

Examiners' Report
June 2014

GCSE Biology 5BI3H 01

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Introduction

This was the second time that the B3 unit has been examined in the science 2011 specification.

It is taken by candidates doing GCSE biology or GCSE further additional science. This was the first time candidates doing these GCSEs were required to sit all three exam units at the end of the course.

As a consequence candidates used knowledge from other units in their explanations to a greater extent than previously. The paper consists of 60 marks assessed by a variety of questions including multiple choice, short answer and two 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 on their 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 contained questions from all three topics from the unit. These included the inheritance of sex-linked genetic disorders, immunisation and monoclonal antibodies, photoperiodicity and co-evolution, human evolution, the kidney and menstrual cycle and enzyme technology.

The candidates accessed both extended writing responses well and were able to demonstrate a very good level of knowledge and understanding on both of the topics. Candidates of all ability demonstrated the ability to use percentages in a calculation. Many candidates were able to extract information from a graph but didn't always interpret data presented in a pie chart accurately. Where there was specification overlap between questions on this paper and the June 2013 papers at both higher and foundation, candidates showed a particularly good level of knowledge indicating that they may have used the past papers in their preparation.

Candidates of all ability were able to interpret the pedigree analysis and give the sex chromosome combination of a female. However, candidates found it more difficult to explain the inheritance of a recessive sex-linked genetic disorder.

Candidates demonstrated good knowledge and understanding on the immune response to immunisation and the role of monoclonal antibodies in medical diagnosis.

There was significant confusion over day neutral plants with respect to photoperiodicity. Candidates showed an understanding of co-evolution but the majority could not explain in detail how it occurs. Candidates were able to interpret information from a cladogram regarding human evolution. There was some confusion over valid methods to extract information from fossil discoveries from the

Homo erectus era. Many candidates were able to give a reason as to why mitochondrial DNA is more useful than nuclear DNA for tracking human migration and some were able to show a very good understanding of this point.

Candidates of all abilities showed understanding of the hormonal response of the body to dehydration. However, many lacked detailed scientific knowledge of the effect of ADH on the kidney beyond increased water re-absorption.

Most candidates were able to give the roles of at least two hormones in the menstrual cycle and many referred to negative feedback mechanisms in their explanations of the control of the menstrual cycle.

There was more confusion over the role of restriction enzymes in the construction of recombinant DNA molecules. Many candidates were able to describe the use of enzymes in the production of vegetarian cheese, lactose-free milk and sweets. Candidates lost marks were they didn't name the enzyme or lacked detail on the role of these enzymes. Chymosin was the most commonly named enzyme but lactase was less well known.

Question 1 (a) (i)

Nearly all candidates correctly identified the sex chromosome of person B as XX by interpreting the pedigree analysis.

Question 1 (a) (ii)

This question required candidates to explain why the male offspring of a homozygous dominant female could not have haemophilia.

This question proved difficult even for high ability candidates.

Many incorrect responses referred to the inheritance of the haemophilia gene rather than the allele for haemophilia.

Some candidates referred to the mother as unaffected but did not explain she was not a sufferer or a carrier but was homozygous dominant.

Some candidates disregarded the information regarding sex linkage and stated that males needed to inherit two recessive alleles to get haemophilia.

Better usage of genetic terms in the explanation would have benefited many candidates. The most commonly awarded marks were for knowing that the allele was located on the X chromosome or that males receive an X chromosome from their mother and a Y chromosome from their father. Some candidates who used a Punnett square to illustrate their answer increased achievement.

(ii) Explain why the male offspring from A and B do not have haemophilia.

(2)

They have not inherited the recessive allele on the X chromosome (x^h) but have both inherited the allele for normal blood clotting (x^H)

	x^H	x^H
A x^H	$x^H x^H$	$x^H x^H$
Y Y	$x^H y$	$x^H y$

The punnett square shows no possibility of a male offspring affected = 0%.



ResultsPlus Examiner Comments

This candidate has been awarded maximum marks for the idea that the males have not inherited the recessive allele but have inherited the allele for normal blood clotting and that the allele is located on the X chromosome.

(ii) Explain why the male offspring from A and B do not have haemophilia. (2)

Because neither males have the recessive haemophilia gene and the women only have one set of the gene and so are carriers therefore none of the offspring of A and B have haemophilia because carry either none or one of the gene.



ResultsPlus
Examiner Comments

This candidate was not awarded a mark because they have used the term gene and not allele.

(ii) Explain why the male offspring from A and B do not have haemophilia. (2)

The male offspring do not have haemophilia as it is a sex-linked disorder that is recessive so it can only be ~~from~~ you need 2 copies to show symptoms and the mother is unaffected so all the males ~~only~~ don't have 2 copies.



ResultsPlus
Examiner Comments

This candidate has not understood the sex-linkage inheritance of haemophilia.



ResultsPlus
Examiner Tip

Avoid repeating information from the question in your answer.

Question 1 (a) (iii)

To complete this question candidates needed to interpret the pedigree analysis and deduce the gametes of individuals C and D. The second mark was for completing the Punnett square to show the offspring with the third mark for calculating the probability of a child being affected by haemophilia.

Candidates who successfully identified the gametes often went on to achieve maximum marks but the question showed that a number of candidates did not understand sex-linked inheritance. Candidates who did not make the sex-linked connection and showed either the inheritance of an autosomal recessive disorder or a Punnett square showing sex determination were unable to gain any marks. The most common error on otherwise correct gametes was to include an allele on the Y chromosome.

(iii) Using the Punnett square, calculate the probability that individuals C and D could have a child with haemophilia.

(3)

	X^H	Y
X^H	$X^H X^H$	$X^H Y$
X^h	$X^H X^h$	$X^h Y$

there is a 25% chance ($\frac{1}{4}$) that the child will be a sufferer. there is a 25% it will be a carrier and 50% it will be homozygous dominant.

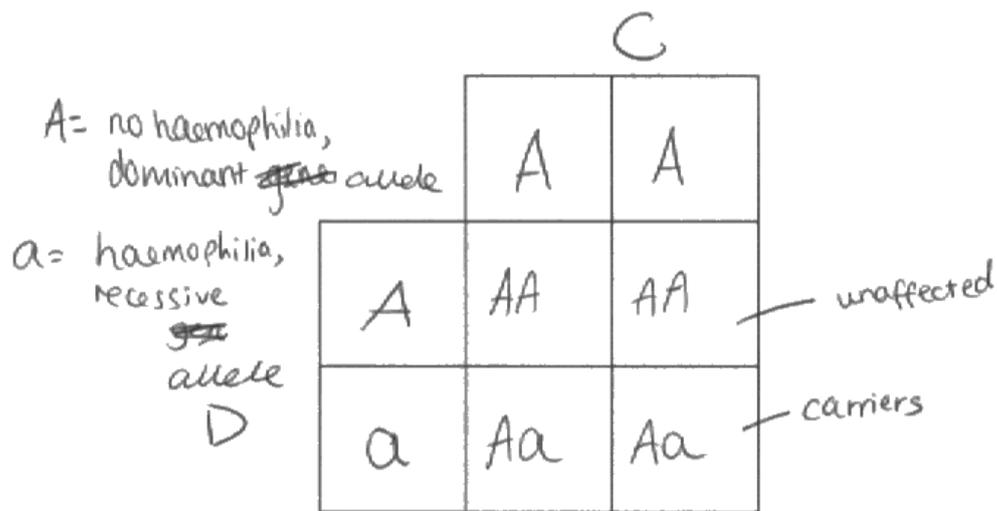


ResultsPlus
Examiner Comments

This candidate was awarded maximum marks for the correct gametes, correct offspring and calculating the probability of individuals C and D having a child with haemophilia as 25%.

(iii) Using the Punnett square, calculate the probability that individuals C and D could have a child with haemophilia.

(3)



There is a 0% chance that the child will have haemophilia but there is a 50% chance they will be a carrier and 50% chance that they will be unaffected. In order to have haemophilia they would need 2 recessive alleles.



ResultsPlus
Examiner Comments

This candidate did not receive any marks. The sex chromosomes have to be included on a genetic diagram for sex-linked genetic disorders.

(iii) Using the Punnett square, calculate the probability that individuals C and D could have a child with haemophilia.

(3)

	X^H	X^h
X^H	$X^H X^H$	$X^H X^h$
Y^H	$X^H Y^H$	$X^h Y^H$

There is no possibility the children of C and D could have haemophilia because it is the mother who carries the haemophilia recessive allele. This means that boys will inherit the dominant allele from their unaffected father but will not inherit the recessive allele on their Y chromosome. However, 50% of the children will be carriers because they will inherit one recessive gene from their mother.



ResultsPlus
Examiner Comments

A common mistake made by candidates was to include an allele on the Y chromosome.

Question 1 (b)

The question was accessed well by most candidates with temperature and pH the most commonly named conditions. The explanations often referred to the denaturing of enzymes or the impact on the optimum growth of micro-organisms. Some explanations were not specific enough, such as enzymes denaturing at high and low temperatures, so candidates did not gain the second mark.

The most common answer which did not gain credit was for using the term sterile rather than aseptic. Some candidates described the role of stirrers which is a feature of a fermenter rather than a condition.

(b) Haemophilia can be treated using a blood clotting factor produced in a fermenter.

The conditions inside a fermenter have to be carefully controlled.

Explain why **one** named condition must be controlled in a fermenter.

(2)

The fermenter must have the correct oxygen levels. The mixture needs oxygen so that the microorganisms inside can respire.



ResultsPlus
Examiner Comments

This candidate was only awarded one mark for oxygen levels as they have not explained that oxygen is needed for aerobic respiration.

(b) Haemophilia can be treated using a blood clotting factor produced in a fermenter.

The conditions inside a fermenter have to be carefully controlled.

Explain why **one** named condition must be controlled in a fermenter.

(2)

The temperature inside the fermenter needs to be in control because if it gets too hot or cold, the enzymes would denature and wouldn't work best.



ResultsPlus
Examiner Comments

This candidate was only awarded one mark as enzymes do not denature at low temperatures in a fermenter.

(b) Haemophilia can be treated using a blood clotting factor produced in a fermenter.

The conditions inside a fermenter have to be carefully controlled.

Explain why **one** named condition must be controlled in a fermenter.

(2)

temperature must be controlled, too hot and the enzymes will denature but too cold and the growth will be greatly slowed



ResultsPlus
Examiner Comments

This candidate was awarded two marks for explaining that temperature must be controlled to prevent enzymes denaturing at high temperatures.

Question 2 (a) (i) (1)

Most candidates demonstrated the knowledge that the injection of antigen into a mouse's body produces an immune response.

Question 2 (a) (i) (2)

Most candidates knew that an immune response produces antibodies and memory lymphocytes.

Question 2 (a) (iii)

A good level of knowledge and understanding was demonstrated for this question with many candidates giving a more detailed explanation of how these diagnoses are done than was needed for the marks. The most common medical diagnoses listed were the detection of cancer cells and the detection of blood clots. The use of monoclonal antibodies in pregnancy testing was also commonly seen. The most common mistake was to describe the use of monoclonal antibodies in the treatment of cancer which does not answer the question.

(iii) Describe **two** ways in which monoclonal antibodies are used in medical diagnosis. (2)

- 1 They can be used to detect and treat cancer cells.
- 2 They can be used to treat blood clots.



ResultsPlus Examiner Comments

This candidate was only awarded one mark for detecting cancer cells. Treating cancer cells and treating blood clots are not medical diagnoses.



ResultsPlus Examiner Tip

Ensure your responses are answering the question.

(iii) Describe **two** ways in which monoclonal antibodies are used in medical diagnosis. (2)

- 1 Locating the size and severity and position of cancer cells.
- 2 Locating blood clots.



ResultsPlus Examiner Comments

This candidate was awarded maximum marks for locating cancer cells and locating blood clots.

(iii) Describe **two** ways in which monoclonal antibodies are used in medical diagnosis.

(2)

1. they are used in pregnancy tests to detect the pregnancy hormone in the urine
2. They are used to attach to blood clots and cancer cells to find them in the body



ResultsPlus
Examiner Comments

This candidate was awarded maximum marks. They have referred to all three marking points in their response.

Question 2 (b) (i)

This question asked candidates to compare the antibody response after the first and second injection with the same antigen.

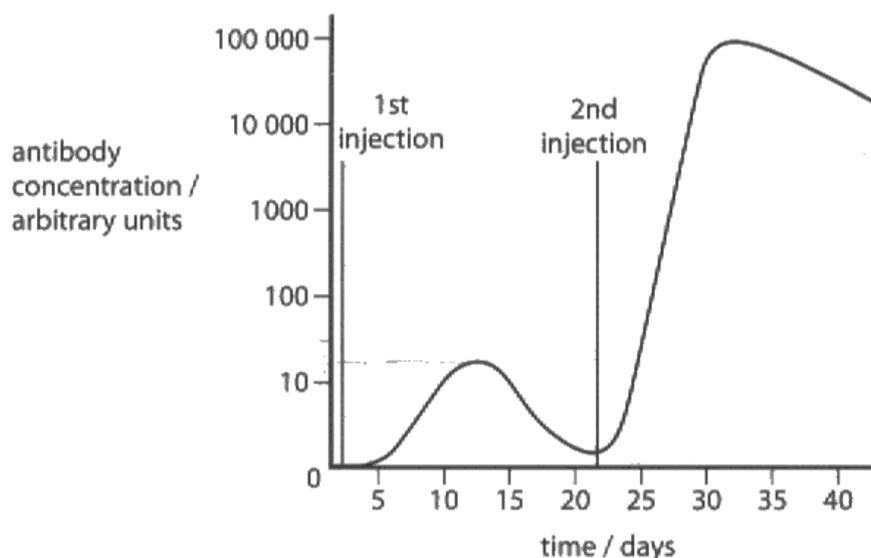
Most candidates were able to make at least one comparison with around half gaining maximum marks for the question. The most common comparisons were about the level of antibody production and the speed at which they were produced, with the idea that more antibodies were produced quicker after the second injection being the most common mark points awarded. Candidates who scored well often used data from the graph to illustrate their answer.

Candidates who used data generally coped very well interpreting the log scale on the y axis.

Some candidates went into a high degree of detail about one comparison and this restricted them to only one mark.

The answer required comparative statements and some candidates lost marks for not making comparative statements about the two responses. For example antibodies are produced quicker is comparative whereas antibodies are produced quickly is not.

(b) The graph shows the antibody concentration in a mouse after the first and second injection of the same antigens.



- (i) Compare the antibody response after the first injection with the antibody response after the second injection.

(2)

After the first injection roughly 30 arbitrary units of antibodies were released to fight the foreign bodies compared to the response after the second injection which saw roughly 100,000 arbitrary units of antibodies produced.



ResultsPlus
Examiner Comments

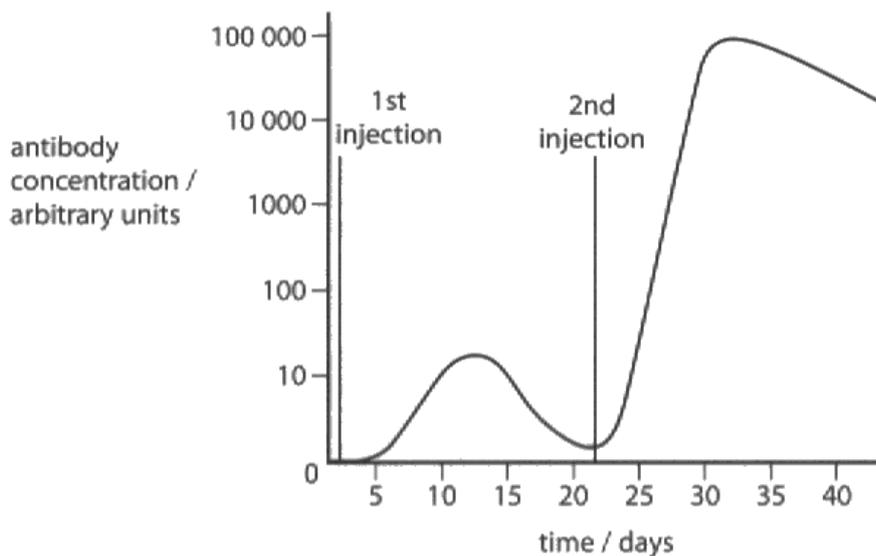
This candidate has used data in their response but was only awarded one mark as they have only made one comparative statement.



ResultsPlus
Examiner Tip

Make sure that you include enough information to match the number of marks available for the question.

- (b) The graph shows the antibody concentration in a mouse after the first and second injection of the same antigens.



- (i) Compare the antibody response after the first injection with the antibody response after the second injection.

(2)

After the first injection, it took the mouse about 13 days to reach the peak antibody concentration, which was about 30. After the second injection, not only did the mouse's immune system respond more quickly, but it also produced a peak of 100,000 antibodies within approximately 8 days. The mouse responded faster and produced more antibodies the second time.



ResultsPlus

Examiner Comments

This candidate was awarded maximum marks for making two comparative statements referring to the speed of antibody production and the amount of antibodies produced.

Question 2 (b) (ii)

Candidates accessed this question well with the most common responses referring to the idea that the mouse did not show symptoms, did not get ill or that the pathogen was killed quicker. Some candidates lost marks but making statements that apply to both the first and secondary response such as the antibodies produced help destroy the pathogen.

Candidates need to ensure that they use scientific terms correctly. The idea of killing antigens is not scientifically correct and was not awarded credit.

(ii) Suggest how this secondary response to antigens benefits the mouse.

(1)

It benefits the mouse as his immune system is quicker and stronger.



ResultsPlus

Examiner Comments

This response is not worthy of credit as it is not specific and doesn't say how this benefits the mouse.

Question 3 (a) (i)

Candidates had to interpret the pie chart to determine the number of hours of darkness needed for a long day plant to flower. Any value between eight and ten hours was awarded a mark. The most frequent error was to read 15 hours directly off the pie chart.

Question 3 (a) (ii)

This question was accessed by candidates of all ability. Most candidates were able to calculate that the number of plants flowering in March was 425 and gained both marks. A small number of candidates calculated 425 and then subtracted it from 500 and this was awarded a mark for the correct calculation providing their working was shown.

(ii) A gardener has 500 short day plants.

85% of these plants flowered in March.

Calculate the number of plants flowering in March.

(2)

~~500~~

$$500 \div 100 \times 85$$

425 plants



ResultsPlus
Examiner Comments

This candidate was awarded one mark for showing a valid calculation.



ResultsPlus
Examiner Tip

Always write your workings out for calculations.

Question 3 (a) (iii)

This question asked candidates to suggest a benefit to a plant of being day neutral with the mark being awarded for the idea of being able to flower for more of the year. References to flowering in more seasons or during long and short days were awarded the mark. More than half of the candidates did not achieve the mark. Many incorrect responses referred to the idea of being able to grow more or the idea that the plant could flower in the light and the dark showing they had misinterpreted the information given in the question.

(iii) Suggest a benefit to a plant of being day neutral.

(1)

As it can flower with either light or darkness.



ResultsPlus
Examiner Comments

This candidate was not awarded credit as they have suggested the plant can flower in light or darkness.

(iii) Suggest a benefit to a plant of being day neutral.

(1)

They can flower for more months of the year
so more insects will pollinate the plant



ResultsPlus
Examiner Comments

This candidate was awarded the mark for the idea of a day neutral plant being able to flower for more months of the year.

Question 3 (b) (i)

This question required candidates to suggest how bamboo plants benefit from having poisonous leaves.

The mark was awarded for the idea of the plant not being eaten by animals or herbivores. The idea that it kills pests was also awarded credit.

The use of the term herbivore was seen by candidates of higher ability. Candidates who did not receive credit for this question frequently described that it stops predators eating the plant.

(b) (i) The leaves of some species of bamboo plants contain the poison cyanide.

Suggest how these bamboo plants benefit from having poisonous leaves.

(1)

It will be eaten less often by predators as
it is toxic to most animals/insects



ResultsPlus
Examiner Comments

This candidate did not receive the mark because they have referred to predators eating the plant.



ResultsPlus
Examiner Tip

Make sure you use the correct scientific terminology.

(b) (i) The leaves of some species of bamboo plants contain the poison cyanide.

Suggest how these bamboo plants benefit from having poisonous leaves.

(1)

It prevents the plant from being eaten by herbivores



ResultsPlus
Examiner Comments

This candidate was awarded the mark and has used appropriate scientific terminology.

Question 3 (b) (ii)

This question was not accessed well by candidates. The question required candidates to explain how the co-evolution of bamboo producing cyanide and the greater bamboo lemur had occurred. One mark was awarded for explaining how the bamboo had evolved, either by mutation or the idea that bamboo producing cyanide was more likely to survive and grow more or reproduce. The second mark was for describing how the greater bamboo lemur evolved. This mark could have been gained by explaining about the mutation of a gene, having a gene for cyanide resistance or for describing that the greater bamboo lemur was more likely survive as it had less competition for food.

The information in the question gave the idea that the greater bamboo lemur is adapted to tolerate cyanide and that the bamboo and greater bamboo lemur have co-evolved. Many candidates re-used the information from the question but did not explain how the adaptations or co-evolution would have occurred.

Very few gained both marks but those that did frequently referred to the idea of mutation in the bamboo and greater bamboo lemur.

Candidates who gained one mark were most likely to achieve this by explaining that the greater bamboo lemur was more likely to survive as it had less competition for food.

A lot of incorrect responses showed the misconception that this adaptation could have occurred by the greater bamboo lemur becoming immune to the cyanide by initially consuming small amounts and the developing immunity allowed them to tolerate increasing amounts of cyanide.

Explain how the co-evolution of bamboo plants and the greater bamboo lemur could have occurred.

(2)

The greater bamboo lemur have both become resistant to cyanide. The bamboo became resistant as it was best constantly, constantly in its presence and so evolved to order to survive. The bamboo plant evolved to contain cyanide and the greater bamboo lemur evolved so it could continue to eat the bamboo leaves and tolerate the cyanide.



ResultsPlus

Examiner Comments

This candidate has not explained how the co-evolution would have occurred. They have repeated information given in the question.

Explain how the co-evolution of bamboo plants and the greater bamboo lemur could have occurred.

(2)

A mutation in the bamboo's DNA means it can produce the cyanide meaning it won't get eaten and therefore, through natural selection, is more likely to survive and pass on its genes until all bamboo can make cyanide and a mutation in a lemur's DNA means it can tolerate the cyanide and therefore it has more food and will be more likely to survive and pass on the cyanide resistant gene to other lemurs until they all have that gene.



ResultsPlus

Examiner Comments

This candidate has referred to a mutation occurring in both the bamboo, enabling it to produce cyanide, and in the lemur so that it can tolerate cyanide. Two marks were awarded as they have explained how the co-evolution occurred.

Question 3 (c) (ii)

This question asked candidates to explain the benefit of communicating using sound rather than facial expressions. The question required the points made in the explanation to be linked.

The most common answer seen was the idea of being able to communicate over larger distances and not needed to have visual contact. Some candidates linked the idea of communicating over long distances with the idea of being able to communicate with more animals or being able to communicate in the dark or that the animal doesn't need good vision.

Some candidates described the idea of being able to communicate over long distances and not needing to be close together to communicate, which did not gain the second mark as it does not give the idea of needing visual contact.

(ii) Explain the benefit of communicating using sound rather than facial expressions.

(2)

Communication by sound doesn't require the species to be close together so it can be done over a distance. The call can also have a longer variety of meanings than facial expressions as these can be limited.



ResultsPlus
Examiner Comments

This response refers to the idea of communication over a distance and not close together and the idea of more meanings. However, the candidate has only received one mark as although they have made two points they are not linked which is required

(ii) Explain the benefit of communicating using sound rather than facial expressions.

(2)

The benefit of communicating by sound is that it ~~means~~ means animals don't have to be looking directly at each other and they can communicate at a larger distance with sound. This meant they could communicate better in groups to work more efficiently such as telling the whole group if a predator is coming.



ResultsPlus

Examiner Comments

This candidate was awarded maximum marks. They have clearly indicated that sound does not require animals to be looking directly at each other. They have also referred to communication over a larger distance.

Question 4 (a) (ii)

More than half of the candidates were able to estimate the number of years that *Homo habilis* inhabited the Earth is between 0.7 and 0.9 million years.

Some candidates misread the timeline and had *Homo habilis* inhabiting the Earth 3.5 million years ago rather than 2.5 million years ago and consequently did not gain the mark for the question.

Question 4 (b)

Most candidates were able to get one mark for this question which asked candidates to describe the methods scientists may have used to date a *Homo erectus* skull. The most common marks awarded were for looking at the structural features of the skull, comparing it to other *Homo erectus* skulls or determining its age based on its location in the rock layer.

Some candidates described how stone tools could be used. A common misconception was that carbon dating and mitochondrial DNA analysis could be used to date a *Homo erectus* fossil, these were not awarded credit.

(b) Scientists in Africa discovered part of a fossilised skull.

The skull was identified as belonging to the species *Homo erectus*.

Describe the methods scientists may have used to identify the skull as belonging to the species *Homo erectus*.

(2)

They may have used mitochondrial DNA extracted from the mitochondria of a cell to be able to tell characteristics to show which group they were from. Carbon dating may also have been used to tell how old the fossil was and hence which group it belonged to.



ResultsPlus
Examiner Comments

Neither mitochondrial DNA analysis nor carbon dating are valid methods for identifying fossils from the time period of *Homo erectus*. This response is not worthy of credit.

(b) Scientists in Africa discovered part of a fossilised skull.

The skull was identified as belonging to the species *Homo erectus*.

Describe the methods scientists may have used to identify the skull as belonging to the species *Homo erectus*.

(2)

Similarities between the shape and size of the skull would have been compared with previously found fossils that are believed to be *Homo erectus*.



ResultsPlus
Examiner Comments

The idea of comparing the skull with previous fossil finds was frequently seen and awarded a mark.

(b) Scientists in Africa discovered part of a fossilised skull.

The skull was identified as belonging to the species *Homo erectus*.

Describe the methods scientists may have used to identify the skull as belonging to the species *Homo erectus*.

(2)

They could have compared it to other *Homo erectus* skulls if they were any available. They could have also dated the ground below and above the fossil by dating its radiation levels which would be used to predict the age of the skull.



ResultsPlus
Examiner Comments

This candidate was awarded maximum credit for the idea of comparing the skull piece with other *Homo erectus* skulls and for dating the rocks surrounding the skull to determine its age.

Question 4 (c)

This question required candidates to compare the benefits of using mitochondrial DNA rather than nuclear DNA to map human migration. This question was accessed well by higher ability candidates. Candidates were not awarded credit if the statements were not comparative.

For example mitochondrial DNA has a high mutation rate was insufficient. The most common marks awarded were for the relative abundance of mitochondrial DNA compared to nuclear DNA and for the acceptable answer that it was inherited down the maternal line.

A number of candidates described how the mutations in mitochondrial DNA can be used to map human migration and did not gain credit.

(c) *Homo sapiens* evolved in Africa and then migrated to other areas of the world.

Mitochondrial DNA analysis can be used to map human migration.

Compare the benefits of using mitochondrial DNA rather than nuclear DNA to map human migration.

(3)

Mitochondrial DNA is better than nuclear DNA analysis

because mitochondrial DNA is inherited from only the mother and not the father. This means it can be traced back as all humans contain similar mitochondrial DNA. It can be used to ~~track~~ map the migration of humans because of this. Nuclear DNA wouldn't be as good as it is different in all humans.



ResultsPlus Examiner Comments

Three marks were available for comparing the benefit of using mitochondrial DNA rather than nuclear DNA. This candidate was awarded one mark for the idea that mitochondrial DNA is inherited from the mother.



ResultsPlus Examiner Tip

Think carefully about your answer and ensure your response matches the command word of the question.

(c) *Homo sapiens* evolved in Africa and then migrated to other areas of the world.

Mitochondrial DNA analysis can be used to map human migration.

Compare the benefits of using mitochondrial DNA rather than nuclear DNA to map human migration.

(3)

Mitochondrial DNA mutates 100-1000 times faster than nuclear DNA. This makes it easier to use it to map human migration because it mutates more often so it is easier to trace movement of mutations. It is also easier to trace because we inherit all the mitochondrial DNA from our mother, compared to inheriting some nuclear DNA from both our parents. Finally, we have a lot more mitochondrial DNA than nuclear DNA. This means it is much easier to find mitochondrial DNA which is in good enough condition to analyse than it is to find nuclear DNA that has not been destroyed.



ResultsPlus Examiner Comments

This response received maximum marks for making three comparative statements on the mutation rate, abundance and inheritance pattern of mitochondrial DNA compared to nuclear DNA.

Question 4 (d)

This question required students to recognise the behaviour response of *Homo sapiens* to the noise of a waterfall as habituation.

For the second mark candidates had to explain that the *Homo sapiens* stopped responding to a harmless or neutral stimulus.

Some candidates simply repeated the information in the question saying that the *Homo sapiens* ignored the waterfall and therefore did not gain the second mark. Another mistake candidates made was to say that this was a response to a repeated stimulus but not highlighting that the stimulus was harmless.

(d) One group of *Homo sapiens* migrated to an environment where there was a large waterfall.

At first, the noise of the waterfall kept them awake at night but they got used to the noise over time.

Explain this behavioural response.

(2)

This is an example of habituation. After exposure to a repetitive stimulus an animal learns to no longer react to it. So whilst originally it would have sparked a reaction from the hominids, eventually they would be unaffected by the noise of the waterfall.



ResultsPlus
Examiner Comments

This candidate was awarded one mark for habituation but they have not made it clear in their explanation that it is a response to a harmless/neutral stimulus.

(d) One group of *Homo sapiens* migrated to an environment where there was a large waterfall.

At first, the noise of the waterfall kept them awake at night but they got used to the noise over time.

Explain this behavioural response.

(2)

Habituation; it is when a species learn that a stimulus is neither beneficial nor harmful, so they learn to ignore it.



ResultsPlus
Examiner Comments

This response was awarded two marks for habituation and an explanation that referred to the stimulus being neither beneficial nor harmful.

Question 5 (a)

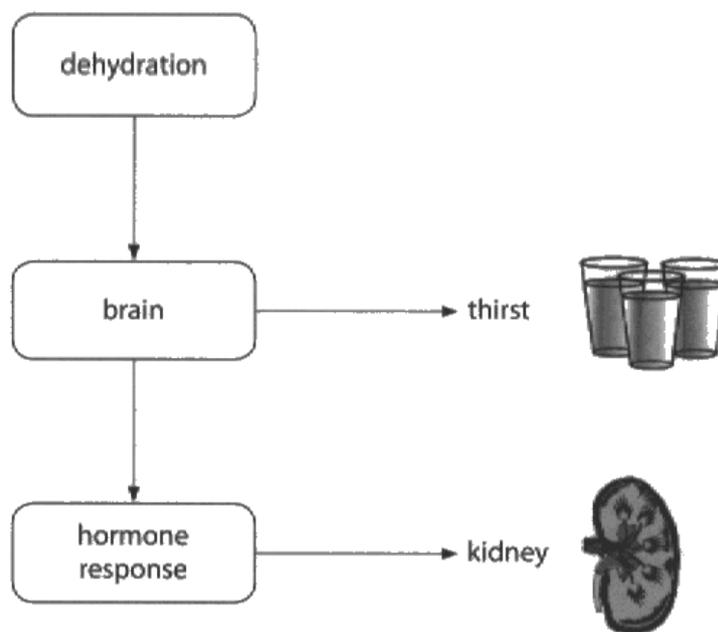
This question required candidates to explain the body's hormonal response to dehydration. A full range of marks were awarded for this question with some candidates demonstrating a high level of knowledge and understanding. The common response which received three marks was that the pituitary gland released more ADH which increases the amount of water reabsorbed into the blood by the kidney.

These candidates could have gained maximum credit for mentioning which part of the brain detected the dehydration or by explaining in more detail how the kidneys reabsorbed more water.

Some candidates described the role of the brain in producing the thirst response which repeated information given on the paper and did not answer the question.

Hormonal control

5 The diagram shows the body's response to dehydration.



(a) Use the diagram to help explain the body's hormonal response to dehydration.

(4)

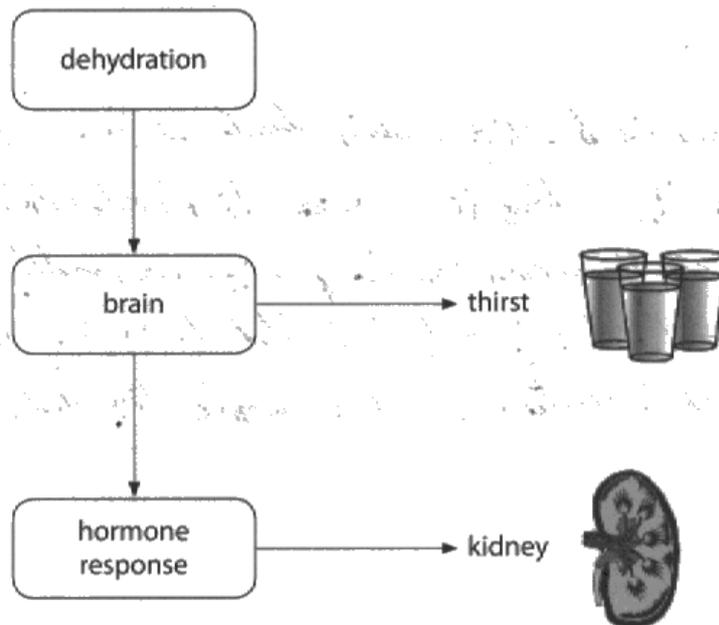
When a person is low on water (dehydrated), this is detected by the hypothalamus. The pituitary gland near the brain then secretes anti-diuretic hormone (ADH) which travels to the kidney via the blood. This ADH increases the permeability of the collecting ducts in kidney nephrons, allowing more water to diffuse back into the blood (selective reabsorption) via osmosis. The brain also actively transports water away from the mouth and throat, causing thirst.



This candidate was awarded maximum marks. They have included detail in their answer referring to role of the hypothalamus and the increase in permeability of the collecting duct.

Hormonal control

5 The diagram shows the body's response to dehydration.



(a) Use the diagram to help explain the body's hormonal response to dehydration.

(4)

The body's hormonal response to dehydration is the brain detects the dehydration in the body. It then tells the pituitary gland to release more ~~antidiuretic~~ anti-diuretic hormone (ADH) which then flows through the blood and tells the kidney to absorb more water back into the blood, so less water is lost through urine and more water is kept in the blood.



This response is typical of responses which were awarded three marks. Marks were given for the pituitary gland releasing more ADH leading to more water being absorbed back into the blood.



Try to include as much detail as possible in your answer.

Question 5 (b) (ii)

This question required students to recall that progesterone maintains the lining of the uterus during pregnancy and most candidates were able to gain the mark.

Candidates need to be careful with the language they use; the use of terms such as strong to describe the uterus lining did not receive credit.

(ii) Describe the effect of high levels of progesterone on the uterus lining during pregnancy.

(1)

The progesterone maintains the ~~the~~ thick lining of the uterus



ResultsPlus
Examiner Comments

This response was worthy of a mark for maintaining the lining of the uterus.

(ii) Describe the effect of high levels of progesterone on the uterus lining during pregnancy.

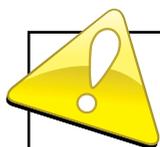
(1)

It strengthens the uterus lining so that the foetus ~~doesn't~~ stays ~~over~~ in the womb.



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Examiner Comments

This response was not awarded credit.



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Examiner Tip

Consider the language you are using in descriptions and explanations and ensure the terms used are accurate.

Question 5 (b) (iii)

Nearly half the candidates gained mark band three for this extended writing question which asked candidates to explain how the menstrual cycle is controlled by hormones and negative feedback.

A very high level of knowledge and understanding was shown by some candidates who have the role of all four hormones including the negative feedback mechanisms.

Candidates awarded mark band two frequently had the role of all four hormones but did not include a control mechanism.

Some candidates confused the roles of the hormones and were awarded mark band 1.

The role of LH was often not mentioned or incorrectly explained and FSH was often linked to causing the breakdown of the uterus lining.

*(b) (iii) Explain how the menstrual cycle is controlled by hormones and negative feedback.

(6)

~~At the~~ At the beginning of the menstrual cycle there is a surge in follicle stimulating hormone which is released by the pituitary glands in the brain, this causes the follicle to mature and the egg to be released into the ovaries, it causes Oestrogen levels to rise. Oestrogen ~~also~~ causes the lining of the uterus to build up.

Next lutealising hormone is released, it is released when there is a surge in Oestrogen levels. Lutealising hormone causes the follicle to burst and the egg to be released into the ovaries, it also turns the empty follicle into a corpus luteum. The corpus luteum releases progesterone.

Progesterone inhibits FSH and LH, it maintains the lining of the uterus, when progesterone levels fall the lining of the uterus breaks down and menstruation

begins. It - When it falls FSH levels begin to rise and the cycle begins again. This is all controlled by negative feedback, the brain monitors levels of hormones in the blood and then responds accordingly.



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Examiner Comments

This is a mark band three response and was awarded six marks. The candidate has explained the role of the four hormones and included the role of progesterone inhibiting the production of FSH and LH. They have also referred to low levels of progesterone allowing the secretion of FSH.

* (b) (iii) Explain how the menstrual cycle is controlled by hormones and negative feedback.

(6)

~~FSH causes the lining of the uterus to build~~
The release of follicle stimulating hormone at the beginning of the cycle stimulates the production of oestrogen. This causes the lining of the uterus to build up, and stimulates the release of luteinising hormone, which encourages ovulation. Progesterone is then produced to maintain the uterine lining.



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Examiner Comments

This is a mark band two response worth four marks. They have explained the role of at least two hormones but have not included a negative feedback mechanism.

*(b) (iii) Explain how the menstrual cycle is controlled by hormones and negative feedback.

(6)

Menstrual cycle is controlled by negative feedback.

Progesterone, Oestrogen, FSH and LH

are all involved in the menstrual cycle

During menstruation the drop in progesterone

and the high levels of LH cause

the lining of the uterus walls

to break down. The high levels

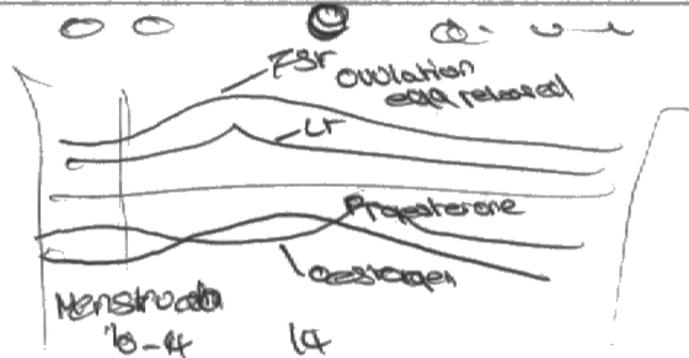
of progesterone causes ovulation

causing an egg to be released

and maintains uterus thickness.

FSH causes follicle to develop into corpus luteum.

(Total for Question 5 = 12 marks)



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Examiner Comments

This is a mark band one response. The candidate has named the hormones involved in the menstrual cycle but has not clearly explained the role of two of them.

Question 6 (a) (i)

Approximately half the candidates knew that the enzyme used to join the insulin gene to the plasmid was ligase.

Question 6 (a) (ii)

Candidates found this question challenging and it revealed some misconceptions. The candidates were asked why the same restriction enzyme is used to cut the gene and the plasmid. The most frequently awarded marks were for the idea that the sticky ends produced would be complementary. A number of incorrect responses referred to the idea that the same size fragments would be cut.

(ii) Suggest why the same restriction enzyme was used to cut the human chromosome and the plasmid.

(2)

The same restriction enzyme was used to cut the human chromosome and the plasmid so they have the same sticky ends. This means they have complementary unpaired bases so that they can be stuck back together.



ResultsPlus
Examiner Comments

This response was awarded both marks. They have referred to the sticky ends which are produced having complementary unpaired bases.

(ii) Suggest why the same restriction enzyme was used to cut the human chromosome and the plasmid.

(2)

to leave sticky ends which would fit together easier.



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Examiner Comments

This response was awarded one mark for the idea of restriction enzymes leaving sticky end. Fitting together easier was not sufficient for the second mark.

Question 6 (b)

This question differentiated candidates ability very well with the range of mark bands being nearly equally awarded.

The question asked for a description of how enzyme technology can be used to produce vegetarian cheese, sweets and lactose-free milk. To reach mark band three candidates had to give the name and role of the enzyme in their description of the production of at least two of the food products.

For mark band two the name and the role of one enzyme in their description of the food production or the name of two enzymes linked to the food they were used to produce was required.

Mark band one required the linking of one enzyme with the correct food product or a description of the food production without the named enzyme.

Mark band one was most frequently awarded because candidates did not name the enzymes involved in the production of the foods. In mark band two candidates usually gave a description of the production of at least two food products but did not describe in sufficient detail the role of two enzymes. Candidates awarded mark band three often had the role of all three enzymes described and showed a very good level of knowledge and understanding. Generally the role of chymosin in the production of vegetarian cheese was best described, followed by the role of invertase in the production of sweeter food products or soft centred sweets.

There were some detailed descriptions of how the lactose-free milk is produced but often the name of the enzyme or the role was missing. The idea that the enzyme breaks down the lactose was insufficient.

Some candidates went onto detailed descriptions of how the chymosin gene is inserted into a plasmid in genetically modified organisms which was not needed to answer the question.

*(b) Enzyme technology can be used in the production of foods including sweets, vegetarian cheese and lactose-free milk.

Describe how enzyme technology can be used to produce these food products.

(6)

Enzyme technology is used in the production of sweets because the enzyme invertase is added. This converts sucrose in the sweet into glucose and fructose which are sweeter giving the sweet a sweeter taste. Vegetarian cheese uses enzyme technology because the enzyme chymosin is required to make cheese. Chymosin was originally obtained from the stomachs of calves however the enzyme was inserted into bacteria so it could be produced and used to make vegetarian cheese. To make lactose free milk, the enzyme lactase is added. Lactose free milk is required because some people suffer an intolerance to lactose. The lactase converts lactose into glucose and galactose which can therefore be drunk by those with

intolerances as it no longer contains lactose. Enzyme technology is the general term for identifying and using specific enzymes to benefit us and produce food.



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Examiner Comments

This response was awarded mark band three. The candidate has named the enzymes invertase and lactase and described their role in producing sweets and lactose-free milk. They have not included the role of chymosin in the production of vegetarian cheese but only two food products were required for the top mark band.



ResultsPlus

Examiner Tip

For the enzymes named in the specification make sure you learn their role and how they are produced.

*(b) Enzyme technology can be used in the production of foods including sweets, vegetarian cheese and lactose-free milk.

Describe how enzyme technology can be used to produce these food products.

(6)

Enzyme technology can be used to produce sweets by adding enzymes to change the sucrose to glucose and fructose. This can make soft centred sweets and make the sweets taste sweeter. Furthermore, enzymes can be used to produce vegetarian cheese by adding chymosin to milk to make it curdle quicker producing the curds and whey, which can then be pressed and left to turn into cheese. Lactose-free milk can be produced using enzymes by ~~adding~~ adding enzymes to remove the lactose from the milk by changing the way it develops.



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Examiner Comments

This is mark band two response as the candidate has not named and given the role of two enzymes. If they had named invertase or sucrase they could have achieved mark band three.

* (b) Enzyme technology can be used in the production of foods including sweets, vegetarian cheese and lactose-free milk.

Describe how enzyme technology can be used to produce these food products.

(6)

Sweets are created using enzyme technology by the enzyme Invertase. Invertase is used on Sucrose (sugar) to produce Fructose and glucose, which are sweeter than the original Sucrose. This means that the producers can use less ingredients to produce the same amount of Sweetness, saving resources and money.



ResultsPlus Examiner Comments

This is a mark band two response. The candidate has named invertase and described its role in the production of sweets converting sucrose to glucose and fructose.

Question 6 (c)

Just over half the candidates gained credit in this question which asked how biological washing powders can make clothes cleaner than non-biological washing powders.

The most frequently awarded single mark was for named biological stains.

Candidates who scored maximum marks often named an enzyme and linked it with a biological stain it would breakdown. There were some responses that showed a good level of knowledge and understanding by describing the breakdown of insoluble stains into soluble products.

(c) Washing powders can be biological or non-biological.

Describe how biological washing powders can make clothes cleaner than non-biological washing powders.

Enzymes like protease, ~~A~~ amylase and lipase can digest insoluble stains. ⁽²⁾



ResultsPlus Examiner Comments

This response was awarded one mark for naming digestive enzymes.

(c) Washing powders can be biological or non-biological.

Describe how biological washing powders can make clothes cleaner than non-biological washing powders.

(2)

biological washing powders can make clothes cleaner than non biological washing powders as they contain the biological washing powders contain enzymes like Carbohydrases, proteases and Lipases to break down the ^{components} ~~parts~~ of the stain into ~~smaller~~ a soluble product that can dissolve into the water making it easier to be removed with water. Such as carbohydrase breaking starch ~~up~~ down into sugars.



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Examiner Comments

This candidate was awarded maximum marks. They have named digestive enzymes and included details of how the stains can be broken down into soluble products.

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.
- check the number of marks given for the question and ensure that they have included enough facts to match the mark awarded.
- recognise that the word 'explain' means additional scientific information is needed that is linked to the answer given.
- ensure that statements are comparative when the command word 'compare' is used in the question.
- use scientific terminology accurately where possible in responses.
- know how to draw sex-linked Punnett squares to explain inheritance of recessive sex-linked disorders.
- use all the information given in the question to help them construct their answer but avoid just repeating the information which has already been given.
- avoid vague answers which will not gain credit and candidates should ensure their answer includes a good level of scientific detail.
- 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.
- read the questions carefully and check answers include enough detail.

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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