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Examiners' Report

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## BIOLOGY 4325, CHIEF EXAMINER'S REPORT

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### Paper 1F

This unit was sat by a small number of candidates so generalisations about performance are difficult.

### Question 1

Questions 1(a) to (j) were answered correctly by most candidates with item (g) on photosynthesis and item (h) on yeast cells proving the most difficult.

### Question 2

Candidates were required to identify two features a farmer would want a cow to have and candidates were able to suggest milk yield, milk quality as well as meat production as suitable examples. Most responses to part (b) also correctly described selective breeding as the farmer choosing two parents with desired characteristics to mate together.

### Question 3

In this question students needed to select the appropriate words from a list to fill in the gaps in a passage describing pollution caused by factories and farms. Candidates were usually able to select the correct word.

### Question 4

Part (a) asked candidates the function of the circulatory system and most correctly gave transport of substances around the body. In part (b) candidates were confused between the left and right and atria and ventricles and some were unable to identify the tricuspid valve. Candidates were able to show the direction of blood flowing into the right side of the heart but did less well on showing the movement of blood from inside the left ventricle, through the tricuspid valve and out of the pulmonary artery. Some were able to describe the function of the valve as opening and closing to allow blood to only flow from atrium to ventricle and not flow back into the atrium. The final part of the question required two differences between blood in the left side and the right side of the heart. Some candidates were able to point out that there is more oxygen and less carbon dioxide in the blood in the left than in the right. Again a few candidates described colour of blood or confused which side contains blood from the lungs.

### Question 5

In this question the paper showed a diagram of a tree and substances entering and leaving through the leaves and the roots. Most responses in part (a) correctly identified water as entering the plant from the soil and being used in photosynthesis. All candidates could identify the sun as the source of energy for photosynthesis. In part (b) several candidates did not know which materials were transported in the xylem or phloem.

### Question 6

Part (a) required candidates to name the system shown almost all correctly identified the reproduction system. In part (b) some confused the location of the ureter and the urethra but most could identify the bladder from the diagram. Most candidates were also able to name two waste products found in urine and the organs that excrete sweat and carbon dioxide and water as the skin and the lungs.

### **Question 7**

In this question students had to explain the meaning of yield and a few had no idea what this term meant. This led to difficulties in answering the rest of the question. The candidates who were familiar with the term could explain in part (b) how chicken manure could add nitrates to the soil therefore increasing crop growth by providing more amino acids for protein synthesis. In part (c) we expected answers to state that both herbicide and pesticide improve plant growth but that herbicide is most effective. Only a small number gained full credit for this. More correct responses were found for part (c)(iii) describing the concept of measuring at the same time to ensure same temperature, rainfall and climate.

### **Question 8**

This question discriminated very well. Candidates who were familiar with the structure of viruses, bacteria and fungi scored highly with most appreciating that viruses are the smallest. Weaker candidates gave answers such as animal or plant, indicating a lack of knowledge and scoring poorly as a result. Answers to part (c) varied considerably. The most frequent wrong answers showed that candidates are unaware that bacteria are made up of a single cell and that fungi can secrete extracellular enzymes.

### **Question 9**

Candidates scored well on this question. Most appreciated that roots grow downwards into soil to access water and mineral ions and that shoots grow upwards to obtain light for photosynthesis. Better candidates used the terms negative and positive geotropism. A common error was to spell geotropism incorrectly as 'geotrophism', an error not penalised this year.

### **Question 10**

Most candidates were able to correctly label the pancreas and the small intestine. Those who drew an arrow head towards the label rather than towards the digestive system were not penalised. The graph posed problems for many who misinterpreted the information provided. As such, their answers discussed lipase being broken down as opposed to lipid. They also believed that the fastest digestion took place in the acidic solution, presumably because this was the smallest bar in the graph. In part (c), starch was well known as the substrate for amylase, but few candidates knew that the product of maltose digestion is glucose.

### **Question 11**

The better candidates recalled that there need to be two copies of the recessive allele present for someone to have cystic fibrosis. A range of incorrect answers were given, with one and three being the most popular. Some candidates left the answer blank. In part (b), candidates are encouraged to make sure that a space exists between the letters representing the alleles to give the examiners confidence that the candidates appreciate that only one allele occurs in a given gamete. The genotypes of the children were appreciated by many, but occasionally only one heterozygote was given. Candidates who achieved success with the gametes and the genotypes of the children understood that only one of the four possible genotypes of the children would develop cystic fibrosis. Weaker candidates struggled with this part of the question. In part (c), most appreciated that the nucleus contains the genetic material in a cell and that the material is made from DNA

### **Question 12**

In this question the standard of food chains was very good with only a small number of candidates choosing an incorrect chain or putting the arrows the wrong way round.

Part (b) challenged more candidates with some believing that voles ate the owls and the weasels. In (c)(i), a very small number failed to name an organism 'from the food web' stressing the need for candidates to read questions carefully. Parts (ii) and (iii) were well answered, though weaker candidates did not appreciate that producers are found at trophic level Y.

#### **Question 13**

Some candidates recalled that transpiration is the name given to the loss of water from the surface of a leaf. Similarly, some candidates appreciated that species A had lost most water. However, most then struggled to provide a detailed reason stating the mass lost by comparison to the other species. Answers to part (c) were encouraging with many candidates appreciating the influence of structural adaptations of leaves and the influence of various abiotic factors.

#### **Question 14**

The responses to this question were disappointing, revealing a lack of knowledge and understanding of micropropagation. Any verb that described the cutting or removal of small pieces of plant was accepted in the passage. Sterilisation was not commonly recalled nor was the role of nutrient agar. In part (b), most candidates recalled that clones are identical but failed to state that they had identical genetic material.

### **Paper 2H**

#### **Question 1**

This question discriminated very well. Candidates who were familiar with the structure of viruses, bacteria and fungi scored highly with most appreciating that viruses are the smallest. Weaker candidates gave answers such as animal or plant, indicating a lack of knowledge and scoring poorly as a result. Answers to part (c) varied considerably. The most frequent wrong answers showed that candidates are unaware that bacteria are made up of a single cell and that fungi can secrete extracellular enzymes.

#### **Question 2**

Candidates scored well on this question. Most appreciated that roots grow downwards into soil to access water and mineral ions and that shoots grow upwards to obtain light for photosynthesis. Better candidates used the terms negative and positive geotropism. A common error was to spell geotropism incorrectly as 'geotrophism', an error not penalised this year.

#### **Question 3**

Almost every candidate was able to correctly label the pancreas and the small intestine. Those who drew an arrow head towards the label rather than towards the digestive system were not penalised. The graph posed problems for many who misinterpreted the information provided. As such, their answers discussed lipase being broken down as opposed to lipid. They also believed that the fastest digestion took place in the acidic solution, presumably because this was the smallest bar in the graph. Better candidates ...

In part (c), starch was well known as the substrate for amylase, but few candidates knew that the product of maltose digestion is glucose.

#### Question 4

The better candidates recalled that there need to be two copies of the recessive allele present for someone to have cystic fibrosis. A range of incorrect answers were given, with one and three being the most popular. Some candidates left the answer blank. In part (b), candidates are encouraged to make sure that a space exists between the letters representing the alleles to give the examiners confidence that the candidates appreciate that only one allele occurs in a given gamete. The genotypes of the children were appreciated by many, but occasionally only one heterozygote was given. Candidates who achieved success with the gametes and the genotypes of the children understood that only one of the four possible genotypes of the children would develop cystic fibrosis. Weaker candidates struggled with this part of the question. In part (c), most appreciated that the nucleus contains the genetic material in a cell and that the material is made from DNA

#### Question 5

The standard of food chains was very good with only a small number of candidates choosing an incorrect chain or putting the arrows the wrong way round. Part (b) challenged more candidates with some believing that voles ate the owls and the weasels. In (c)(i), a very small number failed to name an organism 'from the food web' stressing the need for candidates to read questions carefully. Parts (ii) and (iii) were well answered, though weaker candidates did not appreciate that producers are found at trophic level Y.

#### Question 6

Almost all candidates recalled that transpiration is the name given to the loss of water from the surface of a leaf. Similarly, most candidates appreciated that species A had lost most water. However, most then struggled to provide a detailed reason stating the mass lost by comparison to the other species. Answers to part (c) were encouraging with many candidates appreciating the influence of structural adaptations of leaves and the influence of various abiotic factors.

#### Question 7

The responses to this question were disappointing, revealing a lack of knowledge and understanding of micropropagation. Any verb that described the cutting or removal of small pieces of plant was accepted in the passage. Sterilisation was not commonly recalled nor was the role of nutrient agar. In part (b), most candidates recalled that clones are identical but failed to state that they had identical genetic material.

#### Question 8

A pleasing number of candidates chose C as the correct answer and were able to give a detailed description of the role of osmosis. A well answered question.

#### Question 9

About half the candidates recalled the biuret test correctly. The description of digestion of protein by pepsin into peptides was well answered by most. Similarly, most candidates were able to describe the pattern of egg production by stating it reached a maximum at 32 weeks and decreased thereafter. Many candidates struggled to provide 2700 as the correct answer to the calculation despite being given a formula to help. Clearly, candidates did not use the formula to check the data in the table and then to confirm their calculation. The better candidates appreciated that chickens kept indoors are less likely to use energy to replace heat loss or for movement in search of food. Other answers linked to protection from predators, or disease, were also credited.

### Question 10

The graph was surprisingly challenging for many candidates. Choosing the correct axes posed difficulty as did choosing a sensible numerical scale with which to plot the points for the volume of blood in  $\text{cm}^3$  per minute. Most were able to calculate that 84 000  $\text{cm}^3$  of blood would flow through the intestine in one hour at rest, though a number of candidates wrongly stated 8 400  $\text{cm}^3$ . Calculating the percentage increase in the volume of blood flowing through the skin during exercise compared to the volume at rest was only correctly answered by the very best candidates. Those who failed to provide the correct answer of 300% were still able to gain one mark from their working providing they had divided by 500 or had given the number 1500 somewhere in their calculation. Vasodilation of blood vessels was recalled by many, but only the better candidates stated that it involves the relaxation of muscles in the walls of small arterioles. The heat loss that occurs by radiation or convection to cool the body when blood flows through the skin during exercise was appreciated by many candidates, but some discussed an increase in sweating which was not credited. Part (iii) of part (b) was answered well, with most appreciating the increased supply of glucose and oxygen for respiration. Some candidates discussed the removal of carbon dioxide and lactic acid and these ideas were also credited.

### Question 11

Candidates are encouraged to read accurately from graphs. Many answers to (a)(i) were incorrect. Answers to part (ii) were credited if they could be calculated from the answer given in part (i) minus 6200. The coronary artery seems unknown to many candidates and a variety of wrong blood vessels were given, with the most common being the vena cava and the pulmonary vein. Good candidates described how a blockage to the coronary artery would reduce supply of oxygen and glucose for aerobic respiration and increase the likelihood of anaerobic respiration producing toxic lactic acid with consequent cardiac arrest. Weak candidates only mentioned that a heart attack would occur. Many appreciate the importance of testosterone in the development of male secondary sexual characteristics which was encouraging. A common error with progesterone was to believe that it repaired the uterus lining. Only the better candidates realised that myelin was a structural component of neurones and that it helps to speed nerve impulses.

### Question 12

Most were able to appreciate that increasing the temperature would increase photosynthesis and therefore yield. Only the very best candidates were able to link these ideas to the role of enzymes. A small number of candidates believed that the enzymes would be denatured with consequent decreased yields, clearly not appreciating that it is unlikely that such high temperatures would be used in a glasshouse. The graph question challenged students to think about the differences between biological control and pesticide application in the control of pests. Credit was given for starting a line at one week, letting it fall to the left of the *Encarsia* line below 10 000 and then showing a small rise. Answers to part (c) indicated that many candidates are aware of the advantages of using biological control rather than chemical pesticides, though many answers lacked precision in the use of language.

### Question 13

The vast majority of candidates were able to identify the parts of the fermenter that would allow other bacteria in, or allow the food to overheat if they failed to work properly. About half the candidates failed to read part (b) carefully and described how a fermenter is used to grow microorganisms. The examiners were pleased with the standard of answer given by those candidates who described the process of genetic modification of bacteria. These correct answers included the names and



functions of the enzymes involved and the role of plasmids as vectors. In part (c), most candidates recalled that the pancreas produces insulin, but only the best candidates gave a clear account of how insulin helps to reduce blood glucose levels by converting excess glucose to glycogen which is stored in the liver.

#### **Question 14**

Perhaps thrown by the word 'diabetes', many candidates answered this question as if they were dealing with diabetes mellitus. As such, the pancreas was wrongly named in part (a) (i) and in (b) (i), answers wrongly discussed the need to control blood glucose levels, and in (b) (ii), treatment with insulin was wrongly stated. Those who had read the question carefully and understood the role of ADH scored highly, appreciating that it is produced by the pituitary gland and travels in the blood to the collecting duct of the kidney nephron. Similarly, they understood that a lack of ADH will result in less water in the blood as less is reabsorbed. These candidates also appreciated that people with diabetes insipidus need to drink a lot of water to quench their thirst.

#### **Question 15**

This question discriminated very well. Despite being provided with helpful information, the weaker candidates struggled to outline the principles of natural selection, let alone link them to the topic of cyanogenesis in clover plants. Good candidates were able to discuss the idea of having inherited a characteristic that helps an organisms to survive biotic or abiotic factors, and then being able to reproduce and pass on the genes for the beneficial characteristic to their offspring.

Only the best candidates scored highly when asked to recall the types of bacteria involved in the nitrogen cycle. These candidates appreciated that nitrifying bacteria convert nitrite to nitrate, denitrifying bacteria convert nitrate to nitrogen gas, nitrogen fixing bacteria convert nitrogen gas into ammonium compounds and that decomposers break down dead organic tissue into ammonium compounds.

### **Paper 3**

#### **General comments**

This paper had similar requirements to those set in May 2005, in November 2005 and in May 2006. It was also felt to be of a similar standard to those papers. First impressions were that the candidates did not perform quite as well as in the previous papers.

#### **Question 1**

This question tested candidates' knowledge of food tests. It was generally answered well with most candidates scoring full marks. Some candidates mixed up the test solutions for glucose and lipids, however.

#### **Question 2**

Candidates were required to match the apparatus with the experiment. Many candidates scored full marks. A significant number got the apparatus for comparing the amount of carbon dioxide in inhaled and exhaled air and that for measuring the rate of anaerobic respiration in yeast the wrong way round.

#### **Question 3**

Part (a) required candidates to give a hypothesis for the experiment and this was generally answered successfully. However, it was clear that some of the less able

candidates did not understand the question. The majority of candidates scored full marks for their table of results and most could give a conclusion. Very few candidates scored any marks in part (c) about improving the investigation. There were many vague answers such as 'repeat' or 'gather more results'.

#### **Question 4**

This question was about the effect of acid rain on germination. Most candidates were able to complete the table and a significant number were able to calculate the percentage of seeds that germinated in distilled water. The majority were able to talk about 'calculating an average' in part (b). The majority of candidates were able to say that increasing the acidity of the solution would decrease the percentage of seeds, although some candidates thought the opposite would occur. A significant number knew that temperature light should be kept constant, but very few were able to suggest precisely how this could be done.

#### **Question 5**

Most candidates had difficulty in estimating the density of plantains in area A, although some gained one mark for giving the number '20'. The majority of candidates gained full marks for completing the tally chart along with the number, although some just wrote in the number and forgot the tally. The graph was generally answered well - the main mark lost was in not giving a precise label for the Y axis of the 'total number of plants in three quadrats. Many candidates gained 2 marks in (d) by making appropriate comments about the effect of trampling. The most common answers related to the number of plants in area A being more and the amount of goundsel in area B being less.

#### **Question 6**

Almost all candidates did not answer the question asked about justifying the prediction using scientific knowledge. Many just repeated the hypothesis given in the question. Most candidates were able to fill in the missing mean (average) number of bubbles per minute. Many candidates gained full marks for a suitable conclusion, but fewer candidates gained full marks for explaining whether the results supported the prediction. The majority who gained marks said the results did support the conclusion, but some candidates were able to give a qualified answer as to why the result did not support the conclusion. Marks could be gained either way, although, if the answer was 'no', then it had to be qualified for one mark. In part (d) a significant number of candidates did not appear to understand the question. Some just referred to the results going 'up' or 'down' with an increasing number of attempts. The result of question 6 proved to be too demanding for many candidates. Not many could suggest and explain ways in which this experiment could be modified - some referred to a different experiment. Similarly, when asked about a further experiment to provide more information about the effect of temperature, few answers actually referred directly to temperature. Some candidates were able to stage carbon dioxide or light as a key factor that could affect photosynthesis, but very few could state how either carbon dioxide or light could be controlled.

#### **Question 7**

This type of question has appeared on past papers, but candidates seemed to find planning this particular investigation about the effect of changing the concentration of the enzyme amylase on the rate of starch digestion challenging. The most common marking points gained were reference to time, mention the use of iodine solution, using the same volume of starch and reference to carrying out the investigation at the same temperature.

## COURSEWORK (PAPER 4), PRINCIPAL MODERATOR'S REPORT

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Centres who entered candidates for the coursework option have received a report directly from the Principal Moderator.

For general comments about coursework please refer to the Moderator's Report for June 2006.

## BIOLOGY 4325, GRADE BOUNDARIES

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Option 1: with Written Alternative to Coursework (Paper 3)

	A*	A	B	C	D	E	F	G
Foundation Tier				58	46	35	24	13
Higher Tier	83	71	59	48	37	31		

Option 2: with Coursework

	A*	A	B	C	D	E	F	G
Foundation Tier				N/A	N/A	N/A	N/A	N/A
Higher Tier	83	72	61	50	38	32		

No candidates at foundation tier entered coursework so there are no grade boundaries for this category

**Note:** Grade boundaries may vary from year to year and from subject to subject, depending on the demand of the question paper.

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