Examiners' Report
Principal Examiner Feedback

October 2021

Pearson Edexcel International Subsidiary / Advanced Level In Biology (WBI12)
Paper 01 Cells, Development, Biodiversity and Conservation

Introduction

This paper tested the knowledge, understanding and application of material from the topics ‘Cell structure, Reproduction and Development’ and ‘Plant Structure and Function, Biodiversity and Conservation.

The range of questions provided ample opportunity for students to demonstrate their grasp of these topics and apply their knowledge to novel 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 spread of marks.

Question 1

(a)(i) This multiple choice question was answered correctly by most students.

(a)(ii) asked students to name a substance synthesised by the organelle labelled A in the diagram.
Unfortunately a significant number of students did not study the diagram carefully. These students thought organelle A was rough endoplasmic reticulum and therefore gave an incorrect answer. The most common incorrect answer given was proteins.

However, where students did recognise that the organelle was smooth endoplasmic reticulum, a wide variety of correct answers were seen. The most common answers were lipids or steroids, but other answers such as phospholipids or named steroid hormones were also seen.

(a)(iii) This question asked students to name two structures that could be present inside the nucleus in the diagram.
A significant number of students named more than the requested two structures. Additional answers are not marked and centres are advised to direct their students to follow the given instructions more carefully.

The most common correct answers were nucleolus and DNA.

Some candidates did not understand that they were being asked to name structures inside the nucleus. Answers that referred to nuclear membrane or nuclear pores for example were not creditworthy. Nucleoplasm was another common incorrect response as liquids are not structures.

(b) This question asked students to explain how plant cells increase in size after cell division had occurred.
It was pleasing to see that many students understood that cells can increase in size with increased volume of cytoplasm, increased water uptake and the synthesis of more organelles/proteins. Marking point 2 was the most commonly awarded, perhaps due to the Golgi apparatus question on a recent paper.
A minority of students understood that if cells increased in size then there would be more cell membrane/wall formation. Therefore, mp3 was the least commonly awarded.
Unfortunately, a significant minority of students did not read the question carefully. They picked up on the idea of cell division in plants and gave an irrelevant standard response about how cells divide in plants.

Question 2

(a)(i) This question tested different maths skills and proved to be a good differentiator. Students were required to calculate both surface area and volume for a cube with length 2.5 cm. Then students had to present this as
surface area: volume.
Most students were able to calculate the volume of the cube correctly. However, fewer students could recall how to calculate the surface area of a cube. The most common mistake was to work out the surface area of just one side of the cube.
Very few students failed to show their working in this question. Those students who showed their working were usually able to gain one mark as ECF for their incorrect calculated values.

(a)(ii) asked students to state what is meant by the term habitat.
Nearly all students gave a correct answer and gained the mark.

(a)(iii) This question asked students to state what is meant by the term species.
It was pleasing to see a significant majority of students gave a credit worthy response to this question. Non-credit worthy responses tended to centre around phenotypic similarities.

Part **(b)** asked students to state what is meant by the term polygenic inheritance, with reference to wombat height.
It was pleasing to see a significant majority of students were able to apply their knowledge of polygenic inheritance to the given context.
Unfortunately, there were a minority of students who did not read the question carefully and did not gain the mark for their description of polygenic inheritance.

Part **(c)** required students to study the given photograph of a wombat to assess what visible features would be useful for digging a burrow.
The most common answer given by students centred around the long claws visible in the photograph. Marking point three was also frequently awarded.
The main mistake students made was to ignore the aspect of the question that referred to adaptations to help the wombat to dig the burrow. Many students gave adaptations to help the wombat to live in burrows, such as small size, which were not credit worthy.
Several students did not follow the instruction to use the information in the photograph to support their answer.

Question 3

(a)(i) This question required students to give an example of the molecular evidence used to support the three-domain system.

The key word in this question that students needed to pick up on was 'molecular'. Those students who did, were able to give correct examples and gain the mark. Those students who didn't, gave answers relating to organelles which were not credit worthy.

The most common correct answers related to the comparison of DNA and proteins. Some students correctly identified the presence of branched lipids in archaea or peptidoglycan/cellulose in cell walls.

(a)(ii) Required students to describe the role of the scientific community in evaluating evidence for this system of classification.

A wide variety of responses were seen to this question.

Some excellent responses were seen, which demonstrated the student's knowledge and understanding of the specification point "understand the process and importance of critical evaluation of new data by the scientific community leading to new taxonomic groupings, based on molecular evidence, including the three-domain system".

The most awarded marking point was for the repetition of experiments. Fewer students were able to describe what the scientific community would do with the data.

This is an example of a concise correct answer:

(ii) Describe the role of the scientific community in evaluating the evidence for this system of classification.

(2)

peer review by allowing other fellow scientists to carry out the same investigations to make sure the results are reliable as well as holding conferences to discuss the evidence and come up with a conclusion

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(b) These multiple choice questions addressed features of living organisms in the three domains.

Students were generally able to correctly identify which domains did not have a nuclear envelope.

Most students also knew that ribosomes would be found in all three domains. Fewer students correctly identified that organisms in all three domains would have cell membranes.

Few students knew that some eukaryotic organelles contained circular DNA.

Question 4

(a) This question required students to suggest **two** other conditions that would be needed for maximum growth of the given bacterium.

Students who read the information provided carefully understood that the bacterium would photosynthesise and therefore would not need to be provided with glucose. They also identified that the culture medium was kept at the optimum temperature. These students often underlined key aspects in the question which showed good exam technique.

The most common conditions that gained marks were a suitable pH, light intensity, oxygen, and water.

The most common mistakes were to refer to glucose and temperature.

A significant number of students wasted time by giving more than the required number of answers.

4(b)(ii) required students to suggest how a suitable dose for cancer treatment would be determined in human trials.

Again, the importance of reading the question carefully needs to be emphasised. A significant minority of students gave an answer relating to testing drugs on animals and therefore lost marks.

However, many candidates offered the idea of varying the concentration of the drug used in the human trials. Some recognised that the dose should start at the lowest concentration and then slowly increase, whereas some students thought that the dose should start at the highest end of proposed concentrations.

Explaining what would determine the ideal dose in terms of efficacy and minimal side effects proved more challenging for many students. Some stated that the ideal dose is determined in Phase II or Phase III but didn't develop their answer further. Others launched into a description of double-blinding which was puzzling. As the next question was addressing double-blinding, that should have been a pointer to say that Q4bii is not about that technique and therefore prompt students to rewrite their answer.

This is an example of an answer which scored full marks.

(ii) Curacin A is being developed as a drug to treat some colon and kidney cancers in humans.

Suggest how a suitable dose for cancer treatment would be determined in human trials.

(2)

By phase II of testing on a small group of patients, this involves giving them different doses, and observing what dosage had the least side effects on patients whilst being the most effective in treating cancer (and being of the least concentration while being most effective).

(b)(iii) This question required students to describe how a double-blind clinical trial would be performed with the curacin A drug.
Students' answers showed a good understanding of how a double-blind trial would be performed, with most answers gaining 2 marks for marking points 2 and 3. However, many students wasted time describing three-phase trials before discussing double-blinding.

Higher level responses were able to apply their knowledge to the given context by testing the drug on (colon and kidney) cancer patients and then analysing the results to see if the drug was more effective than the current drug/placebo.
Centres are reminded of the importance of applying answers to the given context. This has been a consistent requirement in each exam series of this specification.
This is an example of a response which gained full marks:

(iii) Describe how a double-blind clinical trial would be performed with this cancer drug.

(4)

A group of 3000 cancer patients (colon and kidney) are separated into 2 groups with equal proportions of age, gender etc. 1 group would be given the cancer drug whereas the other is given a placebo. ~~It~~ Neither the doctor nor the patient knows who's recieved the drug and who recieved the placebo. The placebo is used to eliminate any phsychological effects as well as a control. Once the results are obtained statistical analysis is carried out, and comparisons are made to see how effective the drug was compared to the placebo.

Question 5

(a) This question required students to suggest **three** reasons as to why the Ulin tree species is endangered.
Again, the importance of reading the question carefully and following the instructions needs to be emphasised. A significant number of students wasted time giving more than three reasons.
Most students were awarded marking point 1 for either deforestation or loss of habitat due to natural events. Some lovely answers referring to lack of pollinators or low reproductive rate were seen. It was pleasing to see some high-level responses considering the impact of disease on a population with low genetic diversity.

The most common mistake students made was to give the same marking point more than once, for example:

Suggest **three** reasons why this species of tree is endangered.

(3)

1 Deforestation is increasing, which would in turn decrease the number of this tree species.

2 It is cut down for use of it's wood.

3 It is being cut down for building buildings.

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

Suggest **three** reasons why this species of tree is endangered.

(3)

1 low reproductive rate

2 deforestation ~~ero~~ and disease spread for these trees

3 ~~Fertilisation~~ pollination by sexual reproduction is difficult as distance between trees is large or plant is very tall so there is less insects and organisms for cross pollination

(b)(i)_This question required students to calculate the width of the phloem vessel in the photograph.

Students needed to measure the length of the line XY, convert this measurement into μm, divide by the magnification and then give their answer in standard form.

Students should always show their working in mathematical calculations, and it was pleasing to see that there is an improvement in the number of students doing this and therefore potentially gaining some transfer of error marks as a result.

However, there was still a significant minority of students who did not and therefore gained 0 marks if their answer was incorrect.
The most common mistake was an incorrect unit conversion when students measured the length of the line XY in cm. This was followed by some students not recognising that they needed to give their answer in standard form. A small number of students multiplied by the magnification.

This response shows the two most common errors, incorrect unit conversion and not giving their answer in standard form:

(i) **Calculate the width of the phloem vessel along the line XY in micrometres.**

Give your answer in standard form.

(3)

$a = \frac{I}{M}$

$\frac{3.8}{200} = 0.019$

$0.019 \times 1000 = 19$

Answer 19 µm

This students working allowed them to gain 2 marks, even though their line measurement was out of tolerance:

(i) **Calculate the width of the phloem vessel along the line XY in micrometres.**

Give your answer in standard form.

(3)

$200 = \frac{3.3\text{cm} \times 10^4}{x}$

$x = \frac{3.3 \times 10^4}{200} = 165\ \mu m$

Answer 1.65×10^2 µm

This following response was awarded 3 marks and demonstrates clear working and good exam technique by the student:

(i) Calculate the width of the phloem vessel along the line XY in micrometres.

Give your answer in standard form.

(3)

3.8 cm ⟶ 38 mm ⟶ 38 000 µm

$$\frac{38\ 000\ \mu m}{200} = 190 = 1.9 \times 10^2$$

Answer 1.9×10^2 µm

(b)(ii) This question required students to describe the role of phloem. It proved to be a good differentiator as a wide range of answers were seen.

Some students unfortunately described the role of xylem.
A significant number of students described glucose or nutrients being transported by the phloem, which was not credit worthy.

However, some answers were seen which described the movement of correct molecule(s) by the phloem or used correct terminology such as ‘translocation’ or ‘assimilates’.
Higher quality answers were able to extend their answer by describing where the molecule(s) were transported from and where they were transported to.

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

(ii) Describe the role of phloem.

(2)

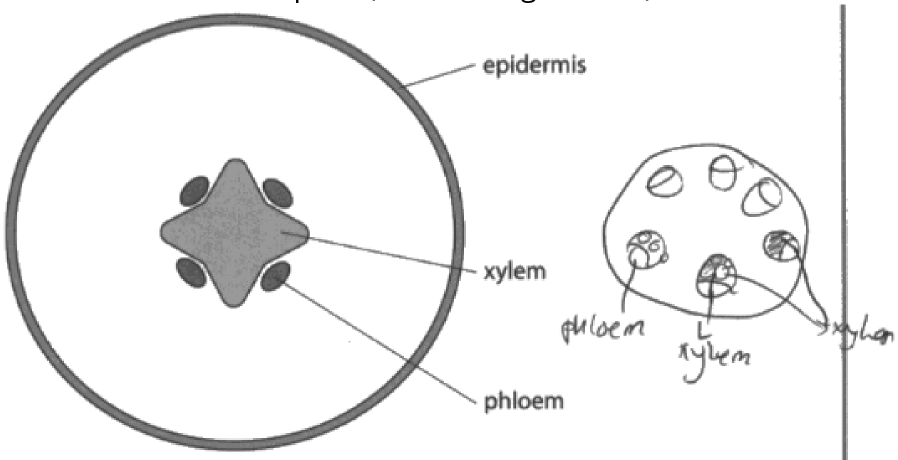
transports amino acids & sucrose (translocation) up & down the plants from sources to sinks through its sieve plates.

(c) This question proved to be a good differentiator as a wide range of answers were seen.
Students were required to carefully study the given diagram showing the distribution of phloem and xylem in the root of a plant.
Students then needed to use their knowledge of the position of phloem and xylem in the stem to identify differences.
It is good practice to use comparative language and statements in these types of questions and it was disappointing that many candidates did not.

A number of students drew labelled diagrams to aid their answers, and this is to be encouraged by centres. Marking points 1,2 and 4 could be awarded for appropriately labelled diagram of the stem.

Some students lost marks as they did not make it clear whether they were referring to xylem or phloem. Some students also lost marks as they described diffierences in the size of the xylem/phloem which was not addressing the question.
Recognition that xylem and phloem are arranged in a circular pattern in the stem was the most commonly given difference.
Another common difference given was that xylem and phloem are separated by cambium in the stem.
Higher-level responses identified the difference in phloem:xylem in the stem compared to the root or referred to (vascular) bundles.

This is an example of a response where a labelled diagram aided the awarding of marks. The response was awarded mp1, 2 (additional guidance) and 4.



Give **three** differences between the distribution of phloem and xylem in the root compared with their distribution in the stem.

(3)

1 in the root they are at the center while in stems they are arranged on the borders. under epidermis under chlerenchyma fibres.

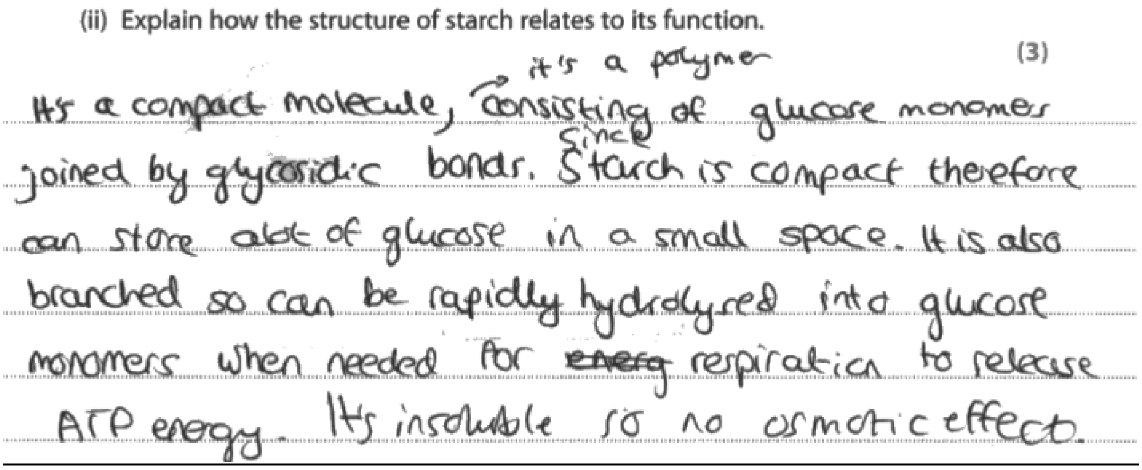
2 in roots xylem is in the middle surrounded by 4 Phloem vessels while in stems there are several xylem vessels next to phloem where xylem is inwards, phloem outwards

3 In stems between phloem & xylem is cambium and above phloem is sclerenchyma fibres, while that isn't the arrangement in roots.

Question 6

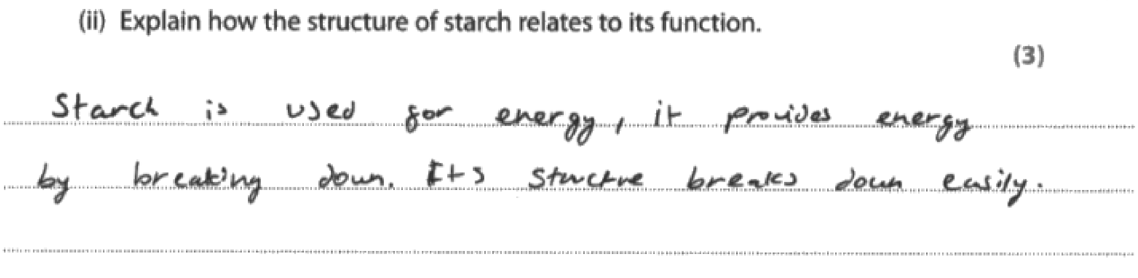
(a)(i) This question required students to carefully study the given information/label on the diagram and identify that they were being asked to name an organelle containing starch granules.
Most students were able to correctly name the organelle, although a wide variety of phonetic spellings of amyloplast were seen.
However, a significant minority of students gave the answer starch grain which was not credit worthy.

(a)(ii) This question asked students to explain how the structure of starch relates to its function.
It was clear that many had learned this aspect of the specification thoroughly and many excellent explanations were seen. The best responses used conjunctions such as *so*, *because*, or *therefore* when relating structure and function. for example, this response which was awarded every marking point for 3 max marks:


(ii) Explain how the structure of starch relates to its function. (3)

It's a compact molecule, it's a polymer consisting of glucose monomers joined by glycosidic bonds. Since Starch is compact therefore can store alot of glucose in a small space. It is also branched so can be rapidly hydrolysed into glucose monomers when needed for ~~energ~~ respiration to release ATP energy. It's insoluble so no osmotic effect.

The main reason students lost marks is because they didn't relate the identified structural aspect to its function.
The most common mistake which prevented marking point 2 being awarded was referring to ease of hydrolysis instead of the rate of hydrolysis, as demonstrated by this response:


(ii) Explain how the structure of starch relates to its function. (3)

Starch is used for energy, it provides energy by breaking down. It's structure breaks down easily.

The previous response also demonstrates that it is important for students to look at the number of marks available for the question, as well as the number of lines given, as a guide to how many points they should make in their answer.

Part **(b)(ii)** required students to calculate the world production of maize to the nearest whole number.
In order to do this students needed to extract the relevant information from the graph and then calculate a 2.3% increase.
It was pleasing to see an improvement in the number of students who are able to perform this type of calculation, however some students failed to give their correct answer to the nearest whole number. For example:

(ii) It is predicted that the world maize production will increase by 2.3 % in the following year.

Calculate the world production of maize in the following year.

Give your answer to the nearest whole number.

(1)

1050 x 0.01 = 10.5

10.5 x 1.3 = 24.15

1050 + 24.15

Answer 1070 million tonnes

= 1074.15

= 1070 (round number)

(c) This was the first of the level-based questions on the paper.
Students were supplied with both quantitative and qualitative information and were expected to use this information to support their answer. The most common error in weaker responses was to just quote from the data, without using comparative language, e.g. there was a higher protein content in maize.

Students were expected to analyse the graph and the table of data to help them discuss the advantages and disadvantages of the three crops. They were also expected to draw on the provided information regarding the bitter chemicals above the graph. Few students considered the advantage of the first sentence 'Some plants contain chemicals that protect them from being eaten by animals'.

Most students achieved level one by giving an advantage or disadvantage from the information contained in the table, for example this response which scored 2 marks:

Use the information in the question to support your answer.

(6)

Bitter cassava:

Advantages → low water and level of nutrients in soil required

disAdv → high mass of bitter tasting chemicals and low protein levels

Sweet Cassava:

Advantages → low water and level of nutrients in soil required.

Lower mass of bitter tasting chemicals. lower mass in dry mass

disAdv → low protein levels

Maize:

Advantages → lowest mass of bitter tasting Chemicals, high protein

disAdv → higher water and levels of nutrients in soil required.

lower mass of carbohydrates.

Level two was usually achieved by students building on this to link the advantage of reduced cost/labour in growing cassava. Some responses suggested that cassava could be grown in more areas of the world which were not suitable for maize. A higher level two response also considered why a high mass of either protein or carbohydrate was an advantage (or converse), by applying knowledge.

This response gained level 2, 4 marks as they fulfilled the level one criteria, addressed several advantages / disadvantages relating to cost as well as considering the disadvantage of low protein levels in cassava.

~~Advantages~~

- Both bitter and sweet cassava ~~require~~ have low to medium water requirements therefore less water is consumed when growing these compared to maize.
- Both cassava types require only a low level of nutrients in the soil, compared to maize's medium to high nutrient requirement, so less fertiliser has to be used.
- Both cassava plants have almost 17g more carbohydrates than maize per 100g of dry plant matter.
- Maize has ~~almost~~ 100 times less mass of bitter tasting chemicals than bitter cassava and 10 times less than sweet cassava, so less processing is required for maize.
- Maize has 8 times more protein per 100g of dry plant matter than both types of cassava, ~~so~~
- However maize has medium to high water and nutrient requirements so providing the additional water and nutrients can be costly.
- Bitter cassava has 100 times more ~~sweet~~ bitter tasting chemicals and sweet cassava has 10 times more than maize, which would require lots of processing to get rid of, which can be costly.
- Both cassava types has very low levels of protein per 100g of dry plant matter, so more has to be consumed to get adequate amount of proteins

(Total for Question 6 = 12 marks)

Level three was usually achieved by students building on the level two criteria to give an answer which showed greater depth and understanding. They considered why a high mass of both protein and carbohydrate was an advantage (or converse).
The highest quality answers also considered the advantage of the chemicals with regards to pesticide use or yield.
These are examples of level 3 responses:

(6)

Both bitter and sweet cassava plants require a low to medium amounts of water, in addition to low levels of nutrients required in the soil. This saves money making it more cost efficive to grow. They also have higher mass of carbohydrate than maize, with bitter cassava at 94.7 / 100g of dry plant matter and sweet cassava at 94.62 /100g and Maize at 77.46 /100g. Bitter cassava has a higher mean mass per plant than sweet cassava, which means it has a higher yield at the same conditions. Maize requires more water and nutrients in the soil, but it also produces less bitter tasting chemicals which are lethal. This cuts down the cost of processing to remove these chemical ~~[illegible]~~. Maize has the least mass of bitter tasting chemicals at 1 to 2 mg kg^{-1}, then sweet cassava at 10 to 50 mg kg^{-1} and Bitter cassava having the highest mass of bitter chemicals at 100 to 500 mg kg^{-1}. Maize plants have the highest mass of protein needed for cell growth in humans at 8.75 /100g of dry plant matter and cassava plants at 1.8 and 1.84 /100g of dry plant matter. The high mass of carbohydrates in cassava plants are needed for respiration to release energy needed for metabolic reactions.

(6)

Cassava has a higher mass of carbohydrate ~~and~~ ~~and protein)~~ per 100g than Maize. So ~~a~~ cassava has a higher energy content. Maize required medium to high levels of waters which is more than both bitter and sweet cassava. Cassava requires less amount of fertilisers as they need low levels of nutrients in the soil but maize requires higher amount of nutrients in the soil so more fertilisers needed which is expensive.

Maize has a about 6.95 grams and 6.91 grams of protein per 100g more than bitter and sweet cassava respectively. This means ~~prot~~ consumption of maize provides high protein which is needed for growth. Mass of bitter tasting chemicals is lowest in maize so this means less processing cost to remove the ~~nutr~~ bitter tasting chemicals.

Bitter ~~tasting~~ cassava has about 0.07kg of mean dry mass more than sweet cassava. This is because animals cannot eat bitter ~~ca~~ cassava as much because of bitter tasting chemicals. But bitter cassava has 5 times more ~~tasting~~ bitter tasting chemicals than sweet cassava. So yield of bitter cassava decreases and processing cost ~~decre~~ increases.

Question 7

(a) This was the second of the level-based questions on the paper.
Students were given pertinent information about nematode reproductive behaviour. They were expected to use this information in their response.
Students were also expected to use their own biological knowledge in order to explain how these reproductive behaviours would aid the survival of nematodes.
Students who used relevant information in their answer, but did not explain how this behaviour would aid survival or affect genetic diversity were limited to level 1. Some responses were very imprecise and sometimes it was difficult to ascertain which reproductive behaviour was being discussed. Few short responses were seen, but a significant minority of students just repeated information given which limited the level that could be accessed.

The most common way that students accessed level two was to begin to explain how the reproductive behaviour would aid the survival of nematodes. Students recognised the question was not just referring to individual nematodes, but also to the population or species. It was pleasing to see many good explanations of sexual reproduction resulting in increased genetic variation of offspring and how this would be of benefit to nematodes. Alternatively some students considered the effect the reproductive behaviours would have on future reproductive success. Level 3 responses considered both of these aspects in their explanations.

This is an example of a response which gained level 2, four marks. If they had extended their answer to explain how an increased population size would aid survival or future reproductive success they would have moved into level 3:

Explain how the reproductive behaviour of these nematodes increases their chance of survival.

(6)

In sexual reproduction, genetic variation rises due to meiosis which produces gametes which are haploid and are genetically diffent due to crossingover ~~of sister~~ between non-sister chromatids of homologous chromosome with reshuffling of alleles producing new combination of alleles in each chromosome in prophase I, and due to random ~~assort~~ assortment of Homologous chromosomes above and below equator giving rise to ~~a~~ new combination of chromosomes in each gamete. Also, random fertilization gives rise to genetic diversity. The ability to self fertilize is good as it produces genetically different offspring even if the male nematodes decreased in number so this causes an increase in population size and gene pool. Also the ability to of ~~[illegible]~~ mating of hermaphrodites with males gives rise to more genetic variation due to outbreeding which introduce new alleles ~~to the~~ from males and it produces higher number of offspring. so this increases population size and increases gene pool. This genetic variation gives rise to higher genetic diversity ~~due~~ which is variety of alleles in gene pool of a population, so theres more chances of having ~~alleles that codes for advantageous~~ adaptation advantageous allele ~~[illegible]~~, coding for resistant to disease for example, so this increases adaptation to environment and so it increases chances of survival.

This is an example of a level 3 response:

Explain how the reproductive behaviour of these nematodes increases their chance of survival.

(6)

Sexual reproduction between a male nematode and an hermaphrodites increases the chances of survival of the species as it increases the number of available alleles, increasing the gene pool and the genetic variety of the offspring. This could ressult in different characteristics between nematodes which will increase the chances of survival of the species in case of a change in conditions such as temperature or disease.. ~~so~~ Offsprings that inherited the beneficial allele will survive avoiding the species to become extinct. Also as more eggs will be fertilised ~~&~~ this way of reproduction will increase faster the population so that a single mutation or a new ~~selection~~ selection pressure will not have such a drastic effect ~~on~~ the nematode population.

However self-fertilisation does not rely on finding a mate so ~~...~~ it can be useful to save species from extiction after a huge loss of or only of males nematodes. Also if that nematode has survive long enough for reproducing it means it has successful alleles which can then be passed on. Therefore being able to carry out both forms of reproduction is a huge advantage for the species ~~...~~ as sexual can be used normally but in case of a change in selection pressure or the dissaprearance of the male nematodes the species can still survive.

(b) This question told students that histone modification can be passed onto embryos and supplied details of two experiments which demonstrated this.
Students were expected to analyse the given information to deduce how histone modification can be passed onto embryos.
This question proved to be a very good differentiator, with the full spread of marks seen.
It was apparent that some students did not spend time reading the information they were given. Instead, they 'word spotted' histone modification and gave a lengthy answer about how histone modification occurs and how this would cause differentiation, limiting the number of marks they could access.
This is an example of a response which only gained mark point 6:

Deduce how histone modification can be passed onto embryos.

(5)

Histone modification can be passed on by mutations. There may be errors which causes events such as histone acetylation to switch on more genes to be allowed for transcription.

These can also be inherited from parents, so if an enzyme or particular protein is not in the parent's sex cell, then it won't be passed down to their young ones.

Histone nethylation adds metyl group to the histone thats coiled in DNA and will prevent the gene from being exposed and prevents things such as RNA polymerase and transcription factors to ~~stop~~ replicate a ~~complementary~~ complementary strand.

Those students who recognised that they were given the diagram for a reason, and spent time reading the information, generally scored 3+ marks.
Marking points 2 and 6 were the most likely to be awarded, followed by mark point 4.
It was disappointing that most students did not recognise that all the maternal chromosomes in the zygotes in both experiments have histone modification and therefore did not gain mark point 1.
Higher level responses recognised that enzyme M could not be produced if it was absent in the egg cell. Similarly, higher-level responses recognised that DNA needed to be replicated if cell division was to occur.

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

Deduce how histone modification can be passed onto embryos.

(5)

To ensure there is ~~as~~ histone modification zygote must inherit presence of enzyme M once a zygote is formed it would have ~~no~~ ~~char~~ Histone modification but as this zygote divides and cells differentiate if enzyme M is not present modification of Histone will decrease until no more modification. enzyme M responsible for Histone modification will ~~be~~ not be transcripted and synthesized not active. At start ~~baby~~ ~~mother~~ ~~parent~~, maternal genes are modified and when fertization occur ~~zag~~ zygote chromosome will be modified as the gametes originated from mother DNA as cells divide and DNA is replicated using semi-conservative model ~~most~~ modified histones will decrease and new chromosome are formed it requires inheritance of enzyme M to keep them modified. ~~gene~~ gene that codes for M should be present and active to maintain modification as inherited from ~~parents~~

In conclusion any zygote that has maternal modified Histone will also have it at start as first set of genes is ~~inter~~ from maternal DNA by meosis as the zygote divides and differentiate it needs to have inherited genes responsible production of enzyme M for having modified allel

(Total for Question 7 = 11 marks)

Question 8

(a) This question asked students to explain how an egg cell is specialised for its function.
The most frequently awarded marking point was mp3 where they explained the function of the cortical granules. A small number of responses referred to a tough fertilisation membrane which was insufficient.
Some high-level responses referred to chemicals being released by the egg cell to attract the sperm or explained the role of the glycoproteins on the egg cell surface.
A significant number of students lost marks for describing the specialised features of the egg cell but did not explain how this aided the function. For example, some remembered that the egg cell was haploid but did not explain why. Similarly, many students knew that the egg cell contained lipid droplets but did not explain why.

This is an example of a response which gain all three marking points for 2 max marks:

(a) Explain how an egg cell is specialised for its function.

(2)

~~A~~ Egg cells are haploid, this helps the ~~embryo~~ zygote to have the original diploid number of chromosomes after fertalisation. It also has a store of lipid droplets that provides energy for the growing embryo after fertalisation. Inaddition to the presence of cortical granules that hardens the zona pellucida after ~~a~~ one sperm enters the egg cell to prevent poly spermy

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(b)(i) This question asked students to compare and contrast metaphase in mitosis and meiosis.
Significant numbers of students did not take notice of the command 'compare and contrast' or the word 'metaphase'. Therefore, many responses were seen with a paragraph of information about mitosis followed by a paragraph of information about meiosis, which were not credit worthy. Some students wated time explaining what occurred in other stages, e.g., prophase.
A compare and contrast question requires both similarities and differences. Therefore, full marks could only be awarded if the answer contained both similarities and differences.
Centres are advised to teach students the importance of comparative language in these types of questions, for example the use of the conjunctive 'whereas.
The most awarded similarity was the lining up of chromosomes or chromatids on the equator of the cell. This was often awarded in conjunction with the third difference mark in the highest-level responses.
The most awarded difference was that independent assortment occurs in metaphase I in meiosis but does not occur in metaphase in mitosis.

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

(b) A student studied beluga fish cells undergoing mitosis and meiosis.

(i) Compare and contrast metaphase in mitosis and meiosis.

(3)

In mitosis it occurs one while in meiosis it occurs twice. In both meiosis and mitosis chromosomes align on the equator, metaphase plate. In meiosis in metaphase 1 independent assortment occurs while in mitosis it doesn't. In metaphase 1 of meiosis chromosomes are being pulled apart by spindle fibres rather than chromatids as in mitosis.

(b)(ii) This question asked students to explain how the cells of the beluga morula change as they develop into the cells of the blastocyst.

This question proved to be a very good differentiator, with more higher marks than lower marks awarded.

It was clear to see that nearly all students understood what was meant by the terms morula and blastocyst. Defining these terms was a way that the weakest students were able to gain a mark (mp1).

Most students knew that differentiation occurs because genes were switched off.

A significant number of responses gained marks for a description of epigenetic modification and transcription/translation of active genes to produce proteins. Higher-level responses extended this to explain how these proteins would cause the cell specialisation.

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

(ii) Some of the cells undergoing mitosis were from a beluga morula whereas some of the cells were from a beluga blastocyst.

Explain how the cells of the beluga morula change as they develop into the cells of the blastocyst.

(4)

Due to certain stimuli some genes will be switched on and some genes will be switched off. The morula contains totipotent cells. The genes which are switched on will be transcribed and mRNA will be produced. This mRNA will be translated and proteins will be formed. These proteins permenantly change the structure of the cell and control its function. This results in the formation of the pluripotent and ~~b~~ multipotent cells in the blastocyst.

(c)(i) This question tested the students knowledge of mathematical skill A.1.9 "Select and use a statistical test".

Centres are reminded that any mathematical skills that are not emboldened in the specification may be tested in units 1-3.

Students were given a partially completed table and were asked to calculate the value for $\sum D^2$.

It was clear that many students knew how to perform this statistical test and many correctly calculated values were seen, for example:

Age / weeks	Rank of age	Mass of egg / g	Rank of mass of egg	D	D^2
36	1	2.27	8	−7	49
39	2	1.91	1	1	1
42	3	2.18	5.5	−2.5	6.25
45	4	2.28	9	−5	25
48	5	2.12	4	1	1
51	6	2.19	7	−1	1
54	7	2.18	5.5	1.5	2.25
57	8	2.09	3	5	25
60	9	2.03	2	7	49

(i) Calculate the value for $\sum D^2$.
Use the table to help you.

(2)

$\sum D^2 =$ 159.5

Some students looked at the rank column and worked out that the missing value was 1, or worked out how to calculate D and D^2 for the 60 week row. ECF was applied for students who attempted to calculate D^2 for at leat one missing value and then calculated $\sum D^2$, for example:

Age / weeks	Rank of age	Mass of egg / g	Rank of mass of egg	D	D^2
36	1	2.27	8	−7	49
39	2	1.91	6.75	-4.75	22.56
42	3	2.18	5.5	−2.5	6.25
45	4	2.28	9	−5	25
48	5	2.12	4	1	1
51	6	2.19	7	−1	1
54	7	2.18	5.5	1.5	2.25
57	8	2.09	3	5	25
60	9	2.03	2	7	49

(i) Calculate the value for $\sum D^2$.
Use the table to help you.

(2)

$$\sum D^2 = (49 + 22.56 + 6.25 + 25 + 1 + 1 + 2.25 + 25 + 49)$$

$$= 181.06$$

$\sum D^2 =$ 181.06

(c)(ii) This question continued to test the students knowledge of mathematical skill A.1.9 “Select and use a statistical test”.
The majority of students were able to recognise that there were 9 rows in the table and substituted this, and their calculated value from (i), into the given formula in their working area to gain one mark. ECF was applied from 8(c)(i).

A common mistake, preventing the awarding of the second mark, was not taking away their calculated answer from 1 at the end.
This is an example of a response showing how the student did not subtract their answer from 1, but mp1 was awarded for their correct value substitution shown in their working.

(ii) Calculate the correlation coefficient, r_s value, for this data using the formula:

(2)

$$r_s = 1 - \frac{6\left(\sum D^2\right)}{n\left(n^2 - 1\right)}$$

$$r_s = \frac{6(159.5)}{9(9^2-1)}$$

$$= 1.329$$

Answer 1.329

This is an example of a response which gained full marks, due to ecf being applied from 8(c)(i):

(ii) Calculate the correlation coefficient, r_s value, for this data using the formula:

(2)

$$r_s = 1 - \frac{6\left(\sum D^2\right)}{n\left(n^2 - 1\right)}$$

$$= 1 - \frac{6(84.5)}{9(9^2-1)}$$

$$= 0.296$$

Answer 0.296

(c)(iii) This question supplied students with a correlation coefficient value of 0.38 and a table of critical values. Students were also told the null hypothesis.
Students were expected to pick up on the information that the study had been replicated, in order to determine which row of the table they should select the correct critical value from. Students needed to recognise the significance of the calculated value of 0.38 being lower than the critical value of 0.683.

Some students responded to the value in the text, 0.38, and then used the critical value table correctly to gain full marks.
Some students knew that the null hypothesis should be accepted, but could not explain why correctly.
Some students did not fully understand the question and tried to evaluate the experimental design in some way, for example stating that the sample size was too small.
This is an example of a response which scored full marks:

(iii) The null hypothesis is that there was no significant correlation between the age of the chicken and the mass of the eggs laid.
Another scientist replicated this study and gained a correlation coefficient value of 0.38.
The table shows the critical values at the 95% probability level.

Number of pairs of data	Critical values at the 0.05 % probability level
8	0.738
9	0.683
10	0.648

Explain whether the null hypothesis should be accepted or rejected.

(2)

It is accepted as the 0.38 is lower than 0.683 ~~a~~ critical value and, therefore, there is no significand correlation between the age of the chicken ant the mass of the eggs laid.

Paper summary

Based on their performance on this paper, students are offered the following advice:

- Read the whole question carefully, including the introduction, to help relate your answer to the context asked.
- You should take into account the command words as well as the context given. Answers which do not match the command words or do not relate to the given context will not gain high marks.
- Information provided in the introduction to questions is provided for a specific reason. Read it carefully and analyse what information will be needed to provide a high-level response to the question being asked.
- Some questions specifically state ‘use information in the question to support your answer’. This refers to more than just quantitative data.
- Do not try and make a mark scheme you have learnt from a previous paper fit a different question with different context and command words.
- Study all of the mathematical skills in the specification which could be tested at this level.
- Make sure you include your working with all calculations. Give relevant units where applicable. If rounding is necessary, make sure that this is done correctly.
- Check to see if a certain number of decimal places or significant figures are required in mathematical calculations. Does the answer require you to convert to / from standard form?

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