

Examiners' Report

June 2016

IAL Biology WBI02 01

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Introduction

Most candidates performed well when attempting this paper. As usual some topics were better understood than others. Questions requiring knowledge of the structure of molecules and cells were usually high scoring whereas those that required candidates to apply their knowledge proved more challenging. It was pleasing to see that questions relating to practical work, in this case determination of tensile strength of plant fibres and the use of plant tissue culture techniques, were both answered well. One area of the specification that was often not well understood was the topic of taxonomic groupings based on molecular phylogeny.

A disappointing number of candidates failed to include units when stating numerical answers after carrying out calculations in data handling questions. Others failed to carefully read the headings in tabulated data with the result that their answers clearly could not be correct; the most obvious example being in a question about an explosion that released radioactive particles into the atmosphere. Here there were a considerable number of candidates offering answers that involved the passing of alleles through several generations of people when the data only covered a span of fifteen years.

It appeared that quite a sizeable proportion of candidates had learned answers from a previous mark scheme. Even though part of the answer was relevant and gained them some marks, it did so at the cost of time wasted which would have been spent more effectively elsewhere on the paper.

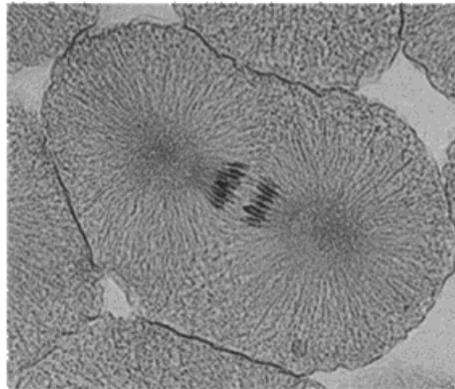
The use of correct biological vocabulary is vital in this paper but it was often evident that terms such as genes and alleles or centriole and centromere were being confused. There was clear evidence that candidates often failed to read the question thoroughly enough and included much irrelevant information in their answers. Examples of this were writing about microfibrils rather than a cellulose molecule and writing about germination of pollen grains when the question asked for an account of fertilisation.

Question 1 (b)

This question was generally well answered with the most common error being to describe chromosomes becoming separated rather than chromatids becoming separated. There was also some confusion between the terms centriole and centromere.

P MAT

(b) The photograph below shows a cell of a blastula at a different stage of mitosis.



Magnification $\times 1000$

Describe what is happening inside the cell during this stage of mitosis.

(4)

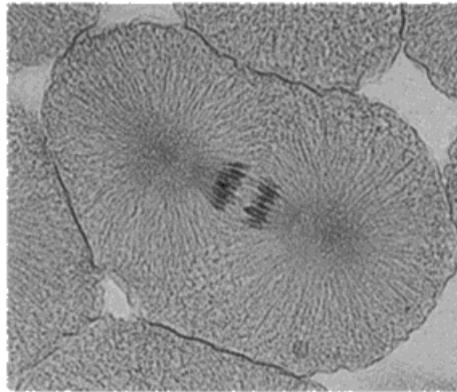
During this stage spindle fibres pull the chromosomes apart and away from the centromere. This stage in Mitosis is referred to as Anaphase. During anaphase ~~Anaphase the chromosomes have identical copies~~ ~~are formed~~ ~~are~~ identical copies of the chromosomes are formed, and they are now pulled apart by spindle fibres to form ~~the~~ separate cells.



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Examiner Comments

This response only gained one mark for correctly identifying anaphase. If the answer had stated that chromatids were being pulled apart rather than chromosomes, an additional mark would have been awarded. There is no reference to the centromeres dividing and the reference to spindle fibres doesn't describe them contracting.

(b) The photograph below shows a cell of a blastula at a different stage of mitosis.



Magnification $\times 1000$

Describe what is happening inside the cell during this stage of mitosis.

(4)

The spindle fibres which are attached to the centromeres of the chromosomes contract and shorten. Centromere splits allowing sister chromatids to be separated to opposite poles of the cell. Spindle fibres shorten more and thus pulling the chromosomes and separating them to opposite poles of the cells. ~~Original~~ Original diploid number of chromosomes is restored.



ResultsPlus

Examiner Tip

This response gained the full four marks available although it did not name the stage of mitosis shown in the photograph. The answer correctly describes chromatids being separated, before going on to describe chromosomes moving to opposite poles of the cell. There is also an understanding that centromeres split and that the spindle fibres shorten.



ResultsPlus

Examiner Tip

Take care with terminology. It is important to be able to distinguish the terms chromatid and chromosome.

Question 1 (c)

The majority of candidates gained one mark for indicating that totipotent cells can give rise to all cell types but relatively few described the totipotent cells as being undifferentiated.

(c) The cells of a blastula are totipotent. Suggest why it is important that these cells are totipotent.

(2)

Totipotent cells are undifferentiated cell which can produce all cell types including extra embryonic cells. If these cells are totipotent they can be used to produce any cell type or even a human being.



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Examiner Comments

A good answer that gained both of the available marks.

Question 2 (a)

A straightforward question in which the majority of candidates could correctly name two organelles that have a single membrane.

2 Some organelles in plant and animal cells are surrounded by a membrane.

(a) Name **two** organelles that have a single membrane.

(2)

1 ribosomes

2 lysosomes



ResultsPlus Examiner Comments

This response gained one mark with the reference to ribosomes being incorrect. Stating ribosome was the most common error seen, although incorrect references to mitochondria, chloroplasts and also to the nucleus were all noted by examiners.

2 Some organelles in plant and animal cells are surrounded by a membrane.

(a) Name **two** organelles that have a single membrane.

(2)

1 golgi body

lysosomes

2 RER having single membrane bound cisternae
(rough endoplasmic reticulum)



ResultsPlus Examiner Comments

This answer gained both marks. However, the question asked for **two** organelles to be named and this candidate named three. Fortunately all three answers were correct but had one of them been incorrect it would have resulted in one fewer mark being awarded. Examiners cannot choose which answers to accept on behalf of the candidate.



ResultsPlus Examiner Tip

Always take care to follow the instructions in the question. If two answers are expected only give two and do not be tempted to include more.

Question 2 (b) (iii)

A question that has the command word 'compare' requires candidates to indicate similarities and differences. When answering this type of question it is better to comment about both molecules in each point being made rather than, for example, stating starch has 1-4 glycosidic bonds and then several lines later stating that cellulose also has 1-4 glycosidic bonds.

Candidates were expected to state that both molecules were polymers of glucose (or made from glucose monomers) rather than simply state that both consist of glucose. Relatively few did this.

The question asks about the structure of a cellulose molecule but many candidates made comments about a microfibril which were not relevant and so could not be given credit.

*(iii) Compare the structure of starch with the structure of a cellulose molecule.

(4)

Both starch and cellulose are made from glucose molecules. Starch is made from α -glucose molecules but cellulose is made from β -glucose molecules. Starch contains two types of polysaccharides amylose and amylopectin but cellulose doesn't. Cellulose molecules and starch molecules contain glycosidic bonds. In cellulose, glucose molecules are linked by 1-4-glycosidic bonds but starch in starch the glucose molecules are linked by 1-4-glycosidic and 1-6-glycosidic bonds. The cellulose molecules are straight chains but starch molecules contain branches. In cellulose ~~the~~ each adjacent glucose molecules is inverted but in starch they are not inverted.



ResultsPlus Examiner Comments

This answer gained full marks (4/4). It gave an example of a similarity by commenting on the fact that both molecules contain 1-4 glycosidic bonds and it gave a few examples of differences by referring to facts such as starch has 1-6 glycosidic bonds but cellulose doesn't and starch contains amylose and amylopectin but cellulose doesn't. This candidate also gained a mark for knowing that adjacent glucose molecules in cellulose are inverted but this is not the case in starch. Fewer candidates made this final comparison.

*(iii) Compare the structure of starch with the structure of a cellulose molecule.

(4)

Cellulose

Starch

β -glucose

α -glucose

β 1-4 glycosidic bonds

α 1-4 and α 1-6 glycosidic bonds

unbranched

contains amylose (unbranched) and amylopectin (branched)

• Both have glycosidic bond/Linkage



ResultsPlus
Examiner Comments

This answer gained full marks (4/4). Examiners will mark from summary tables such as this as long as points are clearly comparative.

This candidate gave one similarity and one difference at the same time when writing their second point in the table.

Question 2 (c) (i)

Many answers started with an account of pollen germination and contained lots of detail about the growth of the pollen tube which were not relevant to the question. Often they ended up describing fertilisation only in the last couple of lines. Failing to target their answer in this way means a loss of time for candidates and increases the chance of leaving out important parts of the answer because they have run out of room in the answer space provided.

A number of candidates did not state that the products of fertilisation were diploid or triploid when referring to the zygote and endosperm nucleus respectively. Far too many answers were seen in which the candidates described the generative nucleus rather than the male nuclei as taking part in fertilisation.

(c) In plant cells, some of the organelles are plastids.

Most flowering plants gain their plastids from the female parent and not the male parent. This is due to the double fertilisation that occurs in flowering plants.

(i) Describe the process of **double fertilisation** in flowering plants.

(3)

The pollen grain lands on the stigma and a secretion of sucrose stimulates ~~growth~~ growth of the pollen tube down the style. The growth of the pollen tube is controlled by enzymes produced by the pollen tube nucleus and these enzymes digest the middle lamella and style tissue to make a pathway for the pollen tube to grow. The generative male nucleus splits to form two haploid male nuclei. The pollen tube grows down the style and enters the ovule through the micropyle and the pollen tube nucleus breaks down. One male nucleus fuses with the haploid female nucleus to form a diploid zygote which is the embryo of the seed and the other haploid male nucleus fuses with the two polar nuclei to form a triploid primary endosperm which is the food store of the seed.



ResultsPlus Examiner Comments

This answer gained the full three marks available; they have all four marking points squashed in at the bottom of the answer space.



ResultsPlus Examiner Tip

It is often a good idea for candidates to underline or circle the key points in the question to help them focus on what is required. In this case the question already has the words 'double fertilisation' in bold to try to draw the candidates to the relevant aspect.

Question 3 (a)

Most candidates correctly described fertilisation leading to genetic variation to gain a mark. The other marking point was not awarded very often. Here candidates were expected to state that the importance of fertilisation was to restore the diploid number of chromosomes. Most did not do this but just made a statement about the number of chromosomes with no emphasis on the importance.

3 Mammals reproduce sexually. This involves fertilisation to produce a zygote.

(a) Explain the importance of fertilisation in sexual reproduction.

(2)
The egg cell has 23 chromosomes, and the sperm cell has 23 chromosomes, so they need to fuse together to form a zygote of 46 chromosomes.



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Examiner Comments

This is just a statement about the number of chromosomes present and there is no indication of restoring the diploid number. This answer was not awarded any marks.

3 Mammals reproduce sexually. This involves fertilisation to produce a zygote.

(a) Explain the importance of fertilisation in sexual reproduction. *Crossy over?*

(2)
Fertilisation restores the original diploid number of chromosomes when 2 haploid gametes fuse. This also gives genetic variation because the offspring would contain a new set of alleles, from the father and mother. *combination*



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Examiner Comments

This is a good example of what we were looking for. It gained both marking points for a score of (2/2). It clearly emphasises the importance of fertilisation rather than just describing it.

Question 3 (b) (ii)

The question was answered reasonably well. Most candidates got two marks for stating that the acrosome contained enzymes and that these enzymes were required for digesting the zona pellucida. Fewer answers successfully described the fact that the sperm would not be able to reach the secondary oocyte or that the nucleus of the sperm would not be able to enter the secondary oocyte. Answers that stated the sperm would not be able to enter the secondary oocyte were not given the final marking point as candidates were expected to realise that the entire sperm doesn't enter even if the acrosome is not damaged.

Many answers just described the acrosome reaction and these were limited to two of the three marks available because the emphasis of the question stem was what cannot happen.

no digestive enzymes - no pathway - no fusion of 2 membranes for entrance of nucleus
* (ii) Suggest why a sperm cell with a damaged acrosome would **not** be able to fertilise an egg cell.

(3)

A sperm with no acrosome will not be able to release its digestive enzymes by exocytosis.

The zona pellucida will not be digested and there will not be a pathway for the sperm to reach the secondary oocyte. No fusion of the cell membranes of the sperm and female gamete and the nucleus of the male gamete will not enter the cytoplasm of the female gamete.



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Examiner Comments

This is a good answer that clearly illustrates all four of our marking points and was awarded the full three marks. There is a statement that the acrosome contains enzymes and that without these the zona pellucida cannot be digested. Also the candidate states that the sperm is unable to reach the egg and crucially emphasises that it is the nucleus of the sperm that will not enter the cytoplasm of the female gamete.

(ii) Suggest why a sperm cell with a damaged acrosome would **not** be able to fertilise an egg cell.

(3)

A damaged acrosome would inhibit the formation of acrosin.

Therefore because the acrosome is damaged it cannot fuse with the cell membrane of the sperm cell and release acrosin into the zona pellucida. Therefore the sperm won't be able to digest the zona pellucida and fuse with the haploid female nucleus resulting in a fertilised egg cell.



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Examiner Comments

This was a typical response gaining (2/4) marks for knowing that the acrosome contains enzymes and that without these the zona pellucida cannot be digested. However, the final sentence incorrectly states that the sperm (rather than the sperm nucleus) fuses with the female nucleus.

Question 3 (c)

It was rather surprising that a number of candidates described the acrosome reaction given that the previous question had been about the acrosome reaction. However, the majority correctly named the cortical reaction and often made a suitable reference to the formation of a fertilisation membrane.

- (c) In fertilisation, the fusion of the sperm cell membrane with the egg cell membrane is followed by changes in the egg cell.

Describe a process that would **not** occur with the ICSI technique.

(3)

No acrosome reaction occurs as no acrosome involved in the process.
The zona pellucida layer doesn't digest and cortical reaction doesn't take place. Cortical granules do not fuse with the egg cell surface membrane and no fertilisation membrane is formed.



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Examiner Comments

Although this candidate starts off by referring to the acrosome reaction the main part of their answer was about the cortical reaction which they named and went on to give correct details. They clearly understood the role of the cortical granules and consequential formation of a fertilisation membrane. This answer gained (3/3) marks.

- (c) In fertilisation, the fusion of the sperm cell membrane with the egg cell membrane is followed by changes in the egg cell.

Describe a process that would **not** occur with the ICSI technique.

(3)

• cortical reaction

- the cortical granules in the egg fuse with the membrane ^(to harden the membrane) once 1 sperm has entered in the egg to prevent other sperm to come in (polyspermy)



ResultsPlus

Examiner Comments

This answer was awarded 2/3 marks for naming the reaction and knowing the role of the cortical granules. However, they seem to imply it is the secondary oocyte (egg cell) membrane that hardens rather than the zona pellucida.

Question 4 (a)

This question was generally well answered with the vast majority of candidates stating that prokaryotic cells do not have membrane bound organelles. Other commonly awarded marks were for stating they had 70s ribosomes and for knowing that their DNA was circular. Far fewer referred to the position of the DNA in the cell as being not enclosed by an envelope or that it was found in the cytoplasm. References to structures that were not possessed by all prokaryotic cells were not given credit (e.g. slime capsule).

4 It has been suggested that all living organisms evolved from simple prokaryotic cells.

(a) Describe how a prokaryotic cell can be distinguished from a eukaryotic cell.

(3)

prokaryotic cells dont have a nucleus or ~~to~~ membrane bound organelles, where as Eukaryotic do
prokaryotic have circular DNA where as Eukaryotic has linear DNA.
prokaryotic has 80s ribosomes where as Eukaryotic has 70s ribosomes.



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Examiner Comments

This answer gained 2/3 marks for knowing that there are no membrane bound organelles and that the DNA is circular. Unfortunately they have the size of the ribosomes the wrong way round.

Question 4 (b) (ii)

Candidates were expected to know the term molecular phylogeny as it is stated in the specification. They are also expected to know it involves a comparison of molecules, in this case molecules in Bacteria and Archaea. This question was not answered very well.

- (ii) Woese suggested that Bacteria and Archaea were two separate groups of prokaryotic organisms.

Describe the evidence Woese used to make this suggestion.

(2)

The differences between bacteria and archaea are great and they have few similarities between them. Woese used molecular phylogeny which means classifying organisms into groups according to their molecules such as DNA structure, RNA structure, protein structure and cell wall structure. Phylogeny refers to classifying organisms according to ancestral relationships.



ResultsPlus Examiner Comments

This response gained both available marks. The term molecular phylogeny is used so gains our first marking point and there is a reference to DNA, RNA and proteins being studied. The second marking point was given as any one of these molecules is a correct example.

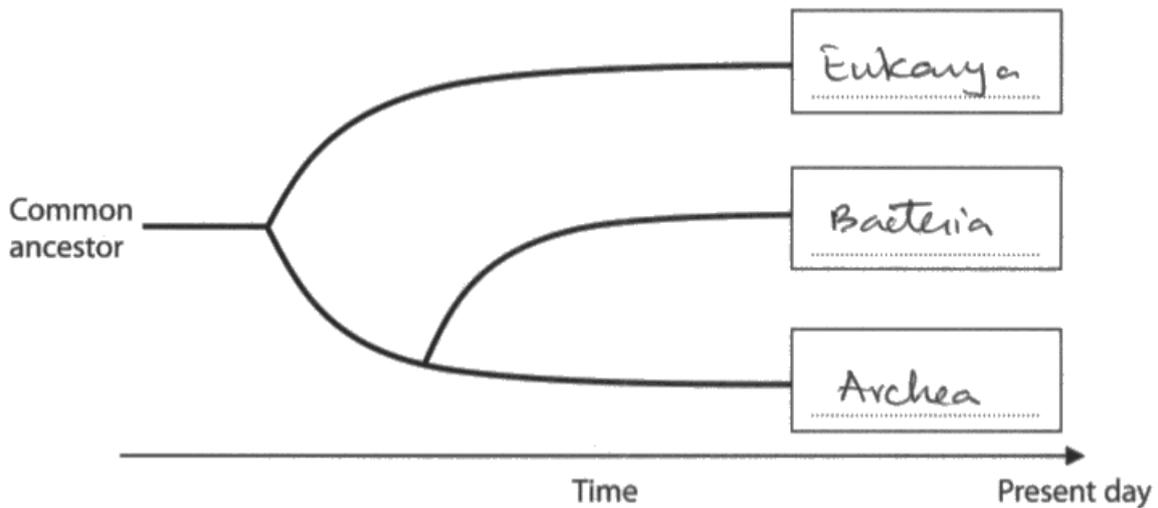
Question 4 (b) (iii)

This was amongst the questions that were least well answered and examiners were given the impression that candidates were often just guessing. Some did not seem to understand the term domains and wrote down the names of kingdoms.

(iii) The diagram below shows the evolutionary relationship between the three groups proposed by Woese.

Complete the diagram to show the positions of these three groups.

(2)

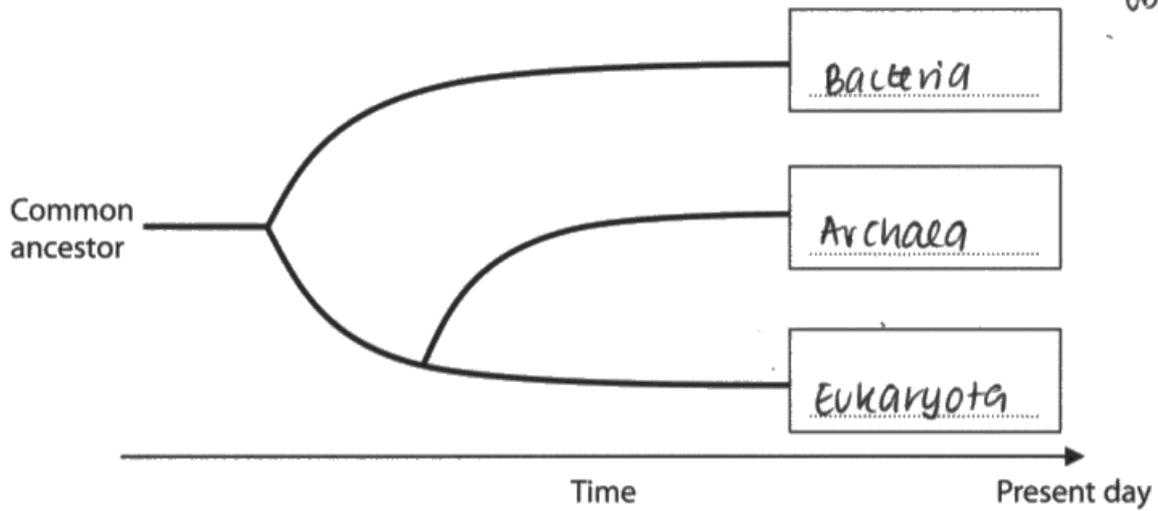


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Examiner Comments

This response did not gain any marks. It illustrates a very commonly seen answer in which Eukarya was written in the top box.

(iii) The diagram below shows the evolutionary relationship between the three ^{classified into} taxonomic groups ^{based on any} proposed by Woese. ~~observable~~ ^{features. specific} features ^{that can} (2) ^{be} observed.

Complete the diagram to show the positions of these three groups.



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Examiner Comments

This answer gained 2/2 and illustrates what was expected. It does not matter in which order the bottom two answers are given.

Question 5 (a) (iii)

Although many candidates obtained a mark for knowing that lignin provides waterproofing not many gained a second mark. As Xylem vessels have the properties of rigidity and high tensile strength it was expected that candidates would make a comparative statement indicating secondary thickening would increase strength rather than just stating it provides strength. Similarly just a statement that secondary thickening would provide rigidity was not enough. To gain a mark the answer had to make clear that secondary thickening would give extra rigidity. However, relatively few wrote this.

(iii) Explain how secondary thickening in the cell wall contributes to the physical properties of xylem vessels.

(3)

Cells are thickened by adding lignin, which makes them stronger and waterproof. If the cell walls are waterproof it means water which the xylem is carrying will not be lost due to osmosis. By strengthening the cells help stop cells from ~~rupture~~ rupturing and allows xylem to provide structural support.



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Examiner Comments

This response gained two marks for their opening statement by referring to lignin making the xylem stronger and waterproof. However, the rest of the answer didn't address the question so a total of 2/3 marks was obtained.

(iii) Explain how secondary thickening in the cell wall contributes to the physical properties of xylem vessels.

(3)

- Secondary thickening: the cells are embedded in ~~to~~ lignin and hemicellulose which provide strength and flexibility
- There are Hydrogen bonds between the cellulose molecules that provide ~~for~~ strength.
- The cellulose are arranged in parallel layers, and with these Hydrogen bonds and glycosidic bonds, the ~~#~~ xylem vessels are strengthened.
- They are hollow dead cells, so water ^{and minerals} can easily be carried ~~to~~ in the xylem.



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Examiner Comments

This answer gained no marks because there was no indication of an increase in strength or a decrease in flexibility.

Question 5 (b) (i)

This was a high scoring question but sometimes poor expression meant a candidate did not score both marks. The most common problem was a description of jute fibres being regrown rather than a statement such as more jute plants can be grown.

(i) Explain why jute fibres are an example of a sustainable resource.

(2)

Jute fibres can be regrown meaning that they do not run out and are therefore sustainable. They are biodegradable, meaning that they are unharmed to the environment and breakdown easily and quickly. They are many of them and so they are reliable.



ResultsPlus

Examiner Comments

Although fibres cannot be regrown this candidate clearly states that they do not run out and that they are biodegradable. They were therefore awarded both of the available marks.



ResultsPlus

Examiner Tip

Take care with expression. Plants and plant fibres cannot be regrown. However, more plants can be grown.

(i) Explain why jute fibres are an example of a sustainable resource.

(2)

Jute fibres are made of plants which are a renewable resource. Plants that are cut down to make jute can be re-grown in the next growing season thereby making these jute fibres available for the use of future generations. These jute fibres are also biodegradable as they are made of plant fibres.



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Examiner Comments

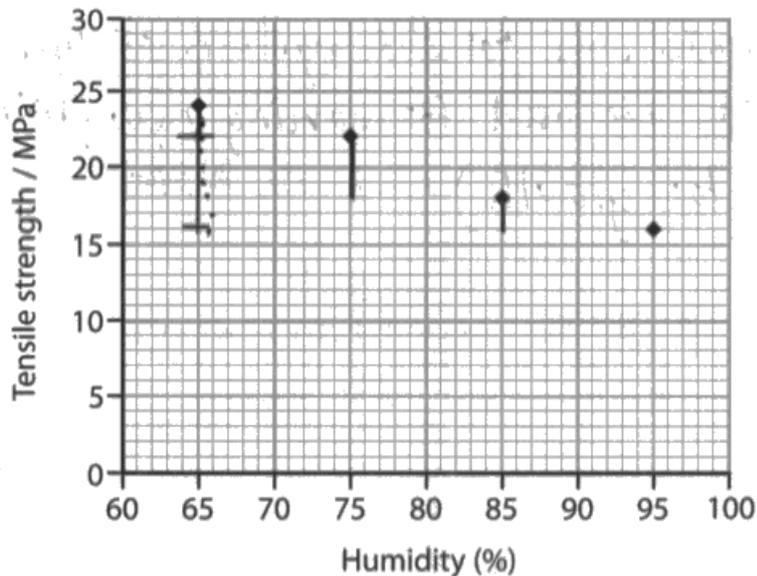
This scored 2/2 marks. The answer illustrates all of the marking points including the statement that the resource will be available to future generations. There is a clear reference to the fibres being both renewable and biodegradable.

Question 5 (b) (ii)

Almost all candidates could state the general trend shown in the graph. Some described it as a negative correlation whereas others were more descriptive. Better answers did more than just quote figures from the graph and carried out a calculation using the data in the graph. Some unfortunately failed to quote units when appropriate.

- (ii) The tensile strength of jute fibres is affected by humidity, the amount of moisture in the air.

The effect of humidity on the tensile strength of jute fibres is shown in the graph below.



Using the information in the graph, describe the effect of humidity on the tensile strength of jute fibres.

(2)

As humidity increases, tensile strength decreases.
→ The biggest difference is from 75% humidity to 85% humidity which is a decrease of 4 MPa
→ The overall decrease is of -8 MPa.



ResultsPlus Examiner Comments

All our marking points are illustrated in this response. The correct trend is described, the greatest change is identified and it is also quantified by a calculation.



ResultsPlus Examiner Tip

Make sure figures from the graph are used to carry out a calculation such as that illustrated by this response. Do not just quote figures from the graph.

Question 5 (b) (iii)

This question was based on a core practical and was very well answered. Some candidates failed to gain a mark when their answer was too vague; these answers included statements such as "use the same size of fibres" and "keep the conditions the same". It was expected that two variables would be stated but some candidates gave a list of several. This is not good practice because one of the additional answers might be incorrect. Some candidates thought light intensity needed to be controlled.

- (iii) Name **two** variables that need to be controlled when investigating the effect of humidity on the tensile strength of jute fibres.

(2)

1. Temp. Age and thickness of fibres
2. The method of storage (conditions: temperature should be kept equal for all).



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Examiner Comments

This answer gained 2/2 marks. The response includes more than two answers but fortunately there are no incorrect statements.

Question 6 (a)

The more able candidates offered a chain of reasoning such as nitrates are used to make amino acids which are used to produce proteins that can be used as enzymes. Weaker responses just gave a list of molecules that can be produced when nitrates are present.

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

(2)

Nitrate ions are important to plants for the synthesis of proteins.
It is also very important for the synthesis of DNA and RNA.
Without nitrates, growth in plants ~~are~~^{is} stunted and it becomes yellow and crinkly.



ResultsPlus Examiner Comments

This response was awarded one of the two available marks. They have just named a molecule that can be synthesised (they have done this twice naming proteins and DNA/RNA) but they have not developed their answer in either case.



ResultsPlus Examiner Tip

Make sure you take careful notice of the command word. In this case it is the word explain which means that some development of the answer is required.

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

(2)

Nitrates are needed to make amino acids, which are needed to make proteins which in turn are needed to make new cells for growth of the plant.
Nitrates are also needed to make DNA and RNA which direct protein synthesis.



ResultsPlus Examiner Comments

Both of the available marks were awarded for this answer. It is an example of the most common answer seen. Here the candidate links nitrates to amino acid synthesis and then links amino acids to protein synthesis.

Question 6 (b) (i)

The definition of niche was well known but very few were able to describe the role of pitcher plants.

(i) Explain what is meant by the term **niche**, with reference to the pitcher plant.

(2)

Niche is the role of the organism like pitcher plant in the habitat.



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Examiner Comments

This gained one mark and is typical of the fact that the definition of niche was well known.

Question 6 (b) (iii)

A significant number of candidates repeated a standard account of natural selection in general, perhaps having learned the mark scheme from a previous paper. Fewer related their answer carefully enough to pitcher plants. It tended to be only the better answers that correctly identified the selection pressure to be a lack of nitrate in the soil. Disappointingly an answer seen on several occasions was that selection pressure caused the mutation. A number of candidates still refer to genes when they should be referring to alleles.

(iii) Suggest how natural selection has given rise to carnivorous plants.

(4)

There is genetic variation in the plant population. Due to a random mutation a few plants possess the allele that makes them carnivorous giving them the ability to digest animal tissue. Therefore when there is an environmental change and a selection pressure is imposed on these plants, for example in ~~these~~ ^{this} case the selection pressure is soil lacking mineral ions such as nitrates which would lead to a lack of nutrients the carnivorous plants with the favourable allele which ~~trap~~ ^{allows them to} trap insects or small ~~animals~~ ^{mammals} and digest their tissue to obtain proteins ~~are~~ are more likely to survive to breed and pass on the favourable allele to their offspring as they are receiving necessary nutrients for growth while the other plants without the favourable allele ^{don't}. As a result the allele frequency of the favourable allele increases in the ~~gene~~ gene pool over many generations giving rise to more carnivorous plants.



ResultsPlus Examiner Comments

This answer gained the maximum available 4 marks. It was a good answer that actually gave five of six marking points. The candidate understood there was genetic variation in the plant population and described the feature that favourable alleles would determine. They also correctly described the selection pressure and later went on to indicate that the favourable alleles (in the context of carnivorous feeding) would be passed to the next generation and that there would be a change in allele frequency.



ResultsPlus Examiner Tip

Questions on natural selection are quite common but don't be tempted to just learn a previous mark scheme. Make sure you can apply your knowledge to the specific example on the paper.

Question 6 (c)

This question is based on a core practical and was well known by most candidates. A few wrote about growing the plant from seed and some failed to realise growth regulators or hormones were needed in the nutrient medium. The mark that was missed by all but a tiny minority was the one that specifically related to pitcher plants. This was the point that the nutrient medium should have a low nitrate concentration. The majority of candidates understood the need for aseptic technique and described this in several ways. These included a reference to sterile agar, working next to a Bunsen flame and covering the culture to prevent contamination by microorganisms. All of these were acceptable answers.

- (c) *Nepenthes attenboroughii* is critically endangered and appeared on the 2012 list of the world's 100 most threatened species.

Scientists have found that it is difficult to grow pitcher plants from seed. Pitcher plants can be grown using tissue culture techniques, as shown in the photograph below.



Suggest how a tissue culture technique could be used to grow pitcher plants.

(4)

- Take explants from a Pitcher plant which are genetically identical.
- Place into agar (that has been sterilised by using aseptic technique which involves adding the agar in autoclave) And add ~~growth~~ nutrients for growth
- Observe for a callus forming (cluster of cells) and divide these cells.
- Add cling foil over agar to prevent entry of any bacteria that could compete.
- Cells should have turned into a new plant by the end of experiment.



This response was awarded three of the five marks. This is a typical example of the most common response in which a candidate knows the term explant, knows that the explant must be placed in agar and understands the need for aseptic technique.

Question 7 (a) (i)

The majority of candidates gained two marks for correctly completing this calculation. In a few cases an incorrect answer was given and no working out was shown resulting in examiners not being able to award any marks. Equally, however, there were some candidates that had shown the correct working but an incorrect answer so examiners were still able to award a mark for the method of working. A significant number calculated a percentage change which was not asked for and this illustrates the importance of reading the question carefully rather than just performing a standard calculation that might have been asked for in many past papers.

- (a) (i) The rate of change in the incidence of thyroid cancer from 1986 to 1991 is 0.74 per 100000 people per year.

Calculate the rate of change in the incidence of thyroid cancer from 1996 to 2001.

Show your working.

(2)

$$17.6 - 8.9 = 8.7$$

..... 8.7 per 100000 people per year



ResultsPlus Examiner Comments

The candidate identified the correct data and carried out a subtraction. This gained 1 mark even though the final answer is incorrect because they have not divided by five. They have failed to read the question carefully and have missed the instruction to calculate the change from 1996 to 2001.



ResultsPlus Examiner Tip

Always make sure you show your working as a method mark can often be awarded even if the final answer is incorrect.

Question 7 (a) (ii)

This question was poorly answered. There was a lack of clarity in answers with mutations commonly mentioned, but no link made to them being caused by radiation. It was insufficient to state that radiation causes cancer. The chain of causation was needed to gain marks so the sequence linking radiation to mutation to specific genes to their impact was expected. It was pleasing to see some good, detailed answers that did this and included references to mutations in tumour suppressor genes and the impact on cell division.

(ii) Suggest an explanation for the difference in these rates of change in the incidence of thyroid cancer.

(3)

The rate of change in incidence increase, there are more cases of thyroid cancer. It is because the people might have mutation in gene which led to the cancer and it being passed on from the closer family relatives. Apart from environment, the genotype also affects the probability of the person getting the cancer.



ResultsPlus
Examiner Comments

This only gained one mark for stating the incidence of thyroid cancer would increase. There is no indication that radiation caused the mutation. The expression isn't clear and seems to indicate that mutations are passed from close family relatives.

- (ii) Suggest an explanation for the difference in these rates of change in the incidence of thyroid cancer.

As time increases, rate of change increases.

(3)

It took a while for the tumours to grow and the cancer to develop. The radioactive fallout in Belarus contaminated the people in Belarus, so older people gave birth to children with tumours due to the radioactive particles in their system, so cancer was only prevalent later on. Thyroid cancer was a dominant allele so people who had the cancer and their children passed on the alleles to their children, who, in turn, developed thyroid cancer.



ResultsPlus
Examiner Comments

This response gained two marks for correctly indicating the incidence of cancer has increased and for realising it takes time for cancer to develop. The candidate fails to read the data in the table carefully enough and describes the passing of alleles to the next generation who in turn developed cancer even though the data starts with a population that were less than four years old and only gives data for fifteen years in total.

Question 7 (b) (i)

Although the majority of candidates could correctly define the term biodiversity, there appeared to be some confusion between the terms "species" and "organisms".

- (i) State what is meant by the term **biodiversity**.

(1)

Biodiversity is the number of different organisms and species.



ResultsPlus
Examiner Comments

Organisms and species are not the same thing. Examiners cannot choose which answer to accept so this response gained no marks.

Question 7 (b) (ii)

This was a high scoring question. Most stated that the number of species would be counted but some preferred the idea of calculating a diversity index.

- (ii) Suggest how scientists could find out if biodiversity within the town of Pripyat has increased or decreased since the Chernobyl disaster in 1986.

(2)

by measuring the number of different species present now and comparing it with the number of different species present ~~before~~ ^{the} at 1986 disaster. Number of organisms in each species should also be included.



ResultsPlus
Examiner Comments

This answer gained two marks for measuring the number of different species and for realising a comparison over time would be needed.

Question 8 (a) (i)

Many candidates unfortunately referred to "genes" in their answer instead of "alleles". Some also confused the terms "genetic diversity" and "biodiversity".

(a) Koalas have a low genetic diversity.

(i) Explain what is meant by the term **genetic diversity**.

(1)

Genetic diversity is variation in genes within a specific species (genotype).



ResultsPlus
Examiner Comments

This response gained no marks because the candidate referred to genes instead of alleles. This was frequently seen.

(a) Koalas have a low genetic diversity.

(i) Explain what is meant by the term **genetic diversity**.

(1)

It is the number of different alleles in a habitat / population.



ResultsPlus
Examiner Comments

Although the reference to population would have been accepted, the candidate has also referred to a habitat which is incorrect. Examiners cannot choose which answer to accept so this response gained no marks. The candidate's indecision over which term to use is probably a sign of confusion between the terms biodiversity and genetic diversity.



ResultsPlus
Examiner Tip

Make sure that definitions of key terms are known, particularly in topics about the environment.

Question 8 (a) (ii)

A surprisingly large number of candidates did not refer to an increase in inbreeding and unfortunately a significant number used the word interbreeding instead of inbreeding. The idea of there being a reduced gene pool was often stated and gained a mark but when candidates described a loss of alleles they were still expected to add "from the gene pool" or "from the population" in order to gain this mark. Fewer candidates referred to genetic drift or increased homozygosity, which were also given credit by examiners when seen.

- (ii) A low genetic diversity in a species can be due to a decrease in population size.

Explain how a decrease in population size can result in a reduced genetic diversity.

(2)

Small population of koalas ~~mease~~ means low genetic diversity.
The number of alleles are reduced and hence reduced inbreeding.
There may be reduce no. of breeding programs as the koala may be ill or too old. The no. of males and female koalas decrease also.



ResultsPlus
Examiner Comments

This response did not gain any marks. They have not given an indication of where alleles are lost from (a reference to gene pool or population was expected). The answer also suggests a reduction in inbreeding rather than an increase in inbreeding.

- (ii) A low genetic diversity in a species can be due to a decrease in population size.

Explain how a decrease in population size can result in a reduced genetic diversity.

(2)

decrease in population size can cause inbreeding between koalas causing genetic drift as homozygosity of genes would increase.



ResultsPlus
Examiner Comments

This response gained two marks. There is a suitable reference to inbreeding and also an understanding of it leading to genetic drift. We would also have given the reference to increased homozygosity a mark had the maximum for the question not already been awarded.

Question 8 (b)

Surprisingly few understood that the range of fur colour was due to polygenic inheritance. Many candidates thought it was due to temperature.

- (b) Koalas in the south of Australia have fur that is brown in colour and those in the north have grey fur.

The fur colour of koalas is not affected by their environment.

Koalas that live in habitats between the north and south of Australia have a range of fur colouration from grey to brown.

Suggest **one** reason for this range of fur colour.

(1)

Continuous Variation



ResultsPlus Examiner Comments

The answer gained no marks because it is just a description of a range and is not a reason for it.

- (b) Koalas in the south of Australia have fur that is brown in colour and those in the north have grey fur.

The fur colour of koalas is not affected by their environment.

Koalas that live in habitats between the north and south of Australia have a range of fur colouration from grey to brown.

Suggest **one** reason for this range of fur colour.

(1)

to allow it to adapt to the temperature.



ResultsPlus Examiner Comments

This was probably the most common response but gained no marks.

Question 8 (c) (i)

Candidates were expected to calculate how much longer Koalas in the South are and also how much heavier they are. A significant number only calculated the difference for one of the parameters. Whenever appropriate it is expected that units will be stated but it was not uncommon to see an answer expressed as 5.3 rather than 5.3 cm. Approximations such as "roughly double" were not accepted. A number of times examiners reported that candidates had confused North and South by stating those in the North were bigger. A number of answers included the statement that "mean body length is greater than mean body mass" which is irrelevant to the question asked.

- (i) Using the information in the table, describe the differences in body length and body mass for koalas living in these two habitats.

(2)

Mean body length and mass of South Australian koalas ~~are~~ is more than North Australia. There is very few difference between mean body length in South Australia and North Australia koalas. (only 5.3cm) The % difference in mean body mass is more than mean body length.



ResultsPlus
Examiner Comments

Only the calculation for the difference in length has been done. This gained one mark. The difference in body mass was not quantified. The last sentence was seen quite frequently but is not relevant to the question.

- (i) Using the information in the table, describe the differences in body length and body mass for koalas living in these two habitats.

Northen koalas are ~~g~~ 5.3 cm shorter than Southern koalas. ... that's 7% shorter. ⁽²⁾

Northern koalas are 4.5 kg less heavy than Southern koalas. ... that's ~~is~~ around 44% less heavy.



ResultsPlus
Examiner Comments

This response gained two marks. The most common approach of candidates was to calculate 5.3 cm and 4.5 kg; however, we also accepted ratios and percentage differences if correctly calculated. This candidate has actually correctly manipulated data in two different ways. The response is included in the report to illustrate examples of percentage values that were given credit when they were seen.

Question 8 (c) (ii)

The vast majority of candidates gained the mark with the most common answers being "a difference in diet" or "a difference in temperature". Much less frequent was the alternative correct response "genetic differences".

- (ii) Suggest an explanation for the difference in size of koalas from these two habitats. ⁽¹⁾

~~These koalas ha~~ Koalas from different habitats have different alleles for mass and length and these koalas have different diets as well.



ResultsPlus
Examiner Comments

This answer gained one mark which could have been awarded for the comment about "different alleles" or for stating "these koalas have different diets".

Question 8 (d)

It appeared that a large number of candidates had learnt the mark scheme from last year's paper as there were lots of references (sometimes half of their answer) to preparing the animals for release into the wild and where to release the animals. Clearly some points from last year's paper were relevant to this question but candidates cannot assume they will score full marks if they attempt to learn previous mark schemes. The change in both context and phrasing from one year to another prevents this happening. The use of stud books, IVF and inter-zoo exchange of animals were all well known. Writing interbreeding instead of inbreeding was a common error. Sadly there were some answers that stated zoos would breed animals from different species indicating these candidates had no understanding of the concept of species.

***(d) Suggest how a captive breeding programme could maintain the genetic diversity of the koalas in Australia.**

(5)

captive breeding programmes help to prevent inbreeding and promotes outbreeding. There are stud books maintained so crosses aren't repeated. And genetically unrelated males are chosen. IVF and Artificial Insemination is carried out on koalas who will not breed in captivity. captive breeding programmes increases genetic diversity by preventing genetic drift. koalas can be exchanged between zoos so genetically unrelated mates are found. gametes can also be exchanged between zoos. Once koala population has reached high enough they can be released in to a safe area away from poachers. ~~Releasing~~ They are tracked once released in to the wild to ensure they have a suitable habitat.



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Examiner Comments

This response was awarded 5 marks. The candidate understood the need to prevent inbreeding and they also stated the most commonly awarded points by referring to inter-zoo movement of animals, the use of stud books and use of IVF. This answer also gained a mark for knowing it is important that the breeding programme helps in avoiding genetic drift.

*(d) Suggest how a captive breeding programme could maintain the genetic diversity of the koalas in Australia.

(5)

Captive breeding programmes can increase the genetic diversity of the koala's. This can be done by preventing inbreeding and encouraging outbreeding by inter zoo animal movement since breeding koala bears from different areas increases the gene pool among koala's as well as the genetic variation. Stud books also have to be maintained to prevent inbreeding ~~among~~ ^{among} koala's. Breeding can be also carried out by the methods of IVF and also by the use of surrogate mother's. The koala bears are then trained on how to obtain food resources and protect themselves from predators before ~~being~~ being released into the wild. Therefore captive breeding programmes ensure that genetic diversity among koala bears is maintained.



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Examiner Comments

This response was awarded 4/5 marks. The candidate understood the need to prevent inbreeding and they also stated the most commonly awarded points by referring to inter-zoo movement of animals, the use of stud books and use of IVF. However, the final third of this response about releasing the animals into the wild is not relevant to the question and possibly indicates the candidate was trying to apply last year's mark scheme.

Paper Summary

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

- make sure you carefully read the headings in tables and the labelling of axes in graphs before trying to analyse the data provided
- remember to include both similarities and differences when asked to compare two molecules or cells
- always quote units when giving numerical answers
- when asked for a specific number of answers do not include more
- always show your working in calculations rather than just writing down your final answer.

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>

Ofqual
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