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Examiners' Report
June 2015

GCSE Biology 5BI2H 01

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Introduction

The paper assessed a reasonable range of the science 2011 B2 specification. These included approximately equal amounts of the three topics: the building blocks of cells, organisms and energy and common systems including the following specific areas: photosynthesis and leaf structure, DNA structure and protein synthesis, the circulatory system, exercise and physiology, red blood cells, fossils and evolution, as well as genetic engineering and cloning. There was an emphasis on application of knowledge in several questions which made access difficult for some candidates. The mathematical skills tested included graph interpretation, extracting data and substituting it into equations, as well as calculating percentages. The paper consisted of 6 questions that increased in complexity both within each question and across the paper. There was a small but significant number of candidates who had writing that was difficult to interpret, in a few cases losing marks as key words were unintelligible. Some candidates did not make the preferred answer clear when they crossed out, and changed their answer to multiple choice questions. Some candidates wrote part of an answer somewhere else on the page but did not make it clear on the paper that there was extra work to be marked elsewhere.

Question 1 (a) (i)

This item required candidates to calculate the percentage of flowers with 5 or more flowers on each stem of plants growing in a meadow. The majority of candidates, 63%, accessed both marks available here. There were 4 basic methods used to calculate the percentage with some candidates working out 10%, and 5% of 20 and then adding these percentages together. The candidates who correctly calculated the percentage based on 13 stems still gained 1 mark.

Question 1 (a) (ii)

This item required candidates to suggest reasons why the plants in a meadow had more flowers per stem than those in a wood. This item was answered well with 63% of candidates gaining both available marks. This early question was designed to be relatively easy and still discriminated well with 28% gaining 1 mark with a relatively small 9% gaining no marks. The majority of candidates stated that light intensity was higher in the meadow and then gained their second mark by either linking this to an increased rate of photosynthesis or stating another resource, usually more rain / water, or temperature being higher. Candidates who gave reverse arguments about the plants in the wood gaining less light seemed to find it easier to express their ideas. Reverse arguments like this as shown in the second clip were awarded each marking point as appropriate. Several candidates wrote long answers that covered 4 or 5 good points. Candidates who lost marks often gave vague answers as illustrated in the first clip below.

(ii) Suggest reasons why there are more stems with five or more flowers in the open grassland.

(2)

The open grasslands provide more space for flowers to blossom as well better soil as it isn't all used by the trees

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This response scores no marks as the points made are too vague. The word 'better' rarely gains credit, and both ideas need qualification - for example more space could be extended to discuss competition and thereby argue that less mineral ions are available for the plants to absorb.

(ii) Suggest reasons why there are more stems with five or more flowers in the open grassland.

(2)

There is nothing blocking the sunlight from reaching the stems so the sunlight and water can reach them easily, leading to photosynthesis taking place more quickly and easily.

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Examiner Comments

The use of the word ' easily' is not creditworthy, however the candidate has also stated that sunlight is not blocked and that photosynthesis thereby takes place more quickly.

Question 1 (b) (ii)

This 'complete the sentence' question required the candidate to state diffusion as the process by which carbon dioxide moves through stomata into a leaf. 79.6% of candidates gained this mark with a common incorrect answer of transpiration being given by the other candidates.

Question 1 (b) (iii)

Item 1biii required candidates to explain how guard cells change on a warm day and how this benefits the plant. Most candidates gained the mark by correctly stating that carbon dioxide enters the leaf by diffusion. A wide range of incorrect responses were seen including ideas based on stomata stopping heat getting in to kill the cells or stopping water getting in which would dilute the cells as shown in the clip below. A few very poor answers were seen stopping photosynthesis getting either in or out. These suggest that the role of stomata had not been learned by a significant number of candidates.

(iii) Explain how changes to the guard cells on the warm day help the plant to survive.

(2)

It stops the plant from absorbing too much CO_2, sunlight and water vapour from the air so it doesn't damage or kill the plant.

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Examiner Comments

This candidate has missed the first available marking point by not stating how the guard cell has changed. The rest shows a poor understanding of the role of stomata with a weak ending 'so it doesn't damage or kill the plant'.

Question 2 (b)

This item required candidates to describe the structure of DNA. This question was very accessible with 57% of candidates gaining all three marks. Discrimination was also good with the remaining 43% of candidates spread well between 2, 1 and 0 marks. Many excellent answers gaining all three marks were seen (see the first clip below) indicating how well the structure of DNA has been taught. Answers included: double helix, paired bases and then weak hydrogen bonds with sugar phosphate backbones seen relatively rarely, often by candidates who had already gained the three available of marks from stating the former points. Diagrams were credited as notated or clearly labelled as shown in clip 2 below. Some candidates just stated that there were four bases or named them missing the idea from the stem of the question that DNA structure was required. Some candidates gained the base pairs mark by showing them as pairs, e.g. A-T, C-G.

(b) The sperm cell contains DNA.

Describe the structure of DNA.

(3)

DNA is two strands coiled together in the structure of a double helix. The two strands are held together by four bases, Adanine, Thymine, Gvanine and Cytosine. The base pairs are joined together by weak hydrogen bonds and are always paired up in the same way, A-T, C-G. A section of the DNA that codes for a specific protein is called a gene.

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This candidate has gained all three marks available by clearly stating that DNA structure has a double helix, paired bases and that the two strands are held together by hydrogen bonds. The candidate gives us good extra detail and the answer flows logically from four bases, to naming them, to stating that they are paired and the way that they are paired.

(b) The sperm cell contains DNA.

Describe the structure of DNA.

(3)

Double delux structure. There are four main parts that make up the DNA: Adenine with Thimine and Genine with Cytocine.

A T
Adenine Thimine
G C
Genine Cytocine

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This candidate has only scored one mark. Double delux is not spelt closely enough to double helix to award a mark. The mark awarded for base pairs is shown both in the written part of the response and as a diagram.

Question 2 (c)

This item further tested the candidates' understanding of the structure of DNA by asking the candidates to describe translation. The item was accessible and discriminated well with 38.4% gaining all four marks with 3, 2 and 1 marks all between 11.2 and 14.8% as can be seen by comparing the two clips below. Where marks were lost, as shown in the first clip, details were often omitted and confused, saying for example, that the tRNA brings bases which are joined to the codons to make protein. Excellent answers were seen that were both detailed and logical, as shown in the second clip. Other candidates lost marks as they wrote down the sequence incorrectly, or missed stages out, or in some cases described transcription.

(c) Information in a DNA strand can be transcribed to make a strand of mRNA.

Describe how this mRNA strand is then used to make proteins.

(4)

mRNA is small enough to leave the nucleus, ~~This becomes~~ ~~Trna~~ ~~tRNA~~ and goes to the ribosome to be decoded. This becomes ~~tR~~ tRNA. When at the ribosome ~~3~~ 3 dna codes for a protein (ie). This is called a codon.

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This candidate has remembered the scientific terminology related to translation, for example mRNA and tRNA, but has not been able to recall their role in protein synthesis, for example stating that mRNA becomes tRNA and that 3 DNA codes for a protein. This answer was awarded 2 marks for leaving the nucleus and going to the ribosome.

(c) Information in a DNA strand can be transcribed to make a strand of mRNA.

Describe how this mRNA strand is then used to make proteins.

(4)

The mRNA moves out of the nucleus through the nucleus pores. Then, in the second stage of protein synthesis, Translation, the mRNA attaches to the ribosome. (Translation occurs at ribosomes in the cytoplasm). Then, the tRNA molecule ~~brings the~~ reads in threes (3 bases make a codon) and brings the correct amino acid. The amino acids form peptide bonds and become a polypeptide chain. The polypeptide chain acheives its final 3D shape and is a protein. This is protein synthesis.

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This example of candidates work shows an excellent understanding of the process of translation being both logical and detailed.

Question 3 (a) (i)

67.9% of candidates who gained this mark correctly identified that structure X was a lung with most correctly stating that it was the right lung although lungs was also credited. Common incorrect answers were: capillaries, liver and kidney.

Question 3 (a) (ii)

To gain both marks available, candidates had to explain how the heart causes blood to move to organ X, the right lung. The diagram was included to allow candidates to visualise the path taken so that the task was accessible to all candidates. Discrimination was again good with very similar percentages gaining 0, 1 or 2 marks. It was pleasing to see answers that were detailed and that used excellent scientific terminology covering all the marking points available, although candidates often scored both marks available by describing the route through the heart saying that blood flowed into the (right) atrium and then was pushed into the (right) ventricle, although 'through the pulmonary artery' was also frequently seen (see second clip). Some candidates confused the sides of the heart or just talked about the heart as one chamber. Spelling let some candidates down with, for example *"the blood is moved by a pomping movement using vowels"* It was disappointing that some answers completely missed the point such as *"the blood moves by diffusion from an area of high concentration to a low one"*, with one response referring to the blood being moved by *"heat from organs causing transpiration".* Once again, marks were not awarded when candidates made fundamental errors, for example listing the heart chambers in the incorrect order, and many lost marks by not writing specifically enough saying, for example, that the heart moves or pumps blood (see first clip) rather than the required heart muscle contracts.

(ii) Explain how the heart causes blood to move to organ **X**.

(2)

The heart pumps blood around ~~the~~ the body, the pulmonary artery will take blood to the lungs

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Examiner Comments

This answer was awarded one mark for "pulmonary artery will take the blood to the lungs". The candidate has not addressed the main point of the question, however, and needed to describe the role of the heart in more detail than just saying the heart pumps the blood around the body.

(ii) Explain how the heart causes blood to move to organ **X**.

(2)

Blood from the body, which is deoxygenated moves into the right atrium through the vena cava, through the right ventricle through the pulmonary artery all the way to the lungs, where the blood gets oxygenated.

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Examiner Comments

Here the candidate has simply, but accurately, described the route the blood takes to gain full marks. Many marks can be gained throughout the paper by learning the basic scientific detail as outlined in the specification.

Question 3 (a) (iv)

Many candidates could only access the basic science of this item which required them to describe how the blood in blood vessel W differed to blood in vessel Y. Candidates often knew the names of the blood vessels and whether the blood was being carried to or from the heart (see third clip) which did not answer the question and therefore gained no marks. Only 11.4% of candidates gained 2 marks with 59.3% of candidates scoring one mark, usually for blood vessel W contains deoxygenated blood, some going on to state that blood vessel Y had oxygenated blood -- see first clip below. Other candidates missed the point that in questions like this, a comparison needs to be made (see second clip). As a result answers often seen, such as blood in W has no oxygen or the blood in Y is under pressure, were not credited with a mark.

(iv) Describe how the blood in vessel **W** is different from the blood in vessel **Y**.

(2)

Vessel W is deoxygenated blood
Vessel Y is oxygenated blood.

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The commonest answers for this question stated that W contains deoxygenated blood / Y contains oxygenated blood. It is important to know that this is only going to be one mark and that in a 2 mark question of this type, two different points need to be made.

(iv) Describe how the blood in vessel **W** is different from the blood in vessel **Y**.

(2)

Blood vessel W (vena cava) is a group of veins together that carry deoxygenated blood back to the heart at low pressure whereas the Blood vessel Y (Aorta) carry oxygenated blood away from the heart at high pressure.

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Examiner Comments

It was disappointing that more candidates could not develop their answer to cover more than the basic idea that W carries deoxygenated blood as shown here with this good response that gained both marks available by adding that the blood in W is at low pressure and compares it to blood in Y which is in high pressure.

(iv) Describe how the blood in vessel **W** is different from the blood in vessel **Y**.

(2)

The blood in Vessel W is deoxygenated blood and that why it is going to the lungs and blood Vessel Y is oxygenated blood and that why it going to the rest of the body.

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Examiner Comments

This candidate has not understood the command word of describe how the blood in vessel W is different from the blood in vessel Y and is answering the question why is the blood in W different to the blood in Y.

Question 3 (b) (i)

Just over half of the candidates scored the available mark here which required them to measure the thickness of the walls of the left (6mm) and right (2 mm) ventricles at set points and then divide the first by the second to calculate how many times thicker the left ventricle wall is compared to the right. Some candidates measured the wrong parts of the wall and some subtracted the smaller number from the larger (6mm - 2 mm = 4mm) rather than divided it.

Question 3 (b) (ii)

Candidates were clearly familiar with this question that required them to explain why the left ventricle wall is thicker than the right ventricle wall. Again, this question discriminated well with 37% gaining one mark, usually by saying that the left ventricle needs to pump the blood further around the whole body, whereas the right side is only pumping blood to the lungs. Some candidates extended their answer to explain that this required the left ventricle to put the blood under greater pressure compared to the right, although a significant number of candidates picked up the second mark by saying that the left side was stronger / more muscular, with 40% gaining both marks available.

(ii) Explain why the wall of chamber B is thicker than the wall of chamber A.

(2)

The wall of chamber B is thicker than the wall of chamber A because it has to pump blood out of the heart at a lot higher force/pressure. This means it needs more muscle to be able to do that - that is why it's thicker - because it has more muscle.

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The linking of the need for higher force/pressure to more muscle gains the two marks here. The candidate has written their answer logically and has included the all-important superlatives, higher and more muscle as opposed to high and muscular which is required to gain marks in questions where candidates are asked to compare two things.

(ii) Explain why the wall of chamber B is thicker than the wall of chamber A.

(2)

Chamber B wall is thicker as it needs to pump blood allow around the body so it needs more/stronger muscles to do so it is thicker. As A only needs to pump blood to the lungs which is a much shorter distance than all around the body so it doesn't needs as much muscle so is thinner.

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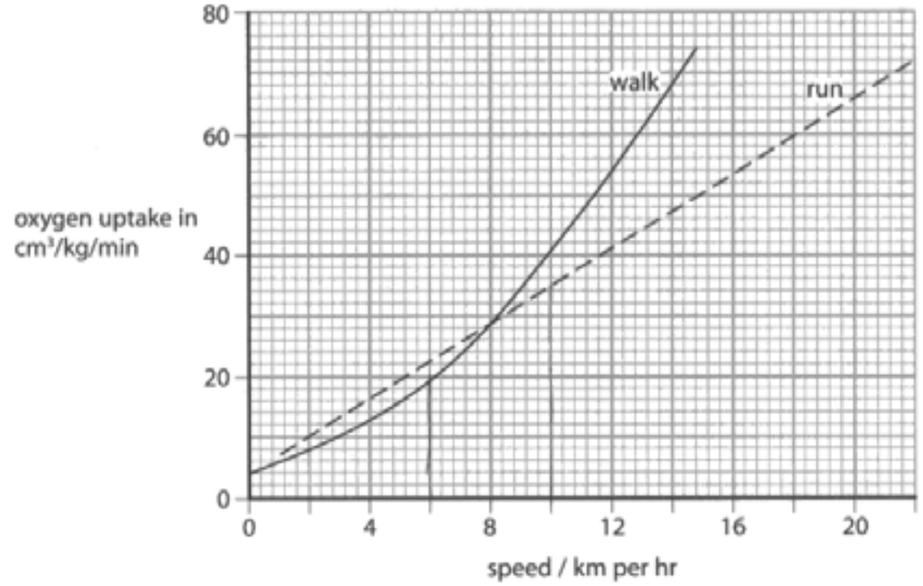
This candidate has also gained two marks but this time in the other common way seen in scripts. They have started with the premise of the requirement for the left ventricle to move blood to further in the body and then used the reason clause to add that it needs more / stronger muscle to do this. They have then described the shorter distance to the lungs for A, ensuring that the comparative is made so that the question is answered fully.

Question 4 (a)

Candidates seemed to find this question hard to access and thereby scored marks with 23% scoring 0 marks and many (27.1%) struggling to gain one mark. Candidates had to compare the oxygen uptake when increasing speed from 6 to 10 km/hr for a runner and a walker. The 14.2% of candidates who did score all 3 marks available tended to break the graph into the three obvious sections, from 6 to 8 km/hr where the runner had a higher oxygen uptake, 8km/hr where they had the same oxygen uptake, and 8 to 10 where the walker had a higher oxygen uptake. There was an easy mark for saying that the oxygen uptake for both increased and a further mark for using the figures to compare by how much each had increased. Candidates lost marks in the following ways: just quoting figures, describing the lines rather than oxygen uptake, e.g. the lines cross at 8, trying to describe the changes in one sentence, and describing parts of the graph that were not in the 6 to 10 km/hr range. The latter point suggests that the candidates that did this needed to read the question more carefully, maybe underlining the key parts to help them focus on what is required.

Walking and running

4 The graph shows the oxygen uptake for an athlete when walking and running.



(a) Compare the oxygen uptake when the athlete is walking and running at speeds from 6 to 10 km per hour.

(3)

When At 6 km per hr the athlete takes in less oxygen to when waking then he does running, but at 10km the athlete takes up more oxygen by walking rather than running.

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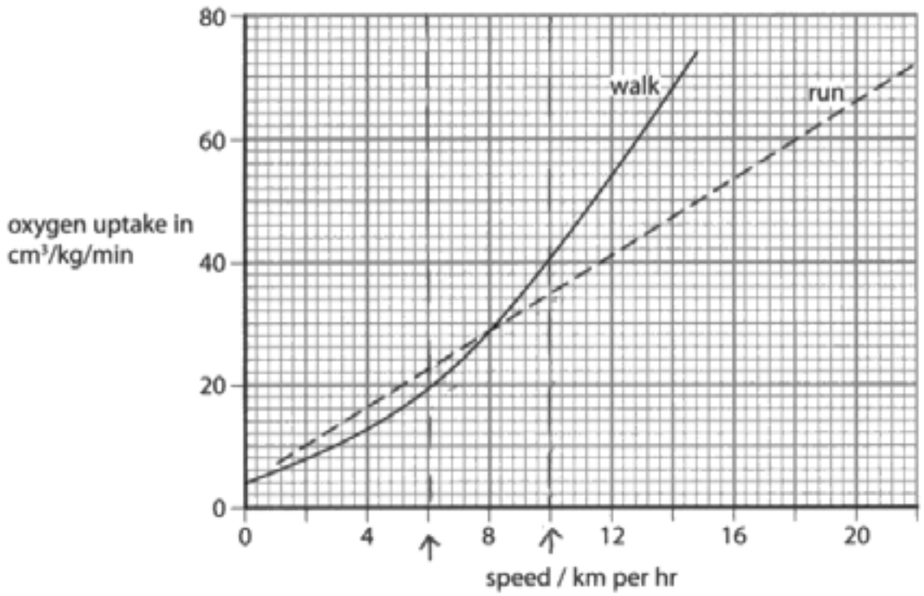
Examiner Comments

This candidate has understood the question and gives a reasonable answer for the two marks awarded, although it would have been better to have stated from 6 to 8 km/hr when the oxygen uptake was higher when running. They have made two clear points and should have checked the number of marks available as there were three marks available and so they needed to make one more.

Walking and running

4 The graph shows the oxygen uptake for an athlete when walking and running.



(a) Compare the oxygen uptake when the athlete is walking and running at speeds from 6 to 10 km per hour.

(3)

when walking the uptake in oxygen is greater than when running, because the speed gradually increases when walking as aerobic respiration requires oxygen. On the other hand, when running the uptake in oxygen is less due to ~~being~~ anaerobic respiration, as oxygen is not required. Therefore it's less needed than when walking.

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Examiner Comments

This candidate has given a vague answer that cannot be credited as it is not related to the appropriate parts of the graph, e.g. from 6 to 8 km/hr. This is a pity as they have used the excellent examination technique of underlining the key words in the question but have then not referred to them in their answer. They have also deviated from the point by trying to explain why the increases occurred.

Question 4 (b) (i)

The majority of candidates, 72%, correctly completed the aerobic respiration equation with water and carbon dioxide, with a significant number adding energy. However, candidates' errors included: using incorrect symbols Co2 and H2O (seen relatively regularly), writing energy instead of one of the products, and including lactic acid. One candidate who wrote lactic acid crossed out the + and the second answer line, saying they were not needed.

Question 4 (b) (ii)

To gain both marks here, the candidates needed to apply their knowledge to explain why oxygen uptake increases as an athlete runs at faster speeds. Some excellent answers were seen (see first clip below) relating contracting muscles to the need for increased energy needed / increased aerobic respiration. However, too many candidates found it hard to make the required connections to be awarded marks and many talked about aerobic and anaerobic respiration and the need for more oxygen to stop the build up of lactic acid or to remove lactic acid. This was taking the question a step further than asked, as it was felt that these were consequences of either not being able to get enough oxygen or dealing with the problem of insufficient oxygen. Marks were not awarded for vague references to using/ moving / working muscles when you run and the candidates had to express their answers more scientifically, for example, muscles contracting faster, for this marking point to be awarded. It was disappointing to see many candidates lose marks by referring to making or creating energy, which was listed in the mark scheme as a 'reject' response. Some wrote about muscles needing more oxygen which was in the stem of the question and so was not awarded marks, and they struggled to make their response address the question, see clip three below. Some candidates confused the question with sprinting and running a marathon instead of just the effect of increasing the speed at which the athlete runs.

(ii) Explain why oxygen uptake increases as an athlete runs at faster speeds.

(2)

Because the muscles are contracting faster and more often which requires more energy. To get more energy respiration in the cell must increase in speed, demanding more oxygen for the process. The oxygen intake must increase so we breathe faster.

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Examiner Comments

This excellent answer covers all three marking points in a logical way showing an excellent understanding of the subject matter.

(ii) Explain why oxygen uptake increases as an athlete runs at faster speeds.

(2)

Because ~~in~~ the muscles require more energy, therefore the oxygen uptake increases to meet the required demands to produce more energy.

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Examiner Comments

A 1 mark response where the candidate repeats themselves instead of developing the answer to relate more energy required to either an increased rate of respiration or in order to move the muscles faster.

(ii) Explain why oxygen uptake increases as an athlete runs at faster speeds.

(2)

Oxygen uptake increases as an athlete runs at faster speeds as he needs more oxygen to allow him to breathe more and faster. More lactic acid and glucose builds up so oxygen debt may be needed.

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This candidate knows some terms but has not been able to link them together so that they answer the question.

Question 4(c) (i)

Candidates mainly scored two marks, 76.2%, or no marks, 23.3%, here which is not uncommon on calculation questions. To gain two marks, candidates had to substitute data from a table and then rearrange the cardiac output equation to calculate the heart rate for an athlete, and it was pleasing to see so many candidates were capable of scoring both marks, see clips below. Some candidates did not know the equation and there was some evidence from working that some candidates had used the other data in the table to work out a method of calculating the correct answer. This was the reason the other data in the table was included. A common error was to find the difference between the heart rate before training and after training and then add this to heart rate after two weeks which showed that these candidate were tackling the question logically.

(c) The heart rate and stroke volume of an athlete training at a high intensity were measured and their cardiac output was calculated.

The table shows the measurements before, after 2 weeks and after 4 weeks of training.

	heart rate / beats per minute	stroke volume / dm^3	cardiac output / dm^3 per minute
Before training	142	0.08	11.4
After 2 weeks training	164	0.10	16.4
After 4 weeks training	200	0.12	24.0

(i) Calculate the heart rate after 4 weeks of training.

(2)

Cardiac output = heart rate x stroke volume

cardiac output / stroke volume = heart rate

24 ÷ 0.12

200 beats per minute

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The correct equation for calculating the cardiac output has been written down and correctly rearranged. The working is clearly shown and the correct answer of 200 has been stated. Both answers of 200, whether written on the line or in the table, were awarded the full 2 marks as is the practice in GCSE science examinations.

(c) The heart rate and stroke volume of an athlete training at a high intensity were measured and their cardiac output was calculated.

The table shows the measurements before, after 2 weeks and after 4 weeks of training.

	heart rate / beats per minute	stroke volume / dm^3	cardiac output / dm^3 per minute
Before training	142	0.08	11.4
After 2 weeks training	164	0.10	16.4
After 4 weeks training	1864 288	0.12	24.0

(i) Calculate the heart rate after 4 weeks of training.

(2)

24.0 ÷ 0.12 = 200

× 100 = 288

1864 288 beats per minute

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A rare example of one mark where the candidate has correctly carried out the first part of the work, 24.0 / 0.12 for 1 mark but has then calculated an incorrect answer.

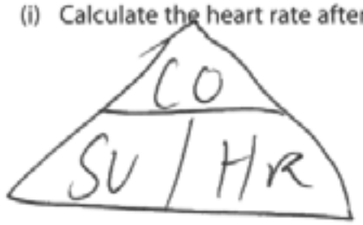
(c) The heart rate and stroke volume of an athlete training at a high intensity were measured and their cardiac output was calculated.

The table shows the measurements before, after 2 weeks and after 4 weeks of training.

	heart rate / beats per minute	stroke volume / dm^3	cardiac output / dm^3 per minute
Before training	142	0.08	11.4
After 2 weeks training	164	0.10	16.4
After 4 weeks training		0.12	24.0

(i) Calculate the heart rate after 4 weeks of training.

(2)



24.0 ÷ 0.12

200 beats per minute

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This candidate has used the 'magic triangle' to help them rearrange the equation and then correctly calculated the correct answer of 200 beats per minute for both marks.

Question 4 (c) (ii)

This question discriminated well for candidates gaining higher grades. Candidates were required to relate higher cardiac output to increased rates of aerobic respiration. It was pleasing to see answers demonstrating a good understanding of the topic which related rate of flow of blood to increased oxygen / glucose supply, for example "cardiac output is the amount of blood pumped out of the heart per minute, if this is increased, more glucose and oxygen will be supplied to the muscle for energy'. However, many candidates talked about more blood, rather than more blood per minute / beat or blood travelling faster and so it was more common for those candidates who scored 1 mark, 41.1%, to do so by saying more oxygen was supplied to the muscle cells.

(ii) Explain how the higher cardiac output after 4 weeks of training increased the rate of aerobic respiration.

(2)

As cardiac output is the volume of blood pumped per minute. Therefore, if the cardiac output increases it allows more red blood cells, that carry oxygen, to get to the lungs and transport oxygen around the body. This would increase the rate of aerobic respiration as more oxygen is getting around the body.

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An excellent answer showing a clear understanding of the concepts required for full marks.

(ii) Explain how the higher cardiac output after 4 weeks of training increased the rate of aerobic respiration.

(2)

The heart is able to pump out more oxygenated blood ~~er~~ per minute to travel around the body.

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Examiner Comments

By adding the 'oxygenated' to their answer here, the candidate has gained the second mark. This could suggest that the candidate has read their answer to make sure that it answers the question.

Question 5 (a) (ii)

This question discriminated well and was accessible to the majority of students. 45.5% of candidates were awarded both marks with a further 27.7% of candidates gaining 1 mark. Most candidates scoring 0 marks, 26.9% understood the question, but were let down by their inability to remember 'haemoglobin' and stating that without a nucleus there was less likelihood of red blood cell cancer, showing that they were applying their biological knowledge. There were, of course, some candidates who were less well informed and it was disappointing to see answers such as: 'This can increase the amount of blood', 'this can increase the amount of blood in red blood cells', 'this means the cells would need less energy' and 'it stops the cell from doing the wrong thing as the nucleus tells the cell what to do'. The majority of candidates scoring both marks stated that without a nucleus, red blood cells could carry more haemoglobin and thereby more oxygen around the body. It was pleasing to see candidates referring to more oxyhaemoglobin in the correct context in their answers, as this was awarded both marks available.

(ii) The scientist said that each red blood cell found contained a nucleus.

In humans, each mature red blood cell does not have a nucleus.

Suggest why not having a nucleus in a red blood cell is an advantage.

(2)

This is an advantage to humans because not having a nucleus in red blood cells means there is more room in the blood cell to carry more oxeggyen.

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It was usual for candidates who scored one mark to do so in this way, stating that more oxygen could be carried. Candidates who stated more haemoglobin, usually followed up by saying more oxygen could be carried.

Question 5 (b)

This question required candidates to explain why individual fossils, when found, can be incomplete. Many candidates answered the question why is the fossil record incomplete which explains the lower than expected numbers of candidates obtaining 2 (18.7%) and 3 (1.0%) marks. This means that this question discriminated quite well for grades D and C, but less well for grades A and B. Soft tissue decaying was a common correct response, although some candidates lost this mark by giving vague answers such as some parts of the dinosaur decay. The other two ideas, that the bones of the dinosaur could be moved before fossilisation, e.g. by a carnivore carrying some of the animal away, or that the fossilised remains could be damaged or missing, e.g. to rocks splitting and one part rolling down a cliff, were seen in about equal proportions. Candidates who did not gain marks often stated that fossils do not form in some soils and confused bones and fossils, e.g. the fossil will rot away as it lies in the rock or the fossil will be eaten by scavengers.

(b) Explain why fossils of dinosaurs are often incomplete.

(3)

Fossils are rarely complete as over the millions of years, the soft tissue breaks down, leaving just the bones and teeth. These can also be destroyed by movement of rocks trapping them and crushing them. Plus, say, if the fossil was of a herbivore, part of the fossils may be elsewhere because a carnivore ate part of the animal and then moved away from the rest of the carcass.

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Examiner Comments

An excellent answer covering the three areas required for full marks to be awarded. The candidate does confuse fossils and bones a little but recovers in the last sentence to say that a carnivore could eat part of the animal and move it away from the rest of the carcase.

(b) Explain why fossils of dinosaurs are often incomplete.

(3)

- While being fossilised, weaker bones & while compressed under high pressure were destroyed
- Some fossils are damaged during excavation
- Some ~~bones~~ bones deteriorate over time
- Some bones would have been damaged during the life span of the creature.

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Examiner Comments

The answer here refers to fossil being damaged twice, which is the same marking point although the second one is stronger. The other points made are vague and not creditworthy.

(b) Explain why fossils of dinosaurs are often incomplete.

(3)

Fossils of dinosaurs are often ~~the~~ incomplete due to the fact their tissue may have washed away when making the fossil. ~~The no~~ Another creature may have eaten and taken some of the bones which leaves a fossil of a dinosaur not complete.

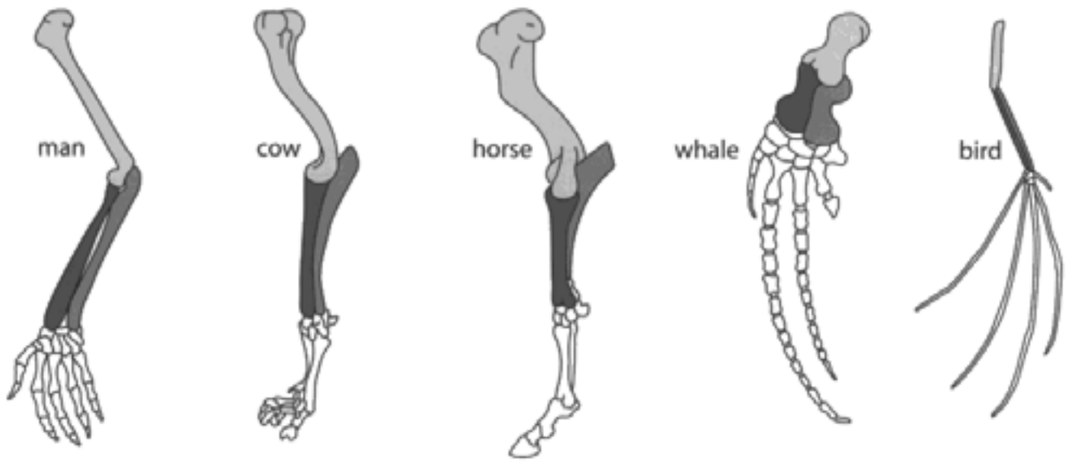
ResultsPlus
Examiner Comments

This answer almost gets a mark for the reference to tissue. If they had referred to 'soft' tissue or named tissues / organs like skin or liver decaying then they could have got a second mark. The idea of parts being washed away could be credited, but is the same marking point as the last sentence hence only one mark being awarded.

Question 5 (c)

This item was the first of the six marker questions where QWC is taken into account, and candidates are assessed on one of three levels that are then converted to marks. Only 0.2% of candidates produced answers where their quality of written communication lead to a mark being deducted. This showed an improvement compared to last year. The question required candidates to interpret the bones of five vertebrate pentadactyl limbs and relate them to evolution. Candidates had little problem in understanding the question and excellent answers were seen, with responses identifying the limbs as pentadactyl, comparing the differences, stating that the similarities suggested a common ancestor, and that the differences were due to natural selection and adaptive radiation (although that term was seen only rarely) as well as describing the individual pentadactyl limbs to specific uses suited to the animal's habitat. Most candidates, 52.5%, however, were judged to be at level 2 (4 marks) and were let down by the last part, relating differences to evolution. Candidates were very good at recognising the limbs as pentadactyl, pointing out similarities, and named bones that were evident in all the limbs and related this to the idea of a common ancestor, but when it came to differences could not develop the ideas to explain how these differences developed, or how this related to advantages, survival and natural selection.

*(c) The diagram shows some limbs of modern-day animals.



Explain how the study of the limbs of different species of vertebrates provides evidence for evolution.

(6)

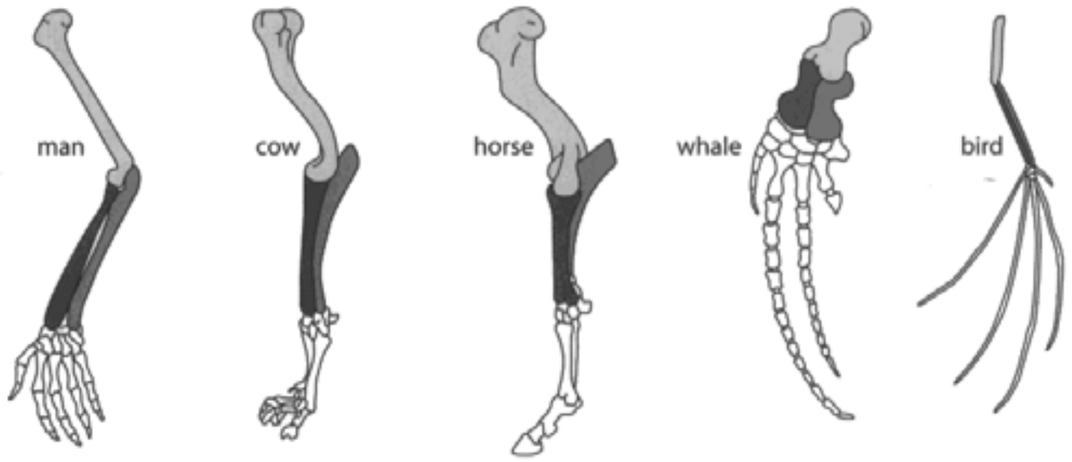
We can see from the structure of these bones that despite these species being different they may have evolved from a common ancestor. For example some species show the same 5 fingered pentadactyl structure meaning they could be related however the positions have been adapted based to this species conditions. For example, the human skeletal structure is perfect for moving, grasping clasping and grabbing objects

whereas the whales flipper structure is more spread so it allows it to swim through more effectively. Also, both the cow and horse need strong legs so they have a more strong supportive bones. This provides evidence for evolution as it shows how bone structures have changed over time to adapt to the conditions these species live in, and the things they do.

ResultsPlus
Examiner Comments

This answer was judged to be just a level 3 (6 marks) as it states more than just the limb being pentadactyl by saying five-fingered and linking this to the idea of a common ancestor. The candidate goes on to say more than merely describing the limbs, but this is not developed to the extent that would be a clear level 3 for this question.

*(c) The diagram shows some limbs of modern-day animals.



Explain how the study of the limbs of different species of vertebrates provides evidence for evolution.

(6)

We can explore the changes in limbs of different species from different times to see if there is any connections in muscles and bone structure or differences to then be able to see changes which means evolution occured.

Evolution can be caused by permanent changes in weather, environment or just an occurance.

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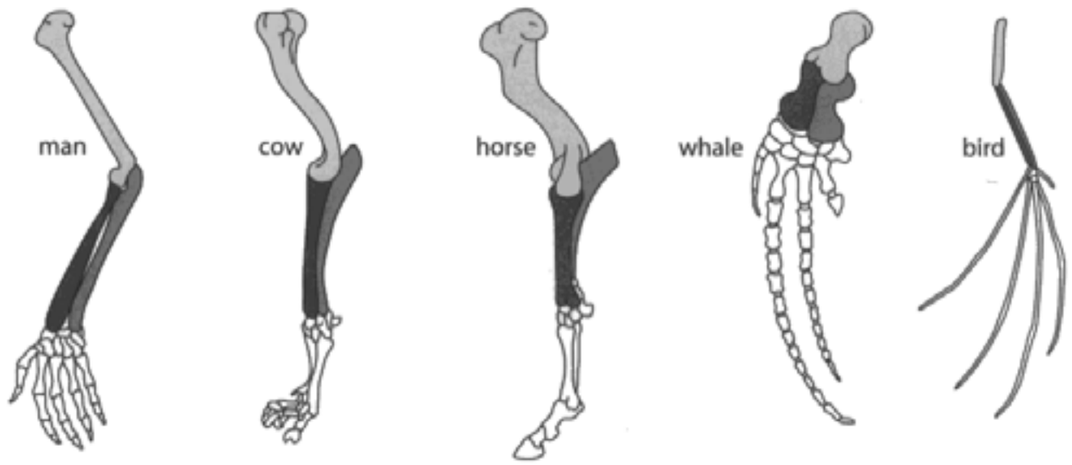
Examiner Comments

This answer gained no marks and is vague suggesting what could be done rather than using the source material supplied. There are areas of the answer that suggest that if put in a different way, the candidate would have been awarded at least level 1 (2 marks).

*(c) The diagram shows some limbs of modern-day animals.



Explain how the study of the limbs of different species of vertebrates provides evidence for evolution.

(6)

That evulation must take place because there is a clear link, although also some differences. for example all vertebrate has 3 types of bones in the arm, and they all connect in the same type of way. All hands are also made out of the same bone. Although all hands are formed differently. Although this could be the adaptations over many years that changed these little factors.

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Examiner Comments

There is just enough here to award level 1 (2 marks). The response refers to similarities in bone structure, e.g. all have three types of bone in their arm however these are vague and not related to evolution which would be required to move to level 2.

Question 6 (b) (i)

It was rewarding to see candidates demonstrating a good understanding of how genes were obtained for genetically modifying organisms. 44.1% were awarded the full 2 marks (see first clip below) with a further 21.6% gaining 1 mark. Some candidates, however, showed a tendency to describe the full process of genetic engineering which may have used up valuable time. Some candidates gave a reasonable account of how to obtain a gene but were awarded no marks as they missed the scientific terms and ideas as required by the mark scheme. These included referring to 'obtaining' the gene which was in the stem of the question and finding the gene -- see clip 2 below.

(b) To genetically engineer the original cell so that it would glow, the scientists had to obtain a suitable gene.

(i) Describe the stages that a scientist would complete to obtain this gene.

(2)

They would obtain a cell that contained DNA that ~~allowed~~ made creatures glow under UV light. They would then use restriction enzymes to cut out the useful UV gene from the DNA and then use restriction enzymes to insert the useful gene into a beagle gene in an adult beagle DNA cell.

ResultsPlus
Examiner Comments

This response was awarded both marks available as it clearly and concisely covers the required marking points. The last part misleadingly refers to using a restriction enzyme which can be ignored as it is extraneous to the question.

(b) To genetically engineer the original cell so that it would glow, the scientists had to obtain a suitable gene.

(i) Describe the stages that a scientist would complete to obtain this gene.

(2)

You cut one organism using an enzyme, and then another organism using an enzyme. You place the firstly cut organism into the Second one using an enzyme.

ResultsPlus
Examiner Comments

No marks were awarded here, firstly the candidate is cutting an organism and although enzyme is on the mark scheme the context of cutting an organism with it means that it was not awarded.

Question 6 (b) (ii)

This second six marker question required the candidates to describe how to clone a dog that glows from the genetically engineered cell from item 6bi. Candidates showed an excellent understanding with 30.2% of candidates gaining level two (4 marks) and another 30.2% gaining level three (6 marks) and it was very pleasing to see full and accurate descriptions, using the correct scientific terminology in many responses. Some candidates misread the question and used a beagle cell as a source of the nucleus to insert into the enucleated egg. It was considered that this should not be penalised by itself as the question was testing the cloning process rather than the source of the nucleus, although it could contribute to a reduction in level if other omissions were made. Candidates found this an easier question to answer compared to question 5c, being less open ended and more sequential. The number of candidates penalised for their quality of written communication was more than on 5c at 0.4%, which is similar to last year's six mark questions. It is possible that this was due to candidates writing more on this six marker and getting the sequence of cloning wrong. Incorrect ideas included: fertilising the egg after implantation, describing genetic engineering, bad terminology and vague descriptions, e.g. the nucleus and egg would be placed together and pulsed to start them off, using meiosis instead of mitosis, as well as inserting cells.

*(ii) Describe the stages used in the laboratory to clone and produce Tegon from the genetically engineered cell.

(6)

First the nucleus would have to be extracted From the cell of the animal that ~~wanted~~ is going to be cloned, and the nucleus needs to ~~be~~ placed in an enucleated ovum cell. Then, the cell must be stimulated using electricity ~~30~~ it starts to divide by mitosis. After the cell is stimulated and the embryo is developed it can be placed in a surrogate mothers womb so the embryo can eventually form a foetus, which will eventually become a living organism after the surrogate mother has given birth.

ResultsPlus
Examiner Comments

This clear and concise response sets out the essential stages of the cloning process correctly. It is logical and shows a clear understanding of the process.

*(ii) Describe the stages used in the laboratory to clone and produce Tegon from the genetically engineered cell.

(6)

The genetically engineered cell would be placed inside a dog egg*. ~~and~~ Then it would be implanted into a surrogate Mother This would cause the egg to (once fertalised) to grow into an embryo and the cell to replicate and form

* By removing a cell and implanting the new genetically engineered cell by using cutting and sticking enzymes.

ResultsPlus
Examiner Comments

This response, awarded level 1 (2 marks) is very weak and includes some details of genetic engineering and inaccuracies, for example inserting a cell and a dog's egg. However, there is just enough correct ideas, specifically inserting something into an egg cell and the use of a surrogate mother.

Question 6 (c)

To gain three marks, candidates had to suggest the advantages of cloning dogs for medical research into human disease. This was designed as a hard question to discriminate at the higher grade range. Good answers were seen, for example, "*in medical testing, clones can be given certain genetic diseases to aid research and there will be no outliers in the results as all the organisms are genetically identical*" -- although these responses were rare. Responses that scored just one mark often stated that the cloned dogs were genetically identical or that dogs like man were vertebrates / similar and so would react in a similar way to each other -- see first clip. Some referred to using the dogs to find cures but did not develop the answer to relate how this could be used to research human diseases. Many candidates misinterpreted the question (see second clip) and wrote about disadvantages, and vague ideas about producing organs for transplanting into humans. A few candidates discussed the ethics of using dogs for research which of course is a disadvantage so was not answering the question.

(c) Suggest the advantages of cloning mammals, such as dogs, for use in medical research into human diseases.

(3)

It can help to cure diseases such as diabetes. The animals are genetically identical so should react in the same/~~similar~~ way. It makes the research more fair and accurate.

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Examiner Comments

This response gains two marks for stating that the clones are genetically different and so should react in the same / similar way (making the research more accurate).

(c) Suggest the advantages of cloning mammals, such as dogs, for use in medical research into human diseases.

(3)

Advantages: → the cloned mammal will have the same features as the parent.

→ the desired characteristic found in the parent will be in the cloned mammal.

Disadvantages: → the cloned mammal has a risk of having an early death.

→ Cloning mammals is harder than cloning plants

→ if the parent has a genetic disorder it will be passed onto it's clones.

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Examiner Comments

The candidate has misread the question which only asks for advantages and the valid points are too vague for credit talking about features rather than being genetically identical.

Paper Summary

The paper performed in a similar way to the equivalent 2014 paper, discriminating well with some excellent answers and understanding being seen in many responses that were awarded the higher grades. Few blank responses were seen this year although there were three questions which were less accessible to a significant number of candidates. These questions were sometimes misinterpreted although it appeared that most of these candidates could not express themselves clearly enough with significant detail to meet the marking criteria. There were large numbers of candidates who extended their answers by the use of additional sheets of paper.

Overall it was pleasing to see answers that showed from a good to excellent understanding of the biology assessed. Answers tended to be presented logically and where explain command words were used, there was clear evidence of improved responses linking initial points made to supporting reasons. Mathematical skills were of a similar standard to previous years with candidates competently extracting data and calculating arithmetic computations, although this year the graph interpretation for item 4a was less well answered with candidates giving generalised descriptions. Overall a complete range of responses were seen with some excellent answers showing a clear understanding of biological principles with accurate use of scientific terminology which showed an excellent understanding of the concepts being assessed.

- Based on their performance on this paper, candidates should:
- Use accurate scientific terminology
- Present their arguments logically
- Link initial points with supporting reasons
- Extract data competently
- Try to avoid generalised descriptions

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

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