

T A S M A N I A N

S E C O N D A R Y

A S S E S S M E N T

B O A R D

BY826

Biology

2000 External Examination Report



Meetings

The Chief Examiners met with the marking team at Newstead College during the week after the exams. With a team of 16 markers the standards required for A, B and C ratings were determined for the externally assessed criteria. The Assessment Panel met in the second week of December to review the results and reassess the borderline candidates on an individual basis. The internal / external correlations for each school were compared with those for the state.

General Comments

The examination appeared to be well received by students on the whole and allowed nearly all students to finish comfortably within the time. However the paper did not prove to be as straight forward as it appeared on the surface to students when it came to the marking. Also while teachers were generally happy with a lot of the questions in most of the sections concern was expressed that in some questions the wording was unclear. This was particularly the case in Question 9 where a wide range of answers was accepted in marking it. Other concerns involved narrow questions that depended on specific information, such as captive breeding, which few of the candidates appeared to be familiar with.

This year it was particularly difficult to come up with a satisfactory set of cut offs that provided a set of results that adequately reflected the standard of the candidates sitting the examination. This was seen in part to be reflection of the increasing number of borderline candidates and ones that really are not of a SA standard. This is not helped where some teachers rely on the examination to determine this for them. The nature of the paper also made it more difficult in some aspects also. In a number of sections it proved difficult for students who were of a bare SA standard to gain many marks. As a result the C standard cut offs were markedly lower than usual.

The cut offs were set to try to reflect the appropriate C, B, and A standards for the examination. However when combined with the internal results the proportion of students gaining an HA in particular was higher than we would like to see. The assessment panel members were also concerned about the upward creep of internal marks, especially on the non-externally assessed criteria. In some criteria the majority of the candidates state-wide received A's, and in all the non-externally assessed criteria there is a very high proportion of students gaining an A or B. This is reflected in the high number of candidates that gained an SA with 8 points.

Once again there was a marked difference between the state-wide results for externally assessed criteria and in the internal assessments for the same criteria. Also this difference varied considerably between schools and colleges, and not just in the ones with small numbers of candidates where statistical variability is to be expected. It was suggested at the assessment panel meeting that there well may be need for support for teachers of the subject in getting a better idea of how to apply the standards, and which sort of assessments are useful to contribute to a summative assessment of a student and which should be regarded as formative assessments only.

Written examination

The following section specifically comments on candidate's performance in the examination. Marking examiners offer suggested answers to each question followed by specific comments on aspects such as how the question was assessed, where candidates gained and lost marks and where candidates misinterpreted questions. Comments on the open-ended questions may necessarily be limited to general comments rather than a suggested answer.

The suggested answers are by no means prescriptive and a number of them go into a greater detail than would be required to gain full marks. Candidates providing different but valid answers were rewarded accordingly.

SECTION A Criterion 3**Question 1**

- (a) (i) Scale: $5 \mu\text{m} = 25 \text{ mm}$; Length of mitochondrion (diagram) = 8 mm;
Real length of mitochondrion = $\frac{8}{25} \times 5 = 1.6 \mu\text{m} (\pm 0.2)$
OR Mitochondrion is $\frac{1}{3}$ of $5 \mu\text{m}$, therefore = $1.6 \mu\text{m} (\pm 0.2)$ (1 mark)
- (ii) Exocytosis, Endocytosis or Secretion (1 mark)
- (iii) $D \rightarrow E \rightarrow B \rightarrow A$ (3 marks)
- (iv) More mitochondria to supply energy; less Golgi apparatus (no secretion); different shaped cell (more elongated). (2marks for any 2 comments)
- (b) This cell is a prokaryotic; bacteria or blue green algae. (any 1 for 1 mark)
Cell lacks distinct nucleus and distinct organelles.
Also very small compared to the Eukaryotic cell. (any 2 for 2 marks)
- (c) **A** As temperature increases rate of reaction increases or low enzyme activity; fewer collisions between enzyme and substrate molecules at low temperature.
- B** Optimum temperature for enzyme activity, greater rate of collision between enzyme and substrate molecules. (Enzyme molecules not destroyed by heat).
- C** Low enzyme activity, most enzyme molecules denatured by excessive heat (with the active site destroyed hence the low activity rate.)

Examiners Comments

A surprising number of students scored low marks on what appeared to be an easy question. In part (a) the majority of students were able to correctly answer parts (i) and (ii). In part (iii) many students incorrectly indicated that the amino acids used to form the protein originated in the nucleus. Presumably these students were confusing the amino acids with the genetic code needed to form the protein. When an incorrect sequence was accompanied by a brief explanation (even though the question did not ask for an explanation) which showed some understanding of the process part marks were given. Many students gave one difference only (usually the increased number of mitochondria) even though the question asked for differences. Consequently many students scored only 1 of the possible two marks. Students who correctly answered part (b) often received full marks. A significant number of

students incorrectly attempted to identify the electron micrograph as an *organelle*, with the nucleus being the most common answer. The most common reason for a poor answer to part (c) was students simply describing the activity levels as high or low, with no attempt to explain why. The best answers were those which included the correct use of appropriate terms in the explanations.

Question 2

- (a) (i) Closely related animals show fewer differences (more similar Hb amino acids sequences). Eg mammals more similar to one another than to other groups). Differences follow evolutionary sequence. Fish amphibian mammal.
- (ii) Initial differences arise through mutation. Differences are then perpetuated by the processes of natural selection.
- (b) (i) TAC GCA
- (c) The cell would not be affected. CGU and CGC code for the same protein Arg (Arginine). The protein would have the same amino acid code.
- (d) (i) The SA/ Vol ratio would be reduced and its functioning could be influenced. There would be a decrease in the rate of exchange of materials with the environment, and a decrease in the rate of metabolism.
- (ii) A spherical shape has a low surface area to volume ratio compared with other shapes, but being small means the ratio is still adequate to service its needs passively.

(Many unicellular organisms are not spherical eg. Euglena and Paramecium. Their elongated shape better enables them to actively move and the flattening of their cells increases the surface area to volume ratio which allows greater exchange of materials to meet their energy requirements.)

Credit was given to students who attempted to say: The bilipid layer is fluid and the spherical shape is in response to greater osmotic pressure inside the cell causing hydrostatic pressures against the cell membrane. The typical student responses of this type included things like: it is a shape which requires little energy to create and maintain, has no friction points, no weak points on the membrane, does not require special structures to hold its shape, being unicellular it will not be squashed by other cell like it would be in a multicellular organism.

Examiners Comments

This question was not well done. It appeared that few parts of the question were accessible to a C standard student.

- (a) (i) Many students did not understand the table and thought that it referred to the total number of amino acids in the haemoglobin rather than the number of differences when compared with human haemoglobin. For full marks students had to link the number of differences with the degree of similarity of the organisms and also link the table to the evolutionary sequence.
- (ii) Well done by most students. For full marks students had to mention mutation and natural selection.
- (b) (i) Well done. The most common error was to write UAC GCA rather than TAC GCA. It asked for the complementary strand of the DNA not the strand of mRNA.

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- (ii) The most common error was to give a general text book answer rather than using the table to see what would happen in this particular case.
- (c) (i) Well done by many although there was a significant proportion of students who thought that an increase in size meant an increase in surface area to volume ratio.
- (ii) This was a difficult question. Most students thought that a sphere would maximise surface area to volume ratios and so they got no marks for this part of the question.

Question 3

- (a) (i) Most photosynthesis occurs when violet/blue or yellow/red light is absorbed by leaves. Green light is of little use in photosynthesis, it is reflected from the leaf which appears green in colour.
- (ii) Yellow areas in a leaf have less chlorophyll and so less capacity for photosynthesis compared to green areas. Variegated plants therefore have less energy and will show less growth than comparable green specimens.
- (b) (i) Fructose (0.01M 0 M)
- (ii) Glucose (0.02M 0.01M)
- (iii) Net flow of water will be into the artificial cell by the process of osmosis (as artificial cell is in a hypertonic (0.05M) solution compared to solution (0.03M) Cell will swell and may burst.
- (iv) As cell membrane is impermeable to sucrose, endocytosis (pinocytosis) has increased the internal concentration of this sugar by enfolding sucrose particles in membrane. Energy is expended.

Examiners Comments

- (a) (i) Some candidates had difficulty in relating action spectrum to absorption, even interpreting the graph as a time sequence. Most were able to indicate that green light was reflected but less than a third of responses referred convincingly to the graph.
- (ii) Over half the candidates obtained full marks, even those who failed completely on part (a)(i). Marks were awarded for answers that convincingly argued that yellow light was being lost to photosynthesis and that this contributed to lessened growth.
- (b) (i) Almost two thirds of candidates were successful, although a few listed water as a solute taken up by the 'cell'.
- (ii) Again easily answered by the majority of candidates.
- (iii) Over two thirds of candidates obtained full marks, even many who had difficulty with (b)(i) and (ii).
- (iv) This part gave difficulty to most, over 60% failing to obtain a mark. Candidates appeared to have so focussed on permeability in the preceding sections as to fail to consider endocytosis, searching instead for other explanations.

Some argued that water must have been lost from the cell (osmotically or by contractile vacuole) to cause a net increase in sucrose level. Since the question failed to specify the tonicity of the animal cell, this argument was rewarded where it was well expressed.

A minority indicated that the extra sucrose might have been synthesised from monosaccharides and where this was logically expressed, again marks were awarded.

A smaller number of candidates clearly read the question to indicate that the sucrose level was artificially increased by experimental intervention and that the subsequent process to be described was osmo-conformation by water influx. One mark was awarded where this was convincingly expressed.

SECTION B Criterion 4

Question 4

- (a) (i) A (1 mark)
- (ii) A's blood glucose level rises to a much higher level than B.
Or After glucose given A's blood glucose level continued to increase.
Or A unable to regulate blood glucose level
Or A's blood glucose level much higher than B's at start. (1 mark)
- (iii) to increase rate of absorption of glucose from blood into cells
or converts glucose to glycogen or lowers blood glucose level
or stimulates glucose uptake from blood into cells
or stimulates removal of glucose from blood (1 mark)
- (iv) to convert glycogen (stored in liver and muscles) into glucose (that is then released into the blood.)
or increases blood glucose level
or increase return of glucose into blood. (1 mark)
- (b) (i) Lower at P than S
Kidney excretes urea extracted from blood (2 marks)
- (ii) Higher at Q than P.
Q closer to the heart than P. Blood pressure lost by the time it reaches P (2 marks)
- (iii) Higher at S than R. S closer to gills where oxygen uptake occurs, whereas R is after the alimentary canal which uses O₂. (2 marks)
- (iv) Level of amino acid is higher at R than P. as amino acids will be absorbed into blood from alimentary canal. Some amino acids deaminated in liver. (2marks)

Examiners Comments

(a)(i), (iii) and (iv) Handled fairly well by majority. Many gained full marks.

(ii) Many students failed to relate their answers to the graph.

- (b) Many students found this question difficult. Very few full marks given. Some did not give comparison as asked or provide reasonable explanations.

Question 5

- (a) (i) Recessive and skips a generation (1 mark)
Ann and Michael are unaffected but their daughter Carla is affected, so Carla must be recessive whilst parents are heterozygous. (2 marks)
- (ii) George Aa
Arlene aa
Sam Aa
Sandra A- (or both AA / Aa) as unsure of the second allele. (0.5 marks each)
- (iii) Not sex linked. (0.5 marks)
If it was then son Sam would have the disease, as he would inherit the characteristic from his mother but doesn't. Or If Carla has the disease then she would have to have inherited it from her father Michael, but as he has not the disease then sex linked inheritance is not possible.
The father of an affected female will have the disease. The mother of an affected male will have the disease or be a carrier. Usually more males than females if sex linked (1.5 marks for a good explanation)
- (b) An advantage of asexual and sexual reproduction could be given from the following:
- Asexual: -Rapid increase in stable conditions (favourable)
 -The existing genotypes/phenotypes have been 'environmentally' tested and are adapted to ambient conditions.
 -Exploitation of resources more efficient.
 -Requires less energy. (2 marks)
 -If only one sex is in the area the organism can still reproduce.
- Sexual -Introduces diversity into offspring, which means more likely that species, will survive environmental change – selective advantage.
 -The products of sexual reproduction (eg, in algae has stored food supply to aid survival of period of adverse conditions) (2 marks)

One or two well explained points expected for this part.

Examiners Comments

Generally this question was done well.

In part (a) the sex linked question was the least well completed. Students could say that the pedigree was not sex linked but could not give valid reasons why. Many said that because both males and females were affected it could not be sex linked.

In part (b) four points were required to obtain full marks; one or two advantages of asexual reproduction and one or two advantages of sexual reproduction.. Many students just defined the two types of reproduction and didn't answer the question. Very few students gained full marks for this question.

Question 6 (a) and (b)

- (a) (i) Endothelium – smooth lining to reduce friction
Muscle / elastic tissue – elasticity – need to be stretched and snap back into shape.
Muscle can control diameter of vein / artery
Connective tissue – holds capillaries, nerves (2 marks)
- (ii) Collections of cells form tissues. Varied type of tissues performing different functions and part of a system (2 marks)
- (iii) -Arteries are more elastic and can recoil after passage of blood and more fibrous tissues to endure greater pressure.
-Less pressure in veins, hence less fibrous tissue and thinner walls, one way valves in veins. (2 marks)
- (iv) Arteries receive blood under pressure from the heart. They dilate under this pressure and then recoil to force blood in between beats of the heart.
Veins under low pressure, hence less fibrous muscle.
Valves present to prevent backflow. (2 marks)
- (b) Two of the following:
- avoid the heat of the day – live in burrow (more humid)
 - produce concentrated urine - less water loss
 - rely entirely on water of respiration (metabolic) – reduce water loss
 - sleep curled up in day with tufted tail across head, up nose
 - nocturnal – to reduce water loss in the heat of the day
 - longer loops of Henle – reduces water loss
 - faecal material more or less dry
 - sweat glands reduced or absent
 - large vascularized ears for cooling
 - stores seeds in ground, which absorb water from humidity. (4 marks)

Examiners Comments

The student's generally did very well on this question, with most of the student's being able to score about 7 out of 12 on the question. The area in which the students did poorly was in part (i) and (ii) this was because the lumen was included as a tissue instead of the students realizing that it is a hole for the blood to flow through. In part (ii) Students also didn't have two reasons why the vein or artery was an organ, or the student's tried to explain what the role of the arteries and veins have in the body. The rest of the question was completed satisfactorily.

Question 6 (c) and (d)

- (c) (i) Tissues – made of similar cells.
Phloem associated with companion cells – they do not form a tissue. (2marks)
- (ii) - elongated cells – long cylinders with end walls porous or absent to enable easier transport of fluid
-narrow diameter facilitates upward movement by capillary action. (2 marks)
- (iii) Reproduction
Protein synthesis

Cell division Active transport
Metabolism
Any physiological process (2 marks for any 2)

- (iv) transport involves active transport, and energy is expended in moving substances here (2 marks)
- (d) Any two of the following answers :
- deep root system to gain water
 - close stomata in heat of day to decrease water loss
 - may have modified photosynthetic mechanisms eg, C3 CAM
 - leaves may hang vertically and adjust to sit parallel in sun's rays to avoid water loss
 - become inactive in hot / dry periods of the year.
 - Opportunistic flowering or in winter when rainfall more likely (4 marks)

Examiners Comments

Parts C & D followed closely along the lines of parts A & B and not surprisingly so did the pattern of answers. Most students recognised that xylem and phloem were tissues, but only a minority gave good reasons. A common misconception was that they were tissues because they were made up of both living and dead cells. In part ii) & iii) the answers were reasonably good, while still showing a spread in the quality of answers. In part iv) most students recognised the energy from the mitochondrion was being used for the transport (1 mark), the second mark was given for identifying it as active transport.

Part D was reasonably well answered. One of two marks were easy to come by. Students needed to give a good explanation of two adaptations for full marks.

Overall question 6 was well done with many students gaining moderate to high marks. This was to be expected due to the straight forward nature of the question.

SECTION C Criterion 5

Question 7

- (a) Any TWO of the following or other suitable answers. (6 marks)
- (i) A strain of resistant larva has emerged as a chance mutation, and the gene which confers resistance in the larvae has increased ; which implies that the number of larvae with resistance has also increased. The Bt gene is now ineffective.
 - (ii) Corn is being attacked by other pests which are not affected by the Bt gene protein.
 - (iii) Mutations in corn causes loss of Bt allele; - maybe loss of Bt allele has had a selective advantage in seed fertility for example.
- (b) Any TWO of the following or other suitable answers. (4 marks)
- (i) Try to ensure genetic variation (as much as possible) in the breeding stock, which has been based on existing caged birds in captivity.

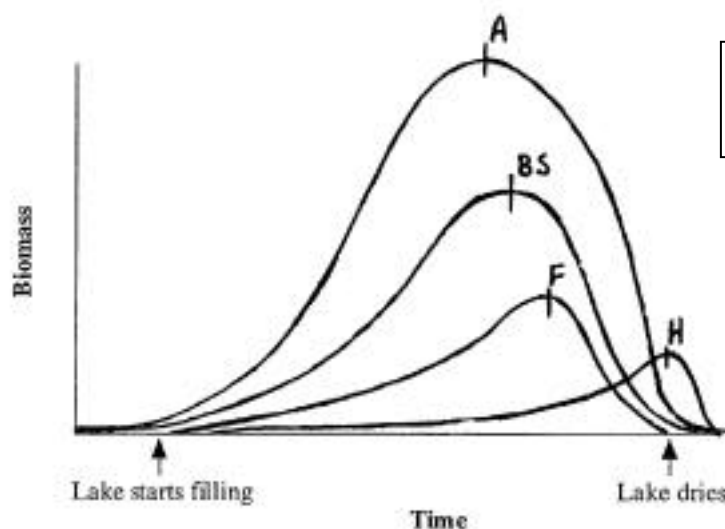
- (ii) Try to avoid closely related birds interbreeding.
OR Maintain a breeding habitat that resembles the natural habitat, is not too cold, no disease, and limited contact with humans.
OR The release of young birds from captive stock will require attention and they may need 'training' to cope with life in the wild.
- (iii) Any TWO of the following: (2 marks)
- Management of birds breeding area to ensure suitable conditions prevail- protection of habitat.
 - Improve feeding grounds by controlled burns after research on vegetation/feeding preferences.
 - Provide artificial nest sites.
 - Predator control- especially of introduced species (eg feral cat)
 - Protection of mainland wintering sites.
 - Heavy penalties for trafficking in illegally trapped birds.

Examiners Comments

- (a) The majority of students produced a reasonably well argued possibility but many simply extended the idea of their answer for part ii. Many students spoke only of resistance to pesticides and these received a low mark. However, the majority did produce two explanations in accord with the scheme above and marks awarded varied with the accuracy of expression and depth of information provided.
- (b) Students answered the question reasonably well but many answers made it obvious that the candidate was not aware of what a captive breeding programme actually is. Overall, it was well answered and there were four really outstanding answers.

Question 8

- (a) The detritivores can ultimately feed on all of the other components of this ecosystem (from all trophic levels) when the lake dries up. (1.5 Marks) They can therefore be considered as the top of the feeding hierarchy in terms of the energy flow through this ecosystem. (.5 Mark)
- b) Marking Scheme:
- | | |
|----------------------|---------|
| Relative Biomass | 2 Marks |
| Staggering of Peaks | 2 Marks |
| Correct Shape | 1 Mark |
| Harriers' Peak Later | 1 Mark |



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- (c) Organisms already present, so rains provide sudden availability of resources which allows rapid breeding (no delay in reproduction). (1 Mark) Organic nutrients and materials do not blow away but are ready to form a nutrient rich medium (for algae growth) when the rains come. (1 Mark)
- (d) Migrant populations add variation to the gene pool (outbreeding can occur). (1 Mark) This increased genetic variation enhances the chances of survival for this species in regard to adverse changes in the environment and other selective pressures (natural selection). (1.5 Marks) Migration also enables this species to exploit and subsequently evolve in different habitats. (1 Mark)

Examiners Comments

- (a) This question was not answered well and only a small number of students (less than 5%) obtained full marks. There was considerable confusion between the meaning of the words 'detritus' and 'detritivores' with some candidates even stating that the detritus feeds off everything else. In addition, many students misinterpreted 'top of the feeding hierarchy' as 'top-order consumer' or 'highest trophic level' and incorrectly stated that the detritivores would have no predators.
- (b) This was a very difficult question in that it was new (unfamiliar) to most students. Most students only obtained between one and two marks for this question and no candidate was able to obtain full marks. The main reason for this was that four separate (and correct) graphs were required and five of the six marks were given for indicating the relationships between the four groups. In addition, many students tried to indicate predator-prey relationships by including two or more peaks in each graph. A surprising number of candidates drew graphs which gave the impression that an inverted pyramid of biomass existed (with shrimp biomass greater than algae biomass, etc.). Furthermore, many students drew five graphs; with one labelled 'brine' and another labelled 'shrimp'. On the other hand, some students correctly stated that their graphs were only diagrammatic in that the approximate percentage drop in biomass from one trophic level to the next would be about 90%.
- (c) Most students scored one mark for this question and very few were able to obtain full marks. Generally, in this kind of question, two marks require two separate points. However, the question should have asked for two reasons as many candidates did not try to think of two separate ideas.
- (d) Once again, very few candidates obtained full marks for this question. In this respect, this part of Question 8 (as with the other three) was able to discriminate between the 'A' and 'B/C' standard answers. Only the 'A' standard answers indicated 'increased genetic variation' as the most significant evolutionary advantage and then explained how this would be an advantage to this species (with natural selection of the 'fittest' taking place due to adverse changes in the environment, etc.). Part marks (usually only 1 mark) were awarded to those students who gave a Darwinian explanation for the evolution of the tendency to continue swimming because they generally stated (correctly) that the small fish that survived were able to reproduce and so enhance the gene pool. Too many students tried to use their prepared explanation of (Darwinian) evolution instead of addressing the question.

Question 9

- (a) Most students considered carbon dioxide levels in the air, but really any changes due to burning would only be temporary. Before logging, levels are lowered as photosynthesis (exceeding respiration in plants) involves uptake of carbon dioxide. At the pre-planting, following the burn, carbon dioxide levels are raised by burning and by lack of photosynthesis by plants. 20 years later the growing forest will lower the levels again, further than before logging, as net photosynthesis is greater.

Most students considered nutrient levels in the soil, but the question could have been interpreted as nutrient levels in the whole ecosystem. A mature forest will store a large quantity of nutrients as biomass, so low levels of nutrients exist in the soil pre-logging. Pre-planting will see a high level of soil nutrients, as the forest burn will release them as ash. 20 years later, the soil nutrients are lowered again by the rapidly growing forest.

If considered from the point of view of nutrients above ground, it would be obvious that the fire removes above ground nutrients.

Biodiversity would be high in a mature forest, which at the climax of a succession would have a large range of niches for plants, animals, fungi and microbes. Pre-planting, the biodiversity is limited to soil organisms that survive the forest fire. 20 years later, succession will ensure new plants grow from seed stored in the soil and seed arriving from surrounding forests. A new community of animals will also appear, but overall diversity will be lower than before logging, due to limited niches in a new forest and the change to the major tree species.

- (b) A variety of answers were possible for this question. Students could argue that the farmland had applied artificial fertiliser and was therefore more fertile at the time of planting than the mature forest which could have many nutrients stored above ground. It could also be argued that the mature forest has much more litter, detritivores and decomposers providing nutrients to the soil than grassland which would be subject to leaching and erosion in the high rainfall area. Also, harvesting of crops/animals will reduce nutrients in the grassland.

Some students compared nutrient level in the farmland to the time the mature forest was planted, which was a valid interpretation, given the wording of the question.

Some common errors, which led to loss of marks were:

- “carbon dioxide is converted to oxygen”
- “carbon dioxide and oxygen levels (in the air) are equal”
- “photosynthesis by plants *produces* carbon dioxide” (so levels increase)
- many students stated that the forest burn led to a loss of soil nutrients. In fact while some nutrients are lost in smoke, the resulting ash bed leads to a gain in soil nutrients.
- many students had a limited idea of biodiversity, and thought it applied to animals only, and many students had obviously not seen what a eucalypt plantation looks like even 5 years after planting, as they indicated there would be only one plant species present.

Overall, the marks scored on all parts of the question were high, given the range of possible answers. A number of students did not attempt part b).

Reasons for each change indicated in answers were required, and this led to answers being cramped for space

SECTION D Criterion 8

Question 10

- (a) (i) Lack of suitable food prevented Pink Galahs from colonizing the Lake St Clair region
Or Temperatures in the Lake St Clair region are too low for hatching Pink Galah eggs
Or Predators of the Pink Galah, not found in urban areas, are present in the Lake St Clair region, preventing the establishment Pink Galahs. (3marks)

- (ii) Find out the food of Pink Galahs (eg by observation) in the areas which have been colonized, survey the area around Lake St Clair to determine whether that food supply is present.
Or Set up an experiment in 2 aviaries where all conditions are controlled except that one is maintained at mean temperature of coastal area during breeding season of Pink Galahs, other is kept at mean temperature of Lake St Clair region. Compare hatching rates of eggs. (3 marks)
- (b) (i) Cell division occurs more rapidly in cells towards the tip of the broad bean radicle than in cells at the base of the radicle.(3 marks)
- (ii) Cell elongation occurs mostly in cells towards the tip of the broad bean radicle. (3 marks)

Examiners Comments

Students found this a very challenging question. In part a)(i) most were able to write a hypothesis, although many simply rewrote the observation given without offering any explanation and causative factors were often vague such as “climate” or “weather” rather than precise factors which could be tested. Part a)(ii) was very poorly done with the majority of students carrying out experiments which simply verified the observation given rather than testing a possible causative. factor.

Many students did not appreciate what the diagrams represented in part b). Most were able to see that the radicle was growing, many recognized that growth did not occur evenly down the radicle and some realized that growth occurred towards the tip. Very few were able to write two hypotheses in terms of cell division and cell elongation. Marks were given for all reasonable hypotheses.

Question 11

- (a) (i) sugar solution/ clonex- solution added to plant stem 1 mark
type of substance/ or just sugar or just clonex _ mark
- (ii) rate of root growth / number of roots 1 mark plant/ stem growth ()
- (b) (i) root growth in sucrose solution is equal to (1 _ marks) or better (1/2 mark) than root growth in Clonex
root growth more than with clonex 1 mark
root growth is promoted/ or effective _ mark.
- (ii) all of the following _ mark each: temperature, water availability, length of experiment, light ; soil type, nutrient level, pot size, same species of plant
- (iii) test on a range of plants, repeat experiment, test for effects positive/ negative on the environment and other species, investigate at different times of the year, use different trial conditions e.g. vary soil ,temp etc., test on different concentrations of hormone/ sugar, test for effective usage time on the stem- ‘expiry’ date. 1 mark was given for each idea.

Examiners Comments

Students found this question to be very straightforward. It was answered by almost all students and was well done. The students were able to show the standard answers learnt in class. Many students gained at least 6 marks or better.

Question 12

There are a large number of valid designs possible; the following table highlights the main points which were considered necessary and the marks awarded.

1 mark	Large sample size	Take 100 people and assign randomly to two groups of 50 people. This will help account for individual variation.
1 mark	Describe treatment of groups	One group receives HiQ bread with Omega-3 fatty acids daily, the other group receives a similar bread with no Omega-3 fatty acids.
1 mark	Identify control group	The group not receiving Omega-3 is the control group, the results from which will be used to compare with the other group.
1 mark	Identify independent variable	The consumption of Omega-3 fatty acids.
2 marks	Identify the key controlled variables (constants)	In order for the results to be valid, many variables that would affect the dependent variable need to be controlled. The groups should be matched for age, gender, health etc. (1 mark). A key variable which must be controlled is diet – must ensure that no other source of Omega-3 is included (1 mark).
1 mark	Identify dependent variable	The dependent variable is one of the following: <ul style="list-style-type: none"> • level of hyperactivity • ability to learn • amount of arthritic pain
2 marks	Specify how the DV will be measured	Specify a practical method for quantifying DV (1 mark) – e.g rate pain felt on a 1-10 scale. Establish baseline data by measuring DV in both groups before experiment commences (1 mark)
Up to 1 mark BONUS	Acknowledge problems associated with human experimentation	e.g. need approval of ethics committee, use of double blind methodology, subjective nature of DV measurement.
0.5 marks	Duration of experiment	Need a time period that is long enough to enable any effect of Omega-3 to become apparent, but not so long as to be impractical (6-12 months).
1 mark	Treatment of results.	The results will be tabulated and averages calculated for each group. Compare averages to see if there is a significant difference in the DV for the two groups.

1 mark	Result which would support hypothesis	If the group receiving Omega-3 bread showed improvement in the DV being monitored.
0.5 marks	Replication	The experiment should be repeated a number of times to ensure that the results are consistent.

NOTE: It is NOT recommended that students present their answer in table format, but rather as a written answer as shown below (however, use of headings can be useful in helping to organize information)

A suggested answer:

Take 100 people and assign randomly to two groups of 50 people. This will help account for individual variation (*1 mark*). One group receives HiQ bread with Omega-3 fatty acids daily, the other group receives a similar bread with no Omega-3 fatty acid (*1 mark*). The group not receiving Omega-3 is the control group, the results from which will be used to compare with the other group (*1 mark*). The independent variable is the consumption of Omega-3 fatty acids (*1 mark*). In order for the results to be valid, many variables that would affect the dependent variable need to be controlled. The groups should be **matched for age, gender, health** etc. (*1 mark*). A key variable which must be controlled is **diet** – must ensure that no other source of Omega-3 is included (*1 mark*). The dependent variable is one of the following: level of hyperactivity, ability to learn, amount of arthritic pain (*1 mark*). Specify a practical method for quantifying DV – e.g. rate pain felt on a 1-10 scale (*1 mark*). Establish baseline data by measuring DV in both groups before experiment commences (*1 mark*). The experiment should be conducted 12 months (*0.5 marks*). At the end of this time, the DV is again measured. The data is tabulated and averages calculated for each group. Compare averages to see if there is a significant difference in the DV between the two groups (*1 mark*). If the group receiving Omega-3 bread showed improvement in the DV being monitored then the hypothesis is supported (*1 mark*). The experiment should be repeated a number of times to ensure that the results are consistent (*0.5 marks*).

Examiners Comments

This question was answered by almost all students and was generally well done, with the majority of students able to gain at least 6 marks. Whilst a large percentage of students were able to identify independent/dependent variables and described how they would manipulate the IV, many failed to describe exactly **how** they were going to measure the DV. Description of the treatment of results was also poor. Statements such as “observe and record results” tell little about the procedures to be followed! Some students used impractical methods (e.g. confining subjects to rooms for the duration of the experiment) and many did not specify the duration of the experiment.

SECTION E Criterion 9

Question 13

- (a) (i) Increase in watering increases potato yield
- (ii) Potato growth is limited by the **frequency of watering**.

The key to this question was that the difference between A & B is only slight compared to that of both A & B to C. Therefore it is not the volume of water that has the affect, if it was then the yield for group A should be much more than the yield for group B, because A receives more water. It is the **frequency** as B is simply watered half the number of times.

Credit was also given for various versions of the following:

Treatment A and B show similar yields.

B received half as much water as A.

Volume of water clearly had little effect on yield of potatoes.

OR

C, which never received water (other than rain), showed a significantly reduced yield.

The frequency of watering thus has a greater effect on yield than volume of water

OR

If volume had a greater affect then the yield of B would be approx mid-way between yield of A and C.

Yield of B is much closer to A, implying that volume is not as significant.

B increases yield to a level not much less than full watering which represents 2x the volume.

- (b) (i) Smaller hole diameter – **lower volume of CO₂** diffusing per hour.
- (ii) Smaller hole diameter - the **greater the rate of diffusion** (per sq cm hole/hour). Need to indicate rate per unit area of hole.
- (iii) Relate to size and number stomata found in leaves:
Large number of small stomata more efficient in terms of CO₂ uptake in leaves than having small number of larger stomata with an equivalent total hole area.

Examiners Comments

- (a) (i) most students obtained this mark although many went into far too much detail for the one mark, often confusing themselves.
- (ii) This part of the question was answered poorly with most students receiving 2 or less. Some credit was given for students who said both factors affected yield and said why.

The table of information was definitely confusing and thus the range of answers from students was vast. Approximately a third answering frequency, another third answering volume and the last third answering both. A significant number of students answered Yes and No and went on to explain their yes or no. Most students ignored the fact that the group A and B yields were very close to each other, simply noting that the ones watered half as much had a lower yield. Other students ignored the statement about 'every alternate time' and simply assumed half watering meant half as much water.

Credit was also given to students that said it was not possible to tell which factor affected yield from the data given. They had to explain why they thought this and state what extra data was needed,

- (b) (i) Answered well.
- (ii) If students just wrote out the relationship as it appears in the data they generally got 2 marks. Many decided to explain the relationship in more detail and became confused. The Surface Area:Volume ratio was discussed by many students, often to their detriment. If volume of CO₂ per unit area was referred to without reference to rate or 'per hour' then only one mark was awarded.
- (iii) Credit given for reference to:
-Stomata are much smaller than 2mm in diameter, therefore rate would be much faster than measured here.
Plant would therefore have an adequate supply of CO₂
OR
Plant has a more efficient means of controlling water loss by controlling stomatal openings.

This part was not answered very well as students did not relate the data directly to their knowledge of stomatal patterns on leaves. Many students received 2 marks for saying that small, numerous stomata were found on leaves which fitted these findings. The extra mark was only obtained if this was compared to a situation of few large stomata with equivalent total hole area.

Some students discussed other aspects of stomata, respiration, transpiration and photosynthesis which had nothing to do with the data given (often textbook stuff).

Question 14

- (a) (i) The higher the temperature the greater the activity of the enzyme up to 50°, above 50° the activity of the enzymes decreases with further increase in temperature.
- (ii) Yield in *in vivo* is higher, yield in *in vivo* starts at 75° and is fairly level +/- 4 between temperatures of (5 - 35°) whereas *in vitro* yield increases from 3 - 54 at the same temperatures.
- (iii) The microorganisms' optimum temperature for habitat is 40 - 50°. They can be found in and function in temperatures ranging from 5 - 60°.
- (b) (i) The higher the partial pressure of oxygen the higher the saturation of haemoglobin.
- (ii) Effect of increasing temperature was to decrease the saturation of haemoglobin with oxygen (or increase oxyhaemoglobin dissociation).
- (iii) The effect of increasing temperature on an exercising muscle involves:
- reduced saturation of haemoglobin with oxygen means there is more oxygen available to the exercising muscle since a lower percentage is bound to the haemoglobin molecule
 - the muscle will be warmer therefore the percentage saturation of haemoglobin will be reduced at any given partial pressure of oxygen. e.g. at 20 mm Hg and 38°C a normal muscle has 32% Hb saturation at 20mm Hg and 43°C an exercising muscle has 20% saturation. i.e. 12% more oxygen is released for the muscle to use.
- Only one of these explanations required.

Examiners Comments

- (a) (i) Generally well done except a number of students referred to the optimum as 55° instead of 50° and were only given 1 _ marks.
Some did not refer to the decrease after 50° and were only awarded 1 mark.
- (ii) Some students did not read the question and did not compare the *in vivo* yield with the *in vitro* yield. Some students failed to use any data from the table and consequently could not get full marks. Any 2 relevant different comments on both yields were accepted to get 2 marks.
- (iii) Many students wrote lots of information about habitats in general but did not refer specifically to the data of the question.
Marks were only awarded if the temperatures in the table were used in the answers.
- (b) (i) Very well done.

- (ii) About 2/3 of the students gave the correct answer.
- (iii) Students had great difficulty with this question and often gave contradictory information by incorrectly saying there would be a reduction in amount of oxygen after a percentage decrease of saturation of haemoglobin with oxygen.
Discussion of anaerobic respiration and lactic acid which was irrelevant was given no marks.

Question 15

- (a) The attention received may cause a subject to change his/her lifestyle “for the better”. With a placebo this aspect is negated, therefore everybody receives a tablet, but its benefits are not apparent until down the track and individual behavioural differences are balanced out. (control _)
- (b) Any four points
- Trial not allowed to run full course.
 - Trial only on male subjects
 - Trial only on people of certain age range, and too broad.
 - Variables such as diet, lifestyle factors (eg exercise), stress levels, marital status, age range within groups etc all need to be controlled.
 - Need more detailed information on heart attacks and things like age profiles etc.
 - Genetics
 - Ethnicity
 - Long term side effects
 -

Any combination of the above with some explanation provided showing depth and understanding for the 6 marks.

Examiners Comments

On the whole this question was not well answered.

- (a) The comment “as a control” was not enough. It was important to clearly state the purpose of a control. A control allows a comparison between the results of the placebo group and the test group. While the recognition of the ‘placebo effect’ was important, many answers failed to include the required examples of possible life-style changes which might occur.
- (b) A number of answers opted for each way bets – yes, for these reasons, but no for different reasons. Credit was given for valid reasons given despite the indecision. Answers which were merely a list of uncontrolled variables, such as sex, ethnic, diet, exercise, genetic could not be given full marks without substantiation.

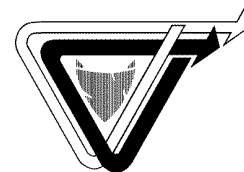
It was important that answers were related directly to the data presented. It was unnecessary to speculate on reasons for the data.

Answers which stated “further experiments were needed” without providing specific examples could not be given credit.

All correspondence should be addressed to:

Tasmanian Secondary Assessment Board
PO Box 147, Sandy Bay 7006
Ph: (03) 6233 6364 Fax: (03) 6224 0175

Email: reception@tassab.tased.edu.au
Internet: <http://www.tassab.tased.edu.au>



Award Summary

Outstanding Achievement (OA)	154
High Achievement (HA)	311
Satisfactory Achievement (SA)	279
Reassessed into neighbour	76
Total candidates	820

Gender Breakdown

Males	238
Females	582

Ratings awarded (internally and externally)

Criterion	A		B		C		D	
	int	ext	int	ext	int	ext	int	ext
Criterion 1	345		282		173		13	
Criterion 2	347		337		126		8	
Criterion 3	211	187	272	210	299	307	35	106
Criterion 4	197	185	261	218	304	316	54	91
Criterion 5	215	171	296	232	274	307	32	99
Criterion 6	362		356		99		1	
Criterion 7	454		235		117		13	
Criterion 8	191	177	302	267	291	280	33	85
Criterion 9	182	178	321	233	295	304	21	94
Criterion 10	325		311		162		12	