Pearson Edexcel

Examiners' Report
Principal Examiner Feedback

Summer 2023

Pearson Edexcel GCE
In Biology Spec A (8BN0)
Paper 02 Development, Plants and the Environment

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Introduction:

This paper tested the knowledge, understanding and application of material from Topic 3: Voice of the Genome and Topic 4: Biodiversity and Natural Resources.

The range of questions provided opportunity for students to demonstrate their grasp of these topics and apply their knowledge to unfamiliar contexts.

The questions on this paper yielded a wide range of responses and some very good answers were seen. The paper appears to have worked very well with all questions achieving the full range of marks available.

There were some straightforward questions that were answered well in the majority of cases and some more challenging questions that discriminated well. Students in this year have shown a greater appreciation for the need to address the context of the question instead of producing generic responses,

Questions that required recall of factual information were generally well answered, as were the majority of the calculation questions.

It should be noted that students can use any blank space within the exam paper to complete answers if they have ran out of lines. If the blank space is directly underneath the lines provided, the student's writing will be seen and marked. It is also helpful to examiners if students indicate that answers are continued elsewhere.

Question 1(a)
This multiple choice question tested knowledge of cell structures specifically those found in both plant and animal cells. Most students answered this correctly, although some incorrectly selected C which had 'cell wall' , indicating that there are students who do not appreciate that animal cells do not possess a cell wall.

Question 1(b)
This multiple choice question asked for the correct definition of mitosis – the most common incorrect response being division of the cell, whereas the correct answer was the division of the nucleus.

Question 1(c)(i)
This multiple choice question required the identification of a stage of mitosis from a photograph and the vast majority correctly identified it as anaphase.

Question 1(c)(ii)
This multiple choice question required a ratio to be calculated from the data in the table provided. Generally answered well, with many having carried out a calculation on the page to assist them in identifying it to be 7:1.

Question 1(c)(iii)
This question required students to describe what happens in a cell during telophase. Many good responses referred to the nuclear membrane reforming around two sets of chromosomes to form two nuclei. Others also mentioned the chromosomes decondensing or uncoiling – become thinner was not sufficient to gain this mark. Good answers also referred to the break down of the spindle fibres and the formation of the nucleolus in each nucleus.

(iii) Describe what happens in the cell during the telophase stage of mitosis.

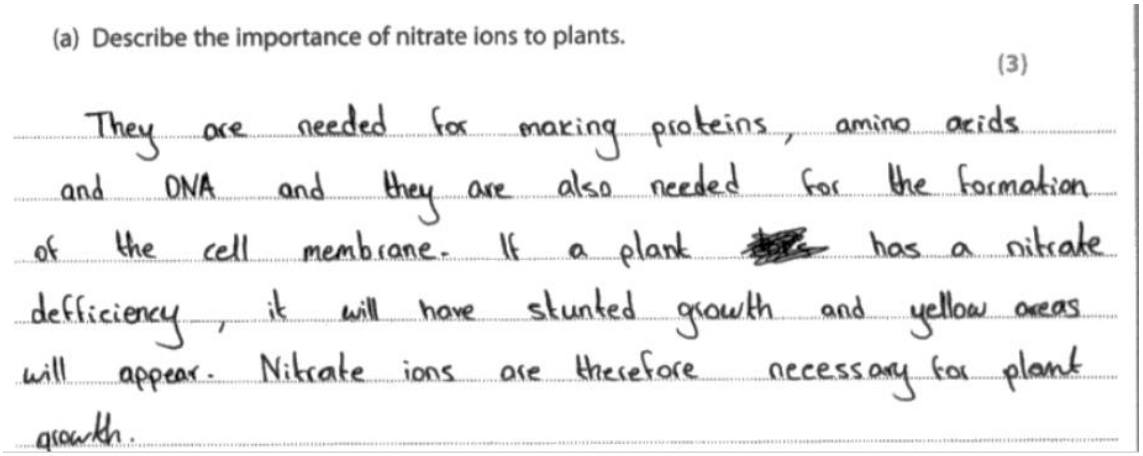
(4)

The nuclear membrane and nucleolous reform and there are two nuclei present. The spindle fibers break down completely and the chromosoms decondense (no chromatids). The cell membran begins to contract to divide the the cell into two genticully identical during cytokinesis

Question 2(a)

Most students referred to the requirement of nitrate ions to produce amino acids and proteins – either of which gained one mark. Many also identified another key biological molecule for a second mark – the commonest being DNA and chlorophyll. The third marking point was awarded for commenting on the fact that plants are stunted in growth in the absence of nitrate ions, or that proteins are required for the growth of plants.

This response gained three marks.



(a) Describe the importance of nitrate ions to plants.

(3)

They are needed for making proteins, amino acids and DNA and they are also needed for the formation of the cell membrane. If a plant has a nitrate defficiency, it will have stunted growth and yellow areas will appear. Nitrate ions are therefore necessary for plant growth.

Question 2(b)(i)

The vast majority of students correctly identified chlorophyll as the molecule that contains magnesium ions in this multiple choice question.

Question 2(b)(ii)

Many students provided irrelevant details for the experiment in terms of how they would put seedlings into test tubes. The context was 'plant' and a photograph of a pea plant was provided at the start of Q2 to provide a visual prompt. The independent variable of 'magnesium ion concentration' was given as was the dependent variable – 'growth of pea plants'. Yet there were responses about mung beans and other mineral ions.

Good responses referred to a range of magnesium ion concentrations – and as no data was provided in the question, the examiners were not seeking a specific range. Marks were also available for controlling biotic and abiotic variables, a suitable period of time allowed for plants to grow, a method for measuring growth and repeats at each concentration to calculate a mean. Although the term 'mean' is better, 'average' was accepted as an alternative. Use of the word 'amount' was not given credit –there must be relevant use of words such as volume or mass.

The example below gained marks for biotic variables (age and species of plant), five different concentrations of magnesium ions, controlled abiotic variables

(temperature and light intensity), growth (as mass or height) measured after 10 days and repeats at each concentation to calculate an average. In total 6 marking points were achieved for a maximum of 4 marks. The response kept to the details required, to the depth required, with no extraneous information about putting seedlings in pots or test tubes.

(ii) Devise a laboratory experiment to measure the effect of magnesium ion concentration on the growth of pea plants.

(4)

Ensure that the pea plants used are from the same parent plant and that the age, size and species of the pea plants are all the same to reduce genetic variability. Use atleast 5 different concentrations of magnesium ions and ensure that all other ions needed for growth are present. Ensure that temperature and light intensity is kept the same. Leave the pea plants to grow in the different concentrations and measure the growth of the pea plants by mass or height after 10 days. Repeat this for each concentration of magnesium ions, atleast 3 times and find the average mass or height.

Question 3(a)(i)

Students were provided with the Hardy-Weinberg equation and asked to identify which part of it showed the proportion of heterozygotes in a population. Most correctly identified this as 2pq.

Question 3(a)(ii)

This multiple choice question provided students with the value for p^2 as 0.49 and asked to calculate the corresponding value of q^2. Many students did correctly carry out the calculation in the space available to determine that p would be 0.7 and therefore q would be 0.3 – but not all went on to work out the value for q^2 as 0.09.

Question 3(b)(i)

Students were provided the information that 60% of a population of 500 hedgehogs had blonde spines – and that this trait was caused by a recessive allele. They were then asked to calculate the number of hedgehogs in the population that were heterozygous for the blonde allele.

A range of figures were accepted to take into account that students may have rounded up at different stages. However full marks were not given for answers not rounded up to a whole number. One or two marks were given to those that had either just worked out the values for p and q or had calculated the proportion of the population without applying that to the population of 500.

Question 3(b)(ii)

This question asked for an explanation of the role of natural selection in increasing the number of blonde hedgehogs on an island. Marks were awarded for describing the selection pressure and explaining that hedgehogs with the **allele** (not gene) for blonde spines would survive and reproduce, passing on the advantageous **allele** to their offspring and that the frequency of this **allele** increased over time or within the population. References to mutation were irrelevant to this question as the blonde hedgehogs were already in the population.

This is an example of a response which scored full marks:

(ii) Before the 1960s, all of the hedgehogs on this island were dark coloured.

It has been suggested that the blonde hedgehogs are less likely to be killed by cars at night.

Explain the role of natural selection in the increase in the number of blonde hedgehogs on the island of Alderney.

(3)

The blonde hedgehogs occured due to a mutation and the light-coloured spines are an advantageous characteristic caused by an advantageous allele. The cars at night act as a selection pressure : the hedgehogs that had the light-coloured spines were able to survive and reproduce : they passed the advantageous allele for light-coloured spines on to the next generations : the allele frequency increases over time : the number of blonde hedgehogs increases.

Question 4(a)

This question asked for a definition of loci in the context of the information provided. Most just provided a definition for locus and that was acceptable. The majority of answers correctly referred to the location of a gene on a chromosome, the expected answer. Responses referring to chromatid instead of chromosome and allele instead of gene were allowed the mark.

Question 4(b)(i)

A graph was provided showing a range of phenotypes and the associated genotypes for a polygenic trait. The question asked students to deduce (work out) the three genotypes that would give the phenotype for which no genotypes were provided. Some missed the word three, despite it being emboldened to stand out and therefore did not gain credit for stating just one correct genotype. However, many tackled this well and gave all three correct genotypes.

Question 4(b)(ii)

This question asked students to explain why two of the phenotypes in the graph had different frequencies. A straightforward mark was given for stating which phenotype had the higher frequency and the other mark was for explaining that phenotype 7 was less frequent as it could only arise from one genotype whereas there were six genotypes that would give phenotype 3.

This response gained both marks.

(ii) Explain why the frequency of phenotype 7 is different from the frequency of phenotype 3.

(2)

As there are 6× as many genotypes that can result in phenotype 3 - causing it to have a higher phenotypic freauency, compared to only one genotype that can produce phenotype 7, which makes it much rarer to inherit all dominant alleles, resulting in a lower phenotypic freauency.

Question 4(c)(i)

This question required students to identify a mode value from a graph. The majority of students correctly identified it as 174 cm. Some students gave a range of heights and others tried to calculate percentage values instead.

Question 4(c)(ii)

This question referred to the histograms for height and stated that there were more adults at the lower end of the height range than the higher end for both males and females. Students were asked to explain how the interaction between environment and genotype accounted for this difference.
This was not answered well, with weak answers referring to 'diet' rather than intake of protein or calcium being awarded a mark as it was the most

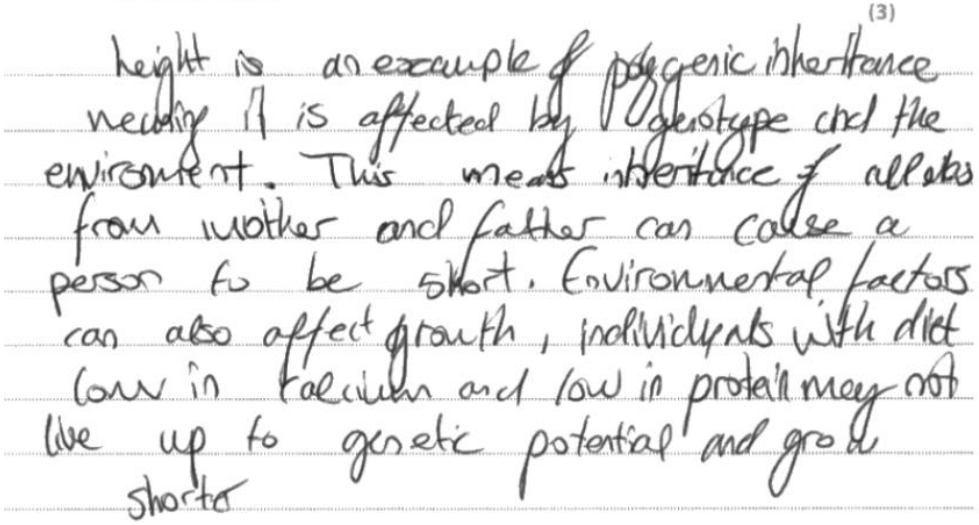
frequently seen comment that correctly referred to an environmental factor. It was apparent that many students believed, incorrectly, that playing sports such as basketball make people taller. Very few achieved the mark for explaining that environmental factors concerning diet or disease affect growth during childhood. There were quite a few good attempts to explain that factors such as diet could prevent a person achieving their genetic potential when it came to height.

This is an example that gained two marks – one for the description of dietary factors such as protein and calcium, and one for noting that if insufficient the person may not 'live up to genetic potential' in relation to height.

(ii) The data show that there are more adults at the ~~lower end~~ of the range for height than at the higher end of the range for both females and males.

Explain how the interaction between environment and genotype can account for this difference.

(3)



Question 5(a)

This question asked how DNA methylation modifies the activation of a gene. Marks were given for stating that methyl groups attached to the DNA, preventing the transcription of a gene, therefore deactivating the gene. Many confused DNA methylation with histone modification. Many repsonses showed an excellent grasp of the concept, even adding details such as the attachment of methyl groups to the CpG site or to cytosine.

This very concise response gained full marks. If it referred to the RNA polymerase being unable to bind to the gene, it would have covered all four marking points.

(a) Explain how DNA methylation can modify the activation of a gene.

(3)

RNA polymerase?

DNA methylation causes methyl groups to bind to the CpG sites on the DNA. This means that the genes cannot be transcribed as RNA polymerase cannot bind, which causes the deactivation of genes.

Question 5(b)(i)

Students were asked to explain how cells become specialised via differential gene expression. Many students discussed the effect of epigenetic factors on gene expression rather than answer the actual question. There were still many excellent answers that achieved full marks, for explaining how a stimulus caused a gene to be activated, resulting in the transcription of that gene and the subsequent translation of the mRNA formed to produce a protein that determined the structure of function of the cell.

This is a good example of response that clearly gained all four marks.

(b) The AHRR gene is involved in regulation of cell growth and differentiation.

(i) Explain how differential gene expression allows cells to become specialised. — give reason

(4)

The cell becomes specialised by first receiving a stimulus, such as a hormone or chemical. This causes for some genes to be activated and other genes to be deactivated. The activated genes are transcribed into an mRNA strand and then translated into a protein. This protein modifies the structure and cellular processes of the cell making the cell ~~to be~~ a specialised cell.

Question 5(b)(ii)

This question required students to deduce (work out from information provided) why reduced DNA methylation of the AHRR gene can increase the risk of lung cancer. Whereas parts (a) and (b)(i) were straightforward recall of knowledge questions, this required applying that knowledge to an unfamiliar context. In order to gain marks, students had to state that reduced methylation would allow for the activation of the AHRR gene, which could then be transcribed. The deduction would then require the conclusion that this would result in uncontrollable cell division causing lung cancer. Increased cell growth was not accepted – there had to be reference to cells dividing out of control, a mark that could be given even if the rest of the answer was incorrect.

There were not many answers achieving full marks, but this was one of the more challenging questions in the paper. However, this response did gain full marks.

(ii) Deduce the reasons why reduced DNA methylation of the AHRR gene can increase the risk of lung cancer.

(3)

Reduced DNA methylation means that the AHRR gene is activated and more likely to be transcribed to form mRNA and then translated to form a specific protein. This protein is involved in catalysing/speeding up the rate of cell growth and differentiate, so increased amounts of the AHRR protein may lead to cells in the lung uncontrollably replicating, leading to the formation of cancer cells and thus lung cancer forms.

Question 6(a)(i)

This calculation required students to work out the area of a zone of inhibition for one plant extract, work out the difference between that area and another area to give an answer to one decimal place.

This response only gained one mark as it did not give the answer to one decimal place as instructed. It is important to read all parts of a question.

(i) The area of the zone of inhibition for lemongrass extract made with water was 50.3 mm^2.

Calculate the difference in the areas of the zones of inhibition for the lemongrass extract made with water and the lemongrass extract made with ethanol.

Give your answer to one decimal place.

(2)

πr^2 = area

12.3 ÷ 2 = 6.25

$\pi \times 6.25^2 = 122.72$

122.72 − 50.3 = 72.42

72.42 mm²

Question 6(a)(ii)

Students were asked to describe how valid results could have been obtained for this investigation. They were expected to describe how variables could have been controlled in order for the results to be valid.

It must be noted that repeats do not make the results valid- if an experiment is conducted multiple times under the same conditions, and the same results are achieved each time, that indicates whether or not a conclusion drawn from that data is valid. Valid results are produced if as many variables as possible have been controlled during the investigation.

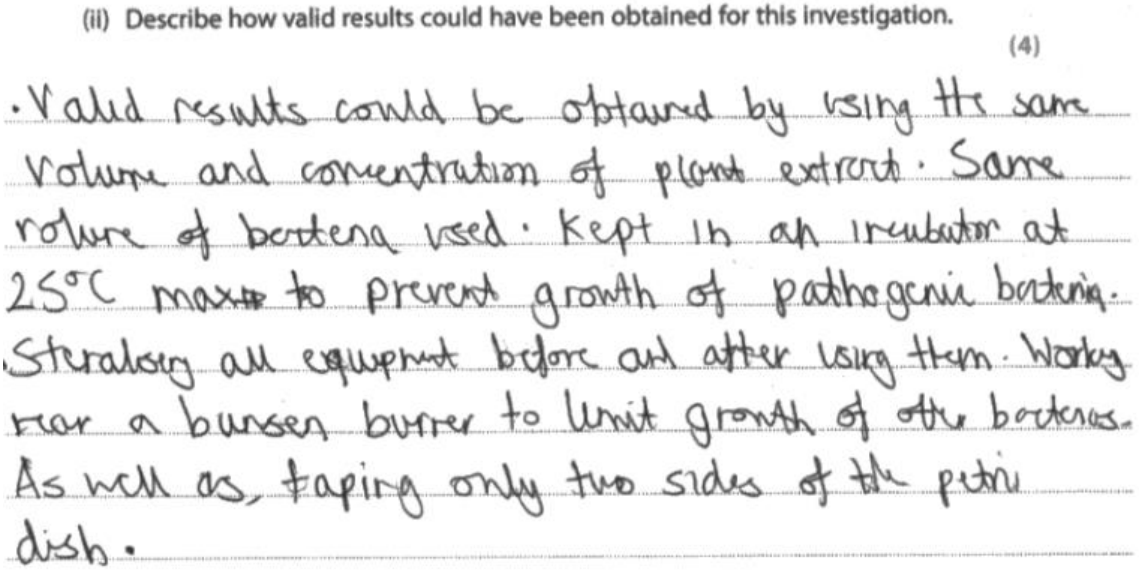
In this context, the variables that could have been controlled concerned reducing contamination by other bacteria by aseptic technique, aspects of the bacteria cultures being used (such as the species of bacteria and the method of inoculating the agar plates), the concentration of the plant extracts, the volume of extract added to the plates and details of the incubation of the plates.

Students who had carried out the core practical were well versed in these procedures, although many wrote at length about aseptic technique, neglecting all other variables in need of controlling, or made vague statements regarding incubation time, such as 'about 48 hours'.

This response gained 4 marks, for controlling concentration of plant extract, using same volume of bacteria, incubating at 25°C and aseptic technique (just). If the response did not mention the need to sterilise equipment, the mark would not have been given for 'working near a Bunsen burner' – they would have to explain that it was the flame needed to produce a convection current to prevent contamination of the plate.

(ii) Describe how valid results could have been obtained for this investigation.

(4)



Question 6(b)(i)

Students were asked to explain pre-clinical trials for testing a new drug. Many seemed unaware that pre-clinical trials take place before a drug is tested on humans. However, many good answers referred to tests on animals or tissues in the laboratory, in order to assess toxicity. Credit was given for stating that the drugs were tested for 'safety', but not for 'side effects' – the latter being assessed from healthy humans in terms of nausea, headaches etc, that cannot be determined from animal tests.

This is a good example of a response that gained full marks.

(i) Explain the pre-clinical trials that will be carried out when testing a new drug.

(2)

Pre-clinical trials will be carried out on animals first to determine the ~~drug's~~ toxin medicine's toxicity and safety. Also the active ingredient will be synthesized artificially to be mass produced.

Question 6(b)(ii)

This question assessed students' grasp of the term 'double-blind trial'. On the whole, this was very well understood, with the majority gaining full marks.

This example covers all three marking points.

(ii) A double-blind trial was used to determine the effectiveness of an antimicrobial drug.

Explain what is meant by the term **double-blind trial**.

(2)

double blind trials involve the doctor and patient ~~being~~ both being unaware of whether the drugs given to the patient is the actual drug or a placebo. This is done to avoid bias.

Question 6(b)(iii)

Students were provided with a table showing the percentage of drug trials that progressed from one stage to another during clinical trials. They were then asked to deduce why more progressed from Stage I to Stage II, than from Stage II to Stage III. There were two marking points available for each part of the question. Many achieved the first two by stating that Stage I was carried out on healthy individuals to determine side effects. Better answers

then went on to deduce that as Stage II tested people with the condition the drug may not go onto further stages as it may not prove to be effective or that it may cause more severe side effects in people who have a medical condition.

Marks were lost by some who were under the impression that Stage I was conducted on animals and Stage II on healthy volunteers.

This response gained two marks – one for Stage I being on healthy volunteers and one for the 'people with the disease' being likely to show more side effects. The second marking point from the mark scheme could not clearly be awarded as the response implies they do not have side effects as they do not have the disease (the converse to the mark given for what may happen at Stage II), rather than the drug being tested on them to see if they do develop side effects.

Deduce the reasons for the higher percentage of trials progressing from Stage I to Stage II than the percentage progressing from Stage II to Stage III.

(3)

Stage 1 is tested on a small group of healthy volunteers, therefore they might not show side effects because they do not have the disease. And their lifestyle is completely different to someone who does have the disease. However Stage 2 is tested on a small group of people with the disease so they may show a lot of more side effects than the healthy volunteers and may need to be stopped from testing on a large group of volunteers with the disease, which is Stage 3.

Question 7(a)(i)

This question assessed knowledge of eukaryotic and prokarotic cell structure. Students were asked to name two structures found **inside** prokaryotic cells but not in eukaryotic cells. Taking into account the context, structures such as pili, flagella or slime capsules were not given credit. However, a mark was given for mesosome even though this structure is not in the cytoplasm of a prokaryotic cell, the infoldings may extend deep within the cell and the diagrams in text books may lead students to believe it to be within the cell.

This response was given two marks on the basis that mesosome was allowed. Preferable answers would have referred to circular DNA or 70S ribosomes.

(i) The pink colour is partly caused by the presence of prokaryotic microorganisms living in the feathers. These organisms contain a red pigment.

Name **two** structures inside the cells of these microorganisms that are found in prokaryotic cells and **not** in eukaryotic cells.

(2)

mesosomes

plasmid

Question 7(a)(ii)

This question asked how molecular phylogeny could be used to determine if microorganisms were Archaea or Bacteria. Many answers did refer to comparing DNA or proteins to get one mark. Better answers went on to explain how it was the comparison of **the sequences** of bases (in DNA or RNA) or amino acids (in proteins) that allowed for similarities to be determined between the microorganisms and Archaea. Common errors came from confusing molecular phylogeny with comparison of cell structures.

This answer gained full marks, showing a clear grasp of the concept being assessed.

(ii) Scientists tested the RNA of these microorganisms and discovered that they belonged to the domain Archaea.

Explain how molecular phylogeny could be used to identify the microorganisms as Archaea and **not** Bacteria.

(2)

Molecular phylogeny could be used to analyse the ~~DNA~~ RNA base sequence of the microorganisms and compare the sequence of the microorganisms to Archaea and Bacteria.

Question 7(b)(i)

A straightforward question asking for a definition of the term 'niche generated a range of answers expressing a good understanding of the concept of niche from the role of an organism in its habitat to the way in which a species interacts with the abiotic and biotic factors in its environment.

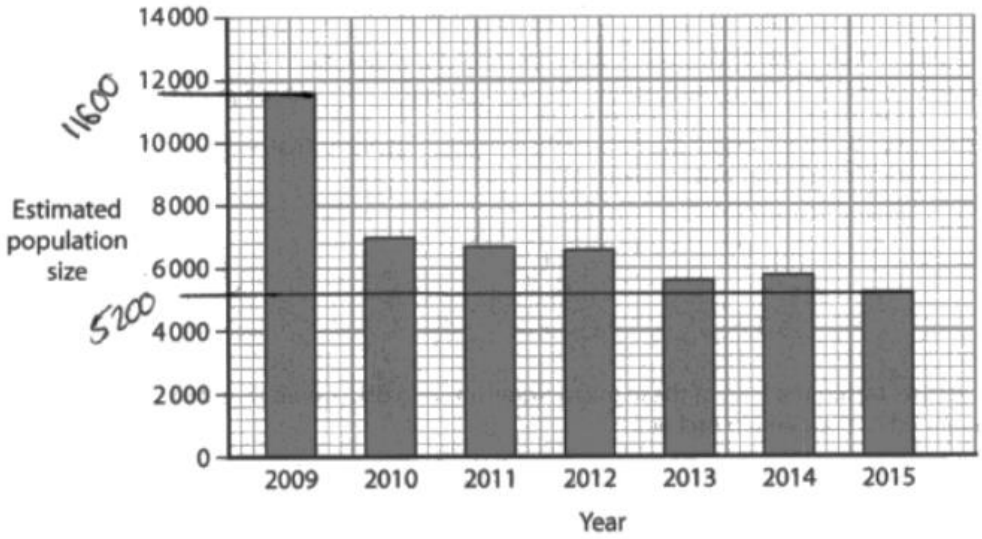
Question 7(b)(ii)

Students were required to read two figures off a bar chart and then calcualte the percentage decrease from one value to the other and then give their answer to three signficant figures.

Many did not read the figures correctly from the graph, but were still able to be awarded the second two marking points from their working out.

This response shows how the student correctly took the figures from the graph enabling them to give the correct answer to 3sf.

The graph shows the estimated population size of the flamingos from 2009 to 2015 in one study.



Calculate the percentage decrease in the estimated size of the flamingo population from 2009 to 2015.

Give your answer to **three** significant figures.

(3)

$11600 - 5200 = 6400$

$\frac{6400}{11600} \times 100 = 55.172\ldots$

55.2 %

Question 7(b)(iii)

Although students were asked to discuss factors concerning captive breeding and reintroduction programmes, many focused on irrelevant details such as welfare of he flamingos and then training them to hunt for prey. The habitat of the flamingo had been described at the start of part (b) including references to warm, salty water and the fact that their habitat was being lost to human development.

As very few responses referred to the need to reintroduce the flamingos to a suitable habitat and to ensure its protection, more marks were made available for details concerning the captive breeding.

This was one of the better responses, referring to the need for studbooks to prevent inbreeding depression and to ensure genetic diversity, along with the need to address habitat destruction before being reintroduced to their natural habitat. There was also mention of water with high salt concentration – but it was in the context of their zoo environment and not linked to reintroduction programmes.

(iii) Captive breeding programmes can be used to increase the number of flamingos.

Flamingos kept in zoos are given food containing carotene pigments to make their feathers stay pink.

Discuss the factors that need to be taken into account when zoos carry out captive breeding and reintroduction programmes for the greater flamingo.

(4)

The zoos should keep the flamingos in conditions that mimic their natural environment. They should be given the same food they eat in the wild and be provided with bodies of water with a high conc. of salt. When breeding the flamingos, studbooks should be used to breed genetically different / unrelated flamingos together to prevent inbreeding depression and a loss in genetic diversity. The flamingos should only be reintroduced when the threat of habitat destruction is solved and the population has risen enough so that they are no longer endangered.

Question 8(a)(i)

A straightforward question asking for a description of the properties of a totipotent stem cell. References to activation of genes were irrelevant as the context was what these cells can do. Marks were available for ability to give rise to all cell types (no credit for stating most cell types), ability to continue dividing and also to be able to give rise to more totipotent cells.

This response gained one mark for being able to differentiate in any type of cell and being able to 'divide/multiply' indefinitely.

(a) The cells in the early stages of embryo development are totipotent.

(i) Describe the properties of totipotent stem cells.

(2)

Totipotent stem cells are undifferentiated stem cells that do not have any activated or deactivated genes that can differentiate into any type of cell through differential gene expression. They can also divide/multiply indefinetly.

Question 8(a)(ii)

The command phrase 'compare and contrast' requires similarities and differences to be described. The context of the question was the structure of the two types of cell – not their properties, therefore stating that one cell was diploid and the other haploid was insufficient – the difference being that the unfertilised egg cell has a haploid nucleus and the zygote a diploid nucleus. The other mark for difference would be the fact that only the unfertilised egg cell would contain intact cortical granules. Similarities included the fact that both had a cell membrane or cytoplasm and a named organelle. No credit was given for descriptions of the zona pellucida or the follicle cells – the question referred specifically to the cells and not the structures surrounding them. Many answers missed out on marks as they did not state the basic similarities in cell structure.

The first example gained three marks for reference to haploid and diploid nuclei (could also have been given for stating the number of chromosomes in each type of cell), cell membrane and mitochondria.

The second example gained two marks for differences, having mentioned both the types of nucleus and the presence of cortical granules, one mark for cytoplasm, but then failed to gain full marks by confusing cell wall with cell membrane.

Compare and contrast the structure of an unfertilised egg cell with that of a zygote.

(4)

An unfertilised egg has a haploid nucleus whereas a zygote has a diploid nucleus. An unfertilised egg cell has half the number of chromosomes (23) whereas a zygote has double the number of chromosomes (46). They both have a cell membrane. They both have mitochondria. Nucleus of a zygote contains both maternal and paternal whereas an unfertilised egg cell only has maternal. An unfertilised egg cell is unspecialised whereas a zygote is specialised

Compare and contrast the structure of an unfertilised egg cell with that of a zygote.

(4)

An unfertilised egg cell contains a haploid nucleus which only contains half of the number of chromosomes. while a zygote contains a diploid nucleus because it has the full set of chromosomes.
An unfertilised egg cell contains cortical granules whereas a zygote does not.
Both a zygote and unfertilised egg cell are as a result of cell division.
Both will contain cell walls and cytoplasm within their cells.

Question 8(b)(i)

This multiple choice question required students to select the correct explanation for cells of the umbilical cord being genetically different to those of the mother. Many worked out by a process of elimination that the answer had to be that the fetus contained genes from both parents.

Question 8(b)(ii)

The six-mark question required a discussion of the issues concerning the use of stem cells derived from three named sources. Many gained credit for making relevant comments about each type of stem cell, although irrelevant information and incorrect statements did affect the overall level and therefore mark that could be awarded.

Common themes referred to the 'killing of embryos' amidst misunderstanding when the umbilical cord is harvested, with many thinking it was removed during pregancy causing death of the fetus. Many attempted to answer this question from their own knowledge alone without referring to the information provided in terms of assessing the relative value of each type of stem cell. The emphasis seemed to be mainly concerning the negative aspects of using stem cells, rather than their benefits – perhaps due to the word 'concerning' in the question itself.

The example below was given full marks. Each type of cell is discussed in terms of both positive and negative factors concerning its use.

Discuss the issues concerning the use of stem cells from the following sources:

- embryos
- bone marrow from donors
- stored umbilical cord tissue.

(6)

Embryonic Stem cells are totipotent stem cells meaning that they can differentiate into any type of cell and have no hayflick limit. This is useful because they can be used to treat any type of disease. However, some people view embryos as life and by using embryonic stem cells you are essentially killing embryos which is considered wrong. Embryos also cannot give consent so people view using their stem cells as wrong as it is forcefully used.

Bone marrow stem cells are [illegible] can also be used to treat any blood disorders. They are more ethical than embryonic stem cells because the donors gave consent to extract the stem cells from their bone marrow. However, there is a risk of rejection from the patients immune system. They would have to use immunosurpressants which increase the risk of infection and could prove more of a hindrance than a help to the patient.

Umbilical cord tissue stem cells is probably the best stem cells to use. This is because they can give rise to every type of blood cell. It is also ethical because the doctors have the mother's consent to store it. It is also good because there is a smaller risk of rejection so the patient won't have to take immunosurpressants.

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