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Examiners' Report
June 2017

GCE Biology B 8BI0 01

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Introduction

This was the second sitting of the AS paper 8BI0/01: Core Cellular Biology and Microbiology designed to assess Biological Molecules, Cells, Viruses and Reproduction of Living Things.

Almost every mark on the paper was achieved and almost all questions achieved a full range of the marks available. However, the mean mark for the paper was low.

Questions that demanded recall tended to score well e.g. when asked to describe the lytic cycle of a virus or to compare the ultrastructure of eukaryotic and prokaryotic cells.

Many candidates did very well with the questions testing their understanding and ability to apply mathematical skills.

Unfortunately there are still a significant number of candidates who struggled with the calculation questions and many were left blank.

Many candidates lost marks through not reading the question carefully often appearing to answer the question they wanted rather than the one on the paper e.g. comparing amylose and amylopectin when asked to compare glucose with glycogen.

Question 1

(a) - (d): These multiple choice questions discriminated well with an average of about 50% of candidates gaining a mark for each question. Questions 1(a) and 1(b) were most commonly correct. For Question 1(c) candidates often gave response option D as their answer listing the organelles from largest to smallest rather than smallest to largest. Question 1(d) was perhaps the most challenging question with all responses seen.

(e): This was the most commonly gained mark on the paper with over 76% of candidates successfully calculating the percentage of genes. However, it does still mean that a significant number of candidates failed to calculate this simple percentage, with some not even attempting the calculation. Some candidates didn't get the mark because they rounded their response incorrectly or used an inappropriate number of significant figures.

This response gained the mark.

(e) The DNA of organelle **R** contains 37 genes. Thirteen of these genes code for proteins involved in part of aerobic respiration.

Calculate the percentage of genes coding for these proteins.

(1)

$\frac{13}{37} = 0.351$

$0.351 \times 100 = 35.135$

Answer 35.1 %

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Examiner Comments

This is an example of the many correct calculations and answers to this question.

This response gained no marks.

(e) The DNA of organelle **R** contains 37 genes. Thirteen of these genes code for proteins involved in part of aerobic respiration.

Calculate the percentage of genes coding for these proteins.

(1)

13 out of 37

37 = 100%.
0·37 = 1%.
0·37 × 13 = 4·81

Answer 5 %

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Examiner Comments

This is an example of an incorrect calculation.

ResultsPlus
Examiner Tip

Don't forget that 10% of the marks on this paper will be awarded for mathematics. Make sure you know how to calculate percentages, etc.

This response did not gain the mark.

(e) The DNA of organelle **R** contains 37 genes. Thirteen of these genes code for proteins involved in part of aerobic respiration.

Calculate the percentage of genes coding for these proteins.

(1)

$\frac{13}{37} \times 100 =$

Answer 35.135 %

ResultsPlus
Examiner Comments

Including an excessive number of significant figures is not appropriate at AS level so this response did not get any credit.

Question 2 (a)

Surprisingly, many candidates seemed to have no idea what translocation was and so failed to score any marks.

Few candidates realised this involved non-homologous chromosomes with many describing crossing over instead of translocation. Many candidates gave a partial answer making reference to parts of chromosomes being swapped between chromosomes and gained a single mark unless it was clear that they were describing swapping between homologous chromosomes. Several candidates did not realise this had anything to do with chromosomes and discussed amino acids and changes in codons instead.

This response gained both marks available.

2 Some genetic disorders result from chromosome mutations.

(a) Translocation is one type of chromosome mutation.

Describe how translocation occurs.

(2)

Translocation occurs when a chromosome breaks and rejoins a completely different chromosome during meiosis. If this happens, a miscarriage can occur.

ResultsPlus

Examiner Comments

Credit was gained here for making it clear that the chromosome breaks and then part rejoins with a different (non-homologous) chromosome.

This response gained no marks.

2 Some genetic disorders result from chromosome mutations.

(a) Translocation is one type of chromosome mutation.

Describe how translocation occurs.

(2)

One of the bases in the codon will be moved from where it is supposed to be to somewhere else. This may or may not change what the codon codes for. This may occur during crossing over or may be a random mutation.

ResultsPlus
Examiner Comments

This is an example of the many candidates that referred to individual bases or codons involved in translocation rather than whole sections of chromatids or genes.

This response gained no marks.

2 Some genetic disorders result from chromosome mutations.

(a) Translocation is one type of chromosome mutation.

Describe how translocation occurs.

(2)

Translocation is when genes are swapped between homologous pairs of chromosomes, maternal and paternal. They can be balanced or unbalanced translocations.

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Examiner Comments

This is an example of the very common type of response that effectively described crossing over rather than translocation.

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Examiner Tip

Make sure you know the difference between translocation and crossing over.

This response gained one of the two available marks.

2 Some genetic disorders result from chromosome mutations.

(a) Translocation is one type of chromosome mutation.

Describe how translocation occurs.

(2)

Due to the random movement of one fragment of a chromatid of a chromosome to another chromosome within the nucleus. Then, random swapping of sections of chromosomes, random swapping of genes. Could be caused by gamma radiation altering activity of restriction enzymes and ligase enzymes in nucleus

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Examiner Comments

Swapping sections of chromosomes between non-homologous pairs is an incomplete answer as it does not make the breaking and rejoining clear, but this response was awarded one of the two marks available.

Question 2 (b)

Less than 50% of candidates gave one of the many appropriate names of chromosome mutation responsible for Down's syndrome with many describing, rather than naming, mutations and many describing gene mutations rather than chromosome mutations.

This response gained no marks.

(b) Name the type of chromosome mutation that results in Down's syndrome.

(1)

Replication.

ResultsPlus
Examiner Comments
This is an example of a common incorrect response.

This response gained no marks.

(b) Name the type of chromosome mutation that results in Down's syndrome.

(1)

Deletion

ResultsPlus
Examiner Comments
This is an example of a common error naming an example of a gene mutation rather than the type of chromosome mutation that results in Down's syndrome.

This response gained the mark.

(b) Name the type of chromosome mutation that results in Down's syndrome.

(1)

Non- disjunction.

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Examiner Comments

This is an example of the most common correct answer given.

Question 2 (c)

Many candidates failed to spot the trisomy of chromosome 13 and so failed to score any marks at all. Many candidates did recognise that there was an extra chromosome on the 13th pair.However, many did not know what this was called (polysomy / trisomy).Of the candidates that recognised that this was trisomy, a large number assumed this trisomy was Down's Syndrome, even though the trisomy was not at chromosome 21. A significant number of candidates incorrectly thought that there was only one X chromosome and so thought the person had Turner's Syndrome.

Candidates should practice looking at karyotypes and should become familiar with how real chromosomes look and how they differ from drawings and other diagrammatic representations. Candidates seemed confused because they expected each X chromosome to look like an X, not realising that real chromosomes in karyotypes often just look like a single line.

A significant number of candidates did not spot the extra chromosome and concluded that this was a healthy female karyotype, with an emphasis on this being female, despite being told this in the question stem.

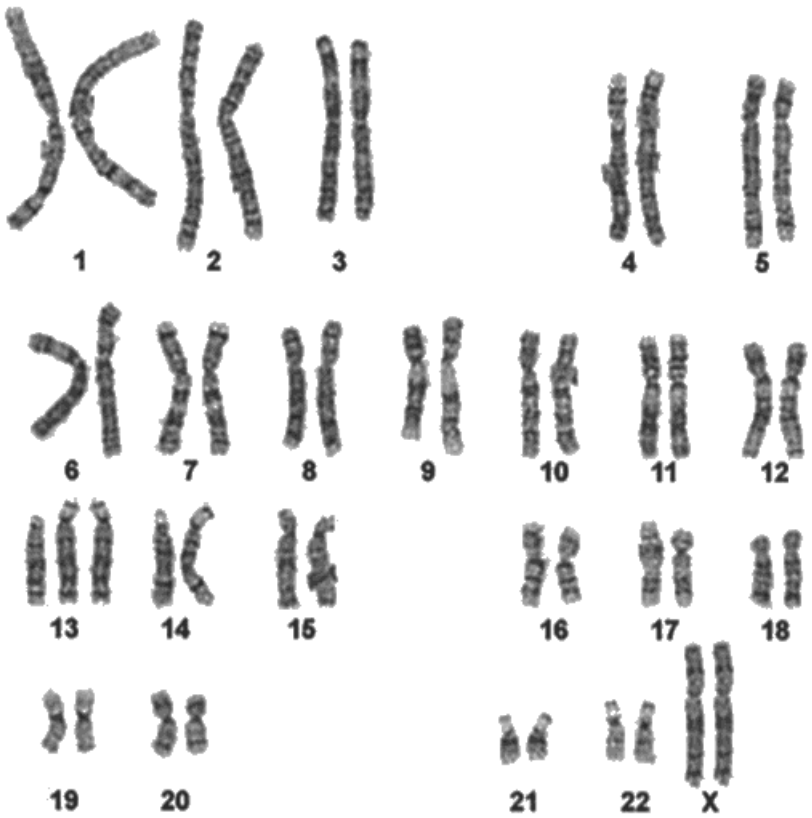
Some candidates thought that there were only 22 pairs of chromosomes and that there should be 23 possibly because the X chromosomes were labelled as X and not 23.

The following response gained both available marks.

(c) Genetic disorders can be diagnosed by looking at an individual's karyotype.

A karyotype shows the number of each type of chromosome present in a cell.

The diagram shows the karyotype of the cells taken from a female embryo.



Explain what conclusion can be made about this female embryo.

(2)

This female embryo has aneuploidy as it has a trisomy of chromosome 13. This means that the individual, if born, may suffer from a genetic disorder

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Examiner Comments

Credit was given for recognising that this karyotype has aneuploidy because there was an extra chromosome 13 (trisomy).

This response gained one of the two available marks.

(c) Genetic disorders can be diagnosed by looking at an individual's karyotype.

A karyotype shows the number of each type of chromosome present in a cell.

The diagram shows the karyotype of the cells taken from a female embryo.

Explain what conclusion can be made about this female embryo.

(2)

The female embryo has 23 pairs of chromosomes and has a genetic disorder where non-disjunction has random assortment does not split the chromatids apart successfully. It is not a healthy female embryo as in 13, there are three chromosomes (non-disjunction). It has Down's syndrome.

ResultsPlus
Examiner Comments

This response gained credit for recognising the extra chromosome 13, but they incorrectly concluded that this meant that the embryo would have Down's syndrome.

This response gained no marks.

(c) Genetic disorders can be diagnosed by looking at an individual's karyotype.

A karyotype shows the number of each type of chromosome present in a cell.

The diagram shows the karyotype of the cells taken from a female embryo.

Explain what conclusion can be made about this female embryo.

(2)

That the baby will be a girl as x x ~~means~~ codes for a girl and y x or x y codes for a guy.

ResultsPlus
Examiner Comments

This is an example of the responses that correctly identified that the embryo would be a girl. Unfortunately this is not worth any credit as the question states that it is a female embryo.

ResultsPlus
Examiner Tip

Read the question carefully and avoid restating information already given in the question as your answer.

This response gained no marks.

(c) Genetic disorders can be diagnosed by looking at an individual's karyotype.

A karyotype shows the number of each type of chromosome present in a cell.

The diagram shows the karyotype of the cells taken from a female embryo.

Explain what conclusion can be made about this female embryo.

(2)

The female embryo contains an extra chromosome X which results in the child having a genetic disorder.

ResultsPlus

Examiner Comments

This is an example of the responses that considered that any embryo with two X chromosomes is a mutant.

Question 3 (a) and (b) (i)

(a) Most candidates confused mitosis and meiosis and therefore thought that two or three of the statements were correct.

(b) (i) Many candidates demonstrated that they understood the need for a stain but ignored the context of the question explaining that stains were needed to see cells or organelles and not the chromosomes that would be needed to see mitosis.

Very few candidates went onto explain why the stain would be appropriate i.e. that it would need to be absorbed specifically by the chromosomes/DNA/etc.

This response gained both available marks.

The student was disappointed with the slide that had been prepared because the nuclei were poorly stained and no stages of mitosis could be seen.

(i) Explain why the student had to make sure that an appropriate stain was used.

(2)

So that the stain could bind to the chromosomes and when examined under the microscope the chromosomes would be visible so that the stages of mitosis could be seen

ResultsPlus
Examiner Comments

Credit was given for the stain binding to the chromosomes and for making them visible.

This response gained one of the two marks available.

The student was disappointed with the slide that had been prepared because the nuclei were poorly stained and no stages of mitosis could be seen.

(i) Explain why the student had to make sure that an appropriate stain was used.

(2)

If an appropriate stain is not used the chromosomes will not be visible when observed under the microscope so the results will be invalid.

ResultsPlus
Examiner Comments

Credit was gained for recognising that the chromosomes would need to be made visible, but did not go on to explain how they would be made visible.

ResultsPlus
Examiner Tip

Aim to include a 'because....' response in an 'explain' question.

This response gained no marks.

The student was disappointed with the slide that had been prepared because the nuclei were poorly stained and no stages of mitosis could be seen.

(i) Explain why the student had to make sure that an appropriate stain was used.

(2)

Beccuse of gram positive and gram negative, therefore effecting the result of the stain

ResultsPlus
Examiner Comments

This is an example of a response where the candidate has confused the context of the question.

This response did not gain any marks.

The student was disappointed with the slide that had been prepared because the nuclei were poorly stained and no stages of mitosis could be seen.

(i) Explain why the student had to make sure that an appropriate stain was used.

(2)

the student had to use an appropriate stain to make sure that the root tips could be seen under the microscope.

ResultsPlus
Examiner Comments

This is an example of a response that lacked specific enough information for credit.

ResultsPlus
Examiner Tip

Make sure you address the specific context of the question asked.

Question 3 (b) (ii)

Although many candidates clearly had some concept of the method for this core practical the level of understanding/recall was often disappointing. Many candidates suggested slicing the root tip 'more thinly' and 'one cell thick'. Obviously, it is not practical to cut things one cell thick in a high school science lab.Also, the reason it is called a root tip Squash is because the squashing of the cells helps to make the sample one cell thick. This point was often missed with many concentrating on describing how to avoid air bubbles.

Heating the acid/stain was the most commonly awarded mark point. Although many candidates had the idea that the cells need to still be living and dividing whilst being observed in order to see mitosis happening so were concerned about the time the cells were in the stain or avoided using acid to prevent killing the cells.

A significant number of candidates suggested using an electron microscope.

Although this would make the chromosomes easier to see, it is highly impractical to use such a device in a normal school lab setting as they are very expensive.Furthermore, it is unnecessary as the stages of mitosis can be seen very well using a normal light microscope, as long as the proper preparation procedure has taken place.This was concerning as all candidates should have done this practical as it is a core practical, so candidates should have known that an electron microscope was not necessary to see mitosis.

This response gained just one of the four marks available.

(ii) Describe the changes that need to be made to this method to allow stages of mitosis to be seen.

(4)

The specimen must be [illegible] smaller than 20mm. A more reasonable size would be 5mm.

Both the stain and the acid must be added to the specimen – not the specimen to the stain and acid.

[illegible]

The preparation should be observed immediately, not after 10 minutes.

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Examiner Comments

Credit was given here for using a smaller specimen - implying a shorter root tip as the original size was stated.

This response gained two of the four marks available.

(ii) Describe the changes that need to be made to this method to allow stages of mitosis to be seen.

(4)

the cell.

when the dilute acid is added to the root tip, it should have been left in a 55°C water bath for 5 minutes to separate and break down the calcium pectate in the cell. After this the root tip should have been heated with the acetic orcein stain in the 55°C water bath for 10 minutes to 'freeze' the cells and enhance the stain in order for us to see each stage of mitosis can be seen.

ResultsPlus

Examiner Comments

Credit was given for heating the specimen in the acid and separating the acid and stain steps.

This response gained no marks.

(ii) Describe the changes that need to be made to this method to allow stages of mitosis to be seen.

(4)

An electron Microscope could have been used instead of a Light Microscope as this allows certain cell Sections to be Seen clearly. root tip could be Slightly Longer making it easier for the Stages to be Seen

ResultsPlus
Examiner Comments

This is an example of the responses that suggested making use of an electron microscope instead. Although this would make the chromosomes easier to see, it is highly impractical to use such a device in a normal school lab setting as they are very expensive. Furthermore, it is unnecessary as the stages of mitosis can be seen very well using a normal light microscope, as long as the proper preparation procedure has taken place.

ResultsPlus
Examiner Tip

Make sure you are familiar with the techniques and practicals set out in the AS specification.

This response gained no marks.

(ii) ~~Describe~~ the changes that need to be made to this method to allow stages of mitosis to be seen.

(4)

The coverslip should be put on at an angle to the slide so that the amount of airbubbles is reduced. The coverslip should be pressed ~~on~~ down with something like tweezers to also reduce risks of airbubbles. The root tip should be cut underwater so that no air gets in the root tip.

ResultsPlus

Examiner Comments

This is an example of the many responses that focussed on minimising the number of air bubbles rather than addressing the specific steps of the procedure.

This response gained all four marks available.

(ii) Describe the changes that need to be made to this method to allow stages of mitosis to be seen.

(4)

A smaller length of root tip could be used, between 5 - 10 mm. The root tips needed to be submerged in ~~H~~ hydrochloric acid for 5 minutes at 60°C. Then ~~they~~ the root tip should be washed and placed in acetic an appropriate stain like acetic orcein for 5 minutes at 60°C. Before placing the coverslip on the root tip, ~~shn~~ the root tip should be spread apart using needles (macerated). Then the cover slip should be placed on the root tips. The slide ~~should be blotted wit~~ and root tips should be blotted with tissue paper to prevent articles from forming on the slide.

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Examiner Comments

Credit was gained for:

- using a shorter length of root tip;
- heating in acid (and stain);
- using acid and then the stain;
- macerating the tissue.

Question 4 (a)

It was disappointing that well over 60% of candidates failed to score any marks on this straightforward question.

Most candidates attempted to compare amylose and amylopectin rather than glucose and glycogen therefore comparing the type of glycosidic bond present rather than recognising that glucose is a monosaccharide and has no glycosidic bonds to hydrolyse.

Candidates should therefore be reminded to answer the question in front of them and not one that may have appeared on a past exam paper.

This response gained both available marks.

4 Most human cells use carbohydrate as a source of energy.

(a) Explain why glycogen releases energy more slowly than glucose.

(2)

Glycogen is a polysaccharide, ~~bonds~~ as a result glycosidic bonds need to be broken to convert the glycogen to glucose. Glucose can be used directly in aerobic ~~respiration~~ respiration.

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Examiner Comments

Credit was gained for recognising that glycogen is a polysaccharide and that glycosidic bonds in glycogen would need to be broken (unlike glucose).

This response gained one of the two available marks.

4 Most human cells use carbohydrate as a source of energy.

(a) Explain why glycogen releases energy more slowly than glucose.

(2)

Glycogen is a polysacchanide whereas glucose is a monosacchanide meaning glucose can be broke quickly to release energy whereas glycogen is branched therefore takes longer.

ResultsPlus
Examiner Comments

This response gained credit for recognising that glycogen is a polysaccharide, but did not go on to explain specifically why it will take longer to release the energy.

This response gained no marks.

4 Most human cells use carbohydrate as a source of energy.

(a) Explain why glycogen releases energy more slowly than glucose.

(2)

Glucose has a 1,4 glycosidic bond structure whereas glycogen is branched with 1,4 and 1,6 glycosidic bonds.

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Examiner Comments

This is an example of the many responses that implied that glucose has glycosidic bonds.

ResultsPlus
Examiner Tip

Make sure you are answering the question asked and not a different question asked on a previous exam paper.

This response gained no marks.

4 Most human cells use carbohydrate as a source of energy.

(a) Explain why glycogen releases energy more slowly than glucose.

(2)

starch is made up amylose + amylopectin. Amylose 1-4 unbranched and coiled. Amylopectin 1-4, 1-6 glycosidic bond and branched so can break down quickly releasing glucose whereas glycogen is just 1-4 and 1-6 branched.

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Examiner Comments

This is another example of a common incorrect comparison, which even makes it clear that they are answering a different question to that asked on the paper.

Question 4 (b) (i)

Many candidates described only the triglyceride but didn't make any reference to carbohydrates or proteins, and as a result lost marks.

Many candidates managed to gain credit for reference to the hydrophobic nature of lipids, but many also described phospholipids instead of triglycerides so lost the mark by describing them as both hydrophobic and hydrophilic.

Few candidates explained that water would be repelled or absorbed by the different molecules.

A significant number of candidates considered this to be a question about the formation of the molecules and thought that the formation of lipids generates less water than the formation of carbohydrates which is why less water would be present.

As a result only a third of candidates gained any marks for this question.

This response gained no marks.

(b) When human cells have used up carbohydrate, they will use lipid and then protein as a source of energy.

The table shows the water content and energy content of three food sources.

Food source	Water content / arbitrary units	Energy content in dry matter / kJ g^{-1}	Energy content in wet matter / kJ g^{-1}	Total energy stored / kJ
Carbohydrate	2 to 3	16.8	4.2 to 6.3	3528
Triglyceride	0	37.8	37.8	567 000
Protein	2 to 3	16.8	4.2 to 6.3	100 800

(i) Explain why the water content of triglyceride is different from the water content of carbohydrate and protein.

(3)

- It is polar (hydrophobic head and hydrophilic tail) meaning that it will form a bilayer preventing water to get in the molecules.
- Carbohydrates and protein are soluble so water can dissolve them.

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Examiner Comments

This is an example of the responses that confused triglycerides and phospholipids and therefore thought that it was the bilayer that prevented water being associated with the molecules. Just describing carbohydrates and proteins as being soluble is not clear enough for explaining why they would have water associated with them.

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Examiner Tip

Don't confuse triglycerides with phospholipids.

This response gained all three marks.

(b) When human cells have used up carbohydrate, they will use lipid and then protein as a source of energy.

The table shows the water content and energy content of three food sources.

Food source	Water content / arbitrary units	Energy content in dry matter / kJ g^{-1}	Energy content in wet matter / kJ g^{-1}	Total energy stored / kJ
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Triglyceride	0	37.8	37.8	567 000
Protein	2 to 3	16.8	4.2 to 6.3	100 800

(i) Explain why the water content of triglyceride is different from the water content of carbohydrate and protein.

(3)

Triglyceride is composed of 3 fatty acids & glycogen, the fatty acid component of triglyceride repels water and thus is termed hydrophobic. whereas carbohydrate and protein attract water due to having an hydroxyl group which makes it polar and so can form transient hydrogen bonds with water.

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Examiner Comments

Although this candidate has made a mistake in describing the structure of a triglyceride they have gained credit for recognising that they are hydrophobic and would therefore repel water. They have also explained the difference by explaining why carbohydrates and proteins would be associated with water.

This response gained two of the three marks available.

(b) When human cells have used up carbohydrate, they will use lipid and then protein as a source of energy.

The table shows the water content and energy content of three food sources.

Food source	Water content / arbitrary units	Energy content in dry matter / kJ g^{-1}	Energy content in wet matter / kJ g^{-1}	Total energy stored / kJ
Carbohydrate	2 to 3	16.8	4.2 to 6.3	3528
Triglyceride	0	37.8	37.8	567 000
Protein	2 to 3	16.8	4.2 to 6.3	100 800

(i) Explain why the water content of triglyceride is different from the water content of carbohydrate and protein.

(3)

~~Triglycerides yield more energy than both~~
Triglycerides have low water content as they have hydrophobic properties which are water repellant, and so do not get involved in water based reactions in cells. The fatty acid tails are hydrophobic, so would not be able to contain any water.

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Examiner Comments

Credit was given here for recognising that triglycerides are hydrophobic and would therefore repel water to explain why they have zero water content. However, it does not explain why they are different from the water content of carbohydrates and proteins.

This response gained one of the three marks available.

(b) When human cells have used up carbohydrate, they will use lipid and then protein as a source of energy.

The table shows the water content and energy content of three food sources.

Food source	Water content / arbitrary units	Energy content in dry matter / kJ g^{-1}	Energy content in wet matter / kJ g^{-1}	Total energy stored / kJ
Carbohydrate	2 to 3	16.8	4.2 to 6.3	3528
Triglyceride	0	37.8	37.8	567 000
Protein	2 to 3	16.8	4.2 to 6.3	100 800

(i) Explain why the water content of triglyceride is different from the water content of carbohydrate and protein.

(3)

Triglycerides are hydrophobic, meaning they are (water hating) This is due to their fatty acids, each triglyceride contains three fatty acids. This gives triglycerides a lack in water.

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Examiner Comments

Credit was given for recognising that triglycerides were hydrophobic, but the response does not go on to explain why the water content would be zero and makes no comparison to carbohydrates and proteins to explain why they are different.

This response gained no marks.

(b) When human cells have used up carbohydrate, they will use lipid and then protein as a source of energy.

The table shows the water content and energy content of three food sources.

Food source	Water content / arbitrary units	Energy content in dry matter / kJ g^{-1}	Energy content in wet matter / kJ g^{-1}	Total energy stored / kJ
Carbohydrate	2 to 3	16.8	4.2 to 6.3	3528
Triglyceride	0	37.8	37.8	567 000
Protein	2 to 3	16.8	4.2 to 6.3	100 800

(i) Explain why the water content of triglyceride is different from the water content of carbohydrate and protein.

(3)

for a triglyceride to form, a condensation reaction must occur between the glycerol and 3 fatty acids, releasing three water molecules. When proteins and carbohydrates form they only release one water molecule, when their reactants combine.

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Examiner Comments

This is an example of the responses that explained the difference in water content as being due to how the molecules are formed. As water is formed in all three reactions it does not explain why the triglyceride has no water content, especially as it is clear in the response that more water would be produced.

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Examiner Tip

Make sure you make reference to the data tables provided and not just your own recall of information.

Question 4 (b) (ii)

Very few candidates linked the hydrocarbon structure of triglycerides to its energy storage capacity.

The most common mark was for recognising that triglycerides have no water content, although some said that triglycerides have 'no osmotic effect' due to lack of water and that therefore this meant they had more energy. This is an incorrect conclusion as the two are unrelated in this case.

Many candidates also compared the total energy stored rather than comparing the energy per gram in wet and dry matter as evidence to explain why triglycerides are a good energy store.

This response gained one of the two available marks.

(ii) Using the information in the table, explain why triglycerides are a good energy store.

(2)

energy - store ~~is~~ has a high propotion of H atoms relative to O atoms so yeild more energy than mass of carbohydrates.

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Examiner Comments

Credit was given for recognising that triglycerides have a high proportion of hydrogen relative to oxygen in their structure, but the candidate does not make any use of the information in the table.

ResultsPlus
Examiner Tip

When a question asks you to make use of the information in the table - it would be a good idea to refer to relevant data from the table in your answer.

This response gained no marks.

(ii) Using the information in the table, explain why triglycerides are a good energy store.

(2)

Tryglycerides are a good energy store because from the table, it shows that they have the same energy content of 37.8kJg^{-1} in dry and wet conditions unlike carbohydrates and proteins. Also their total energy store is 567 000 kJ which is higher that the total energy store of ~~neither~~ ~~either~~ both carbohydrates and proteins.

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Examiner Comments

Although this response does make use of the information in the table they have not compared the energy content in wet and dry matter with that in carbohydrates and proteins and the total energy stored does not provide information about why it is a 'good' energy store.

This response gained both available marks.

(ii) Using the information in the table, explain why triglycerides are a good energy store.

(2)

Triglycerides are a good energy store as they are very compact and hydrophobic, this means they contain no water, whereas carbohydrates and proteins contain 2 to 3 arbitrary unit of water. ~~They also~~ Triglycerides also contain more energy per gram with 37.8kJg^{-1} in both dry and wet matter whereas carbohydrates and proteins contain 16.8kJg^{-1} in dry matter and 4.2 to 6.3kJg^{-1} in wet matter.

ResultsPlus
Examiner Comments

Credit was given for recognising that triglycerides have no water and that they have a higher energy content per gram than both proteins and carbohydrates in both wet and dry matter.

Question 4 (b) (iii)

Most candidates found this question difficult and made a variety of guesses about energy storage in different types of foods. However, relatively few noticed that the units were different in this column compared to the other columns and, as such, a direct comparison between columns could not be made.

This response gained no marks.

(iii) Explain why the **'total energy stored'** column in this table is of limited use in drawing conclusions about the energy content of these food sources.

(2)

It only refers to the energy stored in each molecule, whereas these may combine with other substances in different examples of food.

ResultsPlus
Examiner Comments

This is an example of a response that confuses energy stored with food consumed and does not make clear reference to the data provided.

This response gained one of the marks available.

(iii) Explain why the **'total energy stored'** column in this table is of limited use in drawing conclusions about the energy content of these food sources.

(2)

This table is limited in use as it only specifies the energy, not the amount of energy per unit mass or area of the food source, so you do not know which one stores the most energy per unit mass

ResultsPlus
Examiner Comments

This response gained credit for recognising that units for mass were not provided in the total energy column.

This response gained both marks available.

(iii) Explain why the **'total energy stored'** column in this table is of limited use in drawing conclusions about the energy content of these food sources.

(2)

This column of the table is of limited use as we are not told in what volume or mass of the food source this energy is stored in, so we cannot compare between data.

ResultsPlus

Examiner Comments

As well as recognising that the mass is not recorded it goes on to conclude that it means that you can't make a comparison for a full answer to this 'explain why' question.

Question 5 (a)

Most candidates achieved some marks on this question.

However, many lost marks because their answers were not comparative enough, often listing features of prokaryotes and eukaryotes separately without comparing them e.g. prokaryotes have a nucleoid, with no mention of eukaryotes' nucleus.

Many candidates only described differences and no similarities, despite being asked to 'compare and contrast' in the stem of the question.

This response gained just one of the four available marks.

5 Eukaryotic cells and prokaryotic cells have similarities and differences in their ultrastructure.

(a) Compare and contrast the ultrastructures of eukaryotic cells and prokaryotic cells.

(4)

Eukaryotic Cells contain membrane bound nuclei (they have a nucleus) which not only stores the genetic information in the cell, controls what happens in the cell acting as a command and control center but also allows for transcription and translation which means more efficient protein synthesis. On the other hand prokaryotes lack a membrane The nucleus also stores genetic information for the eukaryotic cells with instructions on the function and type of cell the cell is and is part of it's offspring's too. On the other hand prokaryotic cells lack a membrane bound nucleus, instead their DNA is kept as a floating strand in it's structure, vulnerable to attack by hostile pathogens. Prokaryotes are also thought to be older than eukaryotes as they'd not need to evolve a membrane bound nucleus.

ResultsPlus
Examiner Comments

Only the comparison of the nucleus was covered in this response.

ResultsPlus
Examiner Tip

When a question asks you to compare and contrast and has four marks associated with it you should aim to make four clear points for the marks and not just one lengthy point.

This response gained all four marks available.

5 Eukaryotic cells and prokaryotic cells have similarities and differences in their ultrastructure.

(a) Compare and contrast the ultrastructures of eukaryotic cells and prokaryotic cells.

(4)

Whilst the DNA in eukaryotic cells is found in the nucleaus (most densely found alongside proteins in the nucleolus), in prokaryotic cells genetic information floats freely in the cytoplasm, and the area in which it is found is called the nucleoid, because in prokaryotic cells there is no nucleus. Moreover, eukaryotic cells contain membrane-bound organelles, such as the mitochondria (which is surrounded by a double membrane) whereas prokaryotic cells contain no membrane-bound organelles. There are some similarities, such as that both contain ribosomes, but in prokaryotic cells there are 70s ribosomes, whilst in eukaryotic cells there are 80s ribosomes. Whilst all prokaryotic cells contain a cell wall (made of peptidoglycan), not all eukaryotes do, as cell walls are found in plants (made from cellulose) but not in animal cells.

ResultsPlus
Examiner Comments

Credit was given for comparing:

- nucleus
- membrane bound organelles
- size of ribosomes
- (also cell wall structure, but max 3 differences)

The 4th mark was given for recognising that they both contain ribosomes.

This response gained no marks.

5 Eukaryotic cells and prokaryotic cells have similarities and differences in their ultrastructure.

(a) Compare and contrast the ultrastructures of eukaryotic cells and prokaryotic cells.

(4)

Eukaryotic cells have cell walls made of cellulose if its a plant cell ~~and peptidoglycan~~ and peptidoglycan if it is an animal cell. However, prokaryotic cells have a cell membrane and instead a slime capsule which prevents cell recognition for viruses* and bacteria. The slime capsule layer is impermeable whereas eukaryotic cells have permeable cell walls as it allows the transportation of some substances in and out of the cell.

ResultsPlus

Examiner Comments

This is an example of a response where although the candidate recalled some relevant information the comparisons made were wrong and the focus of the answer is only on the outside of the cell and not the contents.

This response gained just one of the four marks available.

5 Eukaryotic cells and prokaryotic cells have similarities and differences in their ultrastructure.

(a) Compare and contrast the ultrastructures of eukaryotic cells and prokaryotic cells.

(4)

Eg Both cell contain a ~~cell surface membrane~~

Eukaryotes have DNA and a nucleus but Prokaryotes have nucleoids and no nucleus.

Prokaryotes are uni-cellular where as Prokaryotes are multi-cellular

Prokaryotes often have flagellum where as Eukaryotes do not.

Eukaryotes and Prokaryotes both have genetic material which is used for replication.

They also both contain mitochondria.

ResultsPlus

Examiner Comments

Credit was given for comparing the presence and absence of a nucleus.

Question 5 (b) (i)

Many candidates did well on this question, particularly with their descriptions of nucleotides. However, some confused the structure of DNA with a protein and referred to 'polypeptides' and 'amino acids' which are not part of DNA.

This response gained just one mark.

(b) Some antibiotics inhibit RNA synthesis and protein synthesis in cells.

Actinomycin D, Rifamycin and α-Amanitin are antibiotics that work by binding to molecules in a cell. This inhibits protein synthesis.

The scientists who developed these antibiotics had to find out which types of cell were affected and which molecule they were binding to.

The table shows the types of cell that these antibiotics affect and the molecule that they bind to.

Antibiotic	Type of cell affected	Molecule that the antibiotic binds to
Actinomycin D	Prokaryotic and eukaryotic	DNA
Rifamycin	Prokaryotic only	RNA polymerase
α-Amanitin	Eukaryotic only	RNA polymerase

(i) Describe the structure of a DNA molecule.

(3)

A DNA molecule consists of a phosphate, a pentose sugar which is deoxiribose and an organic nitrogenous base.

ResultsPlus
Examiner Comments

This is an example of the many responses seen that just described a single nucleotide rather than the whole DNA molecule so gained just one mark.

ResultsPlus
Examiner Tip

Remember that a DNA molecule is a polymer and not just a mononucleotide.

This response gained no marks.

(b) Some antibiotics inhibit RNA synthesis and protein synthesis in cells.

Actinomycin D, Rifamycin and α-Amanitin are antibiotics that work by binding to molecules in a cell. This inhibits protein synthesis.

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Rifamycin	Prokaryotic only	RNA polymerase
α-Amanitin	Eukaryotic only	RNA polymerase

(i) Describe the structure of a DNA molecule.

(3)

A DNA molecule can be Eukaryotic or prokaryotic. to contains mitochondria or chloroplast for aerobic respiration. DNA molecules must contain DNA helicase, polymerase and ligase for DNA replication. Ribosomes must also be in DNA molecules to transcribe the messenger RNA strand to amino acids. DNA molecules must use RNA polymerase to form mRNA strands with uracil instead of thymine.

ResultsPlus

Examiner Comments

This response is an example of the many seen that were clearly confused about what the question asked and what a DNA molecule is.

This response gained no marks.

(b) Some antibiotics inhibit RNA synthesis and protein synthesis in cells.

Actinomycin D, Rifamycin and α-Amanitin are antibiotics that work by binding to molecules in a cell. This inhibits protein synthesis.

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α-Amanitin	Eukaryotic only	RNA polymerase

(i) Describe the structure of a DNA molecule.

(3)

The DNA molecule includes the genetic material for the cell in which it resides

ResultsPlus
Examiner Comments

No specific attempt has been made to describe DNA structure.

ResultsPlus
Examiner Tip

Make sure you learn the structure of the important biological molecules in the specification and when asked to describe the structure, be specific and don't stray into its function only.

This response gained all three marks available.

(b) Some antibiotics inhibit RNA synthesis and protein synthesis in cells.

Actinomycin D, Rifamycin and α-Amanitin are antibiotics that work by binding to molecules in a cell. This inhibits protein synthesis.

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Actinomycin D	Prokaryotic and eukaryotic	DNA
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α-Amanitin	Eukaryotic only	RNA polymerase

(i) Describe the structure of a DNA molecule.

(3)

A DNA molecule consists of a two strands of polynucleotide joined together by complementary base pairs ~~BETS~~ by hydrogen bonds.* The DNA ~~is~~ ~~a~~ has a double helix structure.
The mononucleotide of a DNA molecule consists of ~~a~~ deoxyribose (pentose sugar), a phosphate group and a nitrogenous base. These mono nucleotides are joined together in a condensation reaction to form phosphodiester bonds to produce a sugar-phosphate back bone.
* There is complementary base pairing between cytosine and guanine (3 hydrogen bonds) and adenine and thymine (2 hydrogen bonds)

ResultsPlus
Examiner Comments

Credit was given for:
- two polynucleotide strands forming a double helix
- mononucleotides with their structure described
- phosphodiester bonds between the sugars and phosphates
- hydrogen bonds between the complementary pairs.

For a maximum of three marks.

Question 5 (b) (ii)

Many candidates found this question difficult and incorrectly started to describe DNA replication even though the stem of the question clearly stated 'protein synthesis'. Although candidates did tend to recognise that mRNA synthesis would be inhibited and some recognised that the DNA strands would not be able to separate.

No candidate attempted to explain why both prokaryotic and eukaryotic cells would be affected by Actinomycin D.

This response gained two of the three marks available.

(ii) Explain the effect of Actinomycin D on protein synthesis.

(3)

Actinomycin D appects DNA in bothe prokaryotic and eukaryotic cells. Because it binds to DNA, the process of protein synthesis is restricted. DNA cannot be unwinded and unzipped, and so mRNA cannot be made. This means that Actinomycin D stops the or slows down the process of protein synthesis.

ResultsPlus
Examiner Comments

This is a clear explanation about why Actinomycin D would slow protein synthesis - by preventing DNA strands separating and therefore preventing the synthesis of mRNA. However, it did not attempt to explain the second column of the table as to why it affected both prokaryotic and eukaryotic cells.

ResultsPlus
Examiner Tip

Examine all data provided in tables carefully - it is included for a reason.

This response gained no marks.

(ii) Explain the effect of Actinomycin D on protein synthesis.

(3)

It would prevent the DNA in the cell from replicating, and as a result there would be no new DNA produced and so the cell could not replicate to produce a new cell when it dies, and so would prevent the spread of the disease.

ResultsPlus
Examiner Comments

This is an example of the many responses that focussed on the effect on replication rather than protein synthesis and therefore gained no marks.

ResultsPlus
Examiner Tip

Read the question carefully.

This response gained no marks.

(ii) Explain the effect of Actinomycin D on protein synthesis.

(3)

Actinomycin D affects both Prokaryotic and eukaryotic cells, however it binds to the DNA molecule, which does not have an effect on protein synthesis

ResultsPlus
Examiner Comments

Several candidates, like this one, thought that it would have no effect as they thought that DNA is not involved in protein synthesis.

ResultsPlus
Examiner Tip

Remember that protein synthesis involves both transcription and translation.

Question 5 (b) (iii)

Most candidates recognised that this would have a negative effect on protein synthesis.

However, many thought that RNA polymerase being inhibited would stop translation and spent a long time explaining this rather than recognising the role of RNA polymerase in transcription.

Some candidates lost marks because they described what happens in normal circumstances (function of RNA polymerase described), but then failed to say what would happen if RNA polymerase was inhibited.

No candidates attempted to explain why the different antibiotics affected different cell types.

This response gained two of the three marks available.

(iii) Explain the effect of Rifamycin and α-Amanitin on protein synthesis.

(3)

- Rifamycin inhibits RNA polymerase in prokaryotes.
- Preventing the RNA polymerase from synthesing mRNA.
- RNA polymerase lines up the nucleotides alongside their complementary bases on template strand.
- It can't do that now.
- It inhibits it making it stop working properly.
- α - Amanitin inhibits RNA polymerase in eukaryotes only and so prevents protein synthesis it prevents mRNA copy from being made. So no proteins will be synthesised.

ResultsPlus
Examiner Comments

Credit was given for recognising that RNA polymerase would be inhibited and that this would prevent mRNA formation. The candidate recognises from the table that the different antibiotics effect different cell types, but does not go on to attempt to explain why.

This response gained one of the available marks.

(iii) Explain the effect of Rifamycin and α-Amanitin on protein synthesis.

(3)

Rifamycin and α-Amanitin work as non-competitive inhibitors which attach to the RNA polymerase, causing the shape of the active site to change so it can not catalyse the reaction

ResultsPlus
Examiner Comments

This response gained credit for inhibiting the RNA polymerase but did not go on to explain what the effect of that inhibition would be on protein synthesis or why the different antibiotics work on different cell types.

This response gained no marks.

(iii) Explain the effect of Rifamycin and α-Amanitin on protein synthesis.

(3)

It would prevent the enzyme that catalyses the attachment of amino acids together once they had been read by the ribosome and tRNA had brought complementary codons. This would prevent the joining of amino acids to create a chain that would be folded into a protein, preventing formation at a much later stage.

ResultsPlus
Examiner Comments

This is an example of the many responses that described RNA polymerase as having a role in translation rather than transcription.

This response gained no marks.

(iii) Explain the effect of Rifamycin and α-Amanitin on protein synthesis.

(3)

Rifamycin affects the RNA polymerase in prokaryotic cells. whereas α-Amanitin affects RNA polymerase in ~~the~~ eukaryotic cells. Both would prevent protein ~~synthesis~~ synthesis as the RNA would be unable to translate base from the DNA molecule.

ResultsPlus

Examiner Comments

This is an example of a response that lacked clarity on how protein synthesis would be prevented.

Question 6 (a) and (b) (i)

(a) Only approximately a third of candidates successfully identified which pair of viruses had an envelope, with only just over 20% recognising which viruses had a helical capsid.

(b) (i) This was well answered by the majority of candidates with most scoring 2 or 3 marks with some excellent detailed descriptions seen. Some candidates described the lysogenic cycle instead, with some suggesting that the virus DNA was only copied when the host cell went through mitosis.

This response gained all three marks.

(b) When a bacterial cell is infected with λ (lambda) phage, the virus will enter the lytic cycle.

(i) Describe the lytic cycle of a virus.

(3)

* The phage attaches to the host bacterial cell.
* The bacteriophage then injects it's generic material into the host cell.
* The generic material takes over the host cell machinery.
* The generic material replicates with the host DNA.
* The capsid is formed by the ribosomes in the RER and golgi.
* The viral parts assemble to form the viruses.
* The viruses leave the cell as the cell lyses.

ResultsPlus

Examiner Comments

This is an example of the many clear descriptions of the lytic cycle seen that gained all marks possible.

This response gained just one of the three marks available.

(b) When a bacterial cell is infected with λ (lambda) phage, the virus will enter the lytic cycle.

(i) Describe the lytic cycle of a virus.

(3)

A In the lytic cycle of a virus, the ~~th~~ virus implants its DNA into ~~the~~ a bacterial cell. Then as the bacterial cell divides by mitosis, the DNA of the virus is ~~th~~ replicated to spread the virus.

ResultsPlus

Examiner Comments

Credit was given for recognising that the viral genetic material goes into the host cell. However, in the lytic cycle the DNA is not only replicated when the host cell undergoes mitosis in the lytic cycle.

Question 6 (b) (ii)

Most candidates seemed to be confused by this question and were not able to manipulate the data to get the correct answer. There were many blank responses showing no attempt made at all.

Most candidates did not use all the data given to them in the stem of the question. Some just attempted a simple calculation for MOI using the concentrations given ignoring the scientists desire to use a MOI of 0.5.

Many candidates struggled to manipulate values with powers of 10 and therefore made mistakes in their calculations.

Candidates should be reminded that they are expected to be able to use higher level GCSE mathematics skills in their AS Biology and that many calculations required will be multi step calculations.

This response gained all three marks available.

(ii) The multiplicity of infection (MOI) is one factor that determines whether a virus enters the lytic cycle or latency.

$$\text{MOI} = \frac{\text{number of infectious virus particles}}{\text{number of target cells present}}$$

A scientist needed to use a MOI of 0.5 for an investigation.

The virus particles were at a concentration of $2 \times 10^9\,\text{cm}^{-3}$ and the bacteria were at a concentration of $8 \times 10^8\,\text{cm}^{-3}$.

Calculate the volume of virus particles that should be added to $0.25\,\text{cm}^3$ of bacteria.

(3)

$0.5 = \frac{(2\times10^9) \times x\ \text{cm}^3}{(8\times10^8) \times (0.25)}$

$0.5 = \frac{(2\times10^9) \times x\ \text{cm}^3}{200000000}$

$160000000 = (2\times10^9) \times x\ \text{cm}^3$

$x = 0.05\,\text{cm}^3$

Answer 0.05 cm^3

ResultsPlus

Examiner Comments

This is an example of one of the common methods used to calculate the correct volume needed.

This response gained one of the three marks available.

(ii) The multiplicity of infection (MOI) is one factor that determines whether a virus enters the lytic cycle or latency.

$$\text{MOI} = \frac{\text{number of infectious virus particles}}{\text{number of target cells present}}$$

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Calculate the volume of virus particles that should be added to $0.25\,\text{cm}^3$ of bacteria.

(3)

$$\text{MOI} = \frac{2 \times 10^9\,\text{cm}^{-3}}{8 \times 10^8\,\text{cm}^{-3}}$$

$$2.5 = \frac{2 \times 10^9\,\text{cm}^{-3}}{8 \times 10^8\,\text{cm}^{-3}}$$

$$\div 5 \qquad 0.5 = \frac{2 \times 10^9\,\text{cm}^{-3}}{5} \div \frac{8 \times 10^8\,\text{cm}^{-3}}{5}$$

Answer ..... cm^3

ResultsPlus

Examiner Comments

This is an example of the responses that gained a mark for calculating the MOI by using equal volumes of the concentrations given, but then failed to calculate the volume of virus that would be needed to be added to the 0.25cm^3 of bacteria.

This response gained no marks.

(ii) The multiplicity of infection (MOI) is one factor that determines whether a virus enters the lytic cycle or latency.

$$\text{MOI} = \frac{\text{number of infectious virus particles}}{\text{number of target cells present}}$$

A scientist needed to use a MOI of 0.5 for an investigation.

The virus particles were at a concentration of $2 \times 10^9\,\text{cm}^{-3}$ and the bacteria were at a concentration of $8 \times 10^8\,\text{cm}^{-3}$.

Calculate the volume of virus particles that should be added to $0.25\,\text{cm}^3$ of bacteria.

(3)

$0.5 = \frac{2 \times 10^9\,\text{cm}^{-3}}{8 \times 10^8\,\text{cm}^{-3}}$

$= \frac{}{0.25\,\text{cm}^3}$

Answer ..... cm^3

ResultsPlus
Examiner Comments

This is an example of the many responses that set out some of the values but failed to apply the information provided so made no relevant calculations.

ResultsPlus
Examiner Tip

Read all the information provided in a question carefully and when setting out figures check that they make sense.

Question 7 (a) (i)

Many candidates struggled with the specific context of this question. Many just wrote general answers about the secondary and tertiary structures of proteins. Many did not link the triple helix structure with the fact that it had repeating patterns.Although some did recognise that bonds would be needed to hold the polypeptide chains together (although a few specified that these would be peptide bonds).

Very few candidates made any mention of R-groups, which are responsible for all the folding of the protein.

This response gained no marks.

(i) Explain the significance of repeating sequences of amino acids in the formation of tropocollagen.

(2)

It provides for a secondary structure of the 3 polypeptide chains

ResultsPlus

Examiner Comments

This is typical of the many responses that made reference to secondary or tertiary structure in general terms, without attempting to explain the significance of the repeating sequence specifically in the bonding of the chains together.

This response gained one of the two available marks.

(i) Explain the significance of repeating sequences of amino acids in the formation of tropocollagen.

(2)

Repeating sequences of amino acids enable the polypeptide chains to form regular hydrogen bond cross linkages, which allow the three α-helix polypeptide chains to form a triple helix tropocollagen.

ResultsPlus
Examiner Comments

This response recognises that the repeating pattern enables bonding to take place between the chains, but does not describe what may be significant about the amino acids involved to enable this to happen.

This response gained both marks.

(i) Explain the significance of repeating sequences of amino acids in the formation of tropocollagen.

(2)

Every third amino acid is the ~~the~~ small acid glycine which can fit on the inside of the triple helix, forming very tight hydrogen bonds. On either side of glycine is always proline and hydroxyproline, which both have large R groups which stay out of each others way mantaining the strong, insoluble fibrous structure.

ResultsPlus
Examiner Comments

This is an example of the few responses that mentioned glycine and why it was significant in the repeating sequence for bonding of the chains together.

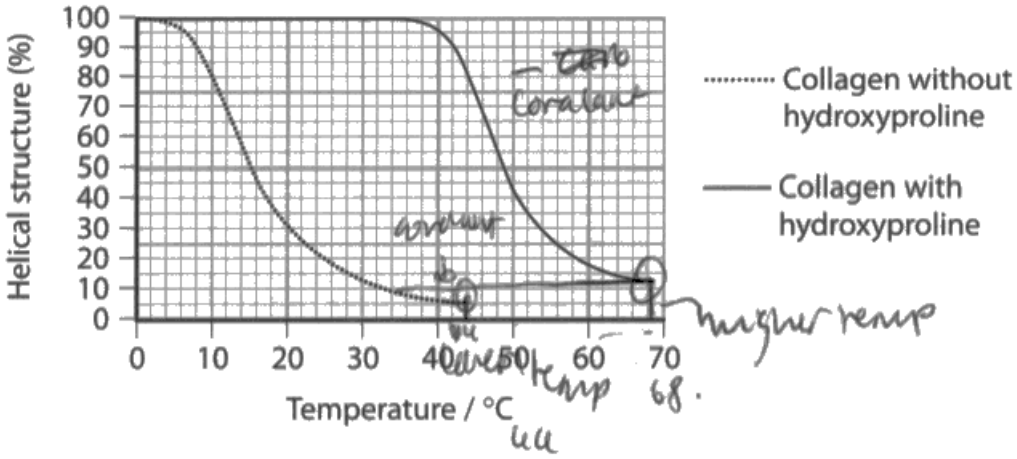
Question 7 (b) (i)

Most candidates achieved one mark on this question for describing the effect of hydroxyproline on the pattern of data in the graph. However, most candidates missed the second mark as they did not follow through with their explanation and do what the question asked them to. Most candidates simply stated the trend, but did not explain why hydroxyproline was important.

This response gained both marks.

(b) Hydroxyproline and proline are components of collagen.

The graph shows the effect of temperature on the helical structure of collagen with hydroxyproline and collagen without hydroxyproline.



(i) Analyse the data to explain the importance of hydroxyproline in the structure of collagen.

(2)

Without hydroxyprolyine the collagen the helical structure breaks down to 5%. ~~of~~ ~~the~~ at by 44°C with hydroxy proline there is a ~~better~~ curve to ~~more structured original~~ lower decline, as by 68% the helical structure is still at around 15%. This means that the hydroxyproline is likely important as it helps for hydrogen bonds to form between the R/side chains, therefore more energy is needed in order to break these and meaning its important as it helps the helix retain its shape at higher temperatures.

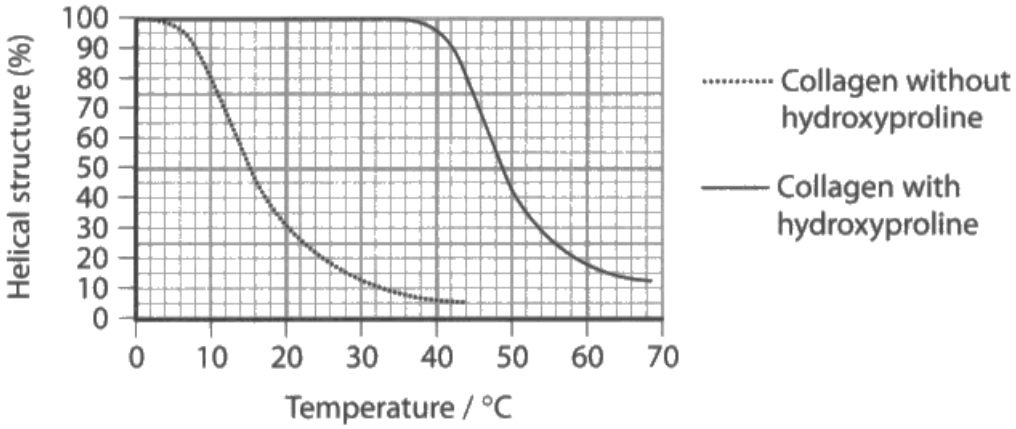
ResultsPlus
Examiner Comments

As well as clearly describing the effect of hydroxyproline using data from the graph the role of hydroxyproline in maintaining the helical structure is explained.

This response gained no marks.

(b) Hydroxyproline and proline are components of collagen.

The graph shows the effect of temperature on the helical structure of collagen with hydroxyproline and collagen without hydroxyproline.



(i) Analyse the data to explain the importance of hydroxyproline in the structure of collagen.

(2)

collagens with hydroxyproline can exist in higher temp. than those without hydroxyproline

ResultsPlus
Examiner Comments

This is a typical example of responses that did not use the data from the graph clearly in their explanations or attempt to explain the role of hydroxyproline.

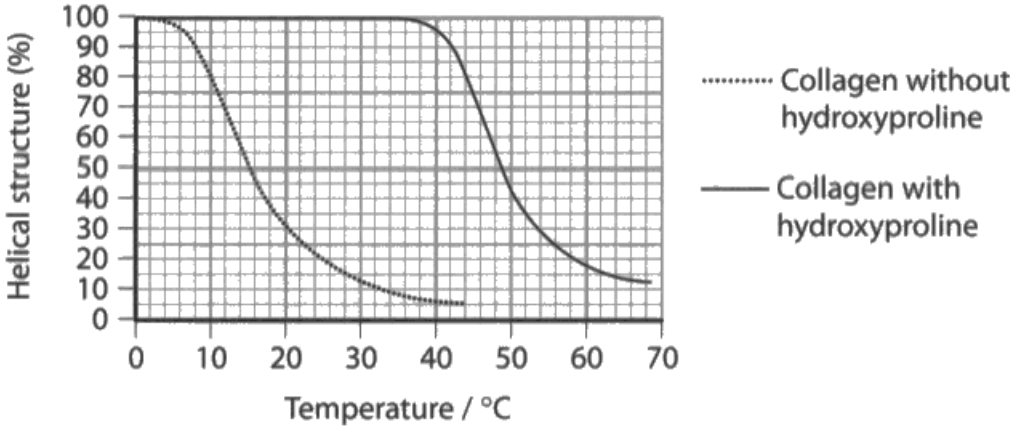
ResultsPlus
Examiner Tip

When provided with data in a graph, use it carefully and check what the axes are labelled.

This response gained no marks.

(b) Hydroxyproline and proline are components of collagen.

The graph shows the effect of temperature on the helical structure of collagen with hydroxyproline and collagen without hydroxyproline.



(i) Analyse the data to explain the importance of hydroxyproline in the structure of collagen.

(2)

- collagen ~~contains~~ consists off hydrogen bonds ~~which~~
- collagen contain covalent cross links which gives the structure strength and the high tensile strength also ~~gives~~ keeps it strong.
- collagen consits of 3 polypeptide chains wound around each other to form a triple helix.
- As the temperature increase collagen with and without hydroxyproline also increases.

ResultsPlus
Examiner Comments

This is an example of a response that essentially ignored the data provided and the question asked and just attempted to describe the structure of collagen.

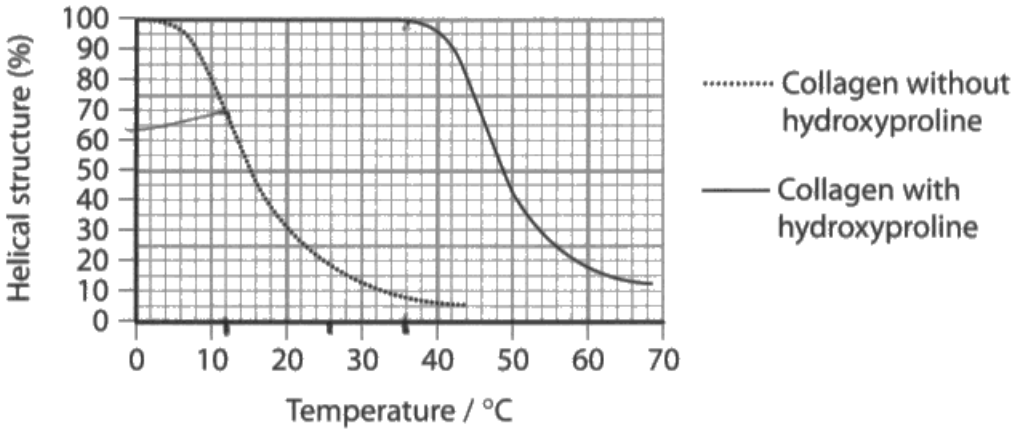
ResultsPlus
Examiner Tip

Read the question carefully and the data provided.

This response gained one mark.

(b) Hydroxyproline and proline are components of collagen.

The graph shows the effect of temperature on the helical structure of collagen with hydroxyproline and collagen without hydroxyproline.



(i) Analyse the data to explain the importance of hydroxyproline in the structure of collagen.

(2)

Collagen with hydroxy proline, begins to loses it's helical structure at 36°C, whereas ~~(hyd)~~ collagen without hydroxyproline begins to lose it's helical structure at 0°C. Collagen is used in bone and cartilage to provide strength and elasticity (due to the triple helix structure) and if the temperature of the body is around 37°C, collagen without hydroxyproline would be less than 10% helical structure.

ResultsPlus
Examiner Comments

This is an example of the responses that used the data to describe the effect of the presence of hydroxyproline, but did not go on to attempt to explain the effect hydroxyproline had on the helical structure.

Question 7 (b) (ii)

Most candidates attempted to interpret data in the table and made reasonable attempts, particularly recognising the correlation with body temperature. However, many decided that because calves have the highest body temperature their collagen would be least stable ignoring that they have a higher proportion of proline and hydroxyproline in their skin.

Few candidates referred back to the graph to calculate shrinkage temperatures and use that in their responses. Some who did refer back to the graph assumed that the cod would follow the graph with no hydroxyproline ignoring the 15.5% in the table.

Candidates should ensure they use clear language when they are analysing data. Avoid using phrases like 'quite high' or 'fairly stable' as they are not clearly comparative.

Candidates should use all the information provided in the question, particularly when directed to use *'the data in the graph and the table.'*

This response gained one of the four marks available.

(ii) The table shows information about the skin collagen of three animals and the body temperature of each animal.

Animal	Percentage of proline and hydroxyproline in skin collagen (%)	Body temperature / °C
Calf	23.2	37
Shark	19.1	24 to 28
Cod	15.5	10 to 14

The thermal stability of collagen is described by its shrinkage temperature (T_s). This is the temperature at which 50% of the helical structure is lost.

Analyse the data in the graph and the table to comment on the stability of collagen in these animals.

(4)

Percentage of proline and hydroxyproline in skin collagen decrease when body temperature decrease.

→ calf have highest % of proline and hydroxyproline with highest body temperature in all 3 animal

There is a difference of 4.1% of proline & hydroxyproline between cat & shark.

→ stability of collagen increase when temperature increase.

ResultsPlus

Examiner Comments

Credit was given for recognising the trend between % of proline and hydroxyproline with body temperature, but no further relevant analysis of the data related to stability of collagen was provided.

This response gained all four marks available.

(ii) The table shows information about the skin collagen of three animals and the body temperature of each animal.

Animal	Percentage of proline and hydroxyproline in skin collagen (%)	Body temperature / °C
Calf	23.2	37
Shark	19.1	24 to 28
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The thermal stability of collagen is described by its shrinkage temperature (T_s). This is the temperature at which 50% of the helical structure is lost.

Analyse the data in the graph and the table to comment on the stability of collagen in these animals.

(4)

According to the graph, the shrinkage temperature (T_s) of the collagen with hydroxyproline is 49°C and without hydroxyproline it is 15°C. This supports the hypothesis that collagen with hydroxyproline is more thermally stable than collagen without. In the table, the calf has the highest body temperature, and the highest percentage of proline and hydroxyproline, so its collagen is the most thermally stable - it loses the least body heat. The shark and the cod have lower percentages of ~~the~~ proline and hydroxyproline, and have body temperatures of 24-28°C and 10-14°C respectively, so their collagen is less thermally stable than the calf. The calf ~~is~~ has approximately 1.5 times the % of proline and hydroxyproline in its collagen as the cod, but the body temperature drops by between 2.6 times and 3.7 times, which suggests that there is a very strong positive correlation between ~~stable~~ the percentage of proline and hydroxyproline, and the thermal stability of the collagen.

(Total for Question 7 = 9 marks)

ResultsPlus
Examiner Comments

Credit was given here for:

- using the first graph to calculate the shrinkage temperatures of collagen
- identifying the correlation between body temperature and % of proline and hydroxyproline
- identifying that the shark would have the most stable collagen because it has the highest %
- making it clear that the presence of hydroxyproline increases the thermal stability of the collagen.

This response gained three of the marks available.

(ii) The table shows information about the skin collagen of three animals and the body temperature of each animal.

Animal	Percentage of proline and hydroxyproline in skin collagen (%)	Body temperature / °C
Calf	23.2	37
Shark	19.1	24 to 28
Cod	15.5	10 to 14

The thermal stability of collagen is described by its shrinkage temperature (T_s). This is the temperature at which 50% of the helical structure is lost.

Analyse the data in the graph and the table to comment on the stability of collagen in these animals.

(4)

The higher the percentage of hydroxyproline the higher the body ~~temp~~ temperature. A Calf has a percentage of 23.2% of hydroxyproline and it has a body temp of 37°C. In contrast, a cod has 7.7% less hydroxyproline than a calf and as a result has a body temperature between 27°C to 23°C ~~less~~ lower. This means that the higher the percentage of hydroxyproline the more thermally stable collagen is. Collagen is least thermally stable in cods and most thermally stable in a calf.

ResultsPlus
Examiner Comments

This is a typical example of the many responses that gained three marks for using the table well to describe the trends and concluding that hydroxyproline makes collagen more stable and that the calf would have the most stable collagen. However, they have ignored the information about the shrinkage temperature and not gone back to clearly use the data in the graph.

ResultsPlus
Examiner Tip

When asked to analyse the data in the graph and the table make sure you clearly use both and don't ignore information provided in the question - it has been included for a reason.

Question 8 (a)

This question elicited a wide range of responses from candidates. There were a significant number of clear, well-presented answers with clear working shown and a correct ratio obtained.

Some candidates lost a mark for expressing their answer in an inappropriate way. Candidates should be reminded that the lowest common denominator and no decimal points should be used in ratios.

Unfortunately many candidates appeared to be confused by this question and did not even attempt to answer it. Some seemed confused by all the different variables involved (i.e. the names of the Hb and all the names of the types of polypeptide chains). For example, many candidates calculated a ratio between the three different types of haemoglobin and not the four different polypeptide chains present.

It would help candidates to put their final answer on the answer line, especially when their work is very convoluted so that examiners clearly know which answer to mark. Candidates should also make sure to show their work so that they can possibly get partial credit, even if they make a mistake in one of the intermediate calculations.

This response gained two of the three marks available.

8 There are three different types of haemoglobin in the blood of an adult human. Each haemoglobin molecule is composed of four polypeptide chains.

(a) The table shows information about these types of haemoglobin.

Type of haemoglobin	Percentage present in the blood (%)	Types of polypeptide chain present
HbA_1	96	2α and 2β
HbA_2	3	2α and 2δ
HbF	1	2α and 2γ

Calculate the ratio of polypeptide chains present in the blood of an adult human.

(3)

%	HbA_1 96	HbA_2 3	HbF 1
	2α & 2β	2α & 2δ	2α & 2γ
	48 = α 48 = β	1.5 = α 1.5 = δ	0.5 = α 0.5 = γ

48 + 1.5 + 0.5
= 50

α : β : δ : γ

50α : 48β : 1.5δ : 0.5γ

Answer 50α : 48β : 1.5δ : 0.5γ

ResultsPlus
Examiner Comments

The calculations have been clearly shown and the % of each of the chains has been calculated correctly. Unfortunately the ratio has not been expressed appropriately as no decimal points should be used in a ratio.

ResultsPlus
Examiner Tip

Use the lowest common denominator and no decimal points when expressing ratios.

This response gained all three marks available.

8 There are three different types of haemoglobin in the blood of an adult human. Each haemoglobin molecule is composed of four polypeptide chains.

(a) The table shows information about these types of haemoglobin.

Type of haemoglobin	Percentage present in the blood (%)	Types of polypeptide chain present
HbA_1	96	2α and 2β
HbA_2	3	2α and 2δ
HbF	1	2α and 2γ

Calculate the ratio of polypeptide chains present in the blood of an adult human.

(3)

2α x 96 = 192

2α x 3 = 6

2α x 1 = 2

200 α

2β x 96 = 192 β

2δ x 3 = 6 δ

2γ x 1 = 2γ

Ratio = 200 : 192 : 6 : 2

= 100 : 96 : 3 : 1

Answer 100 : 96 : 3 : 1 (α β δ γ)

ResultsPlus

Examiner Comments

This is an example of one of the methods used to calculate the correct ratio, which was then expressed appropriately for all three marks to be awarded.

This response gained no marks.

8 There are three different types of haemoglobin in the blood of an adult human. Each haemoglobin molecule is composed of four polypeptide chains.

(a) The table shows information about these types of haemoglobin.

Type of haemoglobin	Percentage present in the blood (%)	Types of polypeptide chain present
HbA_1	96	2α and 2β
HbA_2	3	2α and 2δ
HbF	1	2α and 2γ

Calculate the ratio of polypeptide chains present in the blood of an adult human.

(3)

96% 2α and

0.96 . 0.03 . 0.01

96

Answer 1.3.96

ResultsPlus
Examiner Comments

This is an example of the many responses that just calculated the ratio between the different types of haemoglobin and ignored the types of polypeptide chain present in the table provided.

ResultsPlus
Examiner Tip

Read the question carefully and use all of the relevant information from the table not just some of it.

Question 8 (b)

Almost 70% of candidates did not score any marks for this question because they ignored the question asked '*compare and contrast the sequence of bases in the DNA coding for …*' by making no reference to bases or coding with most just thinking the question was purely spot the difference in the sequence of amino acids.

Some candidates did attempt to address the question but thought that the sequence of amino acids was the sequence of DNA bases, ignoring the labels in the table.

There were a number of excellent answers to this question, including some good descriptions of the degenerate code and the impact this could have on the comparisons made between the three different genes.

This response gained all four marks available.

(b) The β, δ and γ polypeptide chains have similar amino acid sequences.

The table shows the sequence of nine amino acids in a part of each of these polypeptide chains.

Type of polypeptide chain	Sequence of amino acids
β	- phe - ala - thr - leu - ser - glu - leu - his - cys -
δ	- phe - ser - gln - leu - ser - glu - leu - his - cys -
γ	- phe - ala - gln - leu - ser - glu - leu - his - cys -

The β, δ and γ polypeptide chains are coded for by three different genes.

Compare and contrast the sequence of bases in the DNA coding for each of these parts of the three polypeptide chains.

(4)

(3x bases code for one amino acid) likely to be the same

The first codon of bases in the DNA are [redacted] in the 3 genes for B, δ and γ as the first amino acid is phe, so the codon that codes for phe was present in all three genes, however the code is degenerate to avoid slightly mutations, so it may have been different. The second codon is the same in both B + γ as it produced ala, however it was a different sequence for δ as ser was codon for. The third codon was the same for δ and γ as it produced gln. The next 6 codons are all likely to be the same as they all coded for the same amino acids in the same sequence. It is important to note that just because the same amino acid is produced, doesn't mean that the codons are identical as there are multiple base sequences that can code for the same amino acid.

ResultsPlus

Examiner Comments

This response clearly addressed the question asked and identified several clear similarities and differences between the sequences of DNA bases. They also clearly identified that although the amino acid coded for may be the same the base sequence may not be identical because of the degenerate nature of the code.

This response gained no marks.

(b) The β, δ and γ polypeptide chains have similar amino acid sequences.

The table shows the sequence of nine amino acids in a part of each of these polypeptide chains.

Type of polypeptide chain	Sequence of amino acids
β	- phe - ala - thr - leu - ser - glu - leu - his - cys -
δ	- phe - ser - gln - leu - ser - glu - leu - his - cys -
γ	- phe - ala - gln - leu - ser - glu - leu - his - cys -

The β, δ and γ polypeptide chains are coded for by three different genes.

Compare and contrast the sequence of bases in the DNA coding for each of these parts of the three polypeptide chains.

(4)

The all start with the same amino acid: phe, and they all end with the same amino acid: cys. β is the only type that contains the amino acid: thr. The sequences are all very similar, with amino acid 1, 4, 5, 6, 7, 8 & 9 being the same in each type of polypeptide chain. However, its the 2nd & 3rd that are different. In the second one, β & γ have the same amino acid: ala, whereas δ has: ser. And the third amino acid is the same for δ & γ: gln, but different in β: thr.

ResultsPlus
Examiner Comments

This is a typical example of the many responses that just compared the sequence of amino acids and ignored the question that asked to compare and contrast the sequence of bases in the DNA coding for each of these parts of the polypeptide chains. It therefore gained no credit.

ResultsPlus
Examiner Tip

Read the question carefully and make sure you are addressing the question asked.

This response gained no marks.

(b) The β, δ and γ polypeptide chains have similar amino acid sequences.

The table shows the sequence of nine amino acids in a part of each of these polypeptide chains.

Type of polypeptide chain	Sequence of amino acids
β	- phe - ala - thr - leu - ser - glu - leu - his - cys -
δ	- phe - ser - gln - leu - ser - glu - leu - his - cys -
γ	- phe - ala - gln - leu - ser - glu - leu - his - cys -

The β, δ and γ polypeptide chains are coded for by three different genes.

Compare and contrast the sequence of bases in the DNA coding for each of these parts of the three polypeptide chains.

(4)

• 7 of the bases are the same in all three polypeptide chains. phe, leu, ser, glu, leu, his, cys

• All three chains contain the same bases - all contain P, h, e, a, l, t, r, g

• ~~All three polypeptide chains~~

• δ chain contains -ser- instead of -ala-

• β chain contains -thr- instead of gln

ResultsPlus
Examiner Comments

This is an example of the many responses that thought the sequence of amino acids was the sequence of bases so gained no credit.

ResultsPlus
Examiner Tip

Read the headings in the tables provided carefully as they can often provide useful information and add clarity to the data provided.

This response gained no marks.

(b) The β, δ and γ polypeptide chains have similar amino acid sequences.

The table shows the sequence of nine amino acids in a part of each of these polypeptide chains.

Type of polypeptide chain	Sequence of amino acids
β	- phe - ala - thr - leu - ser - glu - leu - his - cys -
δ	- phe - ser - gln - leu - ser - glu - leu - his - cys -
γ	- phe - ala - gln - leu - ser - glu - leu - his - cys -

The β, δ and γ polypeptide chains are coded for by three different genes.

Compare and contrast the sequence of bases in the DNA coding for each of these parts of the three polypeptide chains.

(4)

* The first gene in the β chain is phe-ala-thr which has two amino acids (phe-ala) similar to the γ chain and only one base (phe) similar to the δ chain.

* In the second gene all three polypeptide chains have the same sequence of the three amino acids, meaning the same gene is being coded for. Therefore the second gene in all three polypeptide chains are the same.

* The third gene in all three polypeptide chains is also the same because the three amino acids are identical therefore coding for the same gene.

ResultsPlus
Examiner Comments

This is an example of the many candidates who got confused about what codes for what and therefore gained no credit.

Question 8 (c) (i)

Significantly less than 50% of candidates managed to come up with a recognisable definition of a gene mutation. Many described chromosomal mutations or the result of a gene mutation e.g. describing the change in the sequence of amino acids. Some described this as being a mistake happening during translation.

This response did not gain the mark.

(i) State what is meant by the term **gene mutation**.

(1)

A gene mutation is a change in the sequence of amino acids.

ResultsPlus
Examiner Comments

This is a typical example that focussed on the sequence of amino acids and not the DNA base sequence.

ResultsPlus
Examiner Tip

Make sure you know your key definitions.

This response gained the mark.

(i) State what is meant by the term **gene mutation**.

(1)

A change in the order of the base sequence in DNA.

ResultsPlus
Examiner Comments
This is an example of an acceptable definition.

This response did not gain the mark.

(i) State what is meant by the term **gene mutation**.

(1)

A change in the genes resulting in variation

ResultsPlus
Examiner Comments
This is an example of a definition that is too vague to be creditworthy as it does not make it clear what a gene is and what is changed in a mutation.

This response did not gain the mark.

(i) State what is meant by the term **gene mutation**.

(1)

a gene mutation is the random change in the order ~~of the~~ or number of the chromosomes

ResultsPlus
Examiner Comments
This is an example of the many responses that mixed up chromosomal mutations and gene mutations.

Question 8 (c) (ii)

The majority of candidates recognised that the O_2 saturation for the two types of Haemoglobin were very similar for the same partial pressures of O_2. However, many did not actually draw a conclusion (apart from what was given in the question stem) based on the data and so did not get the second mark.

This response gained no marks.

(ii) With reference to the table, explain why people with HPFH are usually unaware that they have this condition.

(2)

the more pressure of oxygen the nigher percentage of saturation of oxygen there is in both HbF and HbA.

ResultsPlus
Examiner Comments

This response described the trend of the data in the table but gained no marks as they did not address the question asked.

ResultsPlus
Examiner Tip

Read all questions carefully.

This response gained both marks available.

(ii) With reference to the table, explain why people with HPFH are usually unaware that they have this condition.

(2)

HbF and HbA have similar % of percentage saturation at the same partial pressures of oxygen. This suggests that there wouldn't be any symptoms of HPFH. Consequently people may remain unaware that they have this condition.

ResultsPlus
Examiner Comments

As well as making valid points about the % saturation the response provides a clear explanation about why people may be unaware they have the condition - because they have no symptoms.

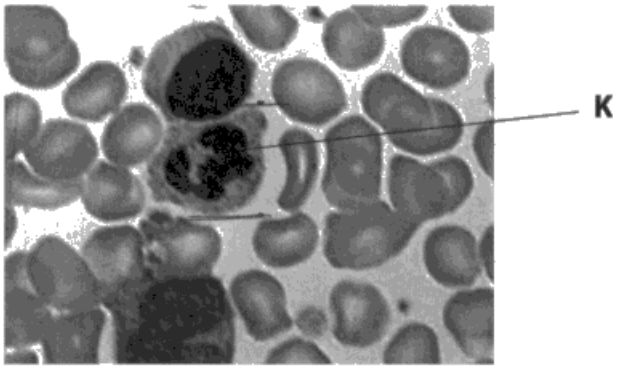
Question 9 (a) (i)

This question tested the ability of candidates to read the question accurately, carefully assess what was in the picture and their drawing and magnification skills. Most of the responses gained two or more marks. Some candidates just showed a magnification calculation and no diagram at all. A small number drew only the nucleus or a completely different cell altogether. Some candidates did not realise that the structure in the middle of the cell was the nucleus, drawing it in two or more pieces.

This response gained all four marks.

9 Microscopy is a technique used to study structures that are not within the resolution range of the human eye.

(a) The photograph shows cells in a blood smear, as seen using a light microscope.

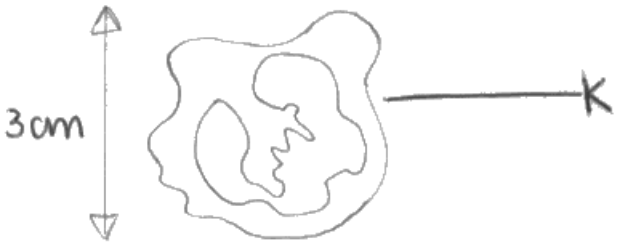


(i) Draw the cell labelled **K**, as shown in the photograph. Your drawing should have a magnification ×2.

(4)

K = 1·5cm in height

1·5cm × 2 = 3cm



ResultsPlus

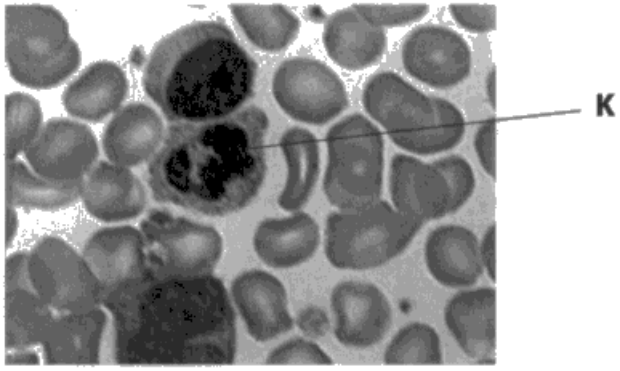
Examiner Comments

This is an example of a drawing that was deemed a close enough representation of cell K at twice the size to gain all 4 marks available.

This response gained no marks.

9 Microscopy is a technique used to study structures that are not within the resolution range of the human eye.

(a) The photograph shows cells in a blood smear, as seen using a light microscope.



(i) Draw the cell labelled **K**, as shown in the photograph. Your drawing should have a magnification ×2.

(4)

ResultsPlus

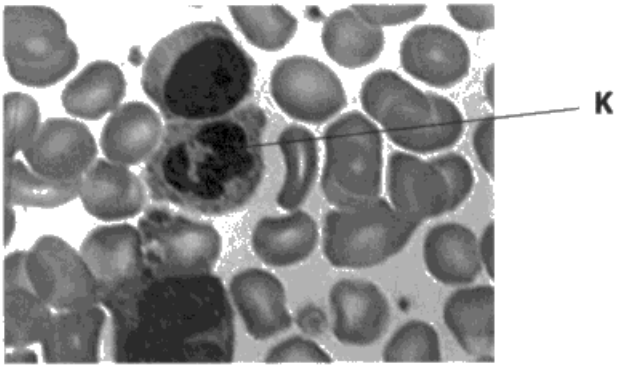
Examiner Comments

No complete cell has been drawn, just the nucleus, and the nucleus is over double the size of the original so no credit was given to this drawing.

This response gained no marks.

9 Microscopy is a technique used to study structures that are not within the resolution range of the human eye.

(a) The photograph shows cells in a blood smear, as seen using a light microscope.



(i) Draw the cell labelled **K**, as shown in the photograph. Your drawing should have a magnification ×2.

(4)

magnification = size of image / size of specimen

2 = 1.1 / size of specimen

diameter across = 1cm

diameter down = 1.1

1.1 x 2

1.3 x 2 =

ResultsPlus
Examiner Comments

This is an example of the many responses seen that did not even attempt to draw a cell so did not gain any credit.

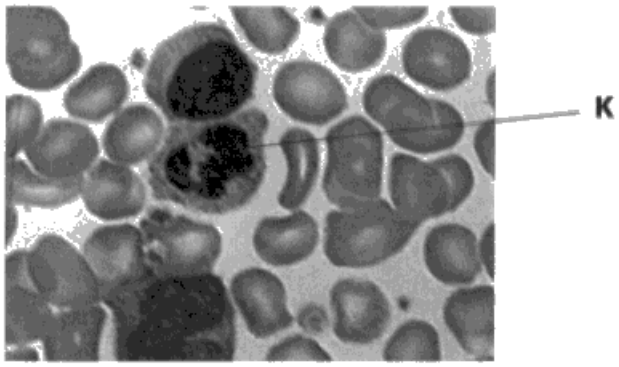
ResultsPlus
Examiner Tip

Read the question carefully.

This response gained two of the four marks available.

9 Microscopy is a technique used to study structures that are not within the resolution range of the human eye.

(a) The photograph shows cells in a blood smear, as seen using a light microscope.



(i) Draw the cell labelled **K**, as shown in the photograph. Your drawing should have a magnification ×2.

(4)

ResultsPlus

Examiner Comments

Credit was given for drawing cell K alone and for the magnification being about twice the size. However, the shape of the cell and nucleus are not that close to the original and shading and sketching should not be used in microscope drawings.

Question 9 (a) (ii)

It was disappointing to see so many blank answers to this question, possibly suggesting that some candidates had not carried out this practical process.

Many candidates appeared to know what a micrometer is and that calibration had to take place, but descriptions of this were often not clear. Many candidates gained a mark for describing how to calculate the magnification. Very few considered the need for taking more than one measurement, despite the fact that many cells have a non-uniform shape and that many candidates took more than one measurement to ensure that their drawing was double the size of the image in their responses to (a)(i).

This response did not get any marks.

(ii) Describe how to use a micrometer to determine how many times bigger your drawing is than the actual cell in the blood smear.

(4)

1 micrometre µg = 1,000 mm

ResultsPlus
Examiner Comments

Several candidates tried to define a micrometre rather than describe how to use a micrometer.

This response gained just one of the four marks available.

(ii) Describe how to use a micrometer to determine how many times bigger your drawing is than the actual cell in the blood smear.

(4)

You would adjust your microscope to the lowest magnification.
You insert the micrometer eyepiece lens to your microscope.
You measure the cell using the eypiece units on the eyepiece lens.
You are then able to work out the correct length.

ResultsPlus
Examiner Comments

Credit was given for recognising that the micrometer could be used to measure the cell, but no explanation was provided as to how you could calculate the size or magnification.

This response gained three of the four available marks.

(ii) Describe how to use a micrometer to determine how many times bigger your drawing is than the actual cell in the blood smear.

(4)

The micrometer can be used to measure a cell by calibrating a graticule. The micrometer is placed on the microscope and used to measure the size of each division of the graticule as the length of the micrometer is know and can be used to work out the graticule length. The graticule can then be used to measure the size of the cell in the blood smear at a set magnification that has been calibrated by the micrometer and then the actual size of the cell can be compared to the drawing of the cell to work out the magnification using the equation

$$\text{magnification} = \frac{\text{image size}}{\text{actual size}}$$

ResultsPlus

Examiner Comments

Credit was given here for providing clear details of how to calibrate the graticule that could then be used to measure the size of the cell, followed by a clear explanation of how to calculate the magnification.

This response gained all four marks available.

(ii) Describe how to use a micrometer to determine how many times bigger your drawing is than the actual cell in the blood smear.

(4)

Calibrate the eye piece graticule to a stage micrometer, by lining our known eye piece graticule units it is to each um, then remove the stage micrometer and measure the length and width of the blood smear using eyepiece graticule units and convert into um. and magnification = size of image / by actual size

So convert cm into um by by multiplying by 10,000 and use 24,000 / actual size to calculate magnification.

ResultsPlus
Examiner Comments

Credit was given for:

- calibrating the eyepiece garticule using a stage micrometer
- measuring the cell using the eyepiece
- measuring both length and width of the cell
- showing how to calculate the magnification.

Question 9 (b)

Unfortunately, all but about 12% of candidates assumed that a higher number for resolution meant a better resolution.

If candidates had carefully considered the data and thought about it from a practical perspective, then they should have realised that if you increase the magnification and aperture, it would make sense that resolution would get better, not worse.

In fact, some candidates clearly defined resolution in their responses but then went on to ignore their definition or even suggest that the data is contradictory to their expectation. Candidates' marks were therefore limited to Level 1 (maximum 2 marks) despite some creative assimilation of both sets of data provided to draw conclusions.

Those candidates who did manage to make correct conclusions tended to describe the effects of magnification, aperture and wavelength independently. Only the best responses compared the variables and concluded things like magnification has the greatest effect and/or that you would need to use shorter wavelengths of light to achieve maximum resolution at the highest magnifications.

This response gained all six marks available.

Analyse the data in Table 1 and Table 2 to determine the extent to which resolution is affected by magnification, numerical aperture and the wavelength of light.

(6)

Table two shows a ~~positive~~ negative correlation between wavelength of light and resolution of lense. As the wavelength of light increase the resolution of the lens gets worse.
For all types of objective lenses the table shows that has the magnification of the objective lens increases the resolution improves.
Looking at the same magnification (x100), but also at varying apetures we shows that the larger the aperture the better the resolution. However the extent to which the apeture affects the resolution is minimal 1.3 apeture

gives 0.21 resolution and 1.4 apeture gives 0.20 resolution.

From table 1 it seems that the magnification has a much larger effect on the resolution.

For best resolution you would look for large magnification, large numerical ~~apeture~~ apeture and small wavelength of light

ResultsPlus

Examiner Comments

This is an example of a Level 3 response that gained all six marks. As well as identifying all the trends successfully the candidate has compared the size of the effects on resolution concluding that magnification has the largest effect and that you would need a short wavelength, large magnification and large aperture for the best resolution.

This response gained one mark.

Analyse the data in Table 1 and Table 2 to determine the extent to which resolution is affected by magnification, numerical aperture and the wavelength of light.

(6)

Increased magnification decreases resolution but increases numerical aperture. Increased wavelength of light, increases resolution. This is because resolution is the measure of how far away something has ~~so that you s~~ to be before you see parts of it as one, and not two distinct parts. Increasing magnification doesn't help resolve anything, it just makes it bigger.

ResultsPlus

Examiner Comments

This response is a Level 1 response because although they have defined resolution they have not demonstrated that they understand the values of resolution provided and therefore have the opposite trends. Only one mark was gained as they have only looked at the effect of magnification and wavelength and have not provided any supporting data to back up their trends.

This response gained four of the six marks available.

Analyse the data in Table 1 and Table 2 to determine the extent to which resolution is affected by magnification, numerical aperture and the wavelength of light.

(6)

resolution is the smallest distance which can be seen between two objects which can still be seen as two seperate points. resolution is affected by magnification because the higher the magnification the higher the resolution. resolution is affected by numerical aperture because as resolution increases, numerical aperture increases. Also, resolution is affected by wavelength, ~~the optimum wavelength of light is between 400nm and~~ as resolution decreases so as wavelength of light increases.

ResultsPlus

Examiner Comments

This is an example of a Level 2 response where all the correct trends were identified so 4 marks were awarded, but it did not get into Level 3 because there was no attempt to compare the trends or comment on the interaction of the three variables on resolution.

This response gained two of the six marks available.

Analyse the data in Table 1 and Table 2 to determine the extent to which resolution is affected by magnification, numerical aperture and the wavelength of light.

(6)

As the wavelength of light increases, so does the resolution although it's not very significant. This is because as the ~~wa~~ peaks of the waves get closer together, you are able to see in finer detail. The general trend is that as the magnification ~~increases~~ and the numerical aperture increase, the resolution decreases. For example, when the ~~magnification is~~ numerical aperture is 0.10μm in lense P, the resolution is 2.75μm. Then in lense R, when the magnification is the same and the numerical aperture has increased to 0.20μm, the resolution has gone down to 1.38μm - a decrease of ~~1.37~~ 1.37μm. Meaning it has gone down by almost half. This shows that numerical aperture has the biggest impact on resolution.

ResultsPlus

Examiner Comments

This is an example of the most common response to this question. It is limited to Level 1 because it has failed to understand that a small value represents better resolution. It has, however, used all the data to comment on each of the variables affecting resolution and has backed the trends up with some relevant data values so two marks were awarded.

Paper Summary

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

- read the whole question carefully, including the introduction, to help relate your answer to the context asked. In particular make sure you are answering the question asked;
- use all of the information provided in the question to help you with your answer, e.g. graphs and tables of data including the labelling. If more than one set of data is provided make use of both and see how they are connected;
- when asked to explain your answer make sure you have effectively included 'because...' in your response;
- aim to evaluate practical procedures and identify why stages are needed in procedures during your practical work in the AS course;
- look at the appendix of the specification to familiarise yourself with the command words and the examples of the mathematical calculations you are expected to be able to perform at AS level;
- explore and assess examples of candidate responses from this report to help you understand what makes a good response to different types of question, and exemplify the level of knowledge and understanding expected at AS level in this new specification.

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

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