

Examiners' Report
June 2013

GCSE Biology 5BI2H 01

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Introduction

This paper is the June series paper for the Science 2011 specification: from now on this can only be assessed in the Summer series as a linear course. The paper consists of 60 marks assessed by a variety of questions including multiple choice, short answer and extended answer questions worth 6 marks each. Candidates should answer all questions in a time period of 1 hour. The extended answer questions are also marked for quality of written communication (QWC) so candidates should ensure that their answer includes good use of spelling and grammar and also that the answer is written with clarity.

The paper covers the topic areas of protein synthesis including mutations, cell structure including blood cells, evidence for evolution and the development of the pentadactyl limb, reproduction of cells and cell division, osmosis and human digestion and finally transport of substances in plants.

Overall the paper was accessed well with candidates able to attain marks across the whole of the paper. Knowledge of the process of protein synthesis was good despite this being a complex subject but candidates struggled when applying the process of protein synthesis to a different area, in this case a mutation in an enzyme. Understanding of cell structure is good as is an understanding of the role of white blood cells in the body. I was particularly impressed by the candidates' ability to manipulate numbers in standard form when applied to a real life situation of blood cell count. Candidates' knowledge of the pentadactyl limb was good and they were able to interpret information based around this very well, although their general knowledge of fossil formation was less well informed. Knowledge of mitosis was excellent, both the outcomes and some specialist knowledge of the process of mitosis was excellent despite this being beyond the remit of the specification. Growth and the role of stem cells was less well understood when applying it the development of a coral. Using visking tubing to model the human small intestine caused some consternation and candidates lost some marks by not distinguishing between a 'describe' and an 'explain' statement. It is vital that candidates are able to describe a trend and then explain the science underlying that trend in order to gain the marks. Finally transport of substances into and through plants caused some problems with much confusion between xylem and phloem vessels and also concentration gradients.

Question 1 (a) (i)

This question involved translating the triplet code into the amino acid it represents and was completed extremely well. Candidates were able to match the code to the respective amino acid with ease and the majority of candidates scored well in this.

Question 1 (a) (ii)

There was a little confusion between the stages of translation and transcription but candidates were generally fine in recognising that it was translation that occurred at the ribosome and also that this is the stage where amino acids are joined together to form a polypeptide chain.

Question 1 (b)

This question required candidates to explain the role of the active site of an enzyme. Credit was given for recognising that its specific shape binds a specific substrate and that the reaction is catalysed there to either join together or break down molecules. Most candidates gained a mark for the idea that a reaction occurred here which breaks something down. Credit was also given for the fact that this is a lock and key mechanism or words to that effect.

The active site of an enzyme is the part where it joins onto its substrate to catalyse the reaction. The active site has to match the shape of its substrate (lock and key mechanism) otherwise the reaction will not occur.



ResultsPlus

Examiner Comments

This is a good answer which recognises the role of the active site on an enzyme and what happens at this active site. The fact that a substrate binds and the reaction is catalysed is sufficient for the marks.



ResultsPlus

Examiner Tip

When asked to explain ensure you are giving scientific detail about the question asked. Try to avoid answering in bland meaningless statements.

The active site is the bit that is prepared for something to join it, it is waiting to be joined with DNA.



ResultsPlus

This candidate's answers have missed out on the marks as they are not specific enough. It needed to mention what binds to the active site i.e. the substrate to gain the mark. It also confused this question with the previous about DNA, remember each part of a question a, b and c may be about different topic areas. Parts of questions (a)(i), (a)(ii) will be related to one another so the links there may be noticeable.

Question 1 (c)

This question required a high degree of understanding, the candidate had to recognise what a mutation was and how this mutation could cause a problem with the enzyme manufactured. Several candidates only referred to the outcome of this rather than the effect on the enzyme and therefore missed out on valuable marks. Several candidates also referred to denaturation which is incorrect but these references were ignored. Denaturation occurs to a functioning enzyme rather than a mutation which may cause an enzyme not to be able to function in the correct way as the amino acids that make up the protein are incorrect or in the wrong sequence.

A genetic mutation could result in a type of enzyme being changed. This may cause it to be unable to catalyse its substrate anymore due to a change in the shape of its active site. This could seriously damage an organisms digestive / immune system.

(Total for Question 1 = 8 marks)



ResultsPlus

Examiner Comments

It is vital here that the candidate refers to the enzyme in question; a mutation could cause the shape of the active site to change. This candidate has just referred to an enzyme being changed which is not specific enough. They later go on to state the active site is changed for a mark and then this stops it binding to the substrate for the second mark.



ResultsPlus

Examiner Tip

Keep an eye on the number of marks allocated to a question this should give you a clue as to the number of valid points that need to be made.

a mutation can make ~~defective~~ enzyme which will disallow them to work properly. A mutation can also make an enzyme not grow properly ~~or not grow at all~~ are not grow in the right place of. This may mean you can get enzymes adapted for the stomach but not mouth



ResultsPlus Examiner Comments

Several candidates gave a similar response to this whereby they just stated the outcome of a mutation rather than the effect on the enzyme itself which was only worth of 1 mark.

Question 2 (a) (i)

Generally most students gained the full two mark points for noticing that yeast have a nucleus and a vacuole where these are absent in bacteria. Most common mistakes were that bacteria don't have a cell wall or they don't have cytoplasm. Other incorrect responses included reference to mitochondria and also reference to tails rather than flagella.

- 1 The nucleus is not in the middle.
- 2 The cell membrane is shaped differently.



ResultsPlus Examiner Comments

This candidate has confused plant cells here by referring to the nucleus not being in the centre. In this case it is the fact that the bacterial cell does not have a nucleus. The cell membrane being a different shape is probably true of almost every cell so is not creditable for the mark.

Question 2 (a) (ii)

On the whole this question was very well answered. The vast majority gained the one mark for this question. The few students who didn't get the mark confused photosynthesis with respiration.

Because they get no light to complete the process of photosynthesis.



ResultsPlus
Examiner Comments

Clear correct response where the candidate has responded regarding the action of photosynthesis.

They do not have chloroplasts.



ResultsPlus
Examiner Comments

This is the alternative answer for this question. The candidate has not referred to photosynthesis but has recognised that the organelle for photosynthesis is missing i.e. chloroplast.

Question 2 (b) (i)

A large number of students did gain the full 2 marks for this question. The use of standard form did confuse some students but more marks were lost due to the incorrect data being selected than by the calculation being incorrect. Several candidates tried to convert the standard form and then convert it back again; quite often they were then out by an order of magnitude. It is essential that the maths skills stated in the front of the specification are covered so as not to disadvantage candidates.



The image shows a student's handwritten work on a piece of paper. The work is as follows:
 $7 \times 10^9 = 70$
 $5 \times 10^{10} = 50$
answer = 20

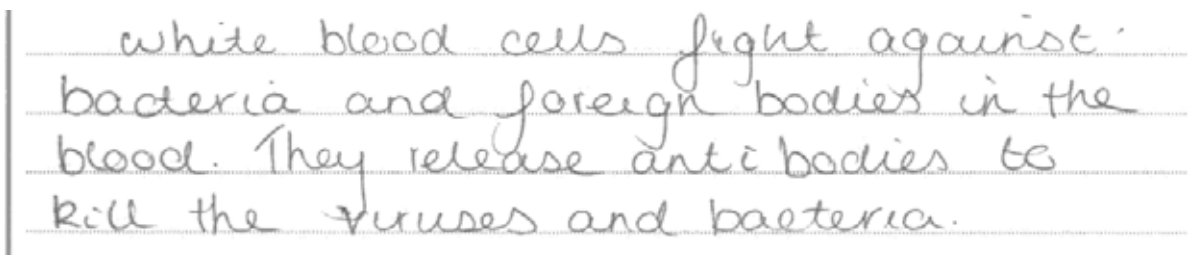


ResultsPlus

This illustrates the importance of selecting the correct data and showing that you have collected the correct data. This candidate gained 1 mark despite not managing the correct calculation.

Question 2 (b) (ii)

Most students were able to get at least one mark by stating that white blood cells were part of the immune response or words to that effect, but many weren't clear about the actual functions of white blood cells. 'White blood cells are antibodies' was a common response as was that they 'gobble up/eat' pathogens which shows poor use of scientific terminology. Candidates' description of phagocytosis was very poor. The antibody production mark was much more accessible for these candidates. Quite a few students also attributed functions of red blood cells and platelets to white blood cells such as carrying O₂, CO₂ and waste or causing clotting and repairing wounds.



white blood cells fight against bacteria and foreign bodies in the blood. They release antibodies to kill the viruses and bacteria.



ResultsPlus Examiner Comments

This response gained both marks but fight against bacteria is really not the scientific rigour we are expecting at GCSE. In this case as the mark was given for defence against disease this became an acceptable response. The second mark was given for the production of antibodies.



ResultsPlus Examiner Tip

Try to use scientific terminology when answering this type of question. The term phagocytosis is the correct term for the action of phagocytes on pathogens in the body.

Question 2 (b) (iii)

The main problem with the answers to this question was that they were referring to breathing difficulties or asthma rather than simply saying short of breath. A small number of students confused anaemia with sickle cell anaemia. The most common correct answer was that there would simply be less oxygen in circulation but some good application of knowledge was also rewarded for responses related to the person doing more anaerobic respiration.

Question 3 (a)

This question was well answered with most students able to get full marks. Students lost marks by not being specific in their answers or describing how the different limbs were adapted or had evolved rather than focusing on common features. There were numerous spellings of 'pentadactyl'. Marks were given for recognition of the common features. All have humerus, similar bone structure and 5 digits known as the pentadactyl limb.

This could be shown as all of the above organisms has the same set of bones however in slightly different shapes. This could show that these bones have been adapted/evolved in the specific organisms for them to do the job they need.



ResultsPlus Examiner Comments

In this case the candidate has failed to gain any marks. Each of the organisms do not have the same bone structure.

The bone structure is similar and the quoting of the names of bones which were labelled would also have gained a mark.



ResultsPlus Examiner Tip

Be specific in your responses, if a large amount of information is given try to use this in your answers.

Question 3 (b)

Students clearly remembered that the fossil record is incomplete because not all the fossils have been found yet – this was by far the most common answer. Many students didn't refer to soft tissue and just said that parts decompose or that not all organisms fossilize which was not enough to credit the second mark. Fossils being damaged was allowed as was the fact that the soft parts of organisms decay and rarely form fossils.

Because some of the fossil may have already fully decomposed leaving no trace behind. ~~There~~ This causes missing links in the fossil record.



ResultsPlus
Examiner Comments

Unfortunately this candidate just missed out on the marks as they have not noted that it is the soft parts of organisms that decay.

Question 3 (c) (ii)

This question was answered very well with the majority of candidates attaining maximum marks. Candidates did lose marks for using the incorrect formula for carbon dioxide or oxygen but these were few and far between.

~~plants than less~~ Because plants take in CO_2 and ~~give~~
~~out~~ release O_2 . So, if there were more plants there would
be less CO_2 and more O_2 and if there were less plants
there would be more CO_2 and less O_2 .



ResultsPlus Examiner Comments

A good clear answer related to the carbon dioxide and oxygen levels in the atmosphere.



ResultsPlus Examiner Tip

If you use formulae please ensure that the formula are used correctly - there is no credit for CO^2 !

Question 3 (c) (iii)

This question was poorly answered with a low proportion of students getting 2 marks. Many students were nonspecific, and merely re-worded the question or answered in terms of lungs, breathing etc. A lot of candidates gave variations of 'they need more oxygen because they are larger'. However a significant proportion were able to link that with more respiration and to a lesser extent the 3rd marking point. Few gained the 1st mark point and when they did it was usually credit given to larger organisms having more cells.

Question 4 (a) (i)

This question was generally understood by candidates but a few believed that the egg cell would have twice the DNA of the sperm cell, this is a common misconception as the egg cell is considerably larger than the sperm cell but the question was specifically asking about the genetic material.

0.8 picogram



ResultsPlus
Examiner Comments

1 mark given for the correct answer as the egg cell and the sperm cell have the haploid amount of chromosomes their DNA mass will be almost the same.



ResultsPlus
Examiner Tip

Be careful when answering numeric answers that you form the numbers carefully. This could have been read as 0.8 picograms but the benefit of doubt was given in favour of the candidate.

Question 4 (a) (iv)

Candidates were very knowledgeable about the structure of DNA and in particular the bonding between the two strands of the double helix. It was very pleasing to note the number of candidates who actually quoted weak hydrogen bonds rather than just hydrogen bonds. The few errors were candidates using terms from chemistry such as covalent or ionic although some candidates referred to peptide bonds which are generally brought in at A level.

Weak hydrogen bond.



ResultsPlus
Examiner Comments

The correct answer and this was answered very well.

Question 4 (b) (i)

This question was well accessed by the majority of candidates who not only have a good knowledge of the outcomes of mitosis but also the process of mitosis. There were some outstanding answers given showing clear knowledge of the phases of mitosis which were naturally credited with the marks despite this level of knowledge being beyond the remit of the specification. Those candidates who lost marks generally did so because they confused mitosis and meiosis.

~~Mitosis~~ Mitosis is ^{the} process where 2⁽³⁾ diploid cells are produced. These cells are genetically identical. Used for growth and repair.



ResultsPlus Examiner Comments

This candidate has hit all three marking points. They recognised that 2 cells were produced, that the cells were diploid and that they were **genetically** identical. Candidates did have to use the term genetically here to gain that third mark.



ResultsPlus Examiner Tip

When looking at mitosis or meiosis be very careful to state that in mitosis the cells are **genetically** identical and in meiosis the cells are **genetically** different rather than making a vague statement.

Question 4 (b) (ii)

This question caused candidates a few problems as they confused mitosis with meiosis. The question is about what happens after fertilisation which is when the cells divide in order for the organism to grow. Further detail regarding stem cells and the differentiation of those stem cells would give the candidate full marks.

It begins to become a small plant from some on the sea bed. As months go by it gets larger in size and circumference, then it begins to grow.



ResultsPlus
Examiner Comments

This candidate has gained 1 mark by recognising that the organism grows, if they had gone on to state because more cells are made this would be worthy of 2 marks.



ResultsPlus
Examiner Tip

This is a 'describe how' question so the outcome - growth is needed but also how that growth comes about to gain full marks.

Question 5 (a) (i)

Candidates generally scored the first mark on this question for stating that the concentration of glucose increased but they did not complete the information on the trend of the graph by saying that at a concentration of 0.79 it levels off. Other candidates lost marks by making generalised statements such as it is positive, or positive correlation, these need to be qualified in order to gain the marks.

Every 5 minutes there was an increase of concentration of glucose. However it was the same for 10 minutes.



ResultsPlus

Examiner Comments

This is the most common mark given for the fact that the concentration increases over time.



ResultsPlus

Examiner Tip

The question asks you to describe the results so quote from the table of results in your answer i.e. it increases until a conc. of 0.79 and then levels off would have been worth 2 marks.

As the time increases so does the distilled ~~water~~ concentration of glucose in the distilled water. This is a positive correlation.



ResultsPlus
Examiner Comments

This is worthy on one mark for the increases over time. Note no marks are given for a positive correlation as this has to be qualified by between what and what to be worth the mark.

The longer the glucose stayed in the water the higher the concentration increased ~~and~~ until 20 minutes in then stayed at that concentration of 0.79gcm^{-3} for another 5 minutes.



ResultsPlus
Examiner Comments

An example of how to gain both marks for the question.

Question 5 (a) (ii)

This question proved to be a problem for candidates with many repeating the answer to the describe question rather than using the scientific information and their own knowledge to answer the question. This answer required an understanding that the starch is broken down to glucose by the enzyme amylase which then allows the glucose to pass through the visking tubing as the molecule is small enough down the concentration gradient, into the distilled water.

The results of this investigation show that as the time increases the concentration of glucose in the distilled water increases. This has happened as the visking tubing allows small molecules to pass through. This means that the glucose will slowly started to pass through to the distilled water.



ResultsPlus

Examiner Comments

This candidate has managed to gain 1 mark for the fact that the glucose molecules pass through the visking tubing. The concentration of glucose going up has already been stated in describing the trend. Now they need to give the scientific information as to why the glucose concentration in the distilled water increased.



ResultsPlus

Examiner Tip

Please read the command words carefully. This is an explain question so you need to explain the reasons for the trend. This includes drawing on your own scientific knowledge and applying it to the question.

At the beginning the concentration of the glucose was 0gcm^{-3} until 5 minutes of being in the beaker its concentration increased by 0.07gcm^{-3} , we then see a steady increase moving from 0.07gcm^{-3} to 0.39gcm^{-3} in the space of 5 minutes.



ResultsPlus
Examiner Comments

This was a classic mistake of many candidates who describe the trend in more detail, scientific information is needed here to justify why the glucose concentration increased. 0 marks gained here.

Question 5 (a) (iii)

This question was answered reasonably well with most candidates able to access level 1 and the better candidates able to gain level 3 and 6 marks. A lot of the information was given in the diagram and this had to be compared with the small intestine. In this case candidates should think about the structure of the small intestine and how this visking tubing is similar and different. Many candidates talked about the experiment and tying the ends up etc. but this was not what was required. The question required an evaluation of the model not an experiment.

Question 6 (a) (i)

Most candidates were able to recognise that the movement of water into plants was by the process of osmosis but a few were confused between osmosis and active transport. Several candidates lost a mark by just mentioning roots rather than root hairs. Very few candidates went onto qualify why the water moves into the root hairs because of differences in water concentration or because the membrane is partially permeable.

Plants have a xylem and it is used to take in water and minerals. This is known as ~~water~~ active transport.



ResultsPlus Examiner Comments

0 marks awarded here, the candidate needs to read the question carefully, this is how the water gets **into** the plant, rather than how it travels through the plant. The candidate is correct that the xylem carries water through the plant but this does not answer the question. Active transport is incorrect for water.



ResultsPlus Examiner Tip

Be careful to read the question. This is 'into' the plant not 'through' it.

The water moves into these plants at the root hair cells via ~~active~~ ^{osmosis} ~~transport~~. The water is then taken up the plant via the xylem. The water then enters the leaves where photosynthesis occurs and oxygen is released via the stomata.



ResultsPlus Examiner Comments

This candidate has correctly identified that the water travels into the plant through the root hair cells by osmosis for 2 marks. If they had then gone on to state across a partially permeable membrane or down a concentration gradient they could have gained all 3 marks.

Question 6 (a) (ii)

This question caused some considerable confusion for candidates, there were several answers about salt blocking the roots and so water could not get in which is clearly incorrect. Candidates needed to state that water movement into the plant would be slower or that more water would move out because of the concentration of water inside or outside the plant.

It would make it slower and
less efficient.



ResultsPlus

Examiner Comments

This is insufficient for the mark as the candidate has not been specific about what would be slower or less efficient, they could be referring to the salt solution or the water so no mark can be awarded.



ResultsPlus

Examiner Tip

Be as specific as possible with your responses, in this case what was slower - if water into the plant then state that!

Question 6 (b)

Most candidates were able to access this question at level 1 and 2 and the better candidates managed level 3 consistently. There was some confusion between the vessels that carry the substances around the plant with many candidates believing glucose is absorbed through the roots rather than being made in the leaves through photosynthesis. It was pleasing to note that several candidates were able to identify that the glucose is converted to sucrose to be transported in the phloem and there were some excellent explanations of the transpiration stream when talking about water movement through the plant.

Water in the soil enters the root hair cells in the roots via ~~osmosis~~ ^{osmosis} ~~transpiration~~. The water then travels up the xylem via ~~transpiration~~ active transport. The xylem are in the centre of the plant ~~to stop insects~~.

Glucose are also absorbed in the ~~root~~ hair cells via diffusion from a higher concentration to a lower concentration. The glucose then travels up the plant via the phloem that are also located ~~into~~ the centre of the stem.

Mineral salts are ~~as~~ diffused into the roots ~~via~~ hair cells from a higher concentration to a lower concentration. They are then transported via active transport through the phloem into the plant.

(Total for Question 6 = 12 marks)



ResultsPlus Examiner Comments

Although this candidate is a little muddled there is sufficient information that is correct to enable the candidate to get into band 2. They have correctly stated movement of water into and through the plant in the xylem and have correctly identified glucose (sucrose) moving through the phloem although they have the mineral ions a little confused and also that the glucose is taken in through the roots. There is still enough for band 2 and 4 marks awarded.



ResultsPlus Examiner Tip

For a question like this which is in 3 parts it may be worth writing 3 headings and placing the information about the three different substances under the relevant headings.

Glucose, produced by photosynthesis in leaves is converted to sucrose which is transported in phloem to the rest of the plant.

Water and dissolved minerals enter plants through their roots from the soil water.

They then from the roots travel in xylem to the rest of the plant.

~~Evaporation of~~ :

Water and substances dissolved in the water are transported around the plant in veins. Veins contain tissues called xylem and phloem.

(Total for Question 6 = 12 marks)



ResultsPlus

Examiner Comments

This candidate has attained level 3 and 6 marks they have correctly identified where glucose is made and how it is transported around the plant in the phloem as sucrose. They have also correctly identified the movement of water and minerals through the plant in the xylem. Clearly written and a good level of QWC.

Paper summary

Based on their performance on this paper, candidates should:

- always show the working when doing calculations as a mark can be awarded for errors carried forward in this case.
- ensure that they read the questions carefully and ensure that they are not linking a previous question to the next one as was the case with the salt solution in the water for the plant.
- check the number of marks associated with graphical questions when tackling them and ensure that if 2 marks are awarded then two separate points about the graph are included.
- know both the role of phloem and xylem vessels within a plant to avoid confusion when answering questions.
- candidates should be giving scientific information and not a vague statement, which may not be worthy of credit when a question asks candidates to **explain** as the command word.
- think about the structure of the answer before starting to write when tackling the extended answers to ensure that the answer shows clarity of writing and flows, while remembering that accurate spelling and grammar in these questions is also important.
- candidates should use the information given to them in the question in their answer as in the case of the visking tubing as a model for the human small intestine, quoting information in the correct context and extracting valid information from that given is worthy of credit.

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