Examiners' Report

Principal Examiner Feedback

October 2020

Pearson Edexcel International Subsidiary / Advanced Level

In Biology (WBI14)

Paper 01 Energy, Environment, Microbiology and Immunity

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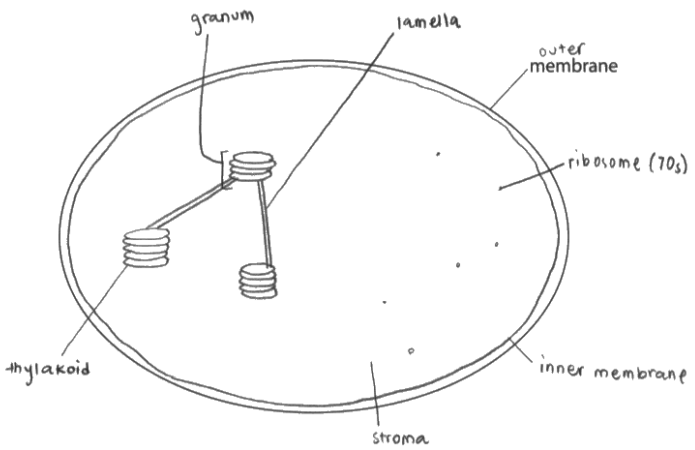
Introduction

This was the second WBI14 paper for the new specification and there were some very good responses with candidates mostly attempting all questions. It was clear that many candidates had been taught how to answer the level-based question as there were good attempts to answer all components of the question using the information in the question, the table and the diagram.

Question 1

(a) This MCQ scored well as the vast majority of candidates knew the location of the light-dependent and light-independent reactions.

(b) A range of diagrams was seen of the chloroplast. The one below is a particularly good example.



(c) This MCQ scored well.

(d) Candidates who did not confuse action spectrum with absorption spectrum generally provided acceptable definitions.

(e) (i) This MCQ scored very well.

(ii) Most candidates calculated the Rf value to be 0.800.

Question 2

(a) Many candidates could explain how to measure the temperature of a dead body. Those who did not score the mark generally did not tell us where in the body the temperature should be taken or else stated it should be taken in the mouth.

(b) (i) This calculation saw a range of responses with a number of candidates scoring both marks. One mark was lost by some candidates who had not read the question correctly and did not give their answer to the nearest hour.

(ii) The second part to part (b) caused more problems. Many candidates did not actually tell us how the estimate would be different. A number talked about the body cooling faster, but we were after the heat being lost faster.

(c) A range of responses were seen to this question. Candidates clearly know about factors affecting rigor but unfortunately a number did not refer to the information in the table in their response.

This is an example of one response written by a candidate who used the information in the table.:

body stiffness [rigor mortis] is the temporary contraction of body muscles hence rigidity of body which largely depends of level of ATP remaining in body at time of death and the surrounding temperature. If the stiffness only is considered, ~~body~~ time of death could be anywhere between 3-36 hours but considering body temperature also narrows range down [if warm stiff - 3-8 hours, if cold stiff - 8-36 hours]. which provides a more accurate answer. Also rigidity does not occur in first three hours and after 36 hours of death either.

(Total for Question 2 = 8 marks)

Question 3

(a) (i) Candidates who read the information that we had given them about one bond in each water molecule being broken, calculated the energy release correctly.

(ii) Candidates generally know the events that take place in photosynthesis very well, however very few candidates wrote about the synthesis of ATP in both cyclic and non-cyclic photophosphorylation. One common error was to write about light hitting the chlorophyll; we really want the light being absorbed by the chlorophyll.

Light energy is absorbed by chlorophyll. Light energy is used for photolysis and the excitation of one electron from photosystem II. This electron ~~undergoes~~ passes through an electron transport chain, where redox reactions occur. From these redox reactions, energy is produced. This energy is used for ATP synthesis.

$ADP + P_i + energy \rightarrow ATP$

(b) (i) There were three possible types of bonds that the candidates could have listed but very few actually listed all three; we were accepting two out of the three.

(ii) This MCQ was well-answered but there were a few candidates who selected the matrix for their answer.

(c) (i) Many candidates selected the correct answer for this MCQ but there were some who confused hydrolysis for condensation.

(ii) The response below illustrates the type of answer that we were looking for:

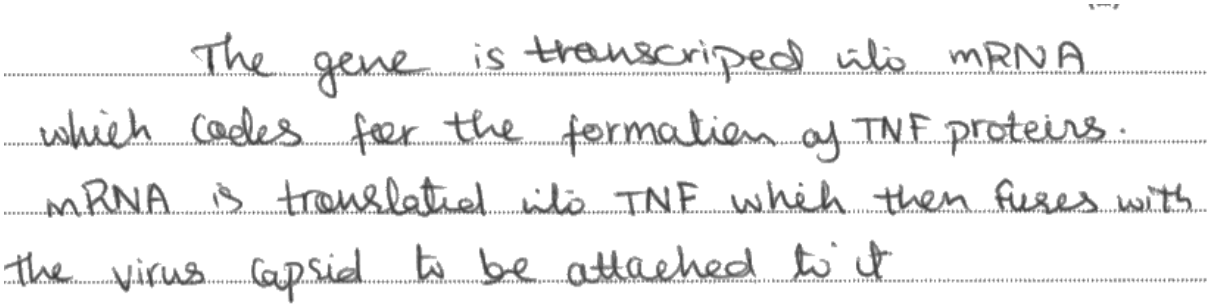
Because glucose doesn't contain nitrogen needed in synthesizing the amino acids, glucose only contains carbon, hydrogen and oxygen while amino acids require nitrogen which is obtained from soil as nitrate ions and transported through xylem vessels.

Many candidates had the gist of what we were looking for but talked about amino acids having an amino group which glucose does not; we felt that this was not precise enough at this level.

Question 4

(a) (i) and (ii) These questions caused few problems except for candidates who did not read the question carefully enough and only gave one sign of inflammation in (ii).

(b) (i) Mixed responses were seen to this question. Not all candidates identified that we were really asking them about how new viral components are synthesised and assembled into virus particles. A number of candidates think that all types of virus replicate in the same way as HIV, so we saw details of viral DNA copies being made using reverse transcriptase and being incorporated into the bacterial genome. A few candidates talked about the DNA being transcribed and translated; strictly speaking the DNA is transcribed and the RNA is translated. This candidate made this quite clear:



(ii) Mixed responses were seen to this question. The most common error was to state that the antibodies bind to the receptors on the cells thus preventing the TNF from binding to the cells.

(iii) Many candidates know the story of how TB infection can result in death, but some do not relate it to the context of the question. This does not stop the candidate from scoring some marks but does prevent access to full marks. The response below is very clear and is in the context of the question.

Antibodies to TNF will ~~ha~~ enhance phagocytosis of TNF and therefore the responses which are stimulated ~~wi~~ by TNF will not occur such as inflammation and phagocytosis. Without phagocytosis the Mycobacterium which causes TB will not be engulfed and be possibly destroyed by enzymes in the macrophage (if they are not resistant and have slime capsule). This ~~em~~pairs antigen presentation by the macrophage to T helper cells. Consequently, the primmary immune response will not occur as T helper cells will not be activated to release cytokines to stimulate B cells to form plasma cells that produce antibodies. Without antibodies, agglutination and opsonisation will not take place and the bacteria will be able to ~~su~~spread in the lungs, destroying the gas exchange surfaces so the person ~~ma~~ will not get enough oxygen and die. **(Total for Question 4 = 10 marks)**

~~TB~~ The bacteria also spreads via the blood to other organs ~~whic~~ causing organ failure that leads to death. Without inflammation blood flow to the area of infection will not increase and there will be no increase in the number of ~~macrophages~~ WBCs and antibodies

Question 5

(a) This MCQ caused few candidates any problems; they have clearly learnt about the different types of virus listed on the spec.

(b) (i) This question was not well-answered, as very few candidates realised that the question was asking about the channel proteins providing a hydrophilic channel for the lysins to pass through the hydrophobic membrane. Those who did, wrote what they had learnt about enzymes and stated that the polar R groups were on the outside of the channel proteins.

(ii) Most candidates picked up a couple of marks for this question by writing what they knew about enzymes as the first two-mark points applied to enzymes as well as these channel proteins.

(iii) Many candidates repeated the stem of the question in their answer by stating that the lysins break down the cell wall to let the viruses burst out. We wanted

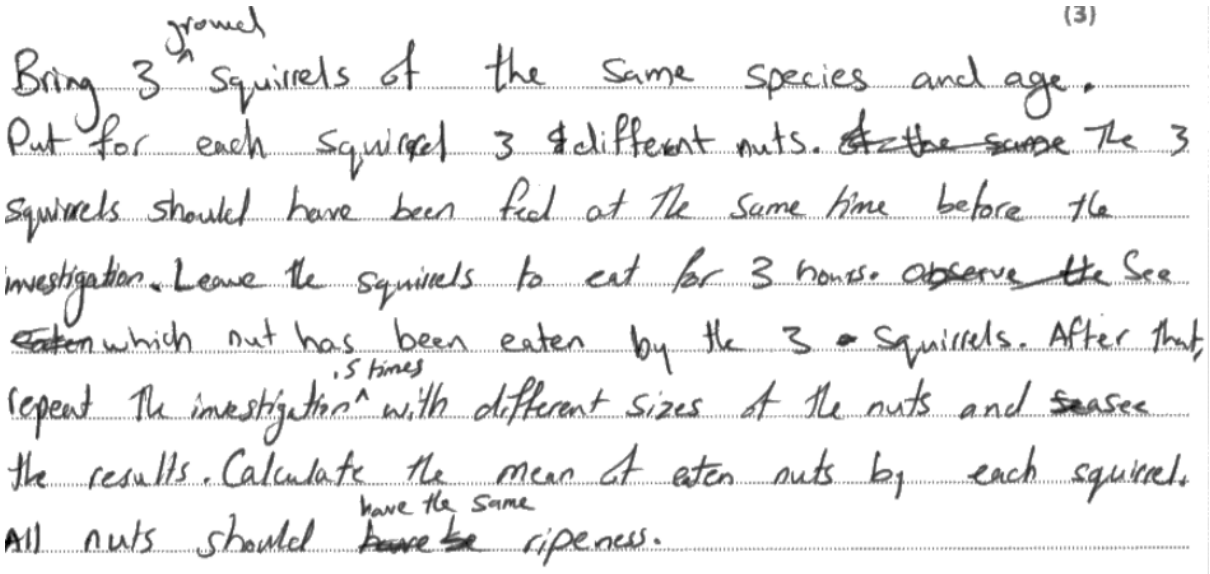
them to extend this idea and tell us some specific detail about the components of the cell wall that were broken down.

Question 6

(a) This calculation did not cause too many problems.

(b) (i) Many of the candidates scored the first- and third-mark points but not many considered that the nuts given to the squirrels needed to be a range of sizes. In fact, a high proportion of candidates stated that the size of the nut needed to be controlled.

The response below illustrates all three of our mark points:


(3)

Bring 3 grouped squirrels of the same species and age. Put for each squirrel 3 different nuts. ~~of the same~~ The 3 squirrels should have been fed at the same time before the investigation. Leave the squirrels to eat for 3 hours. ~~observe the See~~ ~~Eaten~~ which nut has been eaten by the 3 squirrels. After that, repeat the investigation 5 times with different sizes of the nuts and ~~seasee~~ the results. Calculate the mean of eaten nuts by each squirrel. All nuts should ~~have~~ be have the same ripeness.

(ii) A wide range of responses was seen for this question with candidates coming up with some great reasons for the squirrel preferences.
Candidates were required to explain their answer more than just repeating what was provided in the question, and this would have picked up three marks.
However, very few addressed all three parameters.
Below are a couple of good examples:

~~The most~~ The nut which will be eaten the most can be acorn as it is smaller in size so much easier to hold and does not have a hard covering contributing to easy access. The energy content is lesser but can be easily fulfilled as they can be consumed faster. Hazelnut has a hard covering which will take a longer time to be broken but has a higher energy content keeping them full. Walnuts would be least preferred as they are larger and have a tough covering so difficult to hold and consume.

Hazelnut will be most preffered by the squirrel as it is smaller than the walnut but bigger than the acorn and can be easily carried in the food pouch of the ground squirrel and has a greater energy content than acorn and allows the squirrel to be extremely active and can run faster and escape from predactors and it has a hard covering that allows the squirrel to eat easily as compared to the hard shell of walnuts that is not easy to break and is hard for squirrels to eat.

(c) Many candidates know the evolution story very well but there are still many making the errors that we have pointed out in previous series. These include not stating that the mutation is in the DNA, that the selection pressure causes the mutation and confusion between the terms alleles and genes. An example of this is shown below:

Evolution takes place by natural selection. A random mutation due to selection pressure such as starvation or competition between other animals may have produced advantageous alleles; for food pouch pouches

An example of a better response is shown below:

(3)

Due to Some ground Some ground squirrels due to a random mutation in the gene coding for the structure of mouth developed an advantageous allele allowing them to store food in their mouth. When the environmental conditions changed (winter) and they had to travel long distances to find food, the squirrels with the mutated allele survived. They survive till adulthood, reproduce and pass the mutated alleles to offsprings. This process repeats until the whole population of squirrels develop pouches.

Question 7

(a) (i) This MCQ was well answered.

(ii)There were some excellent answers to this question, given that we expected candidates to use the information in the diagram as the structure of fungi is not actually on the spec. Saying that, some candidates have clearly been taught about the structure of fungi as there were answers that mentioned the chitin cell wall that fungi possess. We did add this to our additional guidance so that these candidates could be credited.
The response below is from a candidate who used the diagram:

First of all it has cell wall which means that it can't be animal as animals have no cell wall. Beside that it has nucki which means that it can't be bacteria as bacteria ~~does~~ don't have nucleus. lastly, it has glycogen granules which means that it's not plant as plants don't have glycogen. They have starch.

(b) This question scored poorly, even by the more able candidates. The less able candidates simply described the data, not commenting on the correlation and the more able candidates picked up the selection pressure mark and sometimes the answer in the additional guidance for the third mark point. The vast majority of candidates failed to appreciate that the fall in numbers of resistant bacteria were due to the non-resistant bacteria that were now able to survive and therefore compete.

This is an example of one of the better responses seen:

- There is a strong positive coreletion between number of amino penicillin prescriptions issued and percentage of E.coli ~~bacteria~~ resistant to amino penicillin. Both graphs shows Similar pattern of change, but, Changes in number of amino penicillin prescriptions issued precede changes in percentage of E.coli resistant to amino penicillin by 1 month
- This can be explained by: amino penicillin antibiotic acts as a selection pressure which selects for resistant E.coli, and select against sensitive E.coli as it is killed by antibiotic. Resistant E.coli survive and reproduce passing on their resistant alleles leading to increase in allele frequency of E.coli. As number of amino penicillin prescriptions issued decrease, number of E.coli resistad to amino penicillin indecreases

(c) This question was another that scored poorly with many candidates simply rewriting the information that we gave them in the question. The response below is typical of the many responses that we saw.

Antibiotics should only be perscribed when necessary. while 44% of doctors use it to prevent surgery. ~~Antibiotic~~ and 49% use it ~~frugo~~ frequently. Antibiotics are not used properly for the right infections. These all can increase the percentage of bacteria or viruses ~~which~~ with ~~multiple~~ resistance to multiple antibiotics, and later, the antibiotic can be useless.

This is an example of one of the better responses:

As antibiotics are prescribed more and more often for no necessisaty, more and more resistant bacteria strains develop (antibiotic selection pressure), so a different typed antibiotic need to be ~~prescribed~~ Developed to cure resistant strains, This is called Evelotionary race.

By time more and more ~~diseases~~ bacteria become resistant to most antibiotics, and there will be no cure for some diseases (rate at which bacteria develop resistance can outrun rate at which new Antibiotics are made)

Question 8

(a) (i) Whether the candidates used their own knowledge or used the information given in the question, this MCQ scored highly.

(ii) The vast majority of candidates identified that we were asking about the stimulation of an immune response to antigen B. Common errors made were the same as we have seen in the past: confusion between T helper and T killer cells, B cells releasing antibodies and cells being destroyed by antibodies.
This is an example of a good response.

If blood type A is given, the antigen on AB such as B would get recognized as a foreign antigen. This would cause an immune response. The macrophages would engulf it and become an antigen presenting cell. The T-helper cell with the specific receptor binds to it and causes more divisions of the T cells. Then the B-cell activated T-helper cell would bind to the B-cell receptor which is also an antigen presenting cell and produce cytokinesis This would cause B-cells to differenciate into plasma cells which produces antibodies

(b) (i) Candidates know about the importance of gut flora, so some very good responses were seen. There were still a few candidates who omitted to specify what the bacteria are competing for, or who used the term food when they should have written nutrients.

(ii) Many candidates identified what this question was asking for but some of the responses were very vague, stating that the sugar was used to provide energy, instead of specifying that respiration of the sugar released ATP.

(iii) Candidates recognised that the enzymes would remove the antigens, but few linked this back to transfusions.

Question 9

(a) (i) The vast majority of candidates had no problem answering this question.

(ii) A range of calculations were seen for this question with many candidates scoring both marks.

(iii) All sorts of graphs were seen for this question. The most common error was to plot the number of moose against global warming instead of temperature. A number attempted to plot the temperature against year, which we credited with 1 mark if it was done correctly. However, it frequently was not correctly done.

(b) (i) Another calculation that had a range of answers given for it. Many responses were answered well.

(ii) This was the only levels-based question on the paper, and candidates had a better idea how to approach the question than on the previous paper. A number of candidates were clearly trying to cover all aspects of the question: the effect of global warming, its subsequent effect on the lifecycle of the tick and the subsequent of an increase in ticks on the moose. However, only the more able candidates linked these effects on the moose with the decrease in moose numbers.
A level 2 and a level 3 response are shown below:

Level 2 response:

Effect of global warming

(6)

Global warming is thought to be caused by enhanced greenhouse effect where the greenhouse gases like methane and carbondioxide are ~~accum~~ rising and accumulating in the atmosphere. These gases trap infrared radiation ~~ref~~ reflected from the earth's surface increasing the temperature of

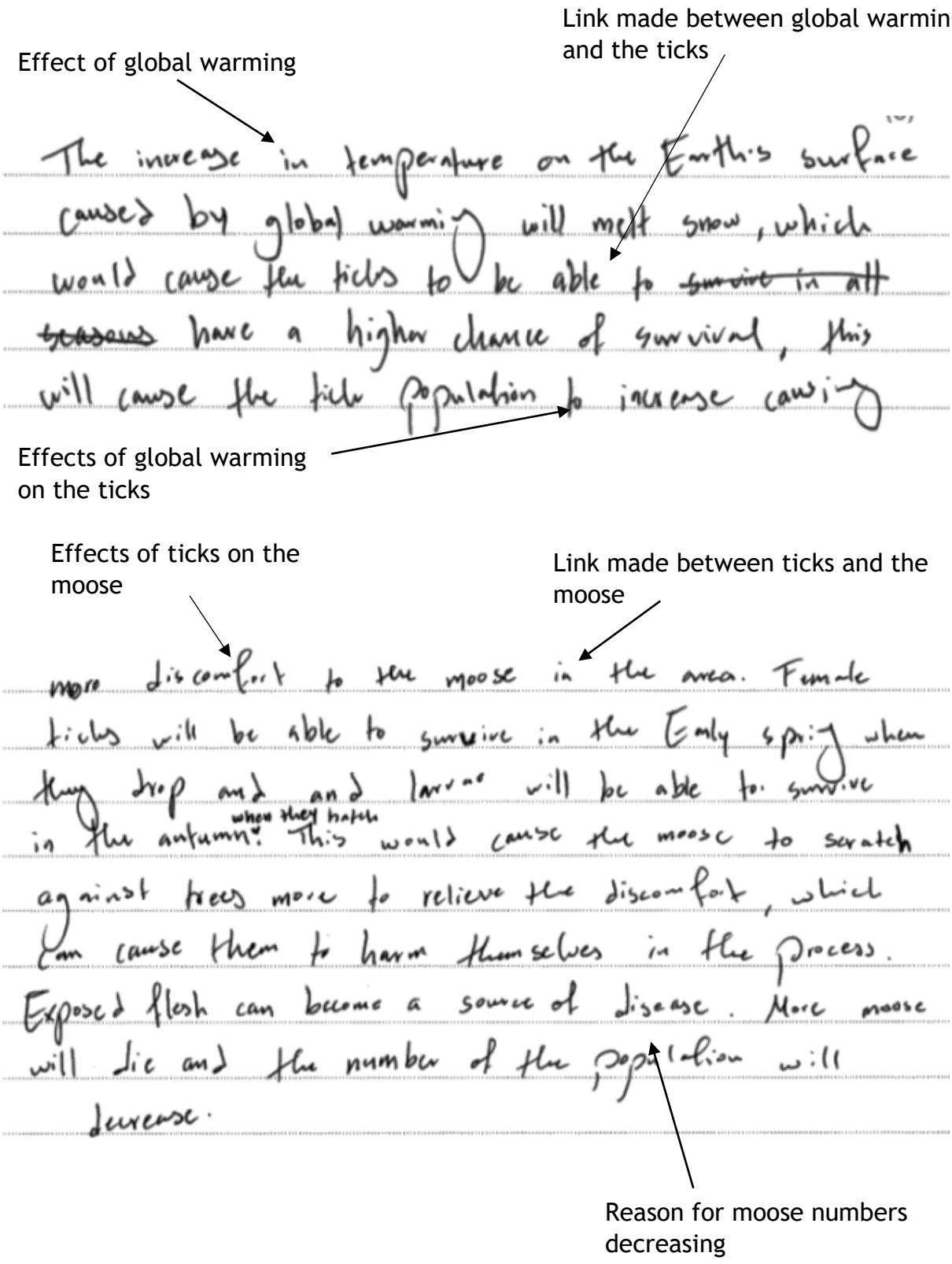
Link made between global warming and the ticks

Effects of global warming on the activity of the ticks

the Earth's surface. Global warming may cause the lifecycle of ticks to get shorter as enzymes involved in the development ~~of~~ and growth of ticks will have more kinetic energy and so will move faster leading to more enzyme-substrate complexes being formed. As a result, dormancy period of the female ticks ~~to~~ decreases so more eggs are laid increasing the population of ticks. Moreover, the chance of larvae being covered in snow is less due to increase in temperature so more larvae can grow into adult ticks which can lay eggs. Due to increase in ticks population more ticks will live on the fur of moose resulting in a decline in the number of moose because ticks feed on moose making moose weaker and hence die. However, because large clumps of fur falls off when moose scratch against trees, less ticks may live on the moose causing increase in the number of moose.

(Total for Question 9 = 14 marks)

Level 3 response:



Summary

The teachers and candidates in centres are clearly embracing the new specification and style of assessment. It is obvious that the candidates are being taught how to answer the new-style questions and that comments we have made in the past are being taken on board.
Performance will improve further if candidates can be taught to do the following things:

- Use past mark schemes and examiner reports to focus on the precise terminology that is required for some of the topics e.g. absorption of light, respiration of sugars to produce ATP, the phosphorylation of ADP into ATP, mutations in the DNA, alleles passed onto offspring, antibodies bind to antigens to increase the destruction of antigen by macrophages.
- The sequence of components in any one question is used to give clues to later parts of the question e.g. in question 6, the calculation in part (a) was asked to get students to think about the range of sizes of the nuts as they were going to need to use this information in part (b).
- The aspects of level-based questions that need to be covered in the response are identified e.g. in question 9 there was mention of global warming and its effect on moose number, data on the number of ticks on moose and a diagram on the life cycle of ticks.
- Responses should not just be a rewrite of the information given in the question e.g. in question 7 the information in the diagram should be used to answer the question, not simply rewritten in the candidate's own words.
- All working to calculations should be shown e.g. in question 9 part (b) a wrong answer with no working shown would score zero but if the working shown indicated that the values 214 and 41 had been used, one mark would have been awarded.

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