

GCE

Biology A

Advanced Subsidiary GCE **AS H020**

OCR Report to Centres June 2016

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This report on the examination provides information on the performance of candidates which it is hoped will be useful to teachers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding of the specification content, of the operation of the scheme of assessment and of the application of assessment criteria.

Reports should be read in conjunction with the published question papers and mark schemes for the examination.

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H020/01 Breadth in biology

General Comments:

Several excellent answers were seen and candidates expressed themselves well on the whole. The new specification highlights opportunities for the introduction of the key mathematical requirements, which are now embedded in the delivery of the specification and assessed in the question papers. The skills required are clearly explained in Appendix 5e of the specification, and further support is provided by the Mathematical Skills booklet available on the OCR website. Those candidates who had been more prepared for the increased emphasis on mathematical content were able to express their skills. This was also true of candidates who were more prepared for the embedded practical requirements by drawing on experience gained from carrying out practical work.

Most candidates focussed their answers on the command words and did not just describe when the question required explanation.

The weaker candidates wrote under-developed answers, did not address the question clearly, and used non-scientific terms. Several candidates did not always refer to the information, diagrams, graphs or figures included in the questions to support their answers. Units were sometimes either not included or wrongly quoted in responses using data. However, the stronger candidates had a clear grasp of the questions and developed their answers using the correct scientific terminology, and used precise supporting data where appropriate.

The provision of an additional page for continued answers at the back on the paper should be used rather than the inclusion of additional separate answer booklets, often comprising several pages, often for a few extra words.

Comments on Individual Questions:

Section A

The inclusion of multiple choice questions is a new feature for the AS and A Level Biology papers. Consequently the specification content can be covered more comprehensively and these questions served to highlight those areas that candidates had not revised prior to the examination.

Given that one of the possible options would be correct, very few questions were not attempted, as candidates realised that by selecting a 'random' letter they had at least a chance of supplying a correct answer.

Candidates should be aware that the answers should be written clearly, without ambiguity. If they change their minds about an answer then it should be crossed out and the intended answer written clearly. When letters are altered, the candidate's intention is frequently unclear and if there is doubt then the mark is not awarded.

The questions varied from straightforward recall to those requiring analysis and deduction, with some requiring the use of mathematical skills or relying on the experience gained from carrying out practical work.

This section achieved a good spread of marks.

Question 1

This was answered reasonably well. It should be emphasised that questions such as this, where data are presented that do not have definitive values (in this case, varying according to the

particular make and model of microscope), that candidates are expected to have an appreciation of the magnitude of the values rather than learning precise figures and expecting to quote those.

Question 2

This was a straightforward question that candidates should have been able to answer by recalling the fact. This was answered correctly by a high proportion of candidates.

Question 3

This question was also straightforward as the material is a clear learning outcome. While many had the ions the wrong way round, the correct choice for the charge of the ions defeated a significant number of candidates.

Question 4

Candidates found this difficult, many suggesting A or D. It is possible that they had misread the question and gave an option that was a correct statement about the genetic code rather than an incorrect one. Candidates should be encouraged to take care when reading questions rather than rushing into answering the question that they thought had been asked.

Question 5

This question was also quite straightforward and answered correctly by many candidates. For those who could be confused with the intercostal muscles, the movement of the ribcage and contraction of the diaphragm should have been sufficient to choose the correct answer.

Question 6

This question was also well answered, with most candidates correctly giving D as the answer.

Question 7

This was well understood by many candidates, correctly interpreting the graph to determine the period of ventricular systole and then choosing the correct time period. C and A were common incorrect suggestions.

Question 8

This question required candidates to study the chart, make their own deductions and then see which of the options was a correct statement. This, understandably, was found to be more difficult. Option A was a popular incorrect answer, but the data had no evidence of death by measles, only the number of cases. Option B, also a common suggestion, was not true for 1980. Those candidates who suggested option D had recognised that there was a correlation, but it is negative and not positive.

Question 9

Candidates needed to be clear about the definitions of species richness and species evenness in order to answer this question. Option D was a common incorrect suggestion. Some candidates suggested G or H, which were not valid options.

Question 10

There is some evident confusion with taxonomy. Despite many candidates choosing the correct option, D was a common suggestion.

Question 11

This was one of the questions that would have advantaged those candidates who had carried out relevant practical work. Many candidates were able to successfully measure the distances and perform the calculation correctly.

Question 12

This question required candidates to draw on their knowledge of the various parts of the circulatory system in a way in which they may not have done previously. The most common error was to think that the blood in the vena cava was under high pressure.

Question 13

This was another question that drew upon the candidates' practical skills. Again, it might have been that some candidates misread the question and suggested a precaution that is needed, accounting for the incorrect answers seen.

Question 14

This should have been fairly straightforward for candidates who had seen images of mitosis or who could interpret the image using knowledge from diagrams of the process. A few suggested M, which was not a valid option.

Question 15

This is another instance where the question should be read carefully. It was clear that many candidates homed in on the 'antibody binding sites' and suggested region A. Careful reading would have revealed that the region was C, the part that flexed and changed the distance between the antibody binding sites.

Question 16

Candidates had a lot to process in this question. They not only had to consider the implications of the test results but also to relate these to the 'cytoplasm' at the start and the 'extracellular fluid' at the end and then to work out what they would have expected to happen in the given scenario. Practical work that they had carried out would have been of considerable help here, but with so much having to be assimilated, drawing on various aspects of the specification, it is not unexpected that candidates found this to be a challenging question. Many candidates failed to appreciate that the enzyme is a protein.

Question 17

This question required basic mathematical skills, as required in the specification, to select the correct answer. A significant proportion of candidates were unable to perform the calculations correctly.

Question 18

Some candidates were unable to distinguish between the various white blood cells, although a few did suggest the erythrocyte.

Question 19

Some candidates confused 'primary defence mechanism' with 'primary response' and suggested various actions of the immune system rather than blood clotting.

Question 20

In this question candidates needed to process quite a lot of information about pathogens. While many chose the correct option, the most common error was to think that malaria is caused by a bacterium and therefore choose the incorrect option C. This type of question is one of those that highlight popular misconceptions.

Section B

Question 21

- (a)(i) This question was relatively well answered but many candidates stated soak time as a factor, despite the question specifying four hours. Some candidates correctly named the variable but failed to keep it the same. A significant number of students did not appreciate that the question referred to the **validity** of the results and gave responses relating to ensuring the accuracy or reliability of results, e.g. using suitable measuring equipment for the volumes or to doing repeats. Candidates did not always use the term volume rather than 'amount', or refer to the discs rather than just the potato tuber.
- (a)(ii) Most candidates did not read the question carefully enough and just described why the discs gained or lost mass in the various sucrose solutions. Typically they gave statements such as 'when the increase in mass is high then the water potential of the solution is higher than in the potato and when mass is lost the water potential of the solution is lower'. There was no indication they understood that the water potential of the potato tissue could be quantified from the results or the significance of the sucrose concentration where no mass change occurred. Several candidates appreciated that the mass difference changed from positive to negative between two stated sucrose solution concentrations, but did not develop the idea further. Candidates who, presumably, had done this as a practical exercise or had analysed similar data, knew that a graph of the results would yield an estimate but most of these said that the water potential could be obtained directly from the point where the line of best fit crossed the zero mass value (rather than the equivalent sucrose concentration).
- (b)(i) Almost all candidates correctly identified X as the cell wall. Few however went on to gain both of the other marks. The vast majority of candidates knew Y was the 'cell membrane' but failed to use the correct A Level terminology of cell surface membrane or plasma membrane. Z was typically identified as the vacuole rather than the vacuole membrane, although label line U was to the vacuole. Some candidates thought the label line pointed to the nuclear membrane, despite the nucleus being clearly labelled.
- (b)(ii) It seems that the majority of candidates did not appreciate that the cell wall is fully permeable and so sucrose solution would therefore enter the space at W. Typical wrong responses were water/air/nothing.
- (c) This question highlighted the failure of many candidates to use the correct scientific terminology. In particular was the use of 'concentration gradient' without showing an appreciation of, or even mentioning, water potential, despite the previous parts of the question being on that subject. Where active transport was mentioned some thought it was the water that was pumped into the cell or that transpiration was also involved. Many candidates understood the principle of reducing the water potential of the root hair cells but failed to gain credit by referring to the roots or the plant without specifying the 'root hair cells'. They also talked about the large surface area of root hair cells, which also failed to gain credit.

Question 22

- (a)(i) Most candidates recognised that the number of kB would be obtained by dividing the length of DNA by the length of a kB to arrive at the number of kB in the length of DNA. However, they were not confident converting units of cm and micrometres to standard form, and also failed to state the answer to the nearest whole number.
- (a)(ii) The majority of candidates correctly scored maximum marks for this calculation, but the most common mistake that was presented was through poor arithmetic, e.g. $100 - 44 = 66$.

- (b)(i) and (ii) Most candidates identified the correct reaction involved and stated that the chemical released was water. Esterification also gained credit for some candidates. A minority of candidates wrongly answered hydrolysis, with hydrogen given off.
- (b)(iii) Generally this was a well answered question with candidates recalling correctly the base pairs and the relevant number of hydrogen bonds between the pairs. Fewer candidates were able to describe the correct location of the phosphodiester bond in the sugar-phosphate backbone. A few candidates were unsure of DNA structure, incorrectly identifying them as polypeptides and then going on to list the bonds found in protein structure.

Question 23

- (a) In the classification table the categories of taxa were correctly stated by the majority but the actual classification groups within the taxa posed more problematical: in particular identifying 'Animalia' as the correct kingdom. Eukaryota was a common error. Although many candidates correctly stated the species as 'sumatrensis', very many were not credited the mark because of using a capital letter.
- (b) Most candidates stated that the advantage of the binomial naming system is that it is used as a universal language and therefore avoids confusion over different common names for the same organism.
- (c)(i) 'Poaching' or 'hunting' and 'deforestation' were the most common correct reasons given for why the species is critically endangered.
- (c)(ii) Many candidates stated that less reproduction would occur but did not further develop the idea. A smaller gene pool or less genetic variation was often correctly stated but fewer candidates went on to explain how this would speed up extinction in terms of a lack of ability to adapt to environmental change or all being vulnerable to a particular disease. There was a misconception for some candidates in this question, since they discussed problems for small animals as opposed to small populations.
- (c)(iii) This question proved to be challenging for most candidates who often failed to note from the information in the question that captive breeding programmes with *D. sumatrensis* have been unsuccessful. It was very common to read in their responses that the zoos could re-introduce the rhinos into the wild, rather than correctly referring to zoos providing funding or support for conservation projects or raising public awareness.

Question 24

- (a) This was a challenging question with no more than a third of candidates knowing how to carry out the percentage change calculation correctly. A large proportion of candidates failed to work out the difference as the first step (so missed the calculation mark) and if they did calculate it, candidates then offered this as the % difference, without the division and x100 part of the calculation. This mathematical skill should be specifically practised.
- (b)(i) Most candidates stated that lack of a nucleus left more space for oxygen/haemoglobin but a significant number referred wrongly to an increase in surface area. The short life span of erythrocyte was commonly stated as a disadvantage but very few candidates realised their inability to carry out protein synthesis. Many candidates simply re-stated that erythrocytes had no membrane-bound organelles or a nucleus without any further qualification. A common misunderstanding was that the erythrocyte would be unable to respire, failing to realise that anaerobic respiration does still take place. A significant number said that erythrocytes would be unable to defend themselves from infection without a nucleus, or could not control cell activities or what entered or left the cell.

- (b)(ii) This was a challenging question for many, and several failed to specify which organism they were talking about. Candidates often understood that viruses couldn't use erythrocytes for reproduction but failed to make the link that viruses must use the host cell to replicate. Candidates restated the question describing that part of the Plasmodium life cycle took place in the red blood cell but failed to realise it did not complete its life cycle. Commonly, candidates said that the Plasmodium used the erythrocyte for transport and as a source of oxygen. Many candidates spoke of Plasmodium using the erythrocyte because it is injected directly into the blood by the mosquito. Only the most able candidates described how Plasmodium could evade the immune response within the red blood cell.
- (b)(iii) Most candidates scored 1 mark for lack of mitochondria although some candidates just referred to no organelles or no organelles for respiration. Very few candidates made the connection with aerobic respiration and the majority of candidates believed that erythrocytes could not respire at all and just had a completely passive role. Many candidates referred to the pointless nature of using the oxygen that they are supposed to be carrying to other tissues, more of a philosophical attitude than biological one.
- (c)(i) Many candidates understood the need to multiply 5×20.1 and gained one working mark for this or a variation of it, but many were clearly struggling with the conversion into different units of different magnitude and the correct answer was only gained by a few.
- (c)(ii) Many candidates made reference to elastic tissue and muscle tissue in arteries and arterioles but did not gain credit because they failed to specify the wall. Some candidates just referred to 'blood vessels' as stated in the question, without naming them. A significant number referred to cell walls of the different vessels. The majority of candidates referred to capillaries as being one cell thick, with no reference to their walls. Most candidates gained credit for diffusion in connection with capillaries.
- (d)(i) The vast majority of candidates answered (and spelled) Bohr effect/shift correctly.
- (d)(ii) Most candidates described the actively respiring cells' 'need' for oxygen and that it is released because the tissues require it. They also stated that actively respiring tissues have a low partial pressure of oxygen (as they use up oxygen), but failed to make the link to more CO_2 being produced. A worrying number of candidates thought that resting tissues did not respire or need any oxygen at all, and some thought that respiring tissues themselves have a higher affinity for oxygen. The more able candidates described the effect of increased carbon dioxide in terms of H^+ from carbonic acid causing dissociation of oxygen from haemoglobin.

Question 25

- (a) Most candidates gained some credit here but only a few gained all four marks. Commonly, correct responses were contradicted by incorrect answers particularly when identifying the evidence for translocation as an active process. It would seem that these students have limited experience of interpreting data/observations or relating them to processes.
- (b) A significant number of candidates were able to describe the process of mass flow correctly but failed to gain credit by not specifying that the sieve tube elements of the phloem that are involved. Some talked about loading sap rather than sucrose. Many also concentrated on a detailed description of the loading mechanism rather than fully addressing the information required. There was some evidence of a lack of care when reading the question. Often there was confusion with the transport in the xylem, e.g. sugars moving along symplast / apoplast pathways, by cohesion and adhesion.

The term 'concentration gradient' was commonly used as a catch-all phrase to explain the movement of anything from one place to another. The terminologies of water potential gradient and/or hydrostatic pressure gradient were only correctly used by the better candidates. It seems that few candidates appreciate that a pressure gradient is set up between the source and sink.

H020/02 Depth in biology

General Comments:

This paper, the first in the new AS Specification, produced a good spread of marks. Most candidates attempted all the questions, although there were some 'no responses' (particularly with calculations and associated questions).

The paper is different in style from the legacy specifications in a number of ways, all of which should be taken into account when delivering the specification content.

- There are fewer questions that depend on straightforward recall. They are often in some sort of context that might well be unfamiliar and so the candidates will have to apply their knowledge in answering the question. There is more reliance on analysis of information and/or data and coming to a conclusion.
- There is greater mathematical content, which is assessed in both the papers. The Mathematical Requirements are clearly set out in the specification and candidates are expected to be able to perform all aspects of the requirements. Additional support material is available on the OCR website.
Psychology departments also have to deal with teaching statistical tests to non-mathematicians and it might be useful to consult with those colleagues for ideas on how to choose and apply the various statistical tests.
- Practical work is embedded in the specification and, although there is no practical endorsement at AS, papers will contain questions that assume that candidates have carried out appropriate practical work and can draw on this experience in order to provide suitable answers.
- Level of Response (LoR) questions feature in this paper. These questions are marked in a holistic way, based on a pre-determined list of scientific valid points. The points do not represent an exhaustive list but are simply used as a guide to locate the response into one of three marking levels. Responses are expected to deal with all aspects of the question in order to determine the highest level into which the question should be assigned. Examiners are looking for clear scientific points to be made that will be relevant and cover the question that has been asked. Scientific language should be of a suitable standard and ideas should be conveyed with order and clarity. Resources are available on the OCR website to support the interpretation of this aspect of the assessment.

Examiners were pleased to note that candidates were indicating when an answer extended onto the additional answer space or additional booklets. Centres are reminded to instruct candidates to clearly identify the additional work by question and part number, e.g. 2(c)(ii). It was noted that some Centres are supplying additional sheets or answer booklets before candidates have used the additional answer space on the question paper.

A significant number of scripts were seen that were word processed. For clarity, double line spacing would be preferred. If any questions (such as calculations or single letters) are answered on the paper then it is also better if this is noted on the type written document.

Comments on Individual Questions:

Question 1

- (a)(i) Generally this was very well-answered. Most candidates know the position of ribs and diaphragm in expiration but some described inspiration or muddled relaxing and contracting. A small minority of candidates failed to gain marks as they either didn't state the letter of the correct diagram (A) or answered incorrectly with B. A number incorrectly referred to the lungs 'relaxing' and some talked about the lungs being completely empty of air.
- (a)(ii) This was moderately well-answered. Most correct answers referred to muscles relaxing. Very few candidates mentioned elastic recoil or the rib cage falling or dropping under the influence of gravity. The most common answers not worthy of credit were a reference to energy/ATP not being needed or pressure differences. Many candidates do not appreciate what passive means in this context, confusing it with subconscious or part of autonomic nervous system. Many of those who correctly recognise passive as not requiring energy then did not connect that to why it doesn't require energy.
- (a)(iii) Most answers referred to airways being narrowed and gases (air/oxygen/carbon dioxide) entering, passing, moving in or flowing. Candidates demonstrated lack of scientific language, just referring to air 'moving in/out' rather than inhalation and exhalation. Key terms should be reinforced whilst teaching. The misconception that smooth muscle was present in the trachea was common. Some candidates referred to smooth muscle contraction in artery walls while others thought the muscle contraction would prevent any air from entering or was used to expel air from the lungs. A small number of candidates described the processes of inhalation and exhalation but failed to address the question.
- (b)(i) It was good to see so many correct responses for this question. It provided a useful scaffold with letter A provided (to emphasise the direction of the trace) but, nonetheless, the candidates did show a good grasp of the features displayed via the spirometer trace. It was interesting to note that a common error was to select E (the expiratory reserve volume) instead of the correct choice H for the residual volume. Total lung capacity was most frequently correct. Several candidates confused F and C.
- (b)(ii) This question was generally answered really well. It demonstrates the emphasis on practical work and the fact that its assessment is now embedded in the question papers. Those with experience were better equipped to describe the process. However, a large minority struggled to link the 'as much as possible' idea to both inhalation and exhalation in terms of quality of expression. Unfortunately, some candidates described breathing out before breathing in and this limited their overall score to 1 mark for this question.

Question 2

- (a) Most candidates struggled to apply their knowledge of mitosis and meiosis in the unfamiliar context of two life cycle diagrams. The most frequent mark to be awarded was for recognising that stage C represented mitosis and that A could be either meiosis or mitosis. Candidates almost universally made the mistake of naming meiosis as producing the gametes in the sporophyte plant life cycle. They made the same mistake at step D for the stage between a haploid organism and its gametes. The association of meiosis with gametes in candidates' thinking clearly over-rides any understanding of the reduction or maintenance of chromosome numbers. The instruction was clear that 'a' tick was needed in each row, but a number of candidates put two ticks in some rows.

- (b)(i) Most candidates selected the gap and synthesis stages of the cell cycle as comprising interphase. A few made the error of including either mitosis or cytokinesis as well. A lot of candidates thought that X, Y and Z were phases, rather than the checkpoints they were already identified as in the question.
- (b)(ii) This question tested candidates' awareness of what happens at the S phase of the cell cycle. Correct answers focused on checking that the DNA had replicated correctly without mutation. Some answers also made irrelevant reference to the replication of organelles.
- (c)(i) Most candidates correctly identified cell Q.
- (c)(ii) Some excellent answers were seen to this question. Candidates were expected to refer to DNA and so references to P being a complex cell without further qualification were not credited.
- (c)(iii) Some candidates incorrectly thought the cell would be dead but there were plenty of good answers to this question with ideas of differentiation and specialisation and suggestions of examples of cells that cell R could be. There were a number of alternatives on the mark scheme to reflect the wide range of potential correct answers.
- (d)(i) This question tested candidates' ability to scan a set of data and select the significant differences. The mark was not awarded if only one of prophase or telophase was discussed. The difference needed to be qualified as more in prophase and less in telophase for cell W, or calculated figure differences for both stages needed to be given.
- (d)(ii) There was wide variation in candidates' familiarity with the Student's t-test. Most correct answers referred to the need for comparing or calculating means for this test. Some stated that the test could only be used for calculations relating to biodiversity, as this had presumably been the context in which it had been taught.
- (e)(i) The chi-squared test was well done by a great many candidates, who were clearly well-prepared for the calculation aspect of the test. It was clear, however, that some candidates had not encountered chi-squared before [ref. the mathematical requirements in the AS Specification]. The scaffolding provided in the question, however, assisted them in completing the calculation. In this question as sample figures in the last column were given to three decimal places, answers should also have been given to three decimal places. The common errors were in rounding figures incorrectly or thinking that the square of -23 is also a negative number.
- (e)(ii) Most candidates followed the instructions given and correctly identified the degrees of freedom as 3.
- (e)(iii) As might be expected, this part of the question proved to be the most challenging. Comparing the calculated value of chi-squared with a statistical table to draw a conclusion was the weakest step in the mental processing. There are many ways of expressing the conclusion that can be drawn from a chi-squared procedure and the mark scheme gives an exhaustive list of examples for use in teaching. Candidates who got parts (e)(i) and / or (e)(ii) wrong were not disadvantaged at this stage, as conclusions were marked based on their figures. The crucial piece of understanding that was missing from wrong answers is that the probability in the column headings is the probability of this amount of deviation (difference) occurring by chance. The use of $p = 0.05$ as the critical value is central to the interpretation. It may also help to explain to students that the smaller the chi-squared value, the better the fit of the two sets of data.

Question 3

- (a) Candidates' understanding of biochemistry was generally good. The mechanism of a condensation reaction was well known, although some candidates confused glycosidic and peptide bonds.
- (a)(i) The presence of the N in various forms was generally recognised.
- (a)(ii) Many candidates correctly suggested beta glucose, although some failed to specify the type of glucose or incorrectly suggested alpha. If using the symbol for beta, rather than writing it in full, it should be stressed to candidates that the symbol must be unambiguous and clearly distinguishable from the letter B. Consequently, β needed to have a clear 'tail' so as not to be confused with B. (B or b were not acceptable answers because of the potential confusion with protein structure.)
- (a)(iii) Many candidates gained 2 out of the 4 possible marks. These tended to be the mark points for condensation reaction and the water released. There were some excellent answers from candidates who applied their scientific knowledge and explained fully how chitin could be formed to gain all 4 marks. The need to 'flip' alternate monomers was recognised but few managed to clearly explain why this was necessary. The similarity to cellulose was identified but some were unable to distinguish between the monomer and polymer, stating that chitin molecules are joined to each other by glycosidic bonds. Weaker answers strayed into descriptions of alpha helices and beta pleated sheets.
- (b)(i) Most recognised the role of chitin in support, although some only mentioned properties of chitin such as strength or structure which were not credited.
- (b)(ii) Candidates generally recognised that the mites would obstruct the airways. References to oxygen frequently neglected to mention that the cells or tissues of the honey bee would receive less. Despite the gas exchange system of an insect being on the specification, a significant number of candidates referred to less oxygen reaching the bee's lungs. Other suitable suggestions included disease transmission or toxin production.

Question 4

- (a)(i) Most candidates selected the correct name and wrote it with a capital letter.
- (a)(ii) It was surprisingly rare for candidates to apply their knowledge of kingdom Fungi to realise that digestion here is extracellular, involving enzymes being secreted by the hyphae and acting outside of them. Some referred to 'it' and their subsequent answer did not make it clear whether the answer referred to the enzymes or the fungus.
- (b)(i) A significant proportion of candidates gave 'stock' answers and did not interpret the information given to realise that pH change is a component of the dependent variable due to the production of fatty acids when lipase digests lipid and therefore indicates when the reaction has taken place.
- (b)(ii) There were five controlled variables for candidates to select from, but answers commonly lacked an important detail, such as the word 'solution' or a clear description of how the variable was quantified such as volume. Students should be encouraged to replace the imprecise term 'amount' with a more precise descriptor of measurement when talking or writing about experimental variables.
- (b)(iii) A surprisingly large number of answers stated that temperature was uncontrolled, although the question states that the first run of repeats occurred at 20°C and subsequently at six other temperatures (all of which are listed in the independent

- variable column in Table 4.1). Correct answers focused on the volume or number of drops of indicator added or sample of reaction mixture solution removed.
- (b)(iv) Many candidates realised the value of a white tile in perceiving a colour change more easily as it provided a contrast.
 - (b)(v) Most candidates picked a single temperature (35°C) and did not realise that with intervals of 5°C between tests there is a possibility that the true optimum lies to one side of this figure. The correct range was 30°C-35°C based on comparing the data for 30°C and 40°C. Marks were not given on this and the next question if units were omitted.
 - (b)(vi) Very few candidates scored full or many marks on this task. Candidates needed to focus on the word 'accurate' and consider ways of measurement that would allow the true optimum temperature to be pin-pointed more truly. Refining the temperature range to include smaller temperature intervals in the suspected optimum range, or sampling more often to identify the end point time more closely were the most frequent good suggestions. A few candidates mentioned the use of more sophisticated equipment such as a colorimeter to detect the end point time, or a pH probe to measure the dependent variable without the need for a subjective colour judgement.
 - (c) Most candidates achieved a level two response. Descriptions of what is meant by the lock and key model and the induced fit model were mostly good, as was description of the events that lead to denaturing of enzyme structure at high temperatures. Level three responses also described reaction kinetics at low temperatures. Errors included the belief that enzymes denature at low temperatures. The question referred to temperature change and this was frequently repeated in the answer without stating whether the information was linked to a raising or lowering of temperature. Given the difference in the effect of low and high temperatures on enzyme structure and action, this needed to be clear.

Question 5

- (a)(i) Most candidates answered this correctly.
- (a)(ii) This question was quite well answered, although those candidates who chose to describe the circulations (rather than stating single for the fish and double for the mammal) frequently only described one. It was interesting to note that a significant number of candidates referred to 'pumps' rather than hearts, although some stated that the fish did not have a heart.
- (b) This was a Level of Response question which was challenging as it dealt with some unfamiliar material and produced a wide spread of marks. The candidates often did well with part or full descriptions of the frog and mammalian circulatory systems but responses often lacked effective accounts of comparative efficiency. The vast majority of candidates recognised that blood is 'mixed' in amphibians but not in mammals. There were some good descriptions of the mammalian circulation, which at times also went on to describe amphibian circulation well. Some thought that the frog has an open circulatory system or sometimes a triple one. Many candidates attempted to explain why the mammalian circulation is effective in terms of the separation of oxygenated and deoxygenated blood and some linked this to the oxygen concentration gradient in respiring tissues. A few linked this to differences in the metabolic rates of the two organisms. A minority of candidates discussed the relative carbon dioxide concentration gradients in the lungs or respiring tissues. Some candidates wrote about pressure differences - blood can be under higher pressure in the mammalian systemic circulation so can travel faster around body. Some references to maintaining body temperature

were seen, but candidates often used simple non-scientific terms such as cold blooded. Some gained full marks by discussing the relative effectiveness of mammalian and amphibian circulation.

Question 6

- (a)(i) Most candidates found this question challenging, tending to repeat or rephrase the stem of the question. Vague or ambiguous references to being exposed to penicillin were insufficient as they needed to clearly refer to the original colonies that survived when the original petri dish was flooded with penicillin. The candidates needed to take careful note of the diagrams and the information provided in order to make an informed statement.
- (a)(ii) This question elicited the following incorrect answers on a frequent basis: binary fission, mutation, evolution and mitosis. Some misunderstood the question and referred to antibiotic resistance, immunity or vaccination.
- (b)(i) Candidates should be encouraged to always show their working for calculations. Those who did were frequently able to be awarded a mark for working despite having the incorrect answer. Most were able to select the correct figures but were unable to manipulate them correctly. Calculation of percentage increase, decrease or change proves to be challenging for candidates.
- (b)(ii) In contrast, most candidates performed this calculation correctly and were able to make a suitable comment relating to its increase since 1993.
- (b)(iii) Most candidates observed the correct trend but did not clearly distinguish between total certificates mentioning *S.aureus*, those mentioning *S. aureus* specified as MRSA and those mentioning *S. aureus* not specified as resistant. Data quoted was frequently raw data rather than processed. Measures to prevent cross-infection were only credited if they were specific rather than vague references to 'better hygiene'.

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