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Introduction

The paper showed that candidates were able to demonstrate their knowledge and understanding of the relevant sections of the specification. The majority of candidates attempted all of the questions and it was pleasing that so few blank spaces were seen.

Most candidates demonstrated a sound grasp of the factual content of the course, such as describing three-phased testing of drugs, naming the three domains used in classification and knowing the appearance of a chromosome as it would appear in metaphase of mitosis.

As stated in previous reports the use of correct biological vocabulary is vital in this paper but it is still evident that similar looking terms such as centriole, centrosome and centromere were being confused.

There was clear evidence that candidates often did not read the question thoroughly enough. Not only do candidates need to read the context of the question carefully but they also need to be aware of the command word. A good example of this was the question about bioplastics in which a large number did not identify that the command word was explain and not just state. In questions that require a comparison to be made, it is essential candidates include comparative words such as higher, more, less or lower in their statements.

The quality of answers to questions involving data handling was very variable. Marks for describing the data will only be awarded if the data has been manipulated: merely copying the data from the graph or table is not sufficient. It is always a good idea for candidates to look at their numerical answers and check that the answer is realistic – if the answer is not feasible they can then look for an error in their working.

The questions based on knowledge of core practical work were in general answered quite well but it was disappointing that so few described the dependent variable. In question 4(c) a significant number of candidates wrote about root tip squashes whereas the context of this particular question was totipotency. This may well be due to candidates seeing that the question was a practical about roots and so launched into an answer about the wrong core practical. It emphasises the need for careful reading of all questions.

As in previous exam series those who had learnt a particular stock answer to a topic were able to gain only the 'generic marks' available and were not able to gain full marks because they did not apply their knowledge to the specific context of the question.

Question 1 (a)

Candidates were provided with a list of three types of adaptation and instructed to choose which applied to the descriptions in the boxes. A few candidates wrote an answer that was not one of those provided and obviously did not gain credit. Phonetic spellings were allowed even though the correct names were provided in the question.

(a) The table below gives some descriptions of adaptations of clownfish and sea anemones.

Complete the table by stating whether each adaptation is behavioural, physiological or anatomical.

(4)

Description of adaptation	Type of adaptation
Sea anemones produce a poison.	physiological
The poison produced by sea anemones is located in the tips of tentacles.	~~anatomical~~ behavioural
Clownfish are brightly coloured, this attracts small fish to the sea anemone.	anatomical
Clownfish feed on dead sea anemone tentacles.	behavioural

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Examiner Comments

The second answer is not correct because it has been replaced by an incorrect response. The other three answers were correct so this scored 3 out of 4 marks.

(a) The table below gives some descriptions of adaptations of clownfish and sea anemones.

Complete the table by stating whether each adaptation is behavioural, physiological or anatomical.

(4)

Description of adaptation	Type of adaptation
Sea anemones produce a poison.	Psychological
The poison produced by sea anemones is located in the tips of tentacles.	Anatomical
Clownfish are brightly coloured, this attracts small fish to the sea anemone.	~~Anatomical~~ Psychological
Clownfish feed on dead sea anemone tentacles.	Behavioural

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Examiner Comments

Although phonetic spellings in general were accepted, here the word psychological has a different meaning to physiological so was not accepted. The third answer indicates where a correct response was initially written but the candidate changed their mind and replaced it with an incorrect answer.

This example therefore gained 2 out of 4 marks.

Question 1 (b)

For each organism a mark was allowed for an example of their interaction and a second mark was given for a description of their feeding niche. Comments about both organisms are needed to gain full marks. Many used up time explaining what the term 'niche' means although the question only asks for descriptions of niches. Candidates must pay attention to the command word used in the question.

(b) Using the information in the table, describe the niches of the clownfish and the sea anemone.

(3)

Clownfish eat dead sea anemone tentacles and remove them while their bright colour attracts small fish which are then killed by the sea anemone due to the poison at the tips of their tentacles, these fish are eaten by the sea anemone.

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Examiner Comments

This answer describes the feeding niche of both organisms to gain two marks. It also describes the role of the clownfish in bringing fish to the sea anemone so gained a third mark.

The full three marks were therefore awarded.

(b) Using the information in the table, describe the niches of the clownfish and the sea anemone.

(3)

Niche is the role of the living ~~or~~ organism ~~s~~ in its habitat (how the organism exploits natural resources).
The clownfish has a ~~feeding~~ nutrient cycle niche which is feeding on dead sea anemones tentacles. Thus, the anemones have a feeding niche.
The clownfish also attract small fish to sea ~~anem~~ anemones.

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Examiner Comments

This response gained two marks out of the three available.

Here the candidate has only written about the clownfish but has made two correct statements. A correct description was given of attracting fish to the anemone and a comment about what the clownfish feeds on was also made. Note that we did expect candidates to use the information given and state that the clownfish feeds on sea anemone tentacles. We would not have given this mark if the answer had only stated that the clownfish feeds on sea anemones.

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Examiner Tip

Make sure you follow instructions - here a comment was needed about the sea anemone as well as the clownfish.

Question 2 (a) (i)

Many lost marks because of inaccurate use of the scales on the axes resulting in inaccurate readings taken from the graph. A significant number of candidates did not read the question and so compared drug A to drug B.

(i) Using the information in the graph, describe the effect of drug **A** on the percentage of mice killed.

(2)

Drug A has no effect on mice below 0.12 a.u., zero % of mice killed. Above 0.12 a.u., as the concentration of drug A increases, the percentage of mice killed increases (positive correlation). At 0.8 a.u., 100% of mice killed - Above 0.8 a.u. till 1.0 a.u., 100% of mice killed (no change).
Overall, it shows a non-linear increase.

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Examiner Comments

All three of our marking points were awarded here. We accepted the idea that drug A has no effect below 0.12a.u as equivalent to our expected answer that drug A is only effective at concentrations higher than 0.12a.u.

(i) Using the information in the graph, describe the effect of drug **A** on the percentage of mice killed.

(2)

The graph shows that as concentration of drug A increases so does the percentage of mice killed increase. However only till 0.7 a.u concentration the the curve is leveled off and shows no change because 100% of mice killed so 0.7 au concentration kills all the mice.

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Examiner Comments

The answer starts well with a good description of the trend shown in the graph. However, the value 0.7 that is quoted is inaccurate so did not gain a second mark. It is quite clear on the graph that at 0.7 not all of the mice are killed.

This response gained one out of the two available marks.

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Examiner Tip

It is vital that you read scales as accurately as you can.

Question 2 (a) (ii)

This time a comparison was expected. Relatively few quantified the difference in LD_{50} values.

(ii) The LD_{50} value of a drug is a measure of the lethal dose of a drug.

The LD_{50} is the dose required to kill 50% of the mice.

Compare the LD_{50} of drug **A** with the LD_{50} of drug **B**.

(2)

LD_{50} of drug A has a lower concentration of drug than drug B. LD_{50} of drug A has 0.1 a.u of drug less than LD_{50} of drug B.

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Examiner Comments

The second sentence gives a good example of what was expected to gain both marks.

This answer gained both available marks.

(ii) The LD_{50} value of a drug is a measure of the lethal dose of a drug.

The LD_{50} is the dose required to kill 50% of the mice.

Compare the LD_{50} of drug **A** with the LD_{50} of drug **B**.

(2)

→ Drug A requires 0.44 a.u to kill 50% g mice with LD_{50} Dose and Drug B requires 0.52 a.u. to kill 50% g drug. It shows that Drug a is more effective than drug B less concentration is required to kill 50% g mice.

ResultsPlus
Examiner Comments

The first sentence quotes an inaccurate value (0.44) so did not gain our first marking point here.

However, the last two lines indicates drug A is "more effective" and also refers to a lower concentration being needed to kill 50% of the mice so we were happy to award our first marking point for this part of the answer.

This response gained one out of two marks.

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Examiner Tip

Make sure you read values on the graph as acurately as possible

Question 2 (b)

In some answers it was impossible to tell which phase was being described. Other answers were not clear when describing phase I testing as they referred to using "healthy patients". If people are healthy they are not usually patients. It was clear that a few had misunderstood the question and interpreted it to mean 'describe phase III testing'.

(b) Clinical trials are performed on drugs that successfully pass the animal testing stages.

Describe three-phased testing.

(4)

In phase 1 a small group of healthy volunteers are used, if the drug passes this phase it moves on to phase 2. This is when a small group of pateints are used, again, if the drug passes this stage it moves on to the last phase (phase 3). This is when a large group of pateints are used. They use double blind trials, where a placebo, the new drug and sometimes a previous treatment is used.

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Examiner Comments

This response gained all four marks as it describes each phase and the use of double blind trials.

(b) Clinical trials are performed on drugs that successfully pass the animal testing stages.

Describe three-phased testing.

(4)

Phase one is when the drug is tested on healthy indivisvals to see if the drug is safe, at phase one its tested on a small group of people. phase two is rested on a large group of patients suffering from the disease to see the effectiveness of the drug. phase three is comparing the drug with existing drugs when the patients are split into 2 groups, this is done to a very large group to see the effectiveness of the new drug. clinical trials usualy involves placebos and double blind trials to see the effectiveness and to avoid bias.

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Examiner Comments

This answer correctly describes phase I at the start but then did not gain the mark for the description of phase II testing as they refer to the use of a large group of patients.

The answer does continue to successfully describe phase III testing and the use of double blind trials.

Overall this was awarded three out of four marks.

Question 3 (a)

We accepted phonetic spellings in this question and as a result a large number of candidates received a mark even though they had an incorrect spelling of Archaea.

Many correctly gave the names of the three domains but far fewer were able to recall that this type of classification is called molecular phylogeny.

3 Living organisms can be classified according to their cell structure.

(a) Read through the following passage about the classification of living organisms.

Write on the dotted lines the most appropriate word or words to complete the passage.

(4)

Living organisms are made up of either eukaryotic cells or Prokaryotic ~~Prokaryotes~~ cells.

Living organisms made up of eukaryotic cells belong to the domain Eukarya.

All other organisms belong to one of the other two domains. These domains are called Archea ~~Archaea~~ and Bacteria.

Classification of living organisms into domains is based partly on their DNA and protein structure. This type of classification is called Taxonomy ~~phylogeny~~

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Examiner Comments

The names of the three domains were each given a mark (the incorrect spelling of Archaea was allowed).

The reference to Taxonomy was seen as many times as the correct answer (molecular phylogeny).

This response gained three out of four marks.

3 Living organisms can be classified according to their cell structure.

(a) Read through the following passage about the classification of living organisms.

Write on the dotted lines the most appropriate word or words to complete the passage.

(4)

Living organisms are made up of either eukaryotic cells

or prokaryotic cells.

Living organisms made up of eukaryotic cells belong to the domain Eukarya.

All other organisms belong to one of the other two domains. These domains are

called Backeria and archaea.

Classification of living organisms into domains is based partly on their DNA and

protein structure. This type of classification is called phenology.

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Examiner Comments

The names of the three domains were correctly stated but the reference to phenology is clearly incorrect.

Three out of four marks were awarded.

Question 3 (b)

Although the majority gained marks for knowing the names of the organelles and a significant number also correctly described the role of the Golgi apparatus, far fewer could adequately describe the structures of centrioles or the Golgi apparatus.

(b) The table below gives information about some cell organelles.

Complete the table by filling in the empty boxes with either the name of the organelle, a description of its structure or its role.

(8)

Name of organelle	Structure of organelle	Role of organelle
centrioles	1 membrane bound 2 cylinder shaped	formation of spindle fibres
mitochondria	1 inner membrane folded to form cristae 2 contains circular DNA	aerobic respiration
Golgi apparatus	1 membrane bound 2 it is made up of fluid filled sacs 2 have a curved shape on both sides	modifies/packages proteins
ribosomes	1 consists of two subunits 2 made of protein and RNA	translation
vesicles	1 surrounded by a single membrane 2 contains hydrolytic enzymes	destruction of bacteria

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Examiner Comments

This candidate correctly named the mitochondrion and ribosomes, as well as giving a suitable description of both the role of the Golgi apparatus and its curved shape to gain four marks out of eight. The reference to centrioles being cylinder shaped was not quite enough as we expected candidates to refer to a pair of cylinders.

(b) The table below gives information about some cell organelles.

Complete the table by filling in the empty boxes with either the name of the organelle, a description of its structure or its role.

(8)

Name of organelle	Structure of organelle	Role of organelle
centrioles	1 made of nine triplets of microtubles 2 present at right angles to each other	formation of spindle fibres
Mitochondria	1 inner membrane folded to form cristae 2 contains circular DNA	aerobic respiration
Golgi apparatus	1 made of stacks of cisternae that curve at the end. 2 Cisternae of decreasing sizes surrounded by secretory vesicles.	Modification of proteins
Ribosome	1 consists of two subunits 2 made of protein and RNA	translation
lysosome	1 surrounded by a single membrane 2 contains hydrolytic enzymes	destruction of bacteria

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Examiner Comments

This is an example of an excellent answer. This candidate gave nine correct statements to gain the maximum mark available which was eight marks.

(b) The table below gives information about some cell organelles.

Complete the table by filling in the empty boxes with either the name of the organelle, a description of its structure or its role.

(8)

Name of organelle	Structure of organelle	Role of organelle
centrioles	1 9 triplets of microtubules 2 ~~Parallel~~ The microtubules are parallel to each other	formation of spindle fibres
Mitochondria	1 inner membrane folded to form cristae 2 contains circular DNA	aerobic respiration
Golgi apparatus	1 Stacked cisternae 2 The ends of the cisternae are curved	Modification of protein ~~Release of protein by exocytosis~~
Ribosome	1 consists of two subunits 2 made of protein and RNA	translation
Lysosome	1 surrounded by a single membrane 2 contains hydrolytic enzymes	destruction of bacteria

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Examiner Comments

This is another example of a very good answer that gained seven out of eight marks.

The only mark not gained was for a second correct statement about the structure of centrioles. We needed to know they are composed of a pair of cylinders or that they are at right angles to each other.

Question 4 (a)

This was a straightforward question that in effect asked for a definition of the term tissue.

Answers were expected to include that a tissue was made of similar cells or a group of cells and that they had a similar function or structure.

(a) Region 1 contains xylem tissue.

Explain why xylem is described as a tissue.

(2)

Xylem is made up of a ~~dead~~ dead cells that are placed end to end, so there are no cell walls. They are also hollow tubes with no nucleus and cytoplasm. They are lignified to provide support ~~of~~ for the plant.

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Examiner Comments

Many candidates scored both marks. This response is an example of the most common reason a candidate does not get both marks. Here there is no indication that a tissue is a group of cells.

We accepted a description of a function of xylem for the second marking point in our mark scheme. The final sentence refers to xylem providing support.

This answer gained one out of two marks.

(a) Region 1 contains xylem tissue.

Explain why xylem is described as a tissue.

(2)

It is made up of one type of cells that have similar functions that work together. It is part of an organ in an organ system that provides plant with water, minerals and support.

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Examiner Comments

Stating it is made of one type of cell was accepted as the equivalent of 'similar cells' and the reference to similar function gained a second mark.

Question 4 (b) (i)

Candidates were expected to have carried out a root tip squash practical and this question asked for the name of a suitable stain that could be used. The most common correct answers were orcein and toluidine blue.

Unfortunately some incorrectly referred to iodine.

(i) Name a stain that can be used to show the chromosomes in mitosis.

(1)

acetocarmine

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Examiner Comments

Acetocarmine is one of several stains that could be used.

(i) Name a stain that can be used to show the chromosomes in mitosis.

(1)

acetic ethanoic stain.

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Examiner Comments

Unfortunately this candidate left out the key name 'orcein'.

Acetic orcein or ethanoic orcein would both have been accepted.

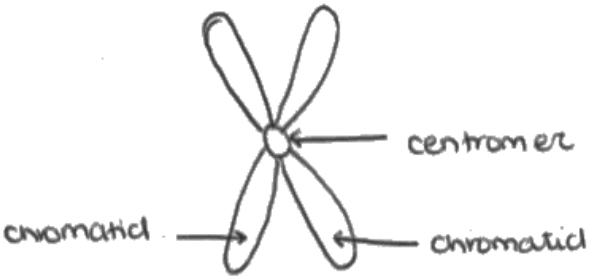
Question 4 (b) (iii)

There were some very untidy drawings that were only just recognisable. Some confused centromere with centrosome and centriole while some wrote chromosome instead of chromatid.

The spelling of the labels was poor but we did accept phonetic spellings.

(iii) Draw and label a diagram of a chromosome as it would appear in cell **R**.

(3)



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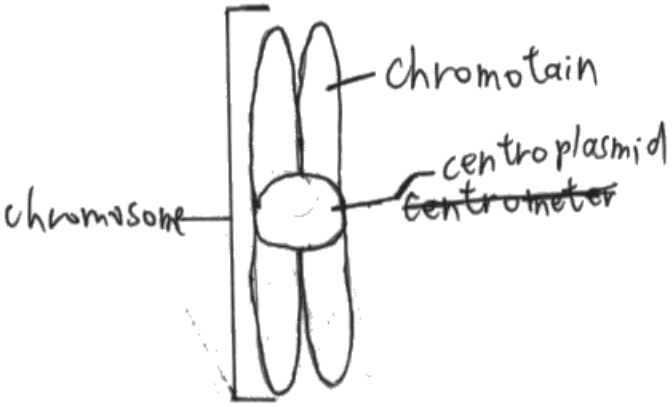
Examiner Comments

A good, clear drawing that gained all three marks.

(iii) Draw and label a diagram of a chromosome as it would appear in cell **R**.

(3)



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Examiner Comments

The labels are clearly incorrect. We cannot accept chromatain instead of chromatid as that means something entirely different.

This answer therefore gained just one mark for the drawing.

Question 4 (c)

There was a disappointingly large number of candidates who just described a root tip squash procedure.

Of those who did attempt to describe an appropriate procedure, most referred to the need for aseptic technique and the idea of removing cells or tissue and growing it on agar. However, a large number omitted a description of taking samples from all four regions and a significant number did not give any indication of a suitable temperature or time for incubation. Most did not refer to the dependent variable.

*(c) A student suggested that **only** region 3 of the root contains cells that are totipotent.

Describe an investigation that the student could carry out to test this suggestion.

(5)

- Use of explants
- Agar in a short necked tubes with hormones for growth (agar should be same volume)
- Place the explants in agar using forceps
- Place under light to grow (same amount of light to all explants used)
- Keep the temperature constant, carrying out the investigation in a thermostatic controlled room
- Leave for 1 week
- Observe the changes, such as measure the length of roots (shows totipotency)
- Use of aseptic techniques, such as flame the test tubes used after adding agar to prevent contamination or pathogenic bacteria from growing

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Examiner Comments

This answer gained four marks out of five for describing the use of explants on agar and stating a time for incubation (this was our minimum value). They also described an example of aseptic technique. Measuring the length of roots will not indicate totipotency so is not a suitable example of the dependent variable.

*(c) A student suggested that **only** region 3 of the root contains cells that are totipotent.

Describe an investigation that the student could carry out to test this suggestion. **(5)**

by cutting parts of each region from the same plant, sterlising an agar ~~petri~~ dish to prevent contamination of bacteria. Placing the each region in an agar plate with the same ~~mu~~ minerals, ions, hormones volume and concentration. incubate at temprature 25°C and leave for 1 week. Observe the number of leaves in each dish and compare. repeat each dish using 9 regions of the same plant, keeping light intensity, pH, humidity constant, (same set up) to get the mean ~~growth~~ in each dish.

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Examiner Comments

This answer gained five out of five marks. There was the idea of using all four regions and growing the samples on agar at the start of the answer. Indicating that the agar had been sterilised was a suitable description of aseptic technique. This candidate also stated a temperature and a time for incubation.

This did not get the mark for the dependent variable as it is the presence/absence of leaves that needs to be noted rather than the number of leaves.

Question 5

Candidates mainly took one of two routes when answering this question. Some described a sequence they had learned which was not linked to the specific context of the tortoises decsribed in the question. Although this approach will gain some marks it will not gain full marks. Others described the idea of adaptation and the specific situation described in the question. The best answers fell in this category but sadly many who attempted this wrote accounts in which the detail of the argument was rarely well developed.

Some thought that Saddlebacks lived on small islands because they were small and did not eat much. Others wrote that alleles survive and are passed on. Although many answers mentioned selection pressure it was quite common for these not to indicate that the selection pressures would be different. Some answers explained geographical isolation on the basis that tortoises could not fly between islands.

Using the information in the table, and your own knowledge, explain why these two species of tortoise are found on different islands.

(6)

Due to Geographical isolation. species found in one area they're endemic to the island.

* There's a genetic variation in the population caused by mutations (increases gene pool.) There is a selection pressue (predatation, food above/below ground.) Those with the advantageous allele (long neck / short neck) survive, breed and reproduce. They pass their alleles to their offspring. Overtime the allele frequency changes and the feature is seen in most of the population.

Natural selection has taken place to suite the conditions in the Gala'pagos Islands.

Both occupy a different niche.

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Examiner Comments

The answer refers to both geographical isolation and natural selection as well as linking genetic variation to mutation. The description of advantageous alleles being passed to offspring also gained credit. Although there is mention here of selection pressure we did expect candidates to refer to different selection pressures.

This response gained four marks out of six.

Using the information in the table, and your own knowledge, explain why these two species of tortoise are found on different islands.

(6)

Each species is endemic to an island. Also a mutation causes variation of alleles in a population. This means the species with the advantageous alleles that enables them to get food and survive with then breed. Breeding results in passing on these advantageous alleles to the offspring. Over time this variation will lead to evolution. So the saddleback tortoise has a small size because it helps her adapt in its island because the island is small so if it had a large size, this could result in competition between species for space. Whereas the domed tortoise needs a lot of food (Abundant vegetation) as it's large and needs a lot of food to function.

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Examiner Comments

This response gained two marks out of six.

These were for linking variation to mutation and for describing advantageous alleles being passed to offspring. Note that the description of the domed tortoise is incorrect because "needs a lot of food" is not the same as our sixth marking point which was "they can grow larger because more food is available".

Question 6 (a)

A number of answers stated meiosis increases variation but we expected there to be an indication that it increases genetic variation.

Not many referred to the importance of meiosis in relation to survival of the species.

6 Reproduction in plants involves meiosis and mitosis.

(a) Explain the importance of meiosis in plants.

(2)

meiosis form a ~~cells~~ gametes ~~that~~ with haploid nucleus. After the fertilisation the diploid number of chromosome is restored. by meiosis non-identical ~~offst~~ plants are produce this increase the genetic variation in the population.

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Examiner Comments

This answer gained two out of two marks.

These marks were for knowing that a haploid nucleus is formed and that meiosis increases genetic variation.

6 Reproduction in plants involves meiosis and mitosis.

(a) Explain the importance of meiosis in plants.

(2)

It produce haploid zygote to restrore original number of chromosomes after fertilization. to avoid double the number of chromosomes.

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Unfortunately this candidate refers to a haploid zygote rather than a haploid gamete. They also described restoring the original number of chromosomes after fertilisation but restoration of chromosome number is more to do with fertilisation than with meiosis.

No marks were awarded.

Question 6 (b) (iii)

It would appear that a significant number of candidates saw the term 'mitosis' and proceeded to give a general description of mitosis being important in growth and producing identical cells. It is vital to target an answer to the specific context of the question.

Some referred to polar bodies rather than polar nuclei and so could not be awarded our final marking point.

(iii) As the pollen tube grows, nucleus **P** divides by mitosis.

Explain the importance of this division.

(3)

produces 2 nuclei that have a role in double fertilization. one fuses with the haploid
produces genetically identical cells that cause the pollen tube to grow down the style and release digestive enzymes to digest the style
the generative nucleus gives 2 male haploid ? that have a role in double fertilization, one male gamete fuses with the egg cell and one fuses with the 2 polar bodies to produce a triploid endosperm that provides energy for the zygote

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The only mark awarded was for the reference to double fertilisation.

The first line of the answer is incomplete as it does not state nuclei. Later there is no statement that a zygote is formed and there is the use of incorrect terminology by stating polar bodies not polar nuclei.

(iii) As the pollen tube grows, nucleus **P** divides by mitosis.

Explain the importance of this division.

(3)

When nucleus P divides by mitosis, two nuclei are produced. These two nuclei enable double-fertilisation for the plant. One nuclei fuses with ~~the~~ 2 Nucleus R and produces a triploid endosperm. The other nucleus fuses with nucleus S to form a diploid zygote.

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Examiner Comments

This answer gained all three marks as we were quite happy to award marks for directly referring to the diagram and answering in the context of nucleus R and nucleus S.

Question 6 (c) (i)

Apart from a few candidates who added up the five mean lengths and divided by five, the vast majority of candidates found the calculation straightforward.

(c) In an investigation, pollen was germinated in different concentrations of sucrose solution for 18 hours.

After 18 hours, the mean length of the pollen tubes in each sucrose solution was recorded.

The table below shows the results of this investigation.

Concentration of sucrose solution (%)	Mean length of pollen tube / µm	
2	8	0.444 /hour
4	15	0.833 /"
6	28	1.555 /"
8	40	2.222 /"
10	30	1.666

(i) Using the information in the table, calculate the fastest mean rate of growth in this investigation.

$\frac{40}{18} = 2.222$

(1)

2.222 µm hour^{-1}

ResultsPlus
Examiner Comments

We accepted 2.22 recurring. This candidate had obviously wasted some time because they worked out the rate for all five results despite the question ony asking for the fastest rate.

(c) In an investigation, pollen was germinated in different concentrations of sucrose solution for 18 hours.

After 18 hours, the mean length of the pollen tubes in each sucrose solution was recorded.

The table below shows the results of this investigation.

Concentration of sucrose solution (%)	Mean length of pollen tube / µm	
2	8 0.2	0.06
4	15 0.2	0.0625
6	28 0.3	0.07
8	40 0.3	0.083
10	30 0.2	0.05

(i) Using the information in the table, calculate the fastest mean rate of growth in this investigation.

(1)

$\frac{40}{8} \div 18 = 0.27$

0.27 µm hour^{-1}

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Examiner Comments

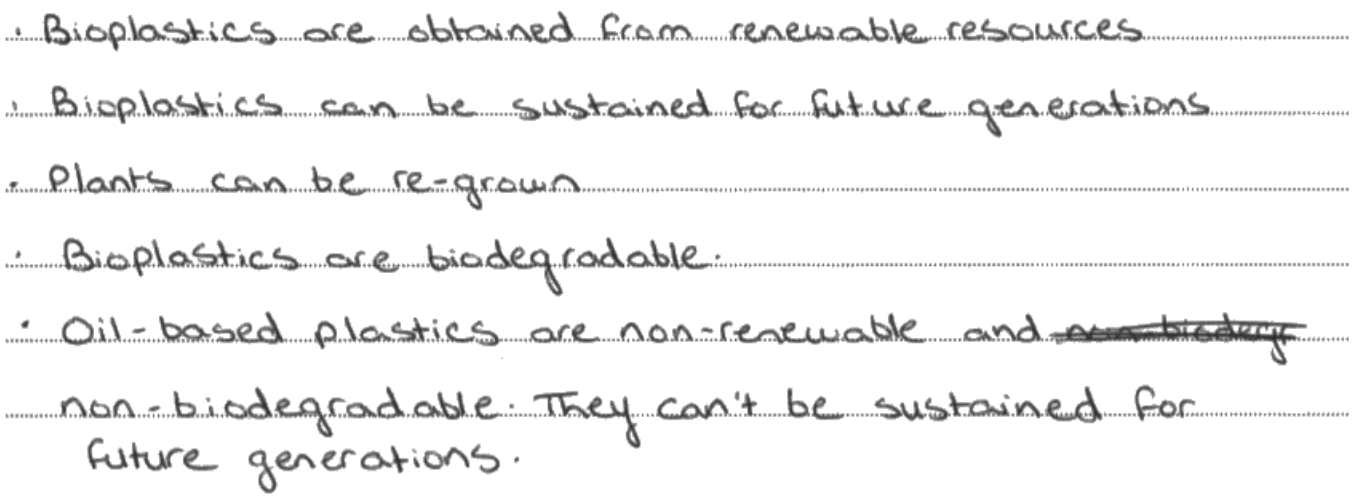
Despite selecting the appropriate value of 40 this was then used incorrectly as the candidate divided by 8 rather than by 18.

Question 7 (b)

Candidates very often ignored the command word. Here they are asked to explain the advantages of using bioplastics whereas in previous years it has been more usual to ask candidates to just state the advantages. Expression of answers also let some candidates down. For example stating more bioplastics can be grown was not accepted as it is the plants (that contain starch and cellulose) that can be grown.

(b) Explain the advantages of using bioplastics compared with using plastics derived from oil.

(2)



ResultsPlus
Examiner Comments

Only one mark was awarded. The first three bullet points tell us the idea that bioplastics are sustainable as more of the plants can be grown. (we allowed the expression re-grown).

Although there is a reference to bioplastics being biodegradable there is no explanation to go with it. We wanted to know there would be less pollution as a result e.g they would not contribute to landfill.

(b) Explain the advantages of using bioplastics compared with using plastics derived from oil.

(2)

Bioplastics are made from renewable resources (as they can be regrown) and decompose → biodegradeable whereas plastics from oil is made from fossil fuels and produce harmful chemicals when burned as they are non-biodegradeable

ResultsPlus
Examiner Comments

No marks were awarded. The first statement did not indicate that the bioplastics are sustainable and the description 'harmful chemicals' is too vague.

(b) Explain the advantages of using bioplastics compared with using plastics derived from oil.

(2)

Bioplastics are produced from renewable sources which are sustainable & will not run out. They are also biodegradable. Plastics from oil are produced from non renewable sources that will run out & are not sustainable.

ResultsPlus
Examiner Comments

One mark was awarded for the statement that bioplastics are sustainable because they are made from renewable sources.

A second mark was not given as there is no explanation to qualify the term biodegradable.

Question 7 (c) (i)

A large number of candidates did not recognise that it was the cellulose that was increasing as the ratio changed. Others simply re-stated figures from the table with no manipulation.

(c) A study was carried out into the effect of adding cellulose to a starch-based plastic.

The tensile strength of the plastic was measured.

The table below shows the results of this study.

Starch : cellulose ratio	Mean tensile strength / MPa	Standard deviation / MPa
100:0	10.0	± 0.5
100:2.5	13.9	± 0.9
100:5	14.0	± 1.5
100:10	26.8	± 0.8
100:15	26.0	± 1.2

(i) Using the data in the table, describe the results of this study.

(3)

as the cellulose increased the mean ~~tensily~~ tensile strength increased due to strong 1-4 glycosidic bonds & hydrogen bonds. ~~after~~ highest increase is from starch:cellulose ratio 100:5 to 100:10, increased by 12.8 MPa &, 91.4% increase. some results are not reliable as the ~~sta~~ ~~standard de~~ ~~errorbars overlap~~ as the standard deviation overlaps eg. between 100:10 and 100:15, Mean tensile strength decreased after 100:10 (optimum), 100:15 is an ~~anomaly~~ anamoly

ResultsPlus
Examiner Comments

All three marks were given as there is a clear comment about the effect of increasing the cellulose, along with a correct statement about the overlap of the standard deviations and an example of a suitable calculation.

(c) A study was carried out into the effect of adding cellulose to a starch-based plastic.

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100:15	26.0	± 1.2

(i) Using the data in the table, describe the results of this study.

(3)

As cellulose increases in the starch: cellulose ratio, the mean tensile strength also increases, therefore there is a positive correlation. However, the result at 100:15 does not fit in with this trend and may be an anamolous result. The Mean Tensile strength increases by 16.8 MPa from a ratio of 100:0 to a ratio of 100:15.

ResultsPlus
Examiner Comments

This response gained two marks. These were for a correct statement about the effect of increasing cellulose and for a suitable manipulation of figures.

Question 7 (c) (ii)

The question asks about the confirmation of the results shown in the table so one mark was given for realising that all five types of plastics must be used, which was very often not stated by candidates. The description of the apparatus that would be used was sometimes so vague that a mark could not be awarded. The other frequent error was not including a clear statement of what would be recorded. Many candidates wasted valuable time describing retting which is clearly not relevant to the context of this question.

(ii) Describe an investigation that could be carried out to confirm these results.

(4)

Obtain the starch from the same specie of plant ~~source~~ The type of cellulose fibres extracted must be from the same species of plant too, To extract the fibres ~~plant~~ soak them in water, then pull them. Combine a fixed amount of starch with a ~~same~~ range of B cellulose fibres to create the ratio in the table. Then add each fibres between two clump stands, and add various ~~of~~ weights. Record the maximum weight ~~to be required~~ to before the fibre (snaps) breaks. Repeat the investigation for each ~~ratios~~ of starch: cellulose to calculate the mean tensile strength

ResultsPlus
Examiner Comments

This answer gained the full four marks that were available. These marks were for describing the apparatus, for hanging weights to the fibre, for recording the maximum weight that does not break the plastic and for stating that replicates using each ratio would enable mean values to be calculated.

(ii) Describe an investigation that could be carried out to confirm these results.

(4)

Take the 5 plastics and suspend each of them from a fixed point using a clamp. The plastics should be the same length and width/diameter. Gradually add masses one by one to the end of the plastic until it reaches its breaking point and snaps. Do this for each type of plastic. ~~Repeat~~ Repeat the experiment for each plastic to calculate a mean and record the maximum volume of masses the plastic can hold. From this one can calculate the tensile strength.

ResultsPlus
Examiner Comments

This candidate did refer to the need to use all five plastics so gained a mark for that. They also realised the need for the diameter of each plastic to be the same. The account then successfully describes suitable apparatus and adding masses to the plastic along with an understanding that replicates enable a mean value to be calculated.

This response gained the full four available marks.

Question 8 (a)

A variety of methods were used to reach the correct answer. Most candidates correctly expressed their final answer as a whole number. Some candidates did not check that their answer was realistic and lost the opportunity to perform a recalculation. Examples of this were answers that quoted values less than 2493 for the total number of identified species in the world. They had been told in the question that this figure represented 11% of identified species so should have realised the answer had to be a lot more than this value.

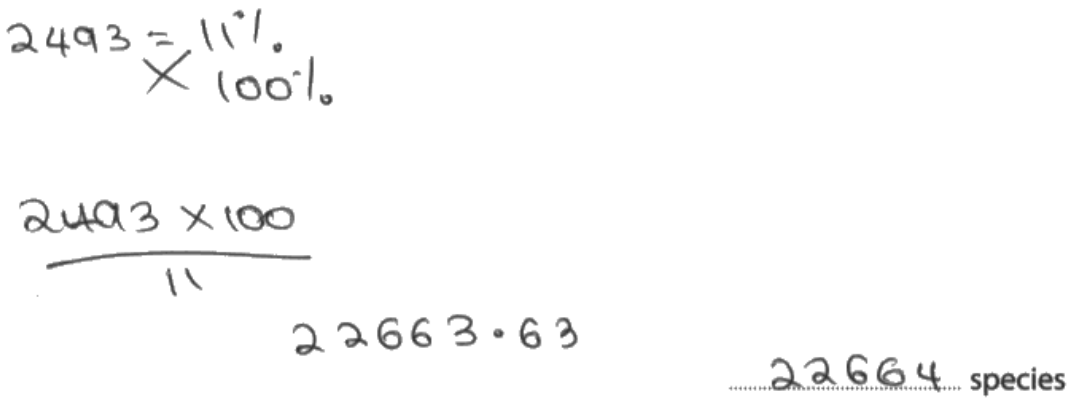
8 Two years ago, 2493 species of plants were thought to be critically endangered.

(a) Critically endangered plants account for 11% of all identified plant species.

Calculate the total number of identified plant species.

Show your working.

(2)



ResultsPlus
Examiner Comments

The correct final answer automatically gained the two marks available.

8 Two years ago, 2493 species of plants were thought to be critically endangered.

(a) Critically endangered plants account for 11% of all identified plant species.

Calculate the total number of identified plant species.

Show your working.

(2)

2493 × 100
?? 11

$\frac{2493 \times 11}{100} = 274.23$

274.23 species

ResultsPlus
Examiner Comments

This is an example of a candidate that multiplied by 11 instead of dividing by 11 so no marks could be awarded. It also gives an example of an answer that is not realistic. The candidate should realise that there must be many more than 274 species of plants in the world (especially as they are told in the question that there are 2493 critically endangered species).

ResultsPlus
Examiner Tip

Check calculated values are realistic - if not, then take the time to check your calculation

Question 8 (b) (i)

It was pleasing to note that a significant number of candidates gained all three marks.

(i) Explain why seeds are dried and then stored in a temperature-controlled environment.

(3)

to ~~prevent~~ reduce germination, prevent enzyme activity and decrease rate of ~~no~~ decaying so the seeds stay viable

ResultsPlus
Examiner Comments

A very concise answer that gained all three of the available marks .

(i) Explain why seeds are dried and then stored in a temperature-controlled environment.

(3)

Seeds are dried to ensure they're dormant preventing any chemical reaction from taking place so that they don't germinate. Also, they are stored in a temperature controlled environment, in a temperature that the enzyme activity of the seed is ~~to~~ low, ~~so~~ inorder to reduce germination of seeds.

ResultsPlus
Examiner Comments

This response gained two out of three marks. One mark was given for stating that germination would be prevented.

We thought that preventing 'chemical reactions' was too vague but later there is an appropriate context of low enzyme activity so a second mark was given at that point.

Question 8 (b) (ii)

Although many candidates gained a mark for the idea of checking that the seeds were still viable, relatively few could explain the need to collect more seeds and so did not gain a second mark.

(ii) Suggest why seed germination is tested at regular intervals.

(2)

To see If the seeds have germinated, then they will be planted, and seeds will be collected again. If seeds germinate, they can't be stored. This is why seed germination is tested at regular intervals.

ResultsPlus
Examiner Comments

This response is unusual in that here there is a description of collecting more seeds but there is no clear reference to preventing germination. Only one mark was awarded.

(ii) Suggest why seed germination is tested at regular intervals.

(2)

To check if the seeds are still viable and can be planted thus collect more seeds from them so the plant can be reintroduced into the wild habitat with genetic diversity so they will have a better chance at survival thus reproducing so it will increase the population of the plant species number so they are no longer extinct.

ResultsPlus
Examiner Comments

This response gained both marks for the description in the first three lines.

Question 8 (c) (i)

The command word in this question was 'compare'. Answers were therefore expected to be comparative and candidates need to include words such as higher or lower in their responses to gain credit. A lot of answers simply quoted values from the graph but did not make comparisons. Many compared the maximum % germination with statements such as Z is 10% higher than Y but this does not reflect the effect of temperature so does not answer the question.

(i) Using the information in the graph, compare the effect of storage temperature on the germination of seeds from these two species.

(3)

- The optimum temperature for species Z is 5°C greater than that for species Y and he perentage successful germination is 10% higher for species Z relative to species Y.
- up to 11°C, an increase in temp means species Y would have a higher germination success rate, beyond that, species Z has a higher success rate.
- Germination success is 0% for Z at 20°C, 5°C cooler than that for species Z.
- Germination begins for Y at around 1.5-2.0°C, Z only begins between 5 and 5.5°C.

ResultsPlus
Examiner Comments

This response gained the full three marks.

The first line gains two marks in one statement as not only do they indicate that the optimum temperature is higher but they also quantify the difference.

The second bullet point in the answer gains another mark as they have described the signicance of the temperature at which the two graphs cross (i.e the idea that up to 11°C species Y would have a higher germination rate).

Note that the third bullet point could not gain any credit as it unfortunately compares Z to Z.

(i) Using the information in the graph, compare the effect of storage temperature on the germination of seeds from these two species.

(3)

For species Y, optimum percentage is 80% at storage temperature of 10°C. Percentage of seeds that germinate decrease ~~with~~ at both lower and higher temperatures.

For species Z, optimum percentage is at 90% at storage temperature of 15°C, 5% and 5°C greater than species Y.

ResultsPlus
Examiner Comments

This response was worth two marks.

Note that it is only at the very end of the answer when the candidate states "5°C greater" that a valid comparison is made.

(i) Using the information in the graph, compare the effect of storage temperature on the germination of seeds from these two species.

(3)

From the graph, we can see that species Y will germinate at a lower temperature and also have a lower optimum temperature than species Z. We can see that increasing the storage temperature increases the percentage of seeds that germinate in both species and they both decrease if too high of a temperature is used. Overall, species Y needs a lower temperature to germinate and a lower temperature to begin germinating. To add to that, we can see a higher percentage in species Z than Y in which they germinate in. This is a 10% difference (90-80).

ResultsPlus
Examiner Comments

This answer gained two marks in the first sentence for comparing the lower temperatures at which germination begins and for comparing the optimum temperatures.

No further marks can be awarded as the final sentence quantifies % germination and not temperature.

Question 8 (c) (ii)

Candidates struggled with this question. A significant number realised that the optimum storage temperature for a species would be known and some stated that different species of plants need different storage temperatures but very few could explain more than that.

(ii) **Suggest how results of studies such as this could be useful to scientists setting up seed banks.**

(3)

These results are useful to scientists setting up seed banks because they can see the optimum temperature for the difference species. For species Y, their optimum temp. is at 10°c which is colder for species Z which is ~~why~~ at 15°c. The scientists can keep their temperature in range in where the ~~of~~ plants enzymes do not denature. They can see that differency would require different temperatures but they can find an average on bon at about 11°c where both lines cross meaning that bot species are stil high of (/.) in seed germinating

ResultsPlus
Examiner Comments

The only part of this answer to gain a mark was the first statement in lines one to three. Much of the rest of the answer is just quoting values from the graphs.

(ii) Suggest how results of studies such as this could be useful to scientists setting up seed banks.

(3)

This allows scientist to know about the optimum temperature to store different type of species in to maximize the amount of seeds that have germinated. This will allow them to increase the population of species that are almost extinct very quickly as well as have more seeds that germinate, which means that they will be more genteracly diverse thus when introduced back to the wild habitat, they will have a better chance at survival and reproduce + increase number of population.

ResultsPlus
Examiner Comments

Another example of an answer that gained just one mark for a suitable reference to optimum storage temperatures for species. The rest of the answer is not relevant to setting up seed banks.

Paper Summary

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

- when describing practical procedures, remember to refer to the dependent variable.
- do not try to make the question fit an answer you have learnt from the mark scheme for a previous examination.
- take into account the command words used in the question; explain is not the same as describe.
- in questions involving calculations, check your final answer is realistic.
- pay particular attention to spelling and the use of technical names and terms.

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