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Paper 01 Energy, Environment, Microbiology and  
Immunity

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## Introduction

This paper saw a wide range of responses to all its questions with very few questions left blank, except for the  $Q_{10}$  calculation at the end of the paper. It was clear that many centres have used our mark schemes and examiners comments to train their candidates into how to answer the questions.

## Question 1

A good number of candidates could name the three characteristics of inflammation in (a)(i). However, there were quite a few who thought vasodilation was a characteristic. In part (ii) a significant number of candidates described the causes of the characteristics and not their role.

In (b) part (i), many candidates picked out one similarity (both reduce inflammation) and one difference (curcumin more effective than drug A). However, candidates then tended to describe the changes that occurred each day for the two treatments without pinpointing specific differences on any one day. The multiple choice in part (ii) was not well answered.

## Question 2

In part (a), candidates who realised that they had to comment on the use of antibiotics in the treatment of the conditions listed in the table easily scored two marks. Weaker candidates explained that antibiotics could be used to treat only bacterial infections and scored one mark as they did not refer to the information in the table. An example of this is shown below:

Explain the use of antibiotics to treat these conditions.

(2)

Antibiotics are used to treat bacterial infections.  
Some conditions are caused by different microorganisms.  
Thus, antibiotics are sometimes used to treat them  
when they're caused by bacteria. Some conditions  
are not caused by bacteria, thus antibiotics won't  
be effective. Some conditions are always caused by  
bacteria. Thus antibiotics are always used to treat  
them.

Candidates interpreted the graph in part (b) very well and therefore selected the correct response for the multiple-choice question.

Candidates scored well in (c) part (i); they are very clear about the role of gut flora. Although the majority of candidates attempted part (ii) it was not particularly high scoring. This was due in part to poor wording, as many implied that the gut flora will be affected by all antibiotics. Unfortunately, many candidates lost the mark in part (iii) as they did not express their answer in standard form as instructed. It was impossible to tell if this was because they had not read the question carefully enough or because they could not write numbers in standard form. Responses to part (iv) were many and varied, and the stronger candidates had no problem in explaining the effects of each of the three antibiotics, whereas the weaker candidates simply described the sizes of the segments. A particularly good response is shown below:

(iv) Deduce the effects of antibiotics P, Q and R on gut flora.

(3)

Antibiotic R has no effect, the gut flora may be resistant to them. Antibiotic P ~~deases~~ kills 4 types of gut flora, it decreases the variety of gut flora. Antibiotic Q, kills ~~one~~ two of the gut flora but one new type of gut flora is ~~formed/produced~~ formed.

### Question 3

Some excellent responses were seen in part (a), such as the one below:

A vaccine is an injection of a dead or ~~non~~ inactivated pathogen that ~~is~~ <sup>is non-</sup> infectious and doesn't cause disease but acts as an antigen to stimulate an immune response. It is engulfed by a macrophage and presented to a T cell in its antigen-MHC complex at the cell surface membrane of the macrophage. The T cell binds its receptors and becomes activated, triggering rapid cell division and clonation. T helper cell clones and T memory cells are formed. T helper clone releases cytokines to B cell with specific antigen on their surface for the B cell to undergo cell division and clonation too. B effector cells and B memory cells are produced. B effector cells differentiate into plasma cell clones and produce specific antibodies that bind to the antigens of the pathogen to be engulfed by phagocytosis. This primary immune response and the production of antibodies is active immunity. If pathogen is encountered again, a secondary immune response will take place which is faster.

Fewer candidates seemed to be writing about dead viruses being used or B cells releasing antibody. There were many responses that gave very accurate details of the sequence of events, which matched the details that we have published in previous mark schemes for similar questions.

The graph in (b) part (i) was not that straight forward to interpret but many candidates made very good attempts at drawing conclusions from the data. Very few blank responses were seen. The weaker candidates did tend to write descriptions of the data rather than making conclusions. There were a number of very good reasons given in part (ii), with probably education being the most frequently seen suggestion.

Candidates had the gist of the idea about the importance of vaccinating large proportions of the population but could not explain their ideas very accurately, often just repeating what was written in the stem of the question. A mark for reference to 'herd immunity' was most frequently awarded. Candidates clearly to not understand the

difference between being infected and developing the disease. A typical response is given below:

Suggest why vaccination is more successful when a greater proportion of people are vaccinated.

(2)

Because of herd immunity, if a large amount of people can't be infected by a disease less people will become able to spread a disease. Disease is less spread.

#### Question 4

Very few candidates got the multiple choice wrong in (a) part (i) and a good number knew the meaning of 'anthropogenic climate change'. The most common errors were to not define climate change and to state that changes in weather patterns are over a long period of time.

Most candidates scored two marks quite easily for explaining that the species moved North due to an increase in temperature. The stronger candidates realised that they needed to include more than this in their answer, as the question was allocated 3 marks, and explained what effect the increased temperature could have. There were a number of vague answers from the weaker candidates who simply talked about habitat destruction.

Candidates found the data presented in part (c) quite challenging as the information in the key had not been considered sufficiently. A common misinterpretation was that the plotted points represented the number of male and female beetles born. The mark schemes for both parts (i) and (ii) still enabled these candidates to score marks. In part (ii) only the stronger candidates went beyond a description of the effect of temperature on enzyme activity.

#### Question 5

A number of candidates misread the question in (a) part (i) and explained how light energy is converted to ATP, and then found themselves writing a similar response in part (iii). The third mark point was the one most commonly awarded but some responses did include the idea that ATP was the energy currency and that light energy

cannot be used directly. Part (ii) saw a range of answers, many correct, but there was confusion over  $P_i$  which is acceptable and  $P$  which is not. If candidates are in doubt of a chemical formula, then they should write out the name of the chemical. The final part to (a) saw some excellent responses; candidates know the light-dependent reactions story very well. Although it was not a mark point in the context of this question, there were numerous candidates writing about light 'hitting' the chlorophyll when they should be mentioning that light is 'absorbed' by the chlorophyll.

The multiple-choice questions in (b) saw a mixture of responses. In part (i) the confusion lay between cyclic and non-cyclic photophosphorylation. Part (ii) was very poorly answered. Partly because we have not asked this question and partly because candidates did not read the question properly; many interpreted the question as asking for the names of the chemicals with the formulae  $C$ ,  $H$  and  $O$ . Many candidates who appreciated what we were asking thought that water was the source of oxygen.

## Question 6

The response below is fairly typical of the responses that we saw for (a) part (i):

(5)

Mutation results in allele that gives resistance to the chemical. The presence of the chemical acts as selection pressure. The flies with the beneficial allele survive and pass on the alleles to their offspring while reproducing. Thus overtime allele frequency changes and flies evolve resistance to the chemical.

Candidates are familiar with previous mark schemes for this type of question. However, there were still candidates that thought that the selection pressure actually causes the mutation. In this case it may well have been the chemicals that caused the mutation, but this is not usually the case. Candidates had no problem answering part (ii).

Many candidates made excellent attempts at the first of our two levels-based questions. It is obvious that many centres are using past mark schemes and examiner's reports to train their candidates in how to approach this style of question and as in this case, to use each set of data given. The weaker candidates were limited to a level one mark as they only compared the painted cows to the unpainted cows; we wanted the two types of stripes compared for a level two mark. One thing that candidates clearly have not taken on board yet is what is expected in a response to a question with the command word 'determine'. This command word requires a level two calculation to be used in the answer for full marks to be awarded and this was rarely seen.

## Question 7

The multiple choice in (a) was very high scoring. Response to part (ii) were not so high scoring however with the majority of responses only being awarded the fourth mark point. Many candidates clearly have a good knowledge of introns and hypervariable regions, but this did not answer our question. The answer below is a good example:

(ii) Explain why the use of an enzyme to cut the DNA results in fragments, of different lengths, that can be separated by gel electrophoresis.

(3)

A specific restriction enzyme, cuts DNA at specific sites only so fragments of DNA of different length are produced as the sites are not at equal distance. A longer fragment is usually heavier so smaller fragments move faster along the gel so fragments of different size are separated in gel electrophoresis when electricity is applied.

The two parts to (b) were reasonably well answered. However, candidates are advised to consider what are appropriate numbers of decimal places or significant figures to express their answers in.

In (c), few candidates linked the higher concentration of gel with the increase in number of molecules so did not pick up the mark for this question.

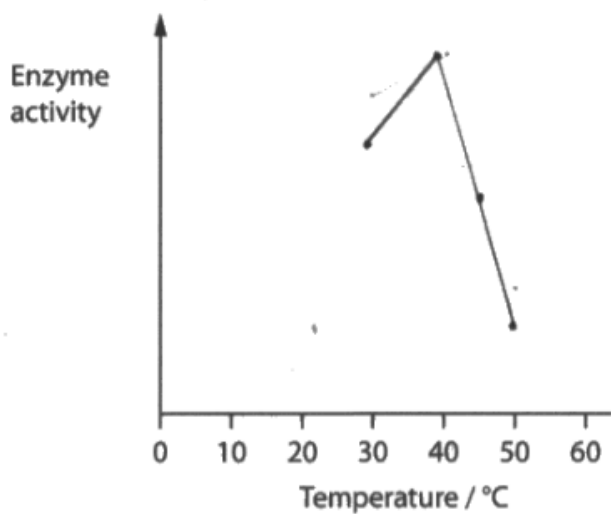
A number of candidates could name at least one example of circular DNA found in cells. Some answers that simply stated 'in bacteria' were considered to be too vague. There were a number of responses that stated 'in DNA viruses', which unfortunately could not be accepted as viruses are not cells. Part (ii) seemed to be challenging for candidates as they clearly had not considered the differences between circular and linear DNA before; the question was very low scoring. The most frequently awarded mark point was for the presence of histones in linear DNA but their absence in circular DNA. On a positive note, significantly more candidates wrote their answers as comparisons and not as two descriptions.



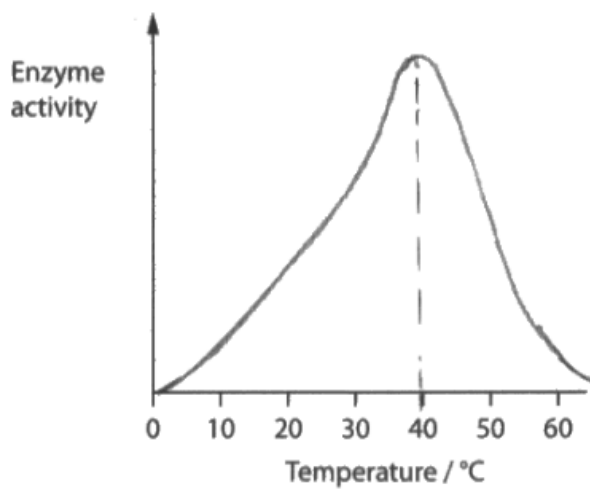
### Question 8

The graphs seen in (a) part (i) usually showed an increase in activity and then a decrease but many candidates lost marks by not drawing their lines accurately enough. Candidates need to be encouraged to draw diagrams carefully and accurately, and not to see them as quick and easy marks to gain. In this graph, a linear relationship between an increase in temperature and activity and the optimum shown corresponding to that in the data given was expected.

The example below is what we had hoped to see:



In the graph below, the optimum temperature has been shown but the lines on the graph have not been drawn accurately enough and with a ruler:



It was very evident from part (ii) that candidates do not fully understand how to calculate  $Q_{10}$ . This was not entirely surprising as this is a new topic on the current specification that has not been tested before. As it was a four-mark calculation, there were several method marks with consequential errors to enable candidates to not score four or zero. Candidates should be encouraged to attempt calculations and not to just leave them blank as they may pick up the odd mark.

In (b) part (i), there were a high number of candidates who could not calculate a ratio. Both marks were not largely awarded for this question. The only mark awarded was for adding up the total concentration of monosaccharides. The multiple choice saw a range of responses. Some candidates had been taught to identify median and mode and some had not. The paper finished with the second of our levels-based questions. Level one and level two requirements discriminated well between the weaker candidates and the rest; weaker candidates wrote a simple generic description about decomposition and did not mention carbohydrates. The response below is very well-expressed but unfortunately was limited to a level two mark. Although they have referenced the table, they have not given specific detail of how these carbohydrates would be decomposed:

**\*(iii) Explain the role of decomposition in returning the carbon present in the carbohydrates in the quince fruit back into the atmosphere.**

Use the information given in part (b) to support your answer.

(6)

Glycosidic bonds in disaccharides, trisaccharides and tetrasaccharides are broken down by decomposers. The decomposers release hydrolytic enzyme carbohydrase to hydrolyse the glycosidic bonds and form single unit carbohydrate. These carbohydrates are broken down respired by decomposers or in aerobic respiration/anaerobic respiration to release  $CO_2$ . Carbon from these or carbohydrates are returned back to the atmosphere in the form of carbon dioxide. Monosaccharides are directly respired by decomposers and contribute most carbon to the atmosphere.

## Summary:

As commented on earlier, some centres are clearly using our mark schemes and examiner's comments to prepare their candidates. However, there are still some points that need emphasising:

- With an increase in maths marks, candidates should be encouraged to attempt all calculations and, most importantly, show their working. Calculations worth three or more marks, and sometimes those worth two marks, will have method marks and consequential error marks.
- Candidates should be taught basic maths skills, as listed in the specification. It should not be assumed that they will have picked up these skills elsewhere. Calculating percentages and ratios seems to cause candidates particular problems. In particular, they should be trained on how to identify the number of decimal places or significant figures to express their answer to.
- Any diagram or graph that has to be drawn should be done with care and attention to detail. Diagrams should be accurate and in proportion and labelled carefully so that label lines touch the intended structures. Graphs should be drawn with a ruler where appropriate and any lines should accurately represent the biology.
- Candidates should be taught the meaning of all the command words listed in the specification so that they know what to include in their answers to access full marks.
- Levels-based questions need lots of practice, even if they are just planned and not actually answered fully. As we increase our assessment of this current specification there is an increasing number of examples available in the past papers.

