with any degree of clarity.

(iii) Some good responses were given here but too often the general idea of counselling was not always made clear i.e. providing information enabling parents to make their own informed choice. Many only concentrated on the options that might be available.

Paper 9700/08
Practical 3
(Mauritius Only)

General comments

Candidates had the opportunity to demonstrate their skills including those of problem solving, deduction, observation and recording observations in the form of a drawing. Their ability to use a microscope was also tested together with their knowledge of simple food tests. The assessment of these skills, together with knowledge and understanding, provided a wide range of marks between 4 and 24 out of a possible total of 25 and discriminated those of high abilities.

Comments on specific questions

Question 1

(a)(i) Most candidates were able to identify starch in solution **S3** but a significant number thought that starch was present with an unboiled enzyme, thus missing the point that a boiled enzyme failed to hydrolyse the starch to sugar. Despite the information in the stem of the question, some thought that **S1** contained boiled enzyme and this led to wrong conclusions being made. Few obtained all the available marks for this question.

(ii) The logic of deducing the composition of the samples by elimination and with knowledge of the correct methods of analysis was tested. Most obtained half marks but very few obtained maximum because they failed to mention the non-reducing sugar.

(iii) It was pleasing to see many candidates with full marks for this part of the question. H[illegible] are still those who do not make accurate statements relating to boiling with Benedict[illegible] Very dilute quantities of reducing sugar will not produce a positive result with lower temp[illegible] than boiling point.

(iv) Most were able to recognise that enzymes are denatured on boiling and the better candidate[illegible] referred correctly to the distortion of the enzyme's active site during this process. Weaker candidates erroneously referred to enzymes being "killed".

(v) The concept of enzyme specificity was tested here. A large number of candidates did not recognise the fact that sucrose was not hydrolysed by the enzyme that hydrolysed starch. Often they did not use their observations from part **(i)** to make the correct deduction.

Question 2

(a)(i) The objective marking scheme for this question credited accuracy of observation and drawing. Many mistook the material as mammalian red blood cells and failed to recognise the central nucleus. The oval shapes of the cells and their nuclei were very standard and should have been obvious to all those who focused their microscopes properly. Organelles, other than the nucleus, were not visible but some candidates imagined that they could see images only possible with an electron microscope. These did not gain any credit. Some candidates failed to read the instruction to label the structures that they had drawn.

(ii) This was a question requiring knowledge of cell structure. Those who were able to re-call the basic differences between plant and animal cells scored full marks.

(iii) Again, this tested knowledge and required an awareness of the differences between prokaryotes and eukaryotes.