GCE

Biology A

Advanced Subsidiary GCE **AS H020**

OCR Report to Centres June 2017

About this Examiner Report to Centres

This report on the 2017 Summer assessments aims to highlight:

- areas where students were more successful
- main areas where students may need additional support and some reflection
- points of advice 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.

The report also includes:

- An invitation to get involved in Cambridge Assessment's research into **how current reforms are affecting schools and colleges**
- Links to important documents such as **grade boundaries**
- A reminder of our **post-results services** including Enquiries About Results
- **Further support that you can expect from OCR**, such as our Active Results service and CPD programme
- A link to our handy Teacher Guide on **Supporting the move to linear assessment** to support you with the ongoing transition.

Understanding how current reforms are affecting schools and colleges
Researchers at Cambridge Assessment[1] are undertaking a research study to better understand how the current reforms to AS and A levels are affecting schools and colleges.
If you are a Head of Department (including deputy and acting Heads), then we would be very grateful if you would take part in this research by completing their survey. If you have already completed the survey this spring/summer then you do not need to complete it again.
The questionnaire will take approximately 15 minutes and all responses will be anonymous.
To take part, please click on this link: https://www.surveymonkey.co.uk/r/KP96LWB

Grade boundaries
Grade boundaries for this, and all other assessments, can be found on Interchange. For more information on the publication of grade boundaries please see the OCR website.

Enquiry About Results
If any of your students' results are not as expected, you may wish to consider one of our Enquiry About Results services. For full information about the options available visit the OCR website. If university places are reliant on the results you are making an enquiry about you may wish to consider the priority 2 service which has an earlier deadline to ensure your enquires are processed in time for university applications.

Supporting the move to linear assessment
This was the first year that students were assessed in a linear structure. To help you navigate the changes and to support you with areas of difficulty, download our helpful Teacher guide: http://www.ocr.org.uk/Images/345911-moving-from-modular-to-linear-science-qualifications-teachers-guide.pdf

Further support from OCR

activeresults

Active Results offers a unique perspective on results data and greater opportunities to understand students' performance.
It allows you to:

- Review reports on the **performance of individual candidates**, cohorts of students and whole centres
- **Analyse results** at question and/or topic level
- **Compare your centre** with OCR national averages or similar OCR centres.
- Identify areas of the curriculum where students excel or struggle and help **pinpoint strengths and weaknesses** of students and teaching departments.

http://www.ocr.org.uk/administration/support-and-tools/active-results/

CPD Hub
Your route to OCR's teacher training

Attend one of our popular CPD courses to hear exam feedback or drop in to an online Q&A session.
https://www.cpdhub.ocr.org.uk

[1] Cambridge Assessment is a not-for-profit non-teaching department of the University of Cambridge, and the parent organisation of OCR, Cambridge International Examinations and Cambridge English Language Assessment.

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Advanced Subsidiary GCE Biology B (Advancing Biology (H020)

OCR REPORT TO CENTRES

H020/01 Breadth in biology

General Comments:

Candidates expressed themselves well on the whole and several excellent answers were seen. The key mathematical requirements are now embedded in the delivery of the specification and assessed in the question papers. 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 focused their answers on the command words and, for example, 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, using precise supporting data where appropriate.

The provision of several additional pages for continued answers at the back on the paper should be highlighted to candidates and the inclusion of additional separate answer booklets discouraged.

Comments on Individual Questions:

Section A

This section discriminated well as a whole, providing a good range of marks. Few questions were not attempted at all.

If candidates change their mind about an answer, they should clearly cross out the letter and write the intended answer clearly in or beside the answer box. If letters are altered then the resulting 'hybrid' would be deemed to be ambiguous and so not credited.

Question 1
This was answered quite well, the more common incorrect answers being **B** and **D**.

Question 2
Most candidates answered this correctly. The most common incorrect answer was not, as anticipated, the distractor **C** but **D**.

Question 3
Candidates also found this question fairly straightforward. **B** and **C** were the common incorrect answers.

Question 4
Most candidates answered this correctly, many with evidence that they had performed the calculation for each population.

Question 5
This was correctly answered by many candidates.

Question 6
This was the most challenging question for candidates, with the fewest number of correct answers. There was no pattern in the incorrect answers supplied.

Question 7
This was answered quite well, although a significant number of candidates opted for the distractors **A** or **B**.

Question 8
This was fairly well answered.

Question 9
This was answered quite well. Option **B** was a common incorrect suggestion.

Question 10
Many candidates got this one wrong with all distractors proving tempting.

Question 11
D was a common incorrect answer provided by a significant proportion of candidates.

Question 12
Candidates could reasonably suggest either **A** or **B** as correct answers and both were credited in order to be fair to candidates.

Question 13
This was correctly answered by many candidates.

Question 14
Given that this was a question requiring application of candidates' knowledge, it was one of the harder questions. **B** was rarely seen as an incorrect suggestion.

Question 15
Candidates found this question straightforward.

Question 16
Candidates found this difficult which was surprising considering that it is a clear learning outcome and that the question set out a scenario that would definitively indicate a particular type of immunity provided.

Question 17
This was well answered. It was, however, surprising the number of candidates who thought that the vessel described was a capillary.

Question 18
Candidates could reasonably suggest either **A** or **D** as correct answers and both were credited in order to be fair to candidates.

Question 19
This was well answered, with many candidates being confident about the definition.

Question 20
This question was challenging. Those who answered incorrectly predominantly suggested **A**.

Section B

Question 21

21(a)(i)
A number of candidates focused on the idea that onion root tips were used for convenience, rather than as the place where cell division occurs. Many answers included factors such as the size of the cells, wide availability and cost, which could be described as features of onion rather than of root tips.

Several candidates repeated the information given in the question without enough qualification to warrant a mark, e.g. brief statements such as 'because mitosis happens here'. A number failed to specify root tips especially when referring to 'growth', or referred to cell growth. Very few candidates realised that the lack of chloroplasts in root tips made them preferable to shoot tips. The term 'meristem' was used by very few candidates.

21(a)(ii)
Candidates who had carried out root tip squashes could correctly name a nucleus-specific stain.

Iodine was a common incorrect answer, presumably because iodine solution is routinely used to make onion cells visible under a microscope in early practical work. Other chemicals that candidates might meet were incorrectly offered, including Benedict's reagent, phenolphthalein, and even food dyes.

21(b)
A common error was misusing the formula linking magnification with image size and actual size, so wrongly dividing 2.35 by 20. The correct units were usually used. Students should be encouraged to think about what their answers actually mean – answers of hundreds of mm or cm for a cell nucleus are clearly wrong.

Question 22

22(a)
Candidates understood that glycogen is more compact than glucose, but didn't usually go on to explain that it stores large amounts of energy. Many commented that glycogen is insoluble, but didn't explain that it can be stored without any water potential implications for cells.

A large number of candidates substituted 'energy' for 'glucose' when describing how the structure of glycogen allows a rapid release of glucose. There was a tendency to describe removal of glucose as 'easy' rather than 'fast'. The highly branched structure was noted but not explained further in terms of the idea of lots of 'ends' for rapid hydrolysis.

A significant minority of candidates appeared to have little understanding of glucose and glycogen structure, e.g. seeming to be unaware that glycogen was a polymer of glucose or making statements about the number of branches in glucose molecules.

22(b)
Some candidates wrongly answered in terms of the transport of the gene, RNA or even the ribosome itself, rather than the protein. Others limited their answers to accounts of transcription and translation without moving on to secretion.

However, many candidates had learned the topic well and gained full marks in a single sentence. Generally candidates knew that processing and packaging happens at the Golgi apparatus, but could be less clear on other details. Few candidates included the distinction between transport vesicles and secretory vesicles, or used the precise terms. Several candidates failed to specify that the vesicle fused with the cell surface membrane, rather than

just the cell membrane, and described the vesicle being released rather than the protein. Some candidates were familiar with the function of the cytoskeleton and used terms like chaperones and motor proteins.

Question 23

23(a)
Most candidates answered this question as a straightforward description of structure of the membrane rather than emphasising the 'fluid' and 'mosaic' aspects of the model. Candidate descriptions of the plasma membrane structure referred to the phospholipid bilayer but did not often elaborate on the orientation of the phospholipid molecules within the bilayer. It was surprising to note the number of candidates who talked about hydrophobic heads and hydrophilic tails.

Few candidates talked about the components of the membrane, i.e. phospholipids or proteins, moving within the membrane, merely stating that the bilayer moves as a whole or 'is fluid'. The mosaic pattern created by the randomly scattered arrangement of the proteins was not well described, often only simple comments about the proteins being arranged in a mosaic pattern were offered.

23(b)(i)
Most commonly candidates stated that the progesterone molecule was small enough to squeeze through gaps in the phospholipid bilayer, which did not gain any credit. However many did refer to the non-polar nature of the molecule, and even that it was lipid soluble, but often did not go on to explain that this meant that the progesterone would not be repelled by the hydrophobic tails of the bilayer and would be able to diffuse through.

Some candidates failed to use the correct terminology, e.g. instead of 'diffusing through' the molecules were 'moving or passing through the membrane' which was given in the question. Several candidates suggested that since progesterone was a hormone it required a channel protein to get through the membrane.

23(b)(ii)
This question was well answered by most candidates. A varied range of examples of molecules that could cross the plasma membrane were seen. Water, oxygen and glucose were common answers, and several candidates continued the theme and stated a steroid hormone such as oestrogen.

23(c)(i)
The vast majority of candidates answered this question with the correct responses of either 'channel' or 'carrier' protein, although a few either omitted reference to 'proteins' or simply described the proteins as being 'intrinsic'.

23(c)(ii)
Surprisingly few candidates gained full marks for this question, with many not knowing the components of ATP, as an example of a nucleotide. The majority of candidates correctly identified adenine as one of the molecules. Few candidates correctly identified ribose, preferring to call it a 5 carbon sugar or pentose. There were many 'adenosine' responses and also those candidates who got a single mark from the imprecise combination of '5 carbon sugar' with 'nitrogenous base'. There was a wide variety of other incorrect answers including other named organic bases, DNA, RNA, triglycerides, nitrogen, carbon, water, and glucose to name but a few.

23(d)(i)
It was pleasing to see that the majority of candidates could calculate the value for the *t* test correctly, though as it was an unfamiliar test many ended up with a negative value which still gained credit. Those who gave an incorrect answer but who nevertheless showed working (which candidates should be strongly advised to always include in calculations), frequently

picked up one or two marks for correct substitutions in the top or bottom parts of the equation. The most common mistake made by candidates was omitting to square the standard deviation in the given formula for calculating *t*.

23(d)(ii)
Candidates were often incorrect in their interpretation as to whether to accept or reject the null hypothesis by comparing the calculated value with the critical value. Some failed to realise that if they calculated a negative value of *t* it would be lower than the critical value and so should accept the null hypothesis. Those who did answer correctly often omitted to go on to comment on whether the difference was significant or not, or just stated whether the value of *t* meant that the 'results' were significant or not rather than refer to the 'difference' (between the means at the two temperature levels).

23(e)
This question proved to be a good discriminator. Many candidates scored poorly on this question, mainly due to a lack of precision in describing the graph and a lack of understanding of the experimental technique involved. A general description of an increase in absorbance as temperature increased was incorrect and failed to gain credit. This was very often all that lower ability candidates offered.

Some candidates correctly gained credit for describing that there was no change in absorbance between 0 - 20°C, but fewer correctly noted that the absorbance did not start to increase until above 30°C. Few candidates understood that the membrane remained intact at these low temperatures. Students should be encouraged to describe data in as much detail as possible and at all relevant points, in order to gain full marks in such questions. Some candidates omitted to use full units (degrees 'C') for temperature quotes and thereby failed to gain credit for otherwise correct answers.

Several candidates correctly described the increase in absorption at high temperatures and most went on to link this to an increase in membrane permeability or membrane disruption. However, few linked this to more betalain pigment leaking out and causing the increased absorbance.

Marks for explanations were less common than for descriptions. There seemed to be misunderstanding of the term 'absorbance' at times with candidates believing that higher temperatures led to more pigment being 'absorbed by the cells'. These candidates may well have never used colorimeters. Candidates who had carried out this or a similar experiment were at an advantage.

Question 24

24(a)(i)
Candidates did not appreciate the term 'component' so although many candidates realised it was RNA they didn't realise that the component would be a ribosome or that it was ribosomal RNA. Incorrect responses included nucleus, or a variety of different parts of the cell including cell surface membrane, cytoplasm or DNA.

24(a)(ii)
Most candidates were able to identify at least one of the two domains correctly, usually 'Archaea'. The most common incorrect answers were Prokaryotes or Prokarya and Protoctists, but also Plantae and Animalia. This indicates that there is some confusion over the Domains classification system.

24(a)(iii)
Most candidates gave one correct answer, usually 'nucleus', and many gave a correct second answer, usually 'membrane bound organelles' or a named organelle. Many candidates stated 'multicellular' which suggested a lack of understanding that many unicellular organisms also

belong to this domain. A few candidates did not specify 'linear DNA', or that ribosomes were 'larger' or '80s'.

24(b)
This question was relatively well answered with the best responses including two clear validation methods such as replication of work and peer review. Most candidates only referred to one method, usually the replication of work or the additional supporting evidence. A few candidates mistakenly discussed why his work was accepted rather than validated.

Question 25

25(a)(i)
Most candidates gave a perfect answer referring to the DNA molecule comprising one original or parental strand and one new strand. The most common mistake was referring to just having an old strand. As in previous years, many candidates found it difficult to express their answer in a creditworthy manner e.g. 'each strand contains one old strand and one new', 'half of the DNA is replaced with new DNA', 'half of the original strand is used to make the new one'. Most of these answers show a lack of understanding of the difference between a DNA strand and a DNA molecule.

Some candidates used logic with the term ‘semi-conservative’ and wrote about ‘half the DNA staying the same’, without appreciating this process compared with dispersive replication.

25(a)(ii)
Most candidates named two enzymes, commonly helicase and DNA polymerase. A few candidates described helicase as unzipping one strand, rather than separating the strands, but most correctly described its action.

The most common misconception was describing DNA polymerase as pairing up free nucleotides with the template strand, and joining or reforming hydrogen bonds. Candidates should appreciate that hydrogen bonds occur due to complementary bases pairing and then DNA polymerase joins the nucleotides ‘vertically’, forming the sugar-phosphate backbone with phosphodiester bonds between the adjacent nucleotides. A few candidates did not specify ‘DNA’ polymerase or stated RNA polymerase.

Some candidates attempted to write about DNA ligase and this illustrates the importance of reading the question properly. A very few candidates suggested random enzymes such as protease.

25(b)
This question was answered poorly. Only a few candidates could apply the information given in the stem, or were already familiar with the experiment, to correctly describe the banding pattern.

Question 26

26(a)
This question was generally well answered. The most common error was the use of the term ‘amount’ rather than ‘concentration’ or ‘volume’. Some students appeared to have learned by rote from previous exam mark schemes and referred generally to ‘substrate’ rather than the name of the actual substrate in this experiment – gelatine.

Some irrelevant answers included the use of the same size beaker or stopwatch. Infrequently students did state ' enzyme concentration' despite it being the independent variable.

26(b)(i)
This question was poorly answered. Very few candidates realised that they could work out the answer by looking at the units in the column heading. Common incorrect answers included enzyme concentration divided by time, or time divided by enzyme concentration.

26(b)(ii)
Few candidates managed to gain both marks here. Many candidates recognised that standard deviation shows the spread of the data but failed to mention 'around the mean' (some used the term 'average'). Some described the changes in SD in terms of the shape of the graph but not in terms of the repeatability of the results obtained, with a common incorrect response being 'the smaller the SD the more reliable or accurate the results'.

26(c)
Few candidates appreciated the difference between 'describe' and 'explain'. The majority of students simply described the shape of the graph without explaining the reason for this shape. The increase in rate with enzyme concentration was often explained in terms of more collisions, but not in terms of more enzyme-substrate complexes formed, or more available active sites. Many candidates recognised that the rate plateaus but did not fully understand that it was the substrate concentration that had become limiting and so wrongly suggested that all the active sites were full.

Many candidates recognised that the standard deviation increased as the concentration of enzyme or rate of reaction increased, and some concluded that this meant the data was 'less reliable'. Very few correctly used the term 'uncertainty' or explained what this meant for this experiment. The overlap of SD bars was rarely commented on, and candidates found it difficult to link the larger SD or overlapping SD bars with the uncertainty of the data.

It appears that whilst candidates are becoming more familiar with the concept of standard deviation and SD bars, they are not yet confident in applying these concepts biologically.

H020/02 Depth in biology

General Comments:

Familiarity with practical work is now embedded in the delivery of the specification and is assessed in the question papers. Those candidates who had experienced the practical skills detailed in the specification were better prepared to answer those questions which relied on such knowledge. There is also increased emphasis on mathematical skills which are also examined in the question papers.

Resources are available on the OCR website to assist centres in developing their candidates' practical and mathematical skills. Of particular note are the Practical Skills, Drawing Skills and Mathematical Skills Handbooks which should be consulted in conjunction with the Specification.

Some candidates seemed to overlook the essential or command words in the question. This meant that information that was biologically correct did not receive credit as it did not answer the question. Some candidates circled or highlighted key words or phrases in the question in order to focus their attention on the relevant key terms.

The mark allocation and space provided should guide candidates on the length of the answer that they should provide. Some responses to the extended writing questions extended to two or more additional pages. It isn't worth the time and effort spent in doing so for a maximum of six potential marks. Relevant information should be expressed concisely and candidates should be discouraged from repeating phrases from the question. Centres are strongly advised not to issue separate additional answer booklets as a matter of course. There will often be one or more lined pages at the back of the question paper, which should be used initially (if necessary).

Comments on Individual Questions:

Question 1

1(a)(i)
This was answered well with most candidates correctly identifying an organelle which could not be seen with a light microscope, but could then be seen in the second image. Many correctly referred to rough endoplasmic reticulum or mitochondria although the presence of organelles simply being visible was insufficient. Many were able to comment on the higher resolution of cell B but a good proportion failed to gain credit due to the use of 'high' rather than 'higher'. Weaker answers often were too vague, simply stating that the 'ultrastructure' or 'detail' of the cell could be seen.

1(a)(ii)
The majority of candidates were not confident in answering this question and as a result gave an incomplete or irrelevant answer. Some candidates were awarded the resolution mark but some were clearly confused as to which microscope has the higher resolution or were unsure about the difference between resolution and magnification. Many students responded in terms of the image being either 2D or 3D, some answers stated 'in colour', and several did not state which type of microscope they were referring to. Of the few correct answers seen, the majority referred to different depths of sample or the usefulness of being able to use a fluorescent tag. None referred to the advantage of being able to see movement (in living cells).

1(b)(i)
Most students could correctly identify that the cell was in prophase. Anaphase was the most common incorrect answer. A few mistakenly referred to prophase 2, which did not gain the mark.

1(b)(ii)
Many candidates observed that the chromosomes were condensed or visible, and were not yet organised or at the equator of the cell. The presence of the nuclear membrane was also noted but a number of candidates failed to gain this mark by thinking that it had disappeared. Many candidates answered in terms of crossing over. The absence of the nucleolus was rarely offered by candidates.

1(b)(iii)
The responses to this question were variable, the best candidates were able to confidently describe how the process of independent assortment led to variation, while other candidates struggled to describe how the random alignment of the homologous pairs of chromosomes gives new combinations of the original maternal and paternal chromosomes in the gamete mother cell. In many cases there was no clear idea of which chromosomes were facing either side or pole of the cell – better use of the terms maternal and paternal would have helped. Few supported their description with a simple diagram, which would have clarified an otherwise vague answer. Many did not seem clear that **pairs** of chromosomes were lining up at the equator, often referring to chromosomes randomly lining up. Explaining the genetic variation was generally done poorly, with reference to crossing over but vague descriptions of the actual outcome.

1(c)
Most students were able to identify two correct sources of stem cells and also discuss an ethical issue associated with their use. Some students did not link the ethical issues they were discussing with the source of the stem cells, e.g. confusing embryo with fetus. There was also frequent inclusion of information which was irrelevant to the question, describing the properties of stem cells and why they were used, rather than focusing on naming the sources and discussing the ethics of their use.

Most candidates gave embryo and bone marrow as their two sources and discussed (successfully on the whole) the ethics of embryo use. Some mentioned fetal or umbilical sources but incorrectly suggested that the fetus either needed to be killed or cells removed during invasive surgery without realising that they would only be obtained from miscarried or aborted fetuses.

Question 2

2(a)
The responses suggested that few candidates had carried out, or even seen, a practical procedure used to observe the distribution of xylem. Standing the leaf stalk in a coloured solution was the most common basic method described but this was often not followed up with the need to cut a section in order to observe the location of the xylem vessels. Few had any understanding of the difference between the stem, leaf and leaf stalk of celery or how to produce a cross or transverse section for viewing with a low power microscope, and often confused transverse and longitudinal or even suggested cutting lengthways. Credit was given for recognising that a stain was needed but naming a suitable stain for xylem was rare. Many candidates knew to observe under a microscope but did not specify under low power. Some candidates described the use of a potometer to view xylem vessels.

2(b)
Many candidates were able to give a good comparison between each of the two plants and a woodland deciduous plant, referring to amounts of lignin and thickness of walls. Not all responses were comparative or referred to other adaptations of hydrophytes and xerophytes and so could not gain credit. A few candidates incorrectly only compared Water Starwort with Cholla, and some attempted to explain the reasons for the differences rather than state what they were.

2(c)
Responses to the similarities between xylem and phloem were generally weak with the most frequent incorrect response being they are both hollow tubes. Many candidates also focused on what was being transported and in which direction.

In the differences section the majority of candidates compared functions rather than structures, or compared them as being dead and living, which failed to gain credit. Statements were not always comparative, with references to only xylem or phloem structural features being given. Non-specific language also hindered some answers. It is useful for candidates to be able to recall the correct terminology when answering this style of question.

Question 3

3(a)
Candidates' responses indicated that few had observed or carried out this practical. Few could correctly name the structures, such as the bony fish operculum or the insect exoskeleton, which needed to be cut through or removed in order to reach the gas exchange systems. Usually only vague descriptions of cutting down the length of the organism were supplied. Very few candidates offered any further detail of how to observe or display the gills or tracheae by flooding with water, lifting relevant parts or the use of appropriate stains.

3(b)(i)
The vast majority of candidates correctly identified 20 as the incorrect answer and gave 19 as the correct one. A few candidates did not round the answer correctly and a very small number identified the mean of 43 as the incorrect number, suggesting that beetle C at 38 was anomalous and so re-calculated the mean excluding 38. Some candidates had not read the instructions and left their answer in the 'working out' area.

3(b)(ii)
The majority of candidates correctly identified the tracheoles. The most common incorrect answers were bronchioles or trachea.

3(b)(iii)
Many candidates failed to provide differences between the trachea in a mammal and in an insect, largely because their statements were not comparative, or only a detailed description of one was given. Imprecise terms such as 'bigger' failed to gain credit for the difference in diameter. Chitin and cartilage commonly gained a mark but candidates did not show understanding of the spiral nature of chitin in insects so failed to gain credit for their comparison with the C-shaped rings in mammals. Several candidates failed to realise that the mammalian trachea leads to bronchi rather than directly to alveoli and that insect tracheae lead to tracheoles rather than directly into muscle. Some candidates thought that the mammalian trachea had collagen rings.

3(c)
Most candidates made a good attempt at this question with the best responses identifying clear adaptations and scientific details and explaining how these resulted in an improved rate of diffusion. The vast majority were able to identify two or three adaptations, most commonly large surface area, one cell thick walls and a good blood supply. Many also gave at least one explanation of how an adaptation ensured efficient gas exchange, such as providing a shorter diffusion path or maintaining a high concentration gradient.
Weaker candidates were able to identify adaptations but found it difficult to accurately link them to an explanation of how the adaptation impacted on diffusion of gases, only referring to making exchange more efficient. A few candidates made errors such as referring to 'thin cell walls' or 'thin cell membranes' and confused the speed of diffusion with the diffusion rate.

Question 4

4(a)

Candidates generally knew that both B and T lymphocytes form part of the immune response (line 1) though not everyone associated T cells with memory cells (line 2). The knowledge needed to associate T cells with lysis of infected cells (line 3) and B cells with plasma cell clones (line 4) was not universal. Candidates need to be taught to fully cross out ticks that have been placed in error as 'hybrid' ticks are not acceptable either as ticks or crosses.

4(b)

Candidates frequently did not describe the changes shown on the graph with sufficient clarity and omitted to mention the slow or delayed primary response. The terms 'clonal selection' and 'clonal expansion' were rarely used in connection with explaining the slow antibody production in the primary response. Memory cells were often correctly referred to as the reason for the quicker secondary response. It was permissible to label the graph to show where the primary and secondary responses were taking place.

Some candidates thought primary response was non-specific, related to barriers to infection, and either had not noted or did not understand the use of the word 'specific' in the introduction to the question.

Some answers were poorly planned, never reaching an explanation of the events underpinning the secondary response.

4(c)

The best responses made use of subject-specific terminology such as pathogen, transmission, droplet and epidemic when explaining communicable disease. Weaker answers did not distinguish between the 'disease' and its cause: the 'pathogen'.

The question asked for a discussion so candidates were expected to expand on the information given in the bullet points rather than simply quoting them. Expansion points were far less common than suggested actions. Frequently suggested actions included vaccination, hand-washing, use of gloves or protective clothing and quarantine. Many gave vague suggestions such as 'train more staff' or 'improve sanitation' that reversed the information given in the question stem without adding enough detail or extra knowledge and understanding to gain credit. Some suggestions were unrealistic and impractical, e.g. massive expansion of health service infrastructure in immediate response to an acute situation.

The case was not that candidates were giving incorrect information. It was more that they were failing to develop their ideas in the answer. Communication was generally good and most answers followed some logical structure.

Question 5

5(a)(i)

Many candidates correctly calculated a percentage difference using the graph to obtain starting and end figures. Candidates are expected to read data from a graph correctly to the nearest half grid-square. They should *not* give approximate or rounded figures.

Some candidates were not sure how to calculate a percentage change. The most common error was to divide the final figure by the starting figure and multiply by 100, instead of finding the *difference* between the starting and final figures and dividing that by the starting figure before multiplying by 100.

A few candidates did not follow the rubric instructing them to give their final percentage difference figure to the nearest whole number.

5(a)(ii)

This question required the skill of description in translating data from the graph into words, but also the skill of drawing paired comparisons. Many candidates did not understand this principle and commented or quoted data about either farmland or woodland but not both. Few recognised

that the farmland population is always higher than that in the woodland, even though this was very clearly seen on the graph.
Stronger answers included comparative adjectives such as *higher* (number in farmland), *greater* (decrease in woodland) and *smaller* (decrease on farmland). Mistakes in quoting the data (i.e. reading figures from the graph or manipulating them to find a difference or the percentage decrease in woodland) were fairly frequent. As previously stated, candidates should *not* give approximate or rounded figures.

5(a)(iii)
Candidates find 'suggest' questions difficult, although in this case many linked new predators, loss of habitat or loss of food supply to the steeper decline in woodland. Fewer candidates gave answers concerning butterfly numbers on farmland.
Some candidates stated that the woodland was overgrown or lacked management without explaining how this has an impact on butterfly numbers, or else providing a very simplistic idea such as 'butterflies have less space to fly'. In direct contradiction to the information supplied in the question that woodlands were becoming more overgrown, deforestation was occasionally mentioned as a cause of the butterfly decline in woodland.

5(a)(iv)
Most candidates made only one comment although there were two marks available. A large number of candidates were afraid to commit and maintained that the statement was partly valid. Acceptable reasons given for the statement not being valid were that there was insufficient data provided and that other factors may also have an effect on butterfly populations. Few candidates used the information that introduced the graph and referred to wet and cold weather conditions being limited to only part of the time period shown in the graph.

5(a)(v)
Most candidates named a suitable variable that should have been controlled and showed an awareness of ecological sampling methods and constraints. A few candidates delivered a 'standard' answer that related more to laboratory-based experiments, such as pH or temperature, or misinterpreted the term 'survey' in this context and referred to asking questions of the same people in the survey.

5(b)
This question assessed candidates' understanding of the term species richness. Most stated that woodland had a greater number of species present, showing they understood what richness means. Some made irrelevant comments about species evenness or confused the ideas of species evenness and richness (such as stating that the habitat was more species rich because the population was higher). The mark scheme allowed either woodland or farmland to be selected as having the higher species richness, but few students gave two good reasons to support their choice.

5(c)(i)
Many candidates correctly named this type of biodiversity as genetic. Incorrect answers included 'variation' or suggested 'environmental', 'habitat' or 'species'.

5(c)(ii)
Many suggested that the colour variation was an adaptation to the environment but did not indicate the crucial idea of a *changing* environment. Camouflage was a popular correct answer.

Question 6

6(a)(i)
Few candidates scored all three marks. Those who failed to quote the y axis variable correctly as 'mean % absorbance', chose a scale that was too small for the available space or who used a non-linear scale were not awarded a mark. Point plotting was usually accurate and this mark

was frequently awarded. As the data showed a calibration curve a line of best fit should have been drawn. Many extrapolated their line of best fit inappropriately. The following guidance can be found in the Mathematical Skills Handbook:
'Where the purpose of the graph is to present the data within the experimental range only (with the possibility for deriving predicted values through interpolation) no extrapolation is needed and the line should be confined to the range of the independent variable.'

6(a)(ii)
Candidates may have been unfamiliar with the use of calibration curves or else struggled to describe their use in a logical, step-wise answer, as the quality of answers was often poor. Few candidates integrated the information across all of the question and realised that they would have to find the absorbance values of **A**, **B** and **C** using the colorimeter before locating these values on the *y* axis, ruling a line across to the line of best fit and reading down to the *x* axis value for concentration. Some scored the mark for the general idea that the curve could be used to find the concentration that corresponds to a particular absorbance. Weaker answers described how the glucose concentration would affect the absorbance without attempting to answer the question.

6(b)(i)
Most candidates showed good knowledge of the Benedict's test though there was some confusion over whether it tests for a reducing or non-reducing sugar. A mark was often scored for controlling a variable during the test such as the volume of juice or Benedict's solution, or the heating time or temperature.

Fewer candidates went on to describe a taste test, either of different juices (**A**, **B** and **C**), or of dilutions of a juice or of a range of glucose concentrations. Answers that discussed taste tests tended to do well and often achieved both the method mark and the idea of ranking the results to give an order of sweetness. Some discussed tasting the juices but did not state 'to see how sweet they were'.

The most insightful answers compared the rank order of sweetness with the rank order found with the Benedict's test.

6(b)(ii)
Where candidates' train of thought had led them to discussing a taste test in the previous answer they almost always came up with a reason why the results might not support the hypothesis, due to different (non-glucose) sugars being present in the juice or other sweeteners or fruit acids affecting the perception of sweetness of the juice. The subjective nature of the taste test or of judging the final colour of the Benedict's test also scored a mark for many.

6(c)(i)
Poor exam technique meant that some answers did not focus on cholesterol's *similarities* with glucose but simply described features shown on the cholesterol molecule. Ideally points should have begun with 'both', as in 'both contain carbon and hydrogen' or 'both include hydroxyl groups'. Elementary flaws in candidates' understanding of chemistry lost marks when atoms, elements or organic groups like the hydroxyl group were referred to as 'molecules'.
Incorrect lines of thought took candidates to discussions of hexose, glycosidic bonds and branched and unbranched polysaccharide structures.

6(c)(ii)
The correct answer was very commonly given. Sometimes the wording was that glucose is polar or able to dissolve in water or plasma. A few candidates stated that glucose was insoluble and some simply wrote the one word 'solubility' without stating how this concept applied to glucose. Some, referring back to a question on paper 1, described it as small and compact rather than homing in on its solubility.

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OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning
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Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

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