Name: _____

TOPIC 1: KEY CONCEPTS IN BIOLOGY PART 1 MS & ER

Date:

Time:

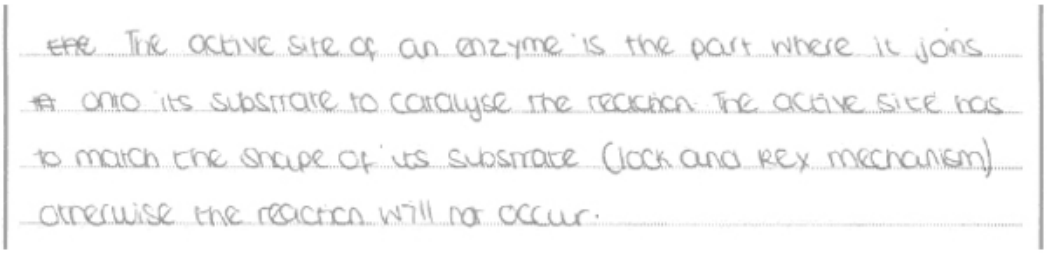
Total marks available:

Total marks achieved: _____

Examiner's Report

Q1.

This question required candidates to explain the role of the active site of an enzyme. Credit was given for recognising that its specific shape binds a specific substrate and that the reaction is catalysed there to either join together or break down molecules. Most candidates gained a mark for the idea that a reaction occurred here which breaks something down. Credit was also given for the fact that this is a lock and key mechanism or words to that effect.

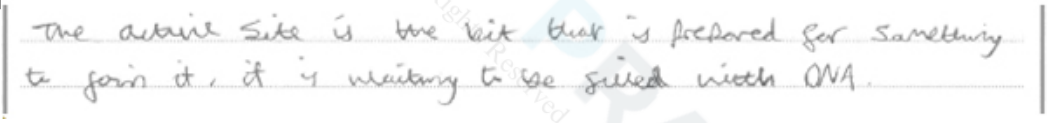

The active site of an enzyme is the part where it joins onto its substrate to catalyse the reaction. The active site has to match the shape of its substrate (lock and key mechanism) otherwise the reaction will not occur.

Results Plus: Examiner Comments

This is a good answer which recognises the role of the active site on an enzyme and what happens at this active site. The fact that a substrate binds and the reaction is catalysed is sufficient for the marks.

Results Plus: Examiner Tip

When asked to explain ensure you are giving scientific detail about the question asked. Try to avoid answering in bland meaningless statements.


The active site is the bit that is prepared for something to join it, it is waiting to be filled with DNA.

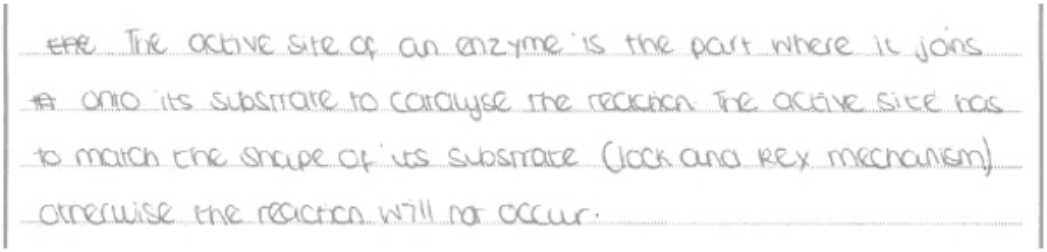
Results Plus: Examiner Comments

This candidate's answers have missed out on the marks as they are not specific enough. It needed to mention what binds to the active site i.e. the substrate to gain the mark. It also confused this question with the previous about DNA, remember each part of a question a, b and c may be about different topic areas. Parts of questions (a)(i), (a)(ii) with be related to one another so the links there may be noticeable.

Q2.

This question required candidates to explain the role of the active site of an enzyme. Credit was given for recognising that its specific shape binds a specific substrate and that the reaction is

catalysed there to either join together or break down molecules. Most candidates gained a mark for the idea that a reaction occurred here which breaks something down. Credit was also given for the fact that this is a lock and key mechanism or words to that effect.

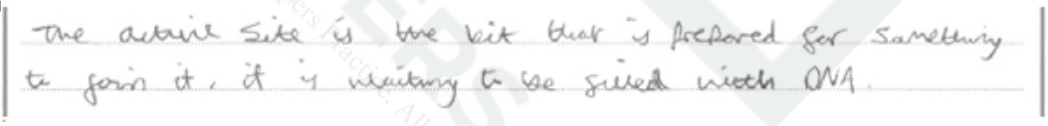


Results Plus: Examiner Comments

This is a good answer which recognises the role of the active site on an enzyme and what happens at this active site. The fact that a substrate binds and the reaction is catalysed is sufficient for the marks.

Results Plus: Examiner Tip

When asked to explain ensure you are giving scientific detail about the question asked. Try to avoid answering in bland meaningless statements.



Results Plus: Examiner Comments

This candidate's answers have missed out on the marks as they are not specific enough. It needed to mention what binds to the active site i.e. the substrate to gain the mark. It also confused this question with the previous about DNA, remember each part of a question a, b and c may be about different topic areas. Parts of questions (a)(i), (a)(ii) with be related to one another so the links there may be noticeable.

Q3. No Examiner's Report available for this question

Q4.

(i)

Candidates were asked to explain why the tip of roots were used to investigate mitosis. Many

responses referred to mitosis in the root tip, but this fact was given in the stem of the question. The term meristem was seen infrequently, but many candidates knew that growth occurs in root tips. There was some misinterpretation of the question, with a number of candidates describing the function of roots in terms of absorbing water and mineral ions.

A student investigated mitosis in the root tip of a garlic plant.

(i) Explain why the student used the tip of the root.

(2)

the tip of the root will have been used as that is where the meristem is found. Mitosis then occurs during growth, repair or asexual reproduction (in this case growth).

Results Plus: Examiner Comments

This is a good answer which scores both marking points. The candidate has referred to the root tip containing the meristem and growth occurring.

The student used the tip of the root because that is where there will be growth and therefore a place where mitosis will occur.

Results Plus: Examiner Comments

This answer scores 1 mark for stating that growth occurs at the root tip. The reference to mitosis does not gain any credit.

(ii)

This question was based on a core practical, requiring knowledge of how to use a microscope to obtain a clear image of cells. Some candidates carefully described how to prepare a root tip squash, but this was not asked for in the question.

Candidates with a good knowledge of the parts of a light microscope and how a light microscope works were able to score two marks. There were many muddled references to eyepiece and objective lenses which could not be awarded a mark. References to zooming in and out were not credited, but different ways of describing how to focus on the cells were accepted, such as moving the stage up and down, or turning the focusing wheel.

(ii) The student squashed the root tip on a microscope slide to spread out the cells.

The slide was placed on the stage of a microscope.

Describe how to use the microscope to obtain a clear image of the cells.

(2)

Start off on the lowest powered magnification and then by using the focus wheel, focus look into the eyepeice and focuss until clear image of the cells is acheived.

Results Plus: Examiner Comments

This answer scores full marks. The candidate has referred to using the focusing wheel and looking into the eyepiece (lens). The reference to lowest powered magnification does not gain any credit - the answer should refer to lowest objective lens.

Use the lowest power objective lens to start with, and adjust the stage using the focusing wheels. Use the coarse focusing wheel at first, then use the fine wheel for fine adjustments

(2)

Results Plus: Examiner Comments

This candidate has a good understanding of how to use a microscope to obtain a clear image of cells. The answer scores full marks, even though there is no reference to switching the lamp on.

Results Plus: Examiner Tip

Check that you know the names of the parts of a microscope and how they are used to obtain a clear image of biological specimens.

(iii)

This question was answered very well. The question was based on a core practical and a large proportion of candidates gave the correct answer of use a stain, or they gave iodine (solution) as an acceptable example of a stain.

(iii) The student could not see the chromosomes inside the cells.

State what can be added to the root tip squash to make the chromosomes visible.

(1)

a dye which sticks to the chromosomes

Results Plus: Examiner Comments

Add a dye is an acceptable alternative to stain for this mark.

They can add a solution to make it clear. (0)

Results Plus: Examiner Comments

This answer does not score a mark because the candidate has not named the type of solution that should be added to make the chromosomes visible.

Results Plus: Examiner Tip

Always try to give a specific answer to a question. Just writing 'solution' is too vague.

Q5.

(i) To obtain the mark on this item, candidates had to recognise that the result at 150 seconds shows that all of the starch had been digested, not just that starch had been digested or that

glucose had been produced. The candidates had to identify that the result at 150 seconds is the first where starch is not detected.

(ii) This practical skills-based question required the identification of controlled variables for an investigation. Marks were awarded most frequently for concentration of the starch or amylase and the time intervals used. The time taken to digest starch was a common incorrect response. Candidates who missed out on marks repeated information given in the question, which had already stated that equal volumes and a temperature of 25°C were used.

(iii) Higher ability candidates recognised that the tubes without amylase added were a control, other responses which were also credited referred to the idea confirmed that it is the amylase that breaks down the starch. A control variable is incorrect and not credited but was seen as an incorrect response.

Q6.

(i) This calculation where candidates were asked to calculate the percentage difference in the mean length of starch grains was challenging, with most unable to extract and find the difference (50 - 30 = 20) from the relevant data in the table. About half of those that did, then stated 20%, as their answer, instead of the correct 40% not noticing that the 20 µm change needed to be compared to 50 µm.

(ii) Candidates tend to be good at which variables to control in an investigation, and plenty of good answers were seen mainly covering temperature and mass / size of potato. A few suggested light intensity which was not credited as the question stated twice that the potatoes were stored in the dark. Time was also not accepted as this was the independent variable.

(iii) This question informed the candidates that the starch was converted to glucose by the potatoes. Candidates were then asked to state why the potatoes needed glucose. Whilst a few candidates stated for respiration / energy most candidates said to grow which was deemed to be secondary point and thereby not creditworthy.

Q7.

(i) This calculation proved to be a little trickier for candidates although most were able to gain the first mark for taking 30 away from 50. Alternative methods of calculating the final mark of -40% were credited.

(ii) Where candidates understood the practical task they were able to give correct variables such as the mass of the potato or the temperature but several referred to making sure the starch grains were all the same size at the start which is not a very practical suggestion.

(iii) This question was well answered and possible answers included both respiration or release of energy. As always we do not credit incorrect science so to produce energy was not credited.

(iv) The majority of candidates could recognise that the starch was broken down by an enzyme but few were able to link this to the breaking of bonds between the glucose molecules or that this occurred at the active site of the enzyme. Named enzymes were accepted as long as they were carbohydrases.

Q8.

(i)

This question required an understanding of the test for starch, which is part of a core practical. Candidates had to interpret information from a table of results and give a reason why the contents of two test tubes were blue-black at the beginning. Many candidates found the question challenging and did not score the mark, which was awarded for stating that starch was present or that iodine had reacted with starch.

The colour of the contents of each test tube was recorded every two minutes for a total of ten minutes.

The results are shown in Figure 11.

time in minutes	colour of the contents of each test tube: test tube 1 starch and iodine solution with liquid from the mouth	test tube 2 starch and iodine solution with liquid from the stomach
0	blue-black	blue-black
2	blue-black	blue-black
4	brown	blue-black
6	orange	blue-black
8	orange	blue-black
10	orange	blue-black

Figure 11

(i) Give **one** reason why the contents of both test tubes were blue-black at the beginning of the investigation.

(1)

Because Starch is present in them both.

Results Plus: Examiner Comments

In this answer the candidate understands that the blue-black colour means that starch is present.

(i) Give **one** reason why the contents of both test tubes were blue-black at the beginning of the investigation.

(1)

because the starch was not broken down by the enzyme yet.

Results Plus: Examiner Comments

This is an alternative way of answering this question. The response scores the mark because the candidate understands that starch is present and hasn't yet been broken down.

Results Plus: Examiner Tip

Make sure that you learn the names of the chemical reagents used to identify starch, reducing sugars, proteins and fats.

(ii)

In this question candidates had to explain the outcome of an investigation involving enzymes from different parts of the digestive system. The majority of candidates found the question very challenging. The marking point awarded most frequently was for the idea that starch had been broken down in test tube 1. Fewer candidates were able explain that starch had not been broken down in test tube 2. Only those candidates who had a clear understanding of the investigation scored a mark for making a link between the presence of amylase and the breakdown of starch.

(ii) Explain the results of this investigation after ten minutes.

(3)

after 10 minutes test tube 1 was orange whilst test tube 2 remained blue-black throughout the investigation. This shows that in test tube 1 the starch was breaking down during the investigation whereas test tube 2 ~~had~~ did not break down during the investigation.

Results Plus: Examiner Comments

In this response the candidate has started by describing the colour of the contents of the tubes after 10 minutes. The description does not score any marks, but the candidate has then explained that in tube 1 starch was broken down. This scores one mark. The candidate has not stated that **starch** has been broken down in tube 2, so this point does not score a mark. The candidate has not explained that amylase is present in the mouth, or that amylase is not present in the stomach.

After 10 ~~mouth~~ minutes the test ~~tub~~ tube 1 had changed from blue-black to orange. However, test tube 2 hadn't changed colour after 10 minutes.

Results Plus: Examiner Comments

This answer does not score any marks because it is a description of the results, not an explanation.

Results Plus: Examiner Tip

Remember to check the command words in questions. Explain means that you must say how or why something happens. So, in this example you should say why test tube 1 changed from blue-black to orange.

Q9.

Approximately half of the candidates scored at least one mark for attempting to calculate the distance diffused by hydrochloric acid in one second for cube B. This question is not based on a core practical, but nevertheless, it is important that candidates are familiar with investigations such as this. The majority of candidates could give an improvement that should be made to confirm the results of the investigation.

Q10.

(i)

Candidates find the idea of a control as part of an experiment hard. Although this was an easier application of the two ways controls were used, relatively few candidates scored the available mark. To score here, candidates had to say that the potato chips in the 0% sodium chloride solution were used to compare to see how much the potato chips in the other concentrations had changed. This item was left blank by a larger number of candidates than most other items and candidates found it hard to express what the role of the control was in an investigation. The most common error was to say to see how the chips changed in it.

A student wanted to investigate the movement of water into and out of cells in potatoes.

The student had the equipment shown in Figure 11.

Figure 11

The test tubes in the rack contain different concentrations of sodium chloride solution.

The solutions were 0.1 M, 0.2 M, 0.3 M, 0.4 M and 0.5 M sodium chloride solution.

The test tube in the beaker contains distilled water.

There are three potato chips in each of the six test tubes.

(i) State why the test tube in the beaker only contains distilled water and three potato chips.

(1)

Because its our controlled one so we can compare it to the others.

Results Plus: Examiner Comments

A good 1 mark answer.

Results Plus: Examiner Tip

When setting up an investigation, we often set up one part of the equipment to use as a baseline. We then compare the results in the other parts of the investigation with this baseline. Make sure you know this use of a control.

(ii)

We insist that in experiments we refer to volume of liquids and so amount of sodium chloride solution was not credited here. This is true across all three of the sciences. This has been stated and stressed in past examinations and so it was disappointing that many candidates wrote amount of sodium chloride solution thus not gaining a mark. Even so, half of the candidates gained 1 mark with a further third gaining 2 marks. Some candidates stated that a variable to control was the concentration of sodium chloride which was the independent variable and therefore had to be different whilst common creditable responses included volume of sodium chloride, mass /size / length / surface area of potato chip at the start of the investigation (as mass was the dependent variable) and time the chips were left in the solution. Many candidates added that these should be kept the same which is true, but not required for the mark in this case due to the way the question was phrased.

(ii) State **two** variables that need to be controlled in this investigation.

(2)

1 Same amount of wate

2 Same amount of potatoe chips

Results Plus: Examiner Comments

This scores no marks as amount of water needs to be volume of solution and same amount of chips is not creditworthy as the investigation set up states that there are three chips in each tube.

Results Plus: Examiner Tip

Read the question carefully, underline key facts and then do not use parts that are stated as the same as something to control as it already has been.

1 The temperature of each test tube.

2 They all need to be left in for the ~~ear~~ exact same amount of ~~#~~ time.

Results Plus: Examiner Comments

2 marks here for marking points one and five.

Results Plus: Examiner Tip

Make and learn a list of things that can affect an investigation and then write about two that are not already controlled or are the independent variable.

(iii)

Less than one third of candidates managed to score any marks with very few scoring all three here where candidates had to explain why the potato chips in 5% sodium chloride solution lost mass. Many candidates just talked about because there were different concentrations inside the chip to the solution but as they did not state the concentration of water could not be credited with a mark. Many of those that talked about water moving across the membrane but did not say out of the potato / into the solution to hit marking point two. The most common marking point seen was osmosis. Candidates need to be trained better into stating which way the water is moving and stating the concentration of either the water or the solute in their responses.

(iii) Explain why the chips in the 0.5 M sodium chloride solution lost mass.

(3)

~~Th~~ They lost mass because the water moved out of the potato chips through osmosis because there was ~~more~~ a lower concentration outside.

Results Plus: Examiner Comments

2 marks here for water moving out of the potato and by stating that this was due to osmosis. Lower concentration is not creditable as it does not specify that the concentration referred to concentration of water.

(iii) Explain why the chips in the 0.5 M sodium chloride solution lost mass.

(3)

water could not depuse in and out of it due to the high concentration of sodium chloride. The sodium chloride allowed reverse osmosis to happen. The liquid molecules travelled from the low concentration in the potato chip, to the high concentration of the sodium chloride solution, This caused the potato chip to loose mass.

Results Plus: Examiner Comments

This is not very clearly written but worth 2 marks for osmosis (ignoring the reverse) and liquid molecules (as the only liquid there is water). We may be tempted to read into the relative concentrations that they are writing about from a low solute concentration to a high solute concentration. The problem with that is other candidates are talking about it in the same way and referring to from the high concentration in the chip to the low concentration in the sodium chloride solution and if we read into this response one way and read into the other the other way, then these candidates will get a mark for giving an opposite response.

Results Plus: Examiner Tip

When talking about water moving into / out of cells:
- state by osmosis
- state clearly which way way the water is moving
- state what concentrations you are talking about, eg from a **high** concentration of **water particles** to a **low** concentration of **water particles**.

Q11.

(ii) Few candidates were able to recall that the three domain classification system was proposed based on increased knowledge of genetics. A few high ability candidates did refer to gene structure or RNA sequencing. The majority of responses focused on the idea that it was easier to classify this way or that not all organisms could be easily classified with the 5-kingdom method.

Q12.

(i) This question was very applied, and candidates had to recognise that they would need to test for both starch and glucose using the correct biological food tests. Many candidates were very clear about the test for starch but several were unable to correctly give an explanation of how to carry out the test for reducing sugars using Benedict's reagent.

(ii) This question asked candidates how the experiment modelled dialysis treatment. We were looking for the idea of the movement of substances by diffusion from high to low concentrations or the idea that the dialysis membrane acts as a cell membrane allowing smaller molecules to move across it. Many candidates referred to the idea of ultrafiltration which was not evidenced in this model.

Q13.

(ii) This question revolved around the use of enzymes and why mashing a foodstuff before adding the enzyme would be an advantage. Many candidates recognised that this would increase the surface area of the food so the trypsin could break down more of it or to allow a faster rate of reaction. Common errors here were the reference to it being small enough for the baby to eat as this was about the use of trypsin in baby food. Please note that we do not control the temperature by using a thermometer we merely measure the temperature with the thermometer which is not the same thing and was not awarded the mark.

Q14.

(ii) – Many candidates indicated that the enzymes were working faster for this item. Higher ability candidates went on to indicate that this was closer to the optimum. Very few candidates explained that this meant there was more kinetic energy, more collisions or more enzyme-substrate complexes. Candidates need to recognise that when the command word is explain their responses need to include scientific reasoning.

(iii) – As is often seen, candidates are better able to explain what happens to enzymes at high temperatures than at low temperatures. Most candidates were able to explain that the milk would not clot or clot at a slower rate because the enzyme would be denatured. Times greater

than 75 seconds were accepted.

(iv) – This item was generally answered well with most candidates giving the idea that it was used to see if the effect of not adding chymosin or that it was a control. Some responses referred to the idea of accurate, precise or reliable results and candidates must be aware that these words have a specific meaning scientifically.

(vi) – Most candidates were able to give at least one improvement to the method with many of them being awarded both marks. The most frequent marks awarded were for smaller intervals between the temperature and for the indication that this would be around 35°C to 45°C or repeating the test at each temperature. Some candidates gave the idea that a wider range of temperatures could be used and this was not credited.

Q15. No Examiner's Report available for this question

Q16. No Examiner's Report available for this question

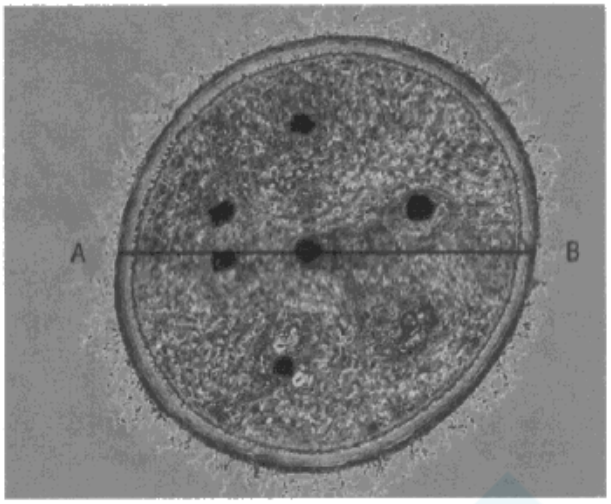
Q17.

(i)

The use of the magnification equation and unit conversion was required for this question and many candidates demonstrated the required mathematical skills, showing an improvement in understanding of this topic. Full marks are given for the correct answer but if this was not obtained there were working marks for the measurement, a division by 50 000 and a unit conversion of x1000 or x10 000 if the candidate measured in cm. Candidates who measured in cm were more likely to make an error during the calculation. Some candidates divided by 1000 rather than multiplied or did not attempt a unit conversion.

Figure 7 shows a cyanobacterium magnified 50 000 times.

The line AB shows the diameter of the bacterial cell.



(Source: © The Christian Science Monitor)

Figure 7

(i) Calculate the actual diameter of the cyanobacterium.

Give your answer in micrometres (μm).

(3)

6·5cm
65mm

$\frac{65}{1000} = 0.065\ \mu m$

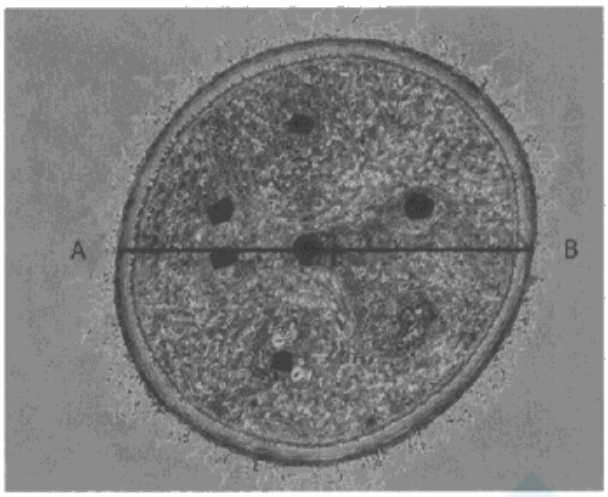
0·065 μm

Results Plus: Examiner Comments

This response is awarded 1 mark for the correct measurement. There is no attempt to use the magnification and the unit conversion attempt is incorrect.

Figure 7 shows a cyanobacterium magnified 50 000 times.

The line AB shows the diameter of the bacterial cell.



(Source: © The Christian Science Monitor)

Figure 7

(i) Calculate the actual diameter of the cyanobacterium.

Give your answer in micrometres (µm).

I A M

(3)

mm → µm ×1000

$\frac{65\text{mm}}{50{,}000} = 0.0013\text{mm}$

×1000

= 1.3

1.3 µm

Results Plus: Examiner Comments

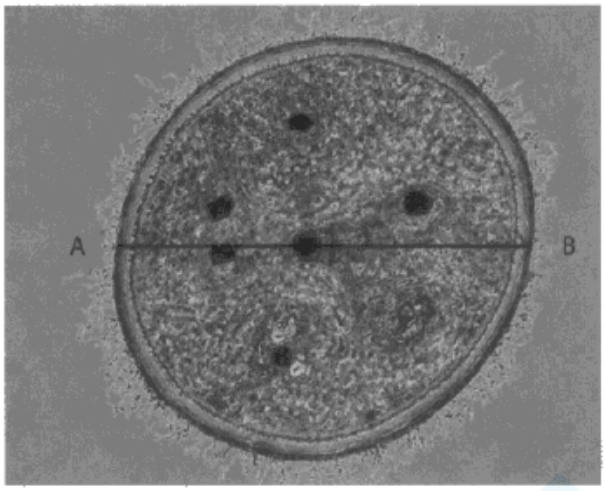
This shows a good model answer. The workings are shown and the measurement, magnification calculation and unit conversion are clearly shown.

Results Plus: Examiner Tip

Always show your workings for magnification calculations including the units used to make measurements.

Figure 7 shows a cyanobacterium magnified 50 000 times.

The line AB shows the diameter of the bacterial cell.



(Source: © The Christian Science Monitor)

Figure 7

(i) Calculate the actual diameter of the cyanobacterium.

Give your answer in micrometres (μm).

(3)

I
A M

6.5cm diameter

$\frac{6.5cm}{50,000} = 1.3 \times 10^{-4}$ micro (10^{-6}) nano (10^{-9}) pico (10^{-12})

130 μm

Results Plus: Examiner Comments

This response shows a common error but still obtained 2 marks highlighting the importance of showing workings. The measurement is correct in cm which are given and this has correctly been divided by 50 000. The x1000 unit conversion is incorrect because the distance has been measured in cm.

Results Plus: Examiner Tip

Always measure in mm which is a standard unit.

(ii)

This question asked for three features of bacterial cells. The question stated that they contained plasmids as this is given in the rest of the question, consequently loops of DNA was insufficient, they needed chromosomal DNA or the idea of no nucleus. All cells have a cell membrane and

cytoplasm so these were insufficient. The most common correct responses were chromosomal DNA in the cytoplasm, flagella and cell wall. Some candidates stated that the cell wall was not made of cellulose but this was not required. A list rule was applied for the reject responses of nucleus and mitochondria and these were the most common incorrect responses seen.

(ii) Bacterial cells contain plasmids.

Describe **three** other features of a bacterial cell.

(3)

- Bacteria do not ~~contain~~ have a nucleus
- Bacterial cells do not have ribosomes
- Do not have any mitochondria

Results Plus: Examiner Comments

This response scored 2 marks for no nucleus and no mitochondria. Ribosomes are found in bacterial cells.

(ii) Bacterial cells contain plasmids.

Describe **three** other features of a bacterial cell.

(3)

Bacterial cells contain chromosomal DNA used to code for proteins.
Bacterial cells may contain flagella for movement and capsules for protection.
Bacterial cells contain ribosomes for protein synthesis.

Results Plus: Examiner Comments

This response scored the full 3 marks although each point they make is correct for a bacterial cell. The explanation of each feature was not required.

(ii) Bacterial cells contain plasmids.

Describe **three** other features of a bacterial cell.

(3)

~~They~~ bacterial cells don't have a nucleus
bacterial cells have a cell wall

Results Plus: Examiner Comments

This response is concise but clear and scored 2 marks.

Q18.

This maths question on magnification required candidates to measure the width of the egg cell and calculate it's actual width with the answer in millimetres and standard form. Some candidates measured the diameter in centimetres which led to an error in the calculated value as it was not converted to millimetres. It is highly recommended that candidates measure in millimetres as it leads to less errors when unit conversions are required. Some candidates completed the calculation correctly but did not express the answer in standard form.

Q19.

(i)

This maths question required candidates to calculate the difference in the number of neurones between the rat and the frog in standard form. Many candidates were able to gain both marks, candidates could have used a calculator giving the answer in standard form. Candidates were more likely to make and error if they wrote out the full numbers. 1 mark was given for the correct answer not in standard form. No marks were awarded if the incorrect data was used.

Figure 16 shows the number of neurones in the brain of different animals.

animal	number of neurones in the brain
lobster	1.0×10^5
frog	1.6×10^7
rat	2.0×10^8
human	8.6×10^{10}

Figure 16

(i) Calculate the difference between the number of neurones in the brain of the rat and the brain of the frog.

Give your answer in standard form. 16000000

(2)

20 $(2.0 \times 10^8) \div (1.6 \times 10^7) = 12.5$

$$\begin{array}{r} 200000000 \\ -\ 160000000 \\ \hline 40000000 \end{array} = 184000000$$

184000000 neurones

Results Plus: Examiner Comments

This response was awarded 1 mark for the correct mathematical answer but not in standard form.

Figure 16 shows the number of neurones in the brain of different animals.

animal	number of neurones in the brain
lobster	1.0×10^5
frog	1.6×10^7
rat	2.0×10^8
human	8.6×10^{10}

Figure 16

(i) Calculate the difference between the number of neurones in the brain of the rat and the brain of the frog.

Give your answer in standard form.

(2)

$2.0 \times 10^8 - 1.6 \times 10^7 = 1.84 \times 10^8$

1.84×10^8 neurones

Results Plus: Examiner Comments

This response is worth full marks for the correct answer in standard form.

(ii)

Candidates of higher ability scored well on these questions as their responses were accurate and concisely presented. This question revealed a number of misconceptions and candidates frequently lost marks because of the phrasing in their responses. Myelination speeds up the electrical impulses and not neurotransmission. The idea that it prevents messages getting lost was insufficient. Messages travel long distances along motor neurones, the neurones do not travel long distances. Descriptions of saltatory conduction were accepted for the idea of speeding up the impulse. In addition, the concept that motor neurones are involved in reflex arcs and therefore impulses need to be transmitted quickly. Speeding up impulses was the most common mark awarded.

(ii) Most neurones in the brain are unmyelinated whereas motor neurones are myelinated.

Explain why myelination is needed on motor neurones but not on neurones in the brain.

(3)

The motor neurons have very long axons. Through this long axon, electrical impulses must be transferred from the cell body to an effector. Myelination is used to insulate the axon, causing the electrical impulses to move to the effector much faster. The neurons in the brain don't need myelination because they don't have to travel as far so don't need to go as fast. Effectors cause the body to move so the impulses need to be fast so people can quickly move so the motor neurons are insulated.

Results Plus: Examiner Comments

This shows a good response, full marks were awarded. They have the idea that impulses have to travel long distances and to effectors. They also give the role of myelination insulating the axon causing the electrical impulses to travel faster.

(ii) Most neurones in the brain are unmyelinated whereas motor neurones are myelinated.

Explain why myelination is needed on motor neurones but not on neurones in the brain.

(3)

Myelin sheath insulate the neurones so that it can transmit the electrical impulse faster. Myelination is needed on motor neurones because they need insulation but the neurones in the brain don't. As they don't need to be myelinated for their purpose and they don't transmit electrical impulses to muscles but motor neurone's roles are to transmit information to the muscles.

Results Plus: Examiner Comments

This response scored full marks for insulating the neuron causing the electrical impulses to be transmitted faster and to muscles which are a named effector.

(ii) Most neurones in the brain are unmyelinated whereas motor neurones are myelinated.

Explain why myelination is needed on motor neurones but not on neurones in the brain.

(3)

Myelination is a process where the axon and dendrons of a neurone are covered by a fatty layer called the myelin sheath, this sheath electrically insulates the neurone. Motor neurones need myelination as it speeds up the neurones by making sure no energy escapes.

Results Plus: Examiner Comments

This response scored 1 mark for insulation. It does not speed up neurones and preventing energy escaping is not creditworthy.

Results Plus: Examiner Tip

Take care when talking about the nervous system that you refer to electrical impulses travelling along the neurones and not the neurones travelling.

Q20.

(ii)

It was pleasing to note than the majority of candidates were able to access this mathematical challenge and correctly apply the magnification calculation. As this is an overlap question with the foundation paper there was not a conversion between units required; however, at a different stage in the paper this may also have been asked for. Common errors were dividing the actual size of the cell by the magnification rather than multiplying it.

(ii) The actual length of the red blood cell from a turtle is 20.5 µm.

Calculate the length of the magnified image of the red blood cell of the turtle when magnified 400 ×.

(2)

Actual
mag

20.5 × 400 = 8200 µm

8200 µm

Results Plus: Examiner Comments

Clear working is shown and the correct answer is on the answer line for 2 marks. In this case no conversion was required but it is always worth checking the units on questions to ensure that all measurements are in the same unit.

(iii)

This magnification calculation also required candidates to convert their answer into standard form. Several candidates calculated the correct response but missed the instruction to present their answer in standard form so lost 1 mark.

(iii) The width of the human red blood cell, when magnified 400×, is 3.08 mm.

Calculate the actual width of the cell and show your answer in standard form.

(2)

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

$A = \frac{I}{M} = \frac{3.08}{400} = 7.7 \times 10^{-3}$ mm

7.7×10^{-3} mm

Results Plus: Examiner Comments

This is the correct calculation and the answer is in standard form on the answer line so 2 marks can be awarded.

(iii) The width of the human red blood cell, when magnified 400×, is 3.08 mm.

Calculate the actual width of the cell and show your answer in standard form.

(2)

Actual size = Image size / magnification

$\frac{3.08}{400} = 0.0077$

7.7×10^{-3}

0.0077 mm

Results Plus: Examiner Comments

The question asks for the answer to be put in standard form which is the second marking point. This response can only be awarded 1 mark as they either missed the instruction or did not understand standard form.

Results Plus: Examiner Tip

Maths skills are now an implicit part of the biology specification: make sure you are familiar with the common calculations such as magnification calculation, calculating a mean, rate calculations and percentage change calculations. All of these are common in biology.

Q21.

It was pleasing to see that most candidates could use the data given to calculate the length of a magnified image. Some candidates may have scored one mark out of two if they had shown their working for the calculation.

Q22.

(i)

The new specification requires an increase in the application of maths in biology assessments. It also requires candidates to be able to interconvert units.

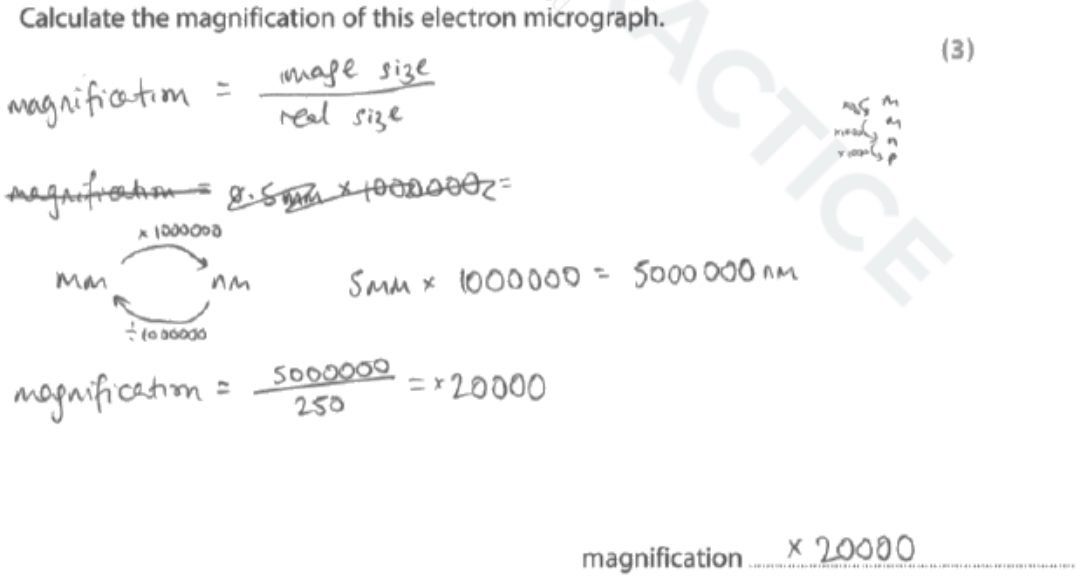
This question required the candidate to calculate the magnification used to produce the image of the electron micrograph and was an overlap item with the higher paper. Very few foundation candidates scored maximum marks on this question.

The first mark was for measuring the diameter. A number of 4, 5 or 6 was accepted without units as mm was assumed. Any other measurement required the unit to be clarified. Candidates should show units for all calculations.

The second mark was for the unit conversion, which was seen very rarely. The final mark was for dividing by the actual size of the image correctly. This was seen on some higher ability candidates for the paper.

This is an example of a model answer to a calculation question. All the stages are shown clearly.

(i) Calculate the magnification of this electron micrograph. (3)



Results Plus: Examiner Comments

This candidate has used the space available to work through the calculation and convert all the units correctly.

(i) Calculate the magnification of this electron micrograph.

(3)

magnification 20,000

Results Plus: Examiner Comments

The correct answer is always awarded maximum marks even if workings are not shown.

This item was given one mark for correctly converting 250 nm into mm.

(i) Calculate the magnification of this electron micrograph.

(3)

0.250 nm

0,000250 mm

5.5cm

magnification 2200

Results Plus: Examiner Comments

It is important to show the units on magnification calculations to avoid getting confused.

Results Plus: Examiner Tip

Always show your workings for calculations

(i) Calculate the magnification of this electron micrograph.

(3)

$\frac{\text{real size}}{\text{image size}} = \frac{6.5}{250} = 0.026$

magnification × 0.026

Results Plus: Examiner Comments

It is not possible to measure 6.5 mm precisely, so no mark was awarded. The mark has been given for the correct calculation. The candidate has not converted the units so only scores one mark.

Q23.

This question caused some difficulties for candidates. They needed to complete the measurement and give the correct units to achieve the first marking point. The second marking point was for the correct conversion. This is a new skill requirement for the maths criteria for the new specification and is quite challenging. The final mark point was for the correct calculation, by dividing by 250 which was given in the question. There were some errors carried forward if the conversion from their measurement was incorrect but the calculation mark could still be awarded.

This question posed some difficulties for the candidates, with several not completing the correct measurement and so not able to start.

Calculate the magnification of this electron micrograph.

(3)

$250 \times 10^{-6} = 0.00025\ mm$

$\frac{5mm}{0.00025} = 200000$

magnification x200000

Results Plus: Examiner Comments

This candidate has completed the correct measurement, the correct conversion and calculated the correct magnification for all three marks.

Results Plus: Examiner Tip

Always show all working.
If a measurement is required then please make sure you include the correct units for the measurement.

Q24.

This question examined candidates' ability to convert units as well as their understanding of the difference between haploid and diploid cells. Many candidates forgot to take into account the fact that they were dealing with a haploid cell, not a diploid cell.

An answer of 6.2 was seen very frequently. This gained 1 mark for converting nanograms to picograms, but not both marks as this answer had not been divided by two.

A scientist obtained a mass of 0.0062 nanograms of DNA from a diploid human cell.

Calculate the mass of DNA the scientist should obtain from a haploid human cell.

Give your answer in picograms.

(1 nanogram = 1000 picograms)

(2)

0.0062 =

0.0062 x 1000 = 6.2

6.2 ~~6.2~~ picograms

Results Plus: Examiner Comments

This answer scores 1 mark for using information given in the question to convert nanograms to picograms.

Results Plus: Examiner Tip

Remember that a haploid cell contains half the mass of DNA of a diploid cell.

Q25.

There are two aspects to this question, the knowledge that haploid cells contain half the genetic material of diploid cells and the unit conversion from nanograms to picograms. Full marks were awarded for the correct answer but if this was not obtained there was a mark for either dividing the mass by 2 or completing the unit conversion, the answer for this could be given in standard form. The most common mistake was only completing one aspect of the question. Some responses doubled the amount of DNA.

A scientist obtained a mass of 0.0062 nanograms of DNA from a diploid human cell.

Calculate the mass of DNA the scientist should obtain from a haploid human cell.

Give your answer in picograms.

(1 nanogram = 1000 picograms)

(2)

0.0062 x 1000 = 6.2

6.2 ÷ 2 = 3.1

3.1 picograms

Results Plus: Examiner Comments

This response shows both aspects of the calculation and the correct answer was obtained scoring the full 2 marks.

A scientist obtained a mass of 0.0062 nanograms of DNA from a diploid human cell.

Calculate the mass of DNA the scientist should obtain from a haploid human cell.

Give your answer in picograms.

(1 nanogram = 1000 picograms)

(2)

0.0062 ÷ 2 = 0.0031 ÷ 10^{-3} = 0.0000031

0.0000031

nano = 10^{-9} pico = 10^{-12}

0.000.0031 picograms

Results Plus: Examiner Comments

This response scored 1 mark for dividing the mass in the diploid cell by 2. They have divided by a 1000 so the unit conversion was not correct.

A scientist obtained a mass of 0.0062 nanograms of DNA from a diploid human cell.

Calculate the mass of DNA the scientist should obtain from a haploid human cell.

Give your answer in picograms.

(1 nanogram = 1000 picograms)

(2)

0.0062 x 1000

6.2 pico grams

6.2 picograms

Results Plus: Examiner Comments

This response also scored 1 mark. This candidate has halved the DNA from the diploid cell but not given the answer in picograms.

Q26.

(i) The majority of candidates correctly calculated the mean number of starch grains in potato cells P, Q and R to gain the available mark.

Q27.

A calculation of the mean number of starch grains was generally well answered with most candidates able to calculate a mean as is expected at GCSE level. Where there were errors this was mainly due to miscounting the starch grains.

Q28.

The maths skill of calculating a ratio was examined in this question. Candidates across the ability range found this question challenging, but when successful they usually gained both marks for giving the correct ratio of 1:3. Incorrect substitution (15:5) leading to an answer of 3:1 scored one mark for an error carried forward.

Q29.

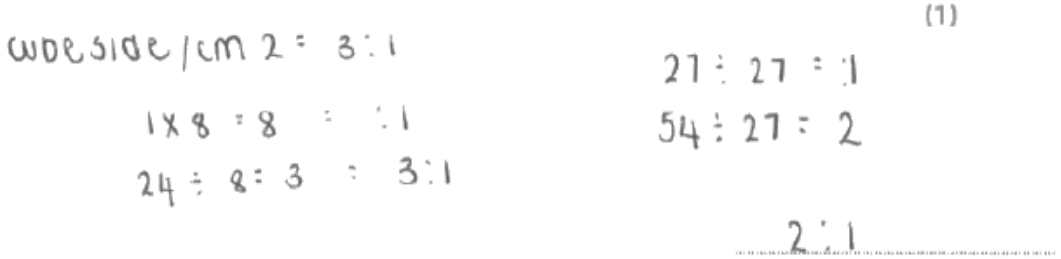
(i)

This question required the candidate to calculate the surface area to volume ratio to its lowest

possible ratio as is shown in the table.

(i) Calculate the surface area to volume ratio for the cube with side 3 cm.

(1)



Results Plus: Examiner Comments

This is a correct ratio given as the ratios were in the table and so is awarded 1 mark.

(i) Calculate the surface area to volume ratio for the cube with side 3 cm.

(1)

Results Plus: Examiner Comments

This is a ratio but has not been adjusted to its lowest possible ratio, as given in the table, so was not awarded the mark.

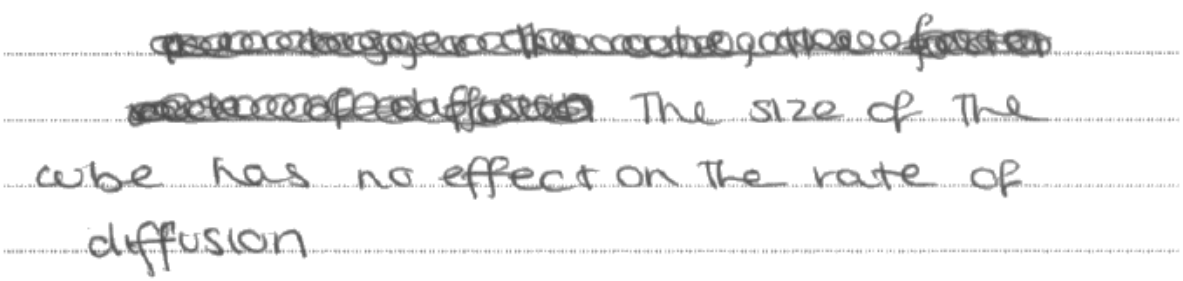
(iii)

Several candidates referred to how far into the cube the sodium hydroxide diffused rather than the rate of diffusion which was calculated and was the same for all cubes.

It is essential that the candidate answers the question asked rather than the one they think is being asked.

(iii) Describe the effect of the size of the cube on the rate of diffusion.

(1)



Results Plus: Examiner Comments

The rate of diffusion was given in the table and was calculated in the previous question. Since the rate was the same for all sizes of cube, a statement that the rate of diffusion is the same is correct.

Results Plus: Examiner Tip

Read the question carefully.
This question was about rate, not about how far into the cube the sodium hydroxide moved.

(iii) Describe the effect of the size of the cube on the rate of diffusion.

(1)

the size of the cube will get smaller the higher the rate of diffusion is

Results Plus: Examiner Comments

This response refers to how far into the cube the sodium hydroxide permeated rather than the rate of the diffusion so 0 marks awarded.

(iv)

This question requires the candidate to state why the sodium hydroxide diffuses into the cube. Candidates were often confused about the idea that it was to do with acids and alkalis neutralising each other, but this is not the reason for diffusion.

This is another required practical and the candidates who have done this investigation will have an advantage over those who have not.

Diffusion is the movement of particles from where they are in high concentration to where they are in low concentration through the agar, which is permeable.

Please note agar is permeable. It does not have a partially permeable membrane.

(iv) Explain why the sodium hydroxide diffuses into the cube.

(2)

Because it is an alkali.

Results Plus: Examiner Comments

There were many comments about acids and alkalis, but these were irrelevant to the question. The question was about why the sodium hydroxide diffuses into the cube.

(iv) Explain why the sodium hydroxide diffuses into the cube.

(2)

Sodium hydroxicle dissuses into the cube because it makes it weaker on the inside so it makes it easier to dissuse the cube.

Results Plus: Examiner Comments

This response is along the right lines but does not refer to the concentration differences inside and outside the cube, so no mark could be awarded.

Q30.

(i)

In this question, the formula for calculating surface area was given and candidates were asked to calculate the surface area of chip B. Many candidates completed the mathematical calculation successfully and were awarded the full 2 marks for the correct answer, 48 or 48.0. The most common error seen related to the values XY, XZ and YZ being added together rather than the correct process of multiplying the values. Occasionally, candidates calculated the surface area of chip A, which was already given in Figure 12.

Figure 11 shows two potato chips.

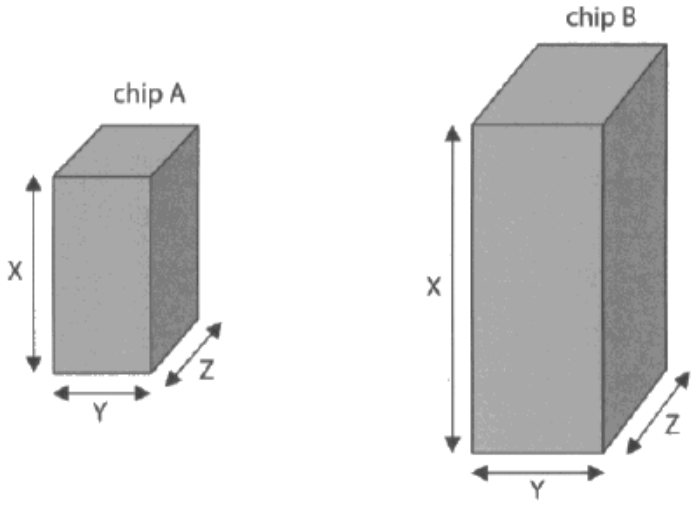


Figure 11

Figure 12 shows some information about each potato chip.

potato chip	length of X in cm	length of Y in cm	length of Z in cm	total surface area of four sides in cm^2	total surface area of top and bottom in cm^2	total surface area of chip in cm^2
A	3.0	1.5	1.5	18.0	4.5	22.5
B	5.0	2.0	2.0	?	?	?

Figure 12

(i) Calculate the total surface area of potato chip B using the formula,

Total surface area = 2XY + 2XZ + 2YZ

(2)

$(2 \times 5 \times 2) + (2 \times 5 \times 2) + (2 \times 2 \times 2)$

$= 180$

total surface area = 180 cm^2

Results Plus: Examiner Comments

This answer scores 1 mark. The candidate has substituted into the formula correctly, but the evaluation is incorrect.

Results Plus: Examiner Tip

Always check your answers to maths questions.

Figure 11 shows two potato chips.

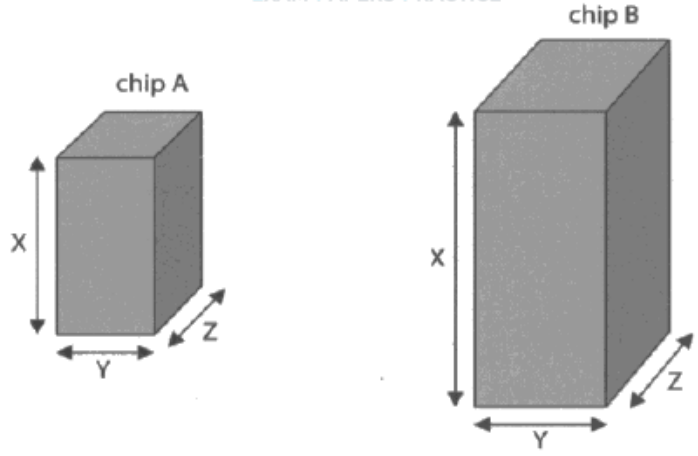


Figure 11

Figure 12 shows some information about each potato chip.

potato chip	length of X in cm	length of Y in cm	length of Z in cm	total surface area of four sides in cm²	total surface area of top and bottom in cm²	total surface area of chip in cm²
A	3.0	1.5	1.5	18.0	4.5	22.5
B	5.0	2.0	2.0	?	?	?

Figure 12

(i) Calculate the total surface area of potato chip B using the formula,

Total surface area = 2XY + 2XZ + 2YZ

(2)

4.5 4.5 2.25
2(3x1.5) + 2(3x1.5) + 2(1.5x1.5)

total surface area = 22.5 cm²

Results Plus: Examiner Comments

This response does not score any marks. The candidate has calculated the surface area of potato chip A instead of potato chip B.

(ii)

This question required candidates to provide an explanation as to why potato chip B had a greater increase in mass. For marking point 1, candidates needed to give a comparative idea for chip B, for example, that it had a larger, greater, bigger or more surface area. Many candidates could do this successfully. The idea of potato chip B having a higher solute concentration or lower water potential than chip A was also accepted. Answers which suggested a larger surface area:volume ratio were not accepted, because this is incorrect.

For marking point 2, candidates needed to refer to the idea that more water is going into potato chip B. Responses which indicated that chip B soaked up more water were accepted. Just the idea of water entering by osmosis was insufficient, as this also occurs in chip A as well.

Candidates were less successful in giving an appropriate explanation.

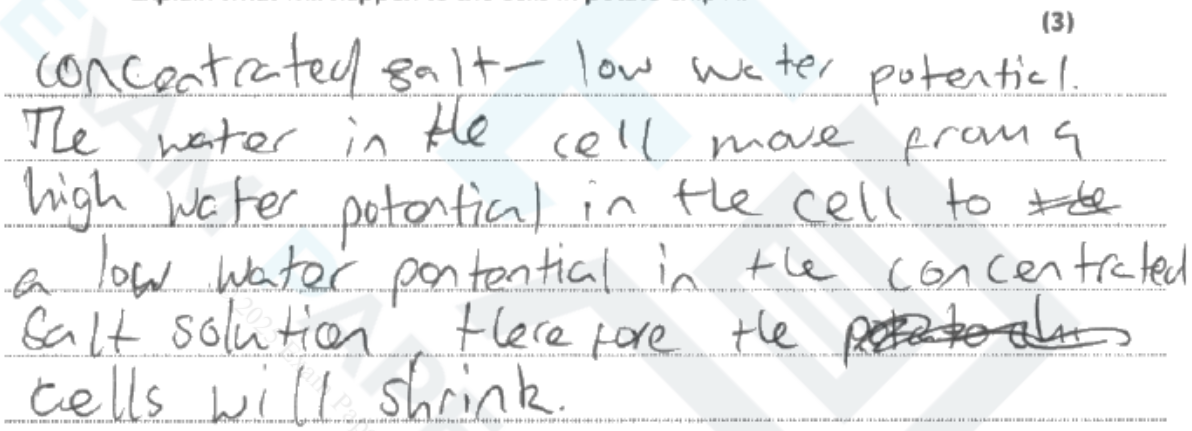
(iii)

In this question, candidates were required to explain what would happen to the cells of chip A if the chip was placed in a concentrated salt solution. This proved to be a very challenging question for many candidates. For marking point 1, candidates had to identify that the cells in chip A would lose water, become plasmolysed, get smaller, shrink or lose mass to gain marks on the linked explanation.

Marking point 2 was for osmosis; the use of the term 'diffusion' was ignored. Marking point 3 could be obtained by referring to the solute concentration gradient or the idea of water potential. Water concentration was accepted, as specific knowledge of water potential itself is not required, although candidates who used this concept were usually successful in obtaining full marks. Candidates who scored marks for this question were frequently successful in obtaining the full 3 marks.

Explain what will happen to the cells in potato chip A.

(3)



Results Plus: Examiner Comments

This answer scores 2 marks. There is a comment about cells shrinking for marking point 1 and a correct reference to water moving due to differences in water potential for marking point 3. Water movement by osmosis has not been mentioned, so marking point 2 has not been awarded.

Results Plus: Examiner Tip

Remember that water moves into and out of cells by osmosis.

Explain what will happen to the cells in potato chip A.

(3)

the Potato chip A will begin to lose mass due to the salt in the solution.

Results Plus: Examiner Comments

This response scores 1 mark for the idea that mass will be lost. The reference to salt solution is too vague to be creditworthy.

Q31.

(i)

In this question, the formula for calculating surface area was given and candidates were asked to calculate the surface area of chip B.

Most candidates completed the mathematical calculation successfully and were awarded the full 2 marks for the correct answer, 48 or 48.0.

A common error in this question related to the values XY, XZ and YZ being added together rather than the correct process of multiplying the values. In some cases, candidates calculated the surface area of chip A, which was already given.

Figure 5 shows two potato chips.

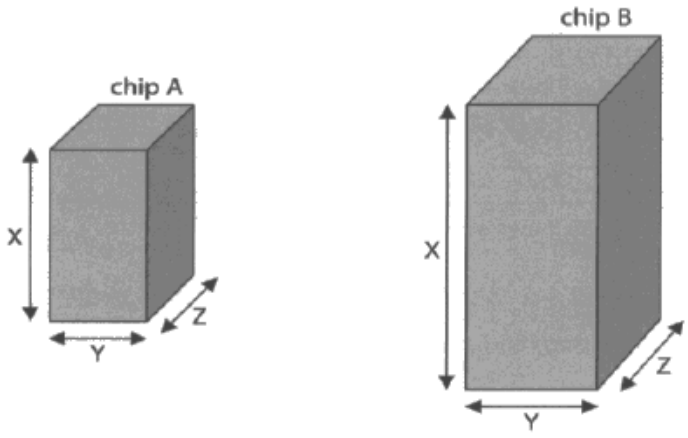


Figure 5

Figure 6 shows some information about each potato chip.

potato chip	length of X in cm	length of Y in cm	length of Z in cm	total surface area of four sides in cm²	total surface area of top and bottom in cm²	total surface area of chip in cm²
A	3.0	1.5	1.5	18.0	4.5	22.5
B	5.0	2.0	2.0	?	?	?

Figure 6

(i) Calculate the total surface area of potato chip B using the formula,

Total surface area = 2XY + 2XZ + 2YZ

(2)

2(5)(2) + 2(5)(2) + 2(2)(2)
20 + 20 + 8

total surface area = 48 cm²

Results Plus: Examiner Comments

This response was awarded the full 2 marks for showing the numbers substituted into the equation and the correct answer.

Figure 5 shows two potato chips.

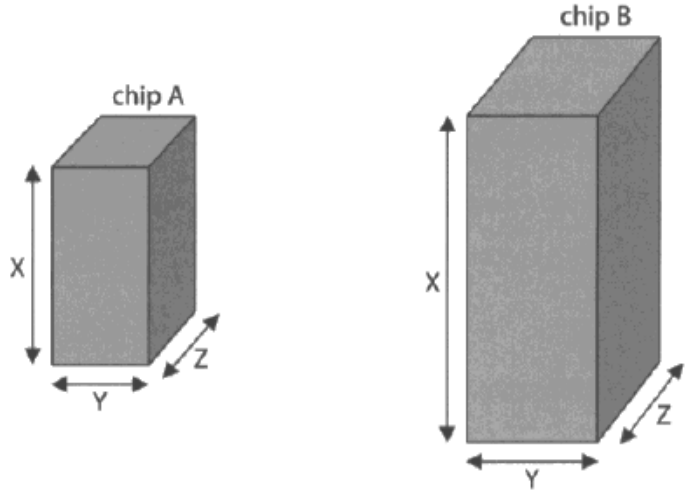


Figure 5

Figure 6 shows some information about each potato chip.

potato chip	length of X in cm	length of Y in cm	length of Z in cm	total surface area of four sides in cm²	total surface area of top and bottom in cm²	total surface area of chip in cm²
A	3.0	1.5	1.5	18.0	4.5	22.5
B	5.0	2.0	2.0	?	?	?

Figure 6

(i) Calculate the total surface area of potato chip B using the formula,

Total surface area = 2XY + 2XZ + 2YZ

(2)

$(2 \times 5.0 \times 2.0) + (2 \times 5.0 \times 2.0) + (2 \times 2.0 \times 2.0)$

$= 78$

total surface area = 78 cm²

Results Plus: Examiner Comments

This response was awarded one mark for substituting the numbers into the equation, but the answer is incorrect.

Figure 5 shows two potato chips.

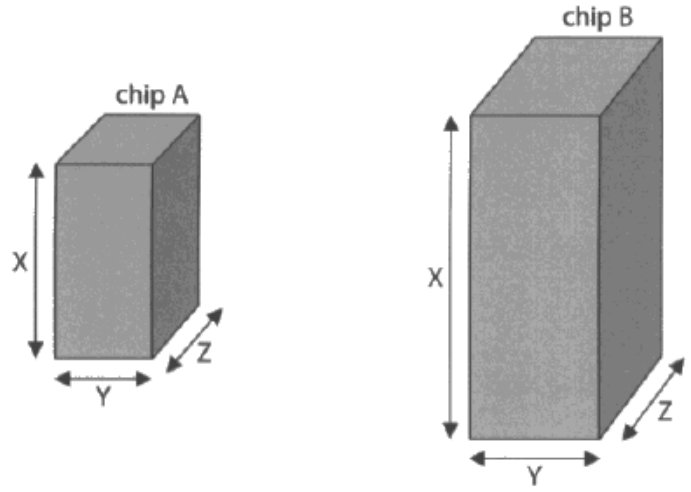


Figure 5

Figure 6 shows some information about each potato chip.

potato chip	length of X in cm	length of Y in cm	length of Z in cm	total surface area of four sides in cm²	total surface area of top and bottom in cm²	total surface area of chip in cm²
A	3.0	1.5	1.5	18.0	4.5	22.5
B	5.0	2.0	2.0	?	?	?

Figure 6

(i) Calculate the total surface area of potato chip B using the formula,

Total surface area = 2XY + 2XZ + 2YZ

x = 5.0
y = 2.0
z = 2.0

surface area = 2(5×2) + 2(5×2) + 2(2×2)

14 + 14 + 8 = 36

(2)

total surface area = 36 cm²

Results Plus: Examiner Comments

This response was not awarded any marks as the substituting into the equation is incorrect. This was one of the main errors seen for those candidates who did not gain credit on this question.

(ii)

This question required candidates to provide an explanation as to why potato chip B had a greater increase in mass. For marking point 1, candidates were required to give a comparative idea for chip B, for example, that is was larger, greater or bigger. Suggestions of chip B having a higher solute concentration or lower water potential than chip A were also accepted.

Answers which suggested a larger surface area:volume ratio were incorrect. For marking point 2,

candidates needed to refer to the notion that more water was going into potato chip B. Responses which just referred to the idea of water entering by osmosis were not sufficient as the process also occurs in chip A. Therefore, for marking point 2, candidates must indicate more water going into potato chip B.

(ii) The potato chips were placed in distilled water for 20 minutes.

Figure 7 shows the increase in mass of each potato chip.

potato chip	increase in mass in grams
A	0.1
B	0.3

Figure 7

Explain why potato chip B has a greater increase in mass than potato chip A.

(2)

It has a bigger surface area, as a result more water goes in to the potato chip by osmosis. More water in means that the increase in mass is greater.

Results Plus: Examiner Comments

This response has been awarded the full 2 marks for reference to a bigger surface area and more water moving into the chip by osmosis for the explanation.

(ii) The potato chips were placed in distilled water for 20 minutes.

Figure 7 shows the increase in mass of each potato chip.

potato chip	increase in mass in grams
A	0.1
B	0.3

Figure 7

Explain why potato chip B has a greater increase in mass than potato chip A.

(2)

The increased surface area increases the chances for osmosis into the chip.

Results Plus: Examiner Comments

This response is worthy of one mark for reference to the increased surface area. Osmosis into the chip is not sufficient to explain the mass increase.

(iii)

In this question, candidates were required to explain what would happen to the cells of chip A if it was placed in a concentrated salt solution for a total of 3 marks.

For marking point 1, candidates were required to refer to the notion that the cells in chip A would lose water or become plasmolysed. Similarly, reference to chip A getting smaller, shrinking or losing mass were also acceptable responses.

For marking point 2, candidates were required to refer to the notion of water being released by osmosis. The use of the term 'diffusion' by some candidates was ignored.

For marking point 3, candidate responses needed to refer to the solute concentration gradient or the idea of water potential. However, the notion of water concentration was also accepted, as knowledge of water potential itself was not required.

Most candidates were successful in achieving full marks for this question. However, candidates who were awarded 2 marks had often neglected using the term osmosis or were unable to provide a clear explanation as to why the water moved out of chip A.

(iii) Potato chip A is transferred from the distilled water into a concentrated salt solution.

Explain what will happen to the cells in potato chip A.

(3)

The cells in chip A will lose water as osmosis will occur, transferring water from the highly concentrated cells to the lower water concentration in the salt solution. They ~~will~~ may lose turgidity and potentially lose their rigid shape

Results Plus: Examiner Comments

This response is worthy of two marks for reference to losing water and osmosis. The description of osmosis has an error as the potato cells are not highly concentrated in comparison to the salt solution. The explanation is not accurate enough for the full three marks.

(iii) Potato chip A is transferred from the distilled water into a concentrated salt solution.

Explain what will happen to the cells in potato chip A.

(3)

The cells will decrease in size, as the salt in the salt solution will draw out the water from them, meaning they contain less water, and so will become smaller.

Results Plus: Examiner Comments

This response was awarded 1 mark for the idea of the water being drawn out of them, or decrease in size. The answer does not explain the change to the cells using scientific knowledge of osmosis.

(iii) Potato chip A is transferred from the distilled water into a concentrated salt solution.

Explain what will happen to the cells in potato chip A.

(3)

potato chip A will lose mass as the water molecules in the cells of potato chip A will go from the high concentration of water to the low concentration of water in the salt solution through the partially permeable membrane of the potato skin, this is osmosis.

Results Plus: Examiner Comments

This response was awarded the full 3 marks for stating what will happen to the cells in chip A and explaining it using scientific knowledge on osmosis.

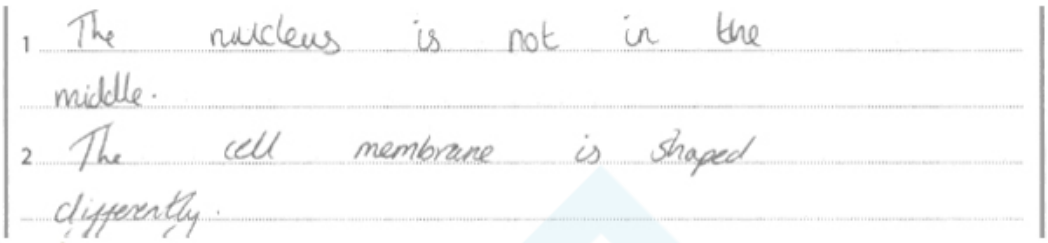
Q32. No Examiner's Report available for this question

Q33. No Examiner's Report available for this question

Q34.

(a) (i)

Generally most students gained the full two mark points for noticing that yeast have a nucleus and a vacuole where these are absent in bacteria. Most common mistakes were that bacteria don't have a cell wall or they don't have cytoplasm. Other incorrect responses included reference to mitochondria and also reference to tails rather than flagella.

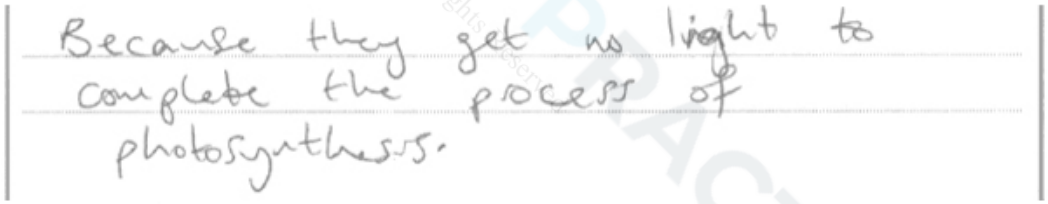

1 The nucleus is not in the middle.
2 The cell membrane is shaped differently.

Results Plus: Examiner Comments

This candidate has confused plant cells here by referring to the nucleus not being in the centre. In this case it is the fact that the bacterial cell does not have a nucleus. The cell membrane being a different shape is probably true of almost every cell so is not creditable for the mark.

(a) (ii)

On the whole this question was very well answered. The vast majority gained the one mark for this question. The few students who didn't get the mark confused photosynthesis with respiration.


Because they get no light to complete the process of photosynthesis.

Results Plus: Examiner Comments

Clear correct response where the candidate has responded regarding the action of photosynthesis.


They do not have chloroplasts.

Results Plus: Examiner Comments

This is the alternative answer for this question. The candidate has not referred to photosynthesis but has recognised that the organelle for photosynthesis is missing i.e. chloroplast.

(b) (i)

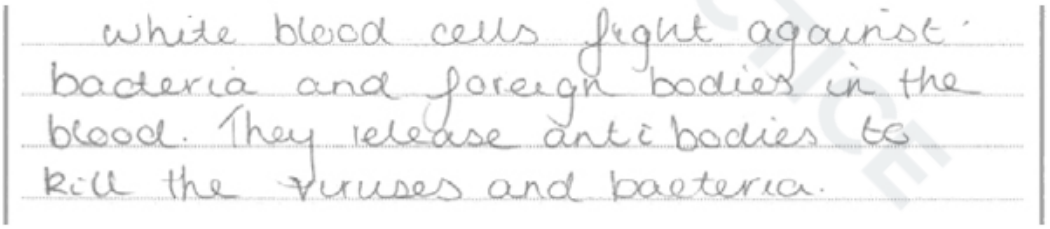
A large number of students did gain the full 2 marks for this question. The use of standard form did confuse some students but more marks were lost due to the incorrect data being selected than by the calculation being incorrect. Several candidates tried to convert the standard form and then convert it back again; quite often they were then out by an order of magnitude. It is essential that the maths skills stated in the front of the specification are covered so as not to disadvantage candidates.

Results Plus: Examiner Comments

This illustrates the importance of selecting the correct data and showing that you have collected the correct data. This candidate gained 1 mark despite not managing the correct calculation.

(b) (ii)

Most students were able to get at least one mark by stating that white blood cells were part of the immune response or words to that effect, but many weren't clear about the actual functions of white blood cells. 'White blood cells are antibodies' was a common response as was that they 'gobble up/eat' pathogens which shows poor use of scientific terminology. Candidates' description of phagocytosis was very poor. The antibody production mark was much more accessible for these candidates. Quite a few students also attributed functions of red blood cells and platelets to white blood cells such as carrying O2, CO2 and waste or causing clotting and repairing wounds.


white blood cells fight against bacteria and foreign bodies in the blood. They release antibodies to kill the viruses and bacteria.

Results Plus: Examiner Comments

This response gained both marks but fight against bacteria is really not the scientific rigour we are expecting at GCSE. In this case as the mark was given for defence against disease this became an acceptable response. The second mark was given for the production of antibodies.

Results Plus: Examiner Tip

Try to use scientific terminology when answering this type of question. The term phagocytosis is the correct term for the action of phagocytes on pathogens in the body.

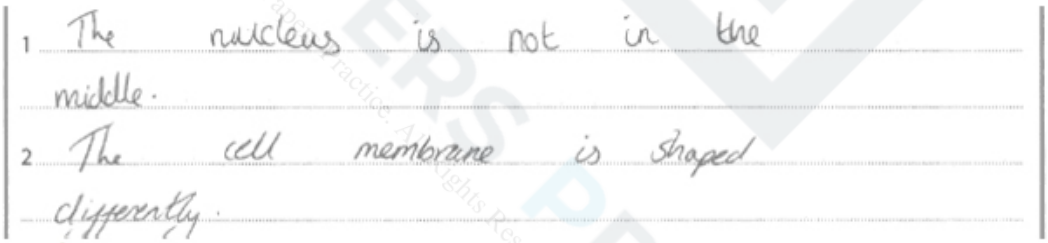
(b) (iii)

The main problem with the answers to this question was that they were referring to breathing difficulties or asthma rather than simply saying short of breath. A small number of students confused anaemia with sickle cell anaemia. The most common correct answer was that there would simply be less oxygen in circulation but some good application of knowledge was also rewarded for responses related to the person doing more anaerobic respiration.

Q35.

(a) (i)

Generally most students gained the full two mark points for noticing that yeast have a nucleus and a vacuole where these are absent in bacteria. Most common mistakes were that bacteria don't have a cell wall or they don't have cytoplasm. Other incorrect responses included reference to mitochondria and also reference to tails rather than flagella.



Results Plus: Examiner Comments

This candidate has confused plant cells here by referring to the nucleus not being in the centre. In this case it is the fact that the bacterial cell does not have a nucleus. The cell membrane being a different shape is probably true of almost every cell so is not creditable for the mark.

(a) (ii)

On the whole this question was very well answered. The vast majority gained the one mark for this question. The few students who didn't get the mark confused photosynthesis with respiration.

Because they get no light to complete the process of photosynthesis.

Results Plus: Examiner Comments

Clear correct response where the candidate has responded regarding the action of photosynthesis.

They do not have chloroplasts.

Results Plus: Examiner Comments

This is the alternative answer for this question. The candidate has not referred to photosynthesis but has recognised that the organelle for photosynthesis is missing i.e. chloroplast.

(b) (i)

A large number of students did gain the full 2 marks for this question. The use of standard form did confuse some students but more marks were lost due to the incorrect data being selected than by the calculation being incorrect. Several candidates tried to convert the standard form and then convert it back again; quite often they were then out by an order of magnitude. It is essential that the maths skills stated in the front of the specification are covered so as not to disadvantage candidates.

$7 \times 10^5 = 70$

$5 \times 10^{10} = 50$

answer = 20

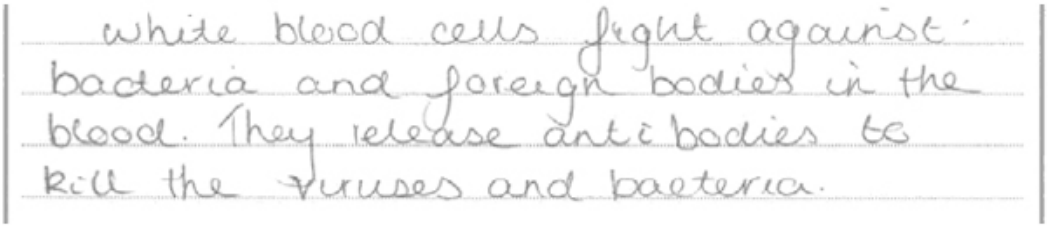
Results Plus: Examiner Comments

This illustrates the importance of selecting the correct data and showing that you have collected the correct data. This candidate gained 1 mark despite not managing the correct calculation.

(b) (ii)

Most students were able to get at least one mark by stating that white blood cells were part of the immune response or words to that effect, but many weren't clear about the actual functions of white blood cells. 'White blood cells are antibodies' was a common response as was that they

'gobble up/eat' pathogens which shows poor use of scientific terminology. Candidates' description of phagocytosis was very poor. The antibody production mark was much more accessible for these candidates. Quite a few students also attributed functions of red blood cells and platelets to white blood cells such as carrying O2, CO2 and waste or causing clotting and repairing wounds.


white blood cells fight against bacteria and foreign bodies in the blood. They release antibodies to kill the viruses and bacteria.

Results Plus: Examiner Comments

This response gained both marks but fight against bacteria is really not the scientific rigour we are expecting at GCSE. In this case as the mark was given for defence against disease this became an acceptable response. The second mark was given for the production of antibodies.

Results Plus: Examiner Tip

Try to use scientific terminology when answering this type of question. The term phagocytosis is the correct term for the action of phagocytes on pathogens in the body.

(b) (iii)

The main problem with the answers to this question was that they were referring to breathing difficulties or asthma rather than simply saying short of breath. A small number of students confused anaemia with sickle cell anaemia. The most common correct answer was that there would simply be less oxygen in circulation but some good application of knowledge was also rewarded for responses related to the person doing more anaerobic respiration.

Q36.

(a)(i)

The majority of candidates correctly identified the nucleus on the diagram of the sperm cell. Whilst some candidates incorrectly stated that the structure was the acrosome which was an understandable error, a significant number labelled it as DNA or genetic material implying that they had not noticed that the question asked them to name a structure.

(b)

This item required candidates to define fertilisation. The majority of candidates stated that it was when sperm and egg cell fuse with many marks being gained from stating that a zygote is formed with many candidates also stating that the gametes are haploid / fertilised egg is diploid. Many candidates wrote answers that covered all of the marking points. It was good to see that candidates knew the details of this area of biology in detail. Candidates lost marks by being vague, for example, stating that the sperm and egg cell meet or referring to sperm and egg as just gametes and the zygote as any later stage of development form embryo to baby as illustrated in the second clip below.

(b) Sperm cells are involved in fertilisation.

Define fertilisation.

(2)

fertilisation is when two haploid gametes meet and combine. The gametes are a sperm and egg cell. Once combined they will become a diploid cell that will grow and reproduce.

Results Plus: Examiner Comments

This candidate has gained both marks through adding detail to the basic definition of fertilisation. They do say that sperm meets the egg; however, although meet is insufficient for credit, the candidate gets the mark as they then qualify the process with the word combine.

Results Plus: Examiner Tip

When revising for a topic that is sequential, make sure that your learning techniques cover the process, the related scientific terminology and further details that will allow you to be credited for subsequent points made.

Fertilisation is when (gamete cells) an egg cell and a sperm cell combine to make an embryo.

Results Plus: Examiner Comments

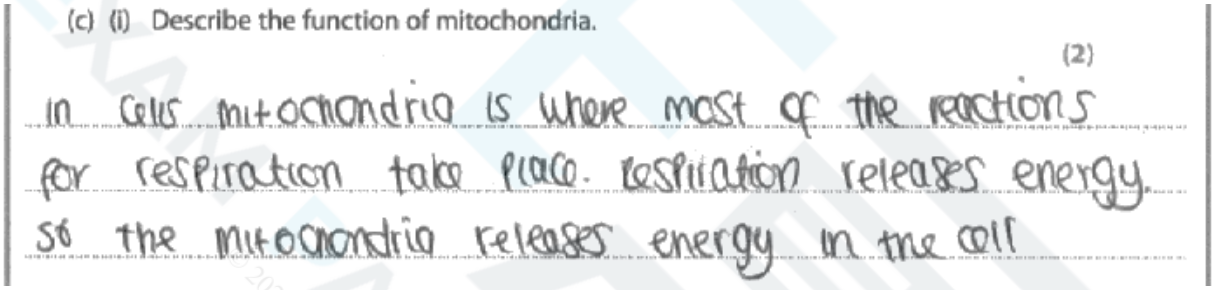
Here the candidate has lost a mark by referring to the fertilised egg as an embryo rather than the correct term, zygote.

Results Plus: Examiner Tip

In sequences like this, ensure that your revision includes all the stages with emphasis on including and learning the relevant scientific terminology.

(c)(i)

To gain both marks, the candidate had to mention both respiration and releasing energy. 'Creates / makes' disqualified the energy mark as it is scientifically wrong. The latter part was the main reason why more candidates scored 1 mark on this item, with roughly one fifth getting both marks. Common incorrect responses included stating that the mitochondria controlled the cell and some that said it glued the sperm to the egg. A few candidates missed the key part of the question as a function and talked about the mitochondria in terms of structure.

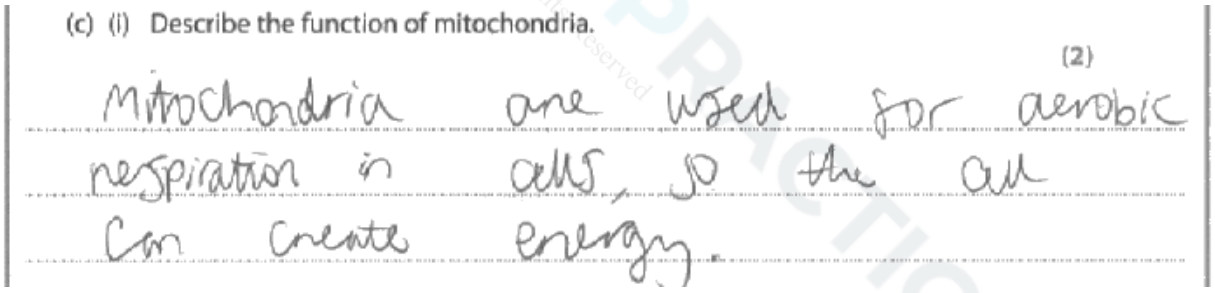

(c) (i) Describe the function of mitochondria.

(2)

in cells mitochondria is where most of the reactions for respiration take place. respiration releases energy. so the mitochondria releases energy in the cell

Results Plus: Examiner Comments

An example of a good response showing a clear understanding of the function of mitochondria.


(c) (i) Describe the function of mitochondria.

(2)

Mitochondria are used for aerobic respiration in cells, so the cell can create energy.

Results Plus: Examiner Comments

'Creating energy' is incorrect science so was not credited, the candidate does, however, get the respiration mark.

Results Plus: Examiner Tip

Use a good text / revision guide when revising so that basic definitions and scientific ideas are accurate.

(c)(ii)

Marks were roughly evenly spread between 0, 1 and 2 on this item. Candidates had to explain how a mutation produces a different protein to gain credit in this item. The candidates here showed that they knew the related science in detail although many of them wrote confused answers that did not allow credit. Many excellent answers were seen explaining in detail how a change in the base sequence related to changing an amino acid with germane details about protein synthesis and it was pleasing to see a few candidates naming a specific type of mutation with deletion being the most common one seen. However, a significant number of candidates misread the question as, 'what is the effect of a changed protein', with some starting off well by stating that the mutation was a change in the base sequence but then going on to describe the lock and key theory and how the protein would not digest food if it was changed in shape.

(ii) Gene mutations in DNA can produce abnormal mitochondria.

Explain how a gene mutation can produce a different protein.

(2)

DNA is ~~not~~ used to give instructions ~~&~~ ~~of~~ ~~how~~ how to make protein, therefor if the DNA is different so are the instructions it gives to make protein, ~~which~~ which leads to a different protein being made.

Results Plus: Examiner Comments

The candidate here gains no marks as the definition of a mutation 'the DNA is different' is too vague with the rest of the response only restating the stem of the question saying that the protein will be different.

Results Plus: Examiner Tip

When revising, practise answering examination questions and have them checked by a teacher who can give guidance on how to ensure that the response answers the question.

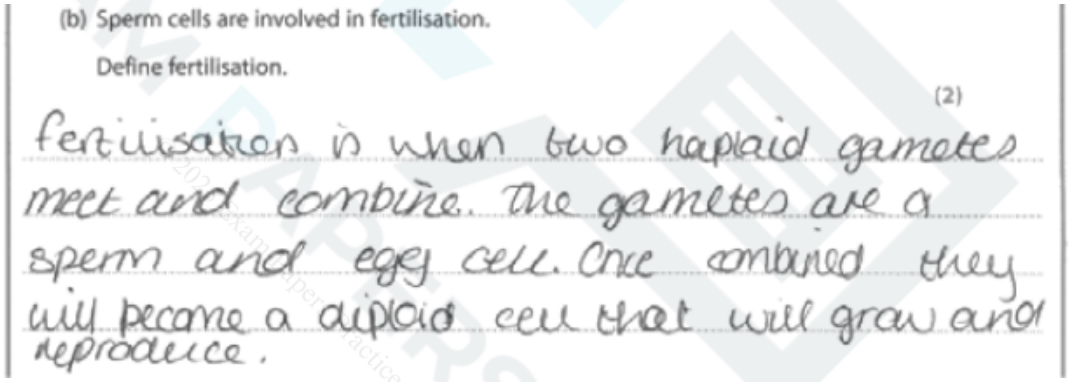
Q37.

(a)(i)

The majority of candidates correctly identified the nucleus on the diagram of the sperm cell. Whilst some candidates incorrectly stated that the structure was the acrosome which was an understandable error, a significant number labelled it as DNA or genetic material implying that they had not noticed that the question asked them to name a structure.

(b)

This item required candidates to define fertilisation. The majority of candidates stated that it was when sperm and egg cell fuse with many marks being gained from stating that a zygote is formed with many candidates also stating that the gametes are haploid / fertilised egg is diploid. Many candidates wrote answers that covered all of the marking points. It was good to see that candidates knew the details of this area of biology in detail. Candidates lost marks by being vague, for example, stating that the sperm and egg cell meet or referring to sperm and egg as just gametes and the zygote as any later stage of development form embryo to baby as illustrated in the second clip below.



(b) Sperm cells are involved in fertilisation.

Define fertilisation.

(2)

fertilisation is when two haploid gametes meet and combine. The gametes are a sperm and egg cell. Once combined they will become a diploid cell that will grow and reproduce.

Results Plus: Examiner Comments

This candidate has gained both marks through adding detail to the basic definition of fertilisation. They do say that sperm meets the egg; however, although meet is insufficient for credit, the candidate gets the mark as they then qualify the process with the word combine.

Results Plus: Examiner Tip

When revising for a topic that is sequential, make sure that your learning techniques cover the process, the related scientific terminology and further details that will allow you to be credited for subsequent points made.

Fertilisation is when (gamete cells) an egg cell and a sperm cell combine to make an embryo.

Results Plus: Examiner Comments

Here the candidate has lost a mark by referring to the fertilised egg as an embryo rather than the correct term, zygote.

Results Plus: Examiner Tip

In sequences like this, ensure that your revision includes all the stages with emphasis on including and learning the relevant scientific terminology.

(c)(i)

To gain both marks, the candidate had to mention both respiration and releasing energy. 'Creates / makes' disqualified the energy mark as it is scientifically wrong. The latter part was the main reason why more candidates scored 1 mark on this item, with roughly one fifth getting both marks. Common incorrect responses included stating that the mitochondria controlled the cell and some that said it glued the sperm to the egg. A few candidates missed the key part of the question as a function and talked about the mitochondria in terms of structure.

(c) (i) Describe the function of mitochondria.

(2)

In cells mitochondria is where most of the reactions for respiration take place. respiration releases energy. so the mitochondria releases energy in the cell

Results Plus: Examiner Comments

An example of a good response showing a clear understanding of the function of mitochondria.

(c) (i) Describe the function of mitochondria.

(2)

Mitochondria are used for aerobic respiration in cells, so the cell can create energy.

Results Plus: Examiner Comments

'Creating energy' is incorrect science so was not credited, the candidate does, however, get the respiration mark.

Results Plus: Examiner Tip

Use a good text / revision guide when revising so that basic definitions and scientific ideas are accurate.

(c)(ii)

Marks were roughly evenly spread between 0, 1 and 2 on this item. Candidates had to explain how a mutation produces a different protein to gain credit in this item. The candidates here showed that they knew the related science in detail although many of them wrote confused answers that did not allow credit. Many excellent answers were seen explaining in detail how a change in the base sequence related to changing an amino acid with germane details about protein synthesis and it was pleasing to see a few candidates naming a specific type of mutation with deletion being the most common one seen. However, a significant number of candidates misread the question as, 'what is the effect of a changed protein', with some starting off well by stating that the mutation was a change in the base sequence but then going on to describe the lock and key theory and how the protein would not digest food if it was changed in shape.

(ii) Gene mutations in DNA can produce abnormal mitochondria.

Explain how a gene mutation can produce a different protein.

(2)

DNA is ~~not~~ used to give instructions ~~&~~ ~~of~~ ~~how~~ how to make protein, therefor if the DNA is different so are the instructions it gives to make protein, ~~which~~ which leads to a different protein being made.

Results Plus: Examiner Comments

The candidate here gains no marks as the definition of a mutation 'the DNA is different' is too vague with the rest of the response only restating the stem of the question saying that the protein will be different.

Results Plus: Examiner Tip

When revising, practise answering examination questions and have them checked by a teacher who can give guidance on how to ensure that the response answers the question.

Q38.

(i)

There are some misconceptions about the use of a coverslip with many candidates believing that it is used to allow light to shine onto the sample which is not the case. Acceptable responses were those which referred to keeping the sample still or keeping it flat. Also acceptable was the idea of protecting the sample from damage. Protecting the sample from bacteria was not acceptable as a marking point.

A student compared the number of stomata on the upper and lower surfaces of a leaf.

She completed a leaf peel as shown in Figure 5.

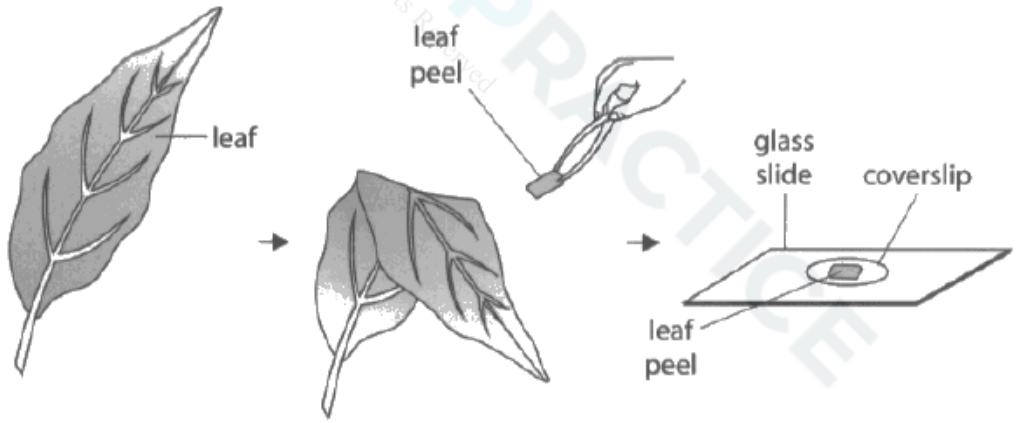


Figure 5

The layer of nail varnish shows an impression of the cells on the surface of the leaf.

(i) State why a coverslip is placed on top of the leaf peel.

(1)

to hold the leaf peel in place

Results Plus: Examiner Comments

This was acceptable for preventing the leaf from moving for 1 mark.

A student compared the number of stomata on the upper and lower surfaces of a leaf.

She completed a leaf peel as shown in Figure 5.

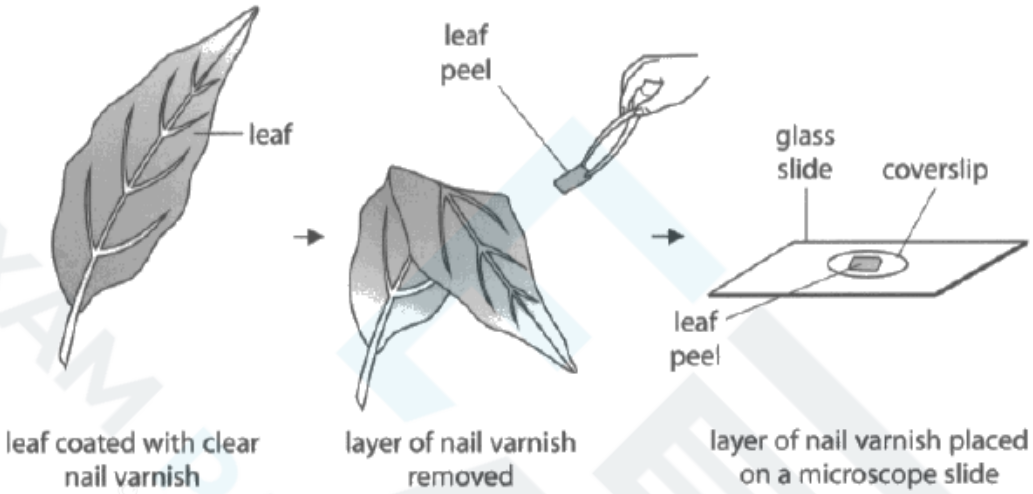


Figure 5

The layer of nail varnish shows an impression of the cells on the surface of the leaf.

(i) State why a coverslip is placed on top of the leaf peel.

(1)

To prevent the impression being altered

Results Plus: Examiner Comments

Prevent the impression being altered is equivalent to protect the specimen, so it is not damaged by the objective lens was also acceptable for 1 mark.

(ii)

The leaf peel was observed because it was thinner and light could pass through more easily. Common errors by candidates were the idea that the leaf was too big: this was not acceptable. The idea that the stomata could be seen was acceptable for a mark.

(ii) Explain why the leaf peel rather than the whole leaf was viewed with a microscope.

(2)

Because the microscope can only look at a small section at one time, you would not be able to view the whole leaf as it is too big. The cells are also more visible on a leaf peel.

Results Plus: Examiner Comments

This was awarded 1 mark for the idea that the cells could be seen, also acceptable was that the stomata/guard cells were visible.

(ii) Explain why the leaf peel rather than the whole leaf was viewed with a microscope.

(2)

leaf would be too thick to view under microscope as light coudn't travel through it while the leaf peal was thin enough to allow light through it and be seen under a microscope.

Results Plus: Examiner Comments

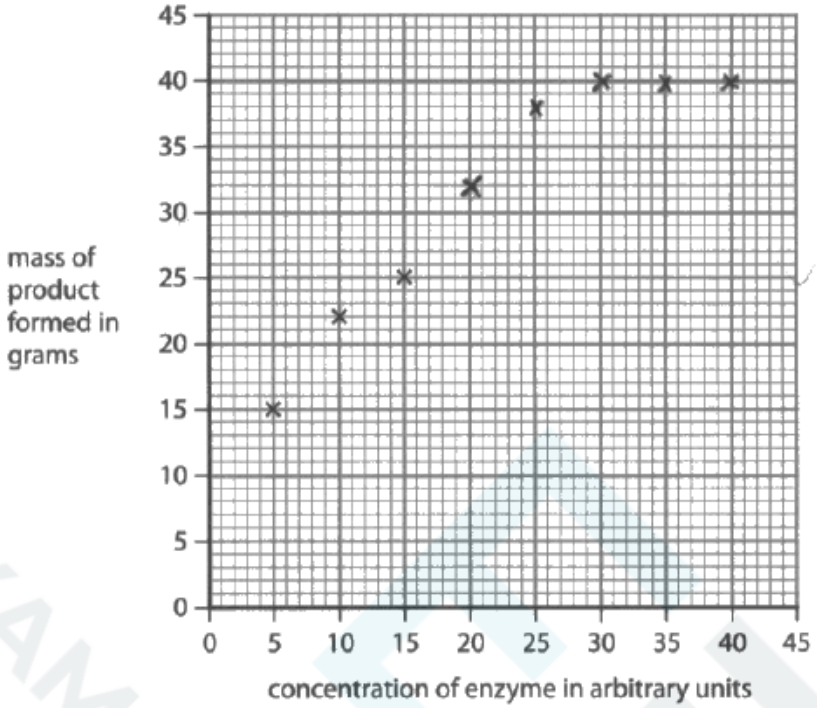
This response attains both marks for the leaf being too thick which is the reverse argument that the leaf peel is thin enough to see and that light can pass through making the cells visible.

Q39.

This question required candidates to plot five points on a graph and then draw a line to show the trend in the data. While the majority of candidates were successful in achieving the first marking point, many candidates did not go on to draw a line, which precluded them from gaining marking point 2. A line showing a steady increase, then levelling off at 30 arbitrary units was required. Dot-todot lines were accepted.

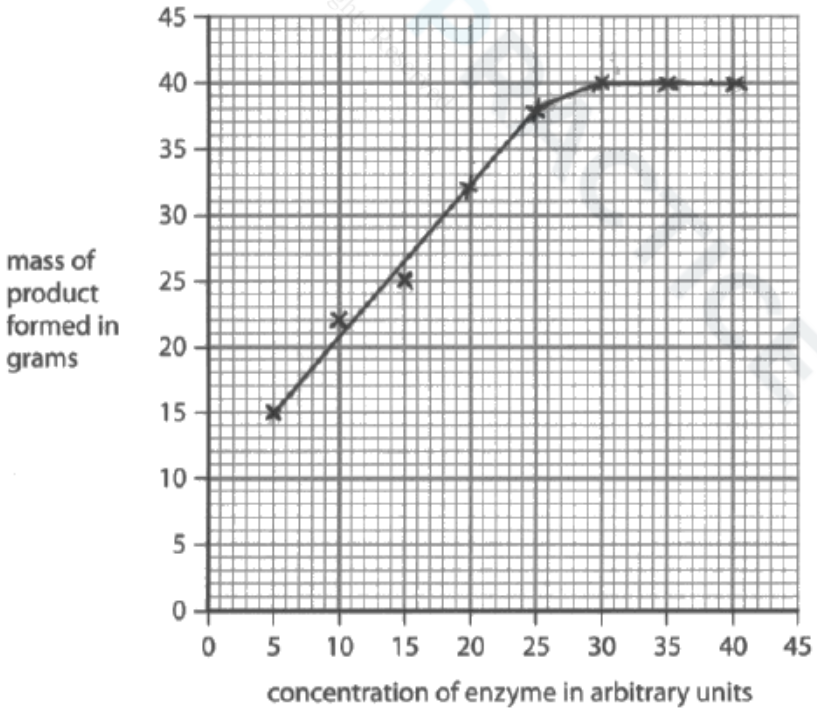
Complete the graph by plotting the points and drawing a line to show the trend in the data.
The first three points have been plotted for you.

(2)



Results Plus: Examiner Comments

This response scores 1 mark for plotting all the points correctly. The candidate has not drawn a line to show the trend, so the second marking point cannot be awarded.



Results Plus: Examiner Comments

This answer was awarded the full 2 marks. The candidate has plotted the points accurately and has drawn a suitable line to show the trend in the data. Lines showing a steady increase that levelled off at 30 arbitrary units were accepted.

Q40.

This fill in the gaps question from the list of words supplied allowed most candidates to gain one of the two marks available with the two answers, smaller (surface area) and diffusion being seen in roughly equal amounts. Almost as many candidates gained both marks available.

Q41. No Examiner's Report available for this question

Q42. No Examiner's Report available for this question

Q43. No Examiner's Report available for this question

Q44.

Many candidates correctly stated that an egg cell has a large amount of cytoplasm so that it can supply the developing zygote / embryo with nutrients, although food was also credited. Of those candidates who did not score the mark here, some stated that the cytoplasm supplied mitochondria, which although true does not answer the question as to why the cytoplasm is large. Others disqualified their answer of more nutrients by stating that the nutrients give the sperm energy to swim to the egg.

Q45.

Many candidates correctly stated that an egg cell has a large amount of cytoplasm so that it can supply the developing zygote / embryo with nutrients, although food was also credited. Of those candidates who did not score the mark here, some stated that the cytoplasm supplied mitochondria, which although true does not answer the question as to why the cytoplasm is large. Others disqualified their answer of more nutrients by stating that the nutrients give the sperm energy to swim to the egg.

Q46. No Examiner's Report available for this question

Q47.

Descriptions of a test to identify fat were usually confused with other food tests and only a small number of candidates scored marks.

Q48.

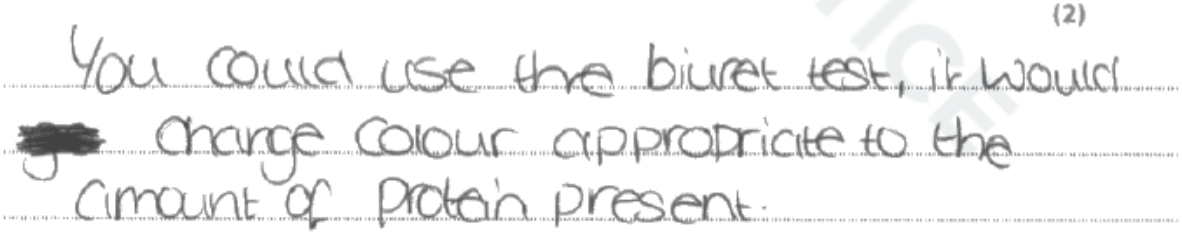
Most candidates were able to recall the test for fat as the emulsion test. Candidates had to include a reference to the use of ethanol and water to obtain the first mark point and then give the result for the second mark, although a reference to the emulsion test was sufficient to get marking point 2. Candidates who did not score on this item identified the incorrect food test reagent.

Q49.

This question required candidates to consider how to test for the presence of protein. The expected answer was to use biuret reagent (solution) which turns purple if protein is present. There was much confusion between biuret and Benedict's reagent; in addition to this, candidates also gave the iodine or emulsion test as an answer. This is a required practical and candidates should have completed these food tests as part of the course.

Describe how a student could test a sample of urine for the presence of protein.

(2)



Results Plus: Examiner Comments

This is part of the answer to the question for 1 mark; the outcome of the test changing colour from blue to purple was needed for the second mark.

Describe how a student could test a sample of urine for the presence of protein.

(2)

A student could ~~test~~ a sample of urine for the protein presence by using a universal indicator, or pH probe ~~or~~ where a low pH indicates the ~~presences~~ presence of protein or if the indicator becomes orange, yellow or red (as well as some light green). ~~Also, a test~~

Results Plus: Examiner Comments

This was a common theme for many of the answers with various different food tests or pH testing being applied. This was not creditable.

Q50.

To gain full marks on this question candidates were required to identify that structure A contains mitochondria for respiration or to release energy and that the acrosome or enzymes are used to digest the egg cell membrane. Candidates need to avoid stating that energy is produced or created. Some incorrect responses gave the idea that the mitochondria store energy and that structure B was the nucleus.

Q51.

For this question candidates had to identify how the calorimeter in Figure 2 could be used to determine the energy content of 10 g of food. The first mark was for measuring the start and end temperature of the water or for using the thermometer to measure the temperature. The second mark was the idea of burning the food. Combusting or igniting the food were accepted but heat the food was insufficient. The final marking point was for using the temperature increase or a temperature change to calculate the energy content. The response needed to indicate that the temperature change or increase could be used to find, measure or calculate the energy content. Just the idea that the temperature rise is the energy content or shows the energy content was insufficient. The details of the calculation were not required, and the mark was awarded if it indicated the requirement for a calculation. A range of marks were awarded for this item but many higher ability candidates obtained full marks and even gave the correct calculation. Common errors that led to marks being lost were just the idea of measuring the end temperature of the water, heating the food rather than burning it and just indicating that the

temperature rise was the energy content.

Figure 2 shows a calorimeter.

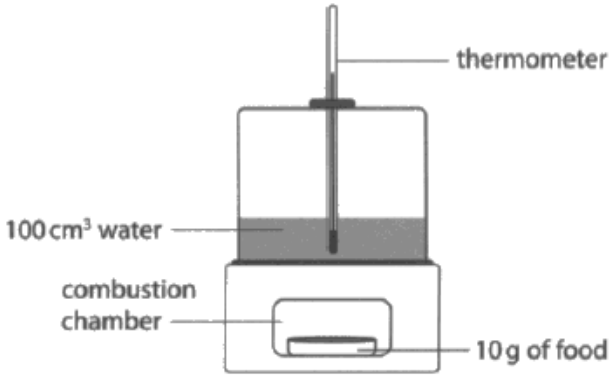


Figure 2

Describe how this calorimeter can be used to find the energy content of 10 g of food.

(3)

measure the temp of water at the beginning then after the 10g of food has fully combusted, mease the temp of water again. calculate the change in temp of 100cm³ of water.

Results Plus: Examiner Comments

This candidate scored 2 marks for measuring the start and end temperature of the water and combusted the food was sufficient for marking point 2. Just calculating the difference in the temperature of the water was insufficient for marking point 3.

Figure 2 shows a calorimeter.

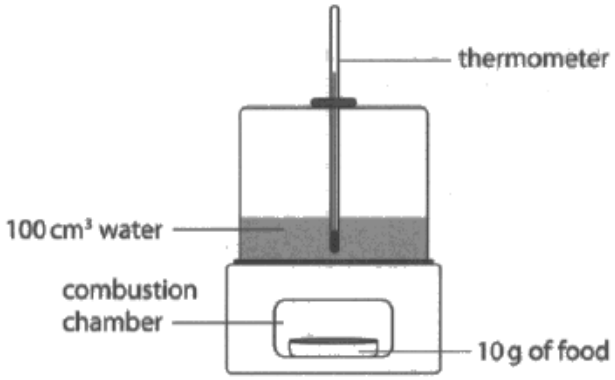


Figure 2

Describe how this calorimeter can be used to find the energy content of 10 g of food.

(3)

First, record the starting temperature of the water. Then set the food alight under the water in the combustion chamber. When the food sample has completely burned, then record the temperature of the water again. We can then use the formula to work out the energy content:

energy content = mass of water (100) × temperature change × 4.2

Results Plus: Examiner Comments

This scored full marks. The final mark needed the idea of calculating the energy content from the difference in the temperature of the water. The specific equation is not required although many candidates sitting the paper will also be studying physics and it was seen on a significant number of responses.

Q52.

Most candidates scored at least one mark on this item with many scoring both. Candidates are not naming the lenses on microscopes, but many recognise the need for a 40x lens and the need to focus the image. Some gave details on placing the slide on the stage and turning on the light which doesn't answer the question. Turning the wheel was not credited for focusing but the idea that the slide needs to move on the stage was sufficient.

Q53. No Examiner's Report available for this question

Q54. No Examiner's Report available for this question

Q55.

This question required candidates to apply their knowledge of food testing to the testing of urine. Glucose was being tested so Benedict's reagent/solution should be used which is heated and turns brick red in the presence of glucose. Other colours such as green and brown were also acceptable. Candidates do confuse the biuret solution with Benedict's frequently.

Q56. No Examiner's Report available for this question

Q57.

For this question, candidates had to describe the effect that enzyme concentration has on the mass of product formed. The first marking point was for a straightforward statement that the mass of product increases as enzyme concentration increases. Many candidates were successful and achieved this mark but did not gain further marks by describing that the mass of product stays the same, or levels off from 30 arbitrary units.

Describe the effect that enzyme concentration has on the mass of product formed. (2)

The higher the concentration of enzymes, the higher the mass. (positive correlation)

Results Plus: Examiner Comments

This answer scores 1 mark for describing the first part of the graph, (up to an enzyme concentration of 30 arbitrary units). The second and third marking points cannot be awarded as there is no reference to the line on the graph levelling off.

Results Plus: Examiner Tip

Always look at the number of marks available for a question and give a full description of the trend shown by a graph.

Q58.

In this question, few candidates could describe the function of a meristem in the growth of a plant, but more than half could describe, at least in part, how a microscope slide of a sample of cells could be prepared.

Q59.

(i) This question required candidates to describe the function of the meristem in the growth of a plant. Growth is given in the question, so candidates needed to give more details on this. Most candidates who achieved full marks stated that the meristem was undifferentiated cells or contained stem cells which can become specialised rather than referring to the process of cell division by mitosis.

(ii) This item was answered well by candidates of all abilities on the paper, recognizing the method required by one of the core practicals. Nearly all candidates gained marking point 1 for putting the cells onto the slide, higher ability students recognized this needed to be a thin section and the second mark for adding a stain was frequently given. Some candidates described adding a second slide on top, rather than naming the cover slip, but this was credited as a possible method they might have used in school.

Q60.

Candidates were asked to describe the laboratory test for protein. The majority described either the test for reducing sugar or starch with a small percentage gaining marks by stating that food is added to Biuret solution, and if there is protein in the food the biuret turns purple.

Mark Scheme

Q1.

	Answer	Acceptable answers	Mark
	An explanation including **two** of the following points: • ref to specific shape (1) • to bind to substrate / form enzyme substrate complex (1) • for reaction to take place / catalysed(1) • joining together {substrates / molecules} / break down {substrates / molecules} (1) • ref to lock and key mechanism / hypothesis (1)		**(2)**

Q2.

	Answer	Acceptable answers	Mark
	An explanation including **two** of the following points: • ref to specific shape (1) • to bind to substrate / form enzyme substrate complex (1) • for reaction to take place / catalysed(1) • joining together {substrates / molecules} / break down {substrates / molecules} (1) • ref to lock and key mechanism / hypothesis (1)		**(2)**

Q3.

Question Number	Answer	Mark
(i)	use a water bath / description of a water bath	**(1)** **AO1 2**

Question Number	Answer	Additional guidance	Mark
(ii)	An explanation linking **three** from: • enzymes have an optimum temperature (1) • so temperature will affect the rate of enzyme activity / the time taken to produce 20cm^3 of oxygen (1) • enzyme activity increases as temperature increases (up to the enzyme's optimum temperature) (1) • {enzymes / active sites} are **denatured** / enzyme activity stops at high temperatures (1)	accept hydrogen peroxide concentration is the independent variable, so other variables (such as temperature) must be controlled (1)	**(3)** **AO2 1**

Question Number	Answer	Additional guidance	Mark
(iii)	• all 4 points plotted accurately (± half a small square) (1) • smooth curve / dot-to-dot line drawn (1)	ignore extrapolations	**(2)** **AO3 1a 1b**

Question Number	Answer	Additional guidance	Mark
(iv)	A description including: • the time taken to collect 20 cm^3 oxygen decreases as hydrogen peroxide concentration increases (1) • the curve flattens (1) • the correct use of data from the table (1)	accept negative correlation data must be used not just quoted from the table	**(3)** **AO3 1a 1b**

Q4.

Question number	Answer	Additional guidance	Mark
(i)	An answer including: • (the root tip) contains {meristem / dividing} cells (1) • for growth (1)	reject meiosis	(2) AO1 1

Question number	Answer	Additional guidance	Mark
(ii)	An answer combining: • switch the lamp on • start with the lowest objective lens / look through the **eyepiece** lens (1) • use the (focusing) wheel to obtain a clear image (1)	accept adjust the mirror accept start with x4 / x10 objective lens	(2) AO1 2

Question number	Answer	Additional guidance	Mark
2(a)(iii)	use a stain / named stain	accept dye / iodine	(1) AO3 3b

Q5.

Question number	Answer	Mark
(i)	all the starch has been converted into glucose / all the starch has reacted with the amylase / all the starch is digested (1)	(1) **AO3 2a**

Question number	Answer	Mark
(ii)	Any two from: • pH of the solution (1) • concentration of amylase (1) • concentration of starch (1) • amount of mixing (1) • size of the tube used (1) • time interval must be the same (1)	(2) AO2 2

Question number	Answer	Additional guidance	Mark
(iii)	it is a control/to check that starch doesn't breakdown into glucose without amylase (1)	ignore control variable ignore allow results to be compared	(1) AO2 2

Q6.

Question number	Answer	Additional guidance	Mark
(i)	Substitution (50 – 30 =) 20 (1) (20 ÷ 50 x 100 =) -40(%)	 Accept 40% Award full marks for answer without working	(2) AO3.1

Question number	Answer	Additional guidance	Mark
(ii)	Any two from: • variety of potato (1) • mass of potato (1) • age of potato (1) • temperature (1) • storage conditions/humidity (1)	 accept type / species accept weight/size accept potato cells taken from the same part of each potato	(2) AO1.2

Question number	Indicative content	Additional guidance	Mark
(iii)	for energy / respiration	ignore make / produce energy accept to produce ATP	(1) AO2.1

Q7.

Question number	Answer	Additional guidance	Mark
(i)	Substitution (50 – 30 =) 20 (1) (20 ÷ 50 x 100 =) - 40(%)	 Accept 40% award full marks for answer without working	(2) AO2.1

Question number	Answer	Additional guidance	Mark
(ii)	Any **two** from: • variety of potato (1) • mass of potato (1) • age of potato (1) • temperature (1) • storage conditions/humidity (1)	 accept type / species accept weight/size accept potato cells taken from the same part of each potato	(2) AO2.2

Question number	Indicative content	Additional guidance	Mark
(iii)	for energy / respiration	ignore make / produce energy accept to produce ATP	(1) AO2.1

Question number	Indicative content	Additional guidance	Mark
(iv)	Any two from: • enzyme / amylase / carbohydrase (1) • starch fits into the **active site** (1) • bonds (between glucose molecules in starch) broken (1)	accept maltase accept polymer broken down into monomers	**(2)** **AO2 1**

Q8.

Question number	Answer	Additional guidance	Mark
(i)	starch is present / iodine reacts with starch (1)	accept starch hadn't reacted / hadn't been broken down (by liquids from mouth and stomach)	**(1)** 1.12 AO1

Question number	Answer	Additional guidance	Mark
(ii)	An answer linking three from: • in test tube 1 starch has been broken down (1) • in test tube 2 starch has not been broken down (1) • because amylase is present in the mouth / no amylase in the stomach (1)	Accept reverse argument for both marking points in test tube two accept starch is still present in tube 2 accept carbohydrase	**(3)** A03 2a+2b

Q9.

Question number	Answer	Additional guidance	Mark
(i)	Substitution 3 ÷ 120 (1) 0.025 (mm)	 award two marks for correct answer with no working	**(2)** AO2 1

Question number	Answer	Additional guidance	Mark
(ii)	Repeat (the investigation)	accept compare with results from other groups	**(1)** AO3 3b

Q10.

Question number	Answer	Additional guidance	Mark
(i)	• Used as a control / to compare with the results of the other tubes		(1) AO1.2

Question number	Answer	Mark
(ii)	Any two variables from: • temperature (1) • age / variety of potato (1) • {size / volume / length / width / shape / mass / surface area} of chip (before investigation) (1) • volume of solution (1) • time left in solutions (1)	(2) AO1.2

Question number	Answer	Mark
(iii)	An explanation including: • There is a higher concentration of sodium chloride outside (the cell) than inside / higher concentration of water molecules inside (the cell) than outside (1) • water moves out of {cells / chips} / into (sodium chloride) solution (1) • by osmosis (1)	(3) AO1.2

Q11.

Question number	Answer	Mark
(i)	A they have membrane-bound organelles **The only correct answer is A** **B** *is not correct because they have a nucleus* ***C*** *is not correct because they do not have a cell wall* ***D*** *is not correct because this is not a specific feature of eukaryotic cells*	**(1)** **AO1 1**

Question number	Answer	Additional guidance	Mark
(ii)	genetic analysis / based on {DNA/genetics} / DNA of Archaea more similar to eukaryotes (1)	accept more knowledge because of better microscopes	**(1)** **AO1 1**

Q12.

Question number	Answer	Additional guidance	Mark
(i)	A description that combines the following points to provide a logical description of the method: • use Benedict's reagent to test for glucose (1) • add it to the solution and heat, if glucose is present it turns green/brick red (1) • use iodine to test for starch (1) • add it to the solution and if starch is present it turns blue/black (1)	accept orange/brown for brick red	(4) AO3 3a

Question number	Answer	Additional guidance	Mark
(ii)	An explanation linking two from the following: • (substances) move through the membrane by **diffusion** (1) • from where they are in high concentration to where they are in low concentration / down a concentration gradient (1) OR • the dialysis membrane acts as a cell membrane (1) • shows small molecules /glucose moving through the membrane (1)	accept dialysis machine for cell membrane	(2) AO2.2

Q13.

Question number	Answer	Mark
(i)	D proteins The only correct answer is **D** proteins A is incorrect because carbohydrates are broken down by carbohydrases /amylase B is incorrect because lipids need to be digested by lipase C is incorrect because fibre is not broken down by enzymes	**(1)** **AO1.2**

Question number	Answer	Additional guidance	Mark
(ii)	An explanation linking the following: • to increase the surface area of the food (1) • so trypsin will break down more protein (1)	 accept the food molecules are smaller accept there is a faster rate of reaction	**(2)** **AO2.2**

Q14.

Question Number	Answer	Mark
(i)	C the volume of milk and the concentration of chymosin **The only correct answer is C** ***A*** *is not correct because time is being measured* ***B*** *is not correct because the temperature is being changed* ***D*** *is not correct because the temperature is being changed*	**(1)** **AO2 2**

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation linking **two** from: • 40°C is the {optimum / closer to the optimum} / there is a faster **rate of reaction** (1) • because as temperature increases (kinetic) energy increases (1) • more chance of collision (between the chymosin and the milk protein) (1) • more enzyme-substrate complexes are formed (1)	accept the enzyme works faster	**(2)** **AO2 1**

Question Number	Answer	Additional Guidance	Mark
(iii)	An explanation linking: • time taken would be longer / the milk would not curdle (1) • because the enzyme is denatured / the active site has changed shape (1)	accept slow rate of reaction / a time greater than 75 seconds	**(2)** **AO2 1**

Question Number	Answer	Additional Guidance	Mark
(iv)	Any **one** from: • it is a control (1) • to confirm that the milk doesn't curdle at that temperature without chymosin (1) • allows for a comparison with the results (1)	accept to see the effect of not adding chymosin	**(1)** **AO2 2**

Question Number	Answer	Additional Guidance	Mark
(v)	Any **two** from: • use a smaller interval between the temperatures (1) • measure temperatures between the range of 35°C and 45°C (1) • controlling a variable not identified in the method (1) • keep the tubes at the required temperature after adding chymosin by using a water bath (1) • repeat the test at each temperature (1)	 ignore a wider range of temperatures accept e.g. volume of milk / type of milk / enzyme concentration accept use a water bath to control temperature accept calculate a mean / identify anomalies	**(2)** **AO3b**

Q15.

Question number	Answer	Mark
(i)	• suitable scale (1) • axes labelled (1) • bars plotted correctly (1)	**(3)**

Question number	Answer	Mark
(ii)	**A**	**(1)**

Question number	Answer	Additional guidance	Mark
(iii)	An answer that combines the following points to provide a logical description of the method: • crush the seeds to release the sugar (1) • add Benedict's solution and heat (gently) (1) • brick-red colour (indicates presence of reducing sugar) (1)	Accept: other correct methods	(3)

Question number	Answer	Additional guidance	Mark
(iv)	wear safety goggles (to prevent chemicals getting into eyes)/heat mixture in a waterbath(1)	Accept other suitable precautions Ignore wear gloves Accept other correct safety precautions	(1)

Q16.

Question Number	Answer	Additional guidance	Mark
(i)	substitution 64.8 ÷ 1.8 x 1.8 (1) **OR** 64.8 ÷ 3.24 (1) 20	full marks for correct answer without any working	**(2)** **AO2 1**

Question Number	Answer	Mark
(ii)	B healthy weight **The only correct answer is B** ***A*** *is not correct because person B is not underweight* ***C*** *is not correct because person B is not overweight* ***D*** *is not correct because person B is not obese*	**(1)** **AO2 1**

Question Number	Answer	Additional guidance	Mark
(iii)	An explanation including: • do more exercise /named exercise (1) • so more energy is used up (1) **OR** • reduce fat / carbohydrate intake (1) • so energy intake is reduced (1)	accept eat less	**(2)** **AO2 1**

Q17.

Question number	Answer	Additional guidance	Mark
(i)	**Measurement** 65 (mm) / 6.5 cm (1) **Conversion** 65 mm = 65 000 µm (1) or 6.5 cm x 10 000 = 65 000 µm (1) **Division** 65 000 ÷ 50 000 (1) 1.3 (µm)	accept 63 mm – 66 mm ecf from incorrect measurement 0.0013 x 1000 (1) ecf from incorrect conversion accept 6.5 ÷ 50 000 (1) 65 ÷ 50 000 (1) correct answer on answer line with no working 3 marks accept 1.26/1.28/1.32 (µm) for 3 marks	**(3)** AO1(2)

Question number	Answer	Additional guidance	Mark
(ii)	An answer including three of the following: • no nucleus /chromosomal DNA (1) • cell wall (1) • flagellum (1) • presence of ribosomes (1) • no membrane bound organelles / no mitochondria (1)	List rule applies: reject nucleus reject mitochondria accept DNA is in the cytoplasm accept: pilli (1) slime {coat / capsule / layer}(1) ignore: cell membrane / cytoplasm / chloroplast	**(3)** **exp** AO1 (1)

Q18.

Question Number	Answer	Additional Guidance	Mark
	measurement 45 (mm) / 4.5 **cm** (1) calculation (45 ÷ 700) = 0.0643 (1) conversion into standard form and millimetres 6.43×10^{-2} / 6.4×10^{-2}	award full marks for the correct answer with no workings allow 44-46 (mm) allow ecf for incorrect measurement allow ecf for incorrect substitution accept answer to any number of decimal places	**(3)** **AO1 1**

Q19.

Question number	Answer	Additional Guidance	Mark
(i)	$2.0 \times 10^8 - 1.6 \times 10^7$ / 200 000 000 – 16 000 000 /184 000 000 (1) 1.84×10^8 / 1.8×10^8	award full marks for correct answer **accept 18.4×10^7 or 18×10^7 for 1 mark**	**(2)** AO2(1)

Question number	Answer	Additional guidance	Mark
(ii)	An explanation linking: • (myelination) speeds up impulses (1) • insulates the {axon/neurone} (1) • motor neurones transmit information from the CNS / motor neurones transmit information to effectors / neurones in the brain connect to other neurones in the brain (1) • (motor neurones) transmit information over a greater distance (than neurones in the brain) (1)	accept signals/messages for impulses accept brain/spinal cord/relay neurone for CNS accept muscles/ glands for effectors accept idea that motor neurones can be part of a reflex so need quick impulses (1)	**(3)** AO2(1)

Q20.

Question number	Answer	Mark
(i)	C a cell wall **1. The only correct answer is C** ***A*** *is not correct because both plant and animal cells have cytoplasm* ***B*** *is not correct because both plant and animal cells have a cell membrane* ***D*** *is not correct because both plant and animal cells have mitochondria*	**(1)** AO 1 1

Question number	Answer	Additional guidance	Mark
(ii)	Substitution 20.5 x 400 (1) Evaluation 8 200 (µm)	award full marks for correct answer with no working	**(2)** AO 1 2

Question number	Answer	Additional guidance	Mark
(iii)	Substitution (3.08 ÷ 400) = 0.0077 (1) Evaluation 7.7×10^{-3}	award full marks for correct answer with no working accept 0.008 accept 8.0×10^{-3}	**(2)** AO 2 2

Q21.

Question number	Answer	Additional guidance	Mark
	Substitution 500 x 0.04 (1) Evaluation 20 (mm)	 award two marks for correct answer with no working	**(2)** AO2 2

Q22.

Question number	Answer	Additional guidance	Mark
(i)	5 (mm) (1) 5 000 000 nm(1) 5 000 000 ÷ 250 = 20 000 OR 5 (mm) (1) 0.00025 mm (1) 5 ÷ 0.00025 = 20 000	accept 4 and 6 (mm) accept 4 and 6 (mm) accept 5 ÷ 250 = 0.02 (2) 4 ÷ 250 = 0.016 (2) 6 ÷ 250 = 0.024 (2) accept numbers in standard form award full marks for 20 000 without working	(3)

Question number	Answer	Mark
(ii)	C axon	(1)

Q23.

Question number	Answer	Additional guidance	Mark
	5 (mm) (1) 5 000 000 nm(1) 5 000 000 ÷ 250 = 20 000 OR 5 (mm) (1) 0.00025 mm (1) 5 ÷ 0.00025 = 20 000	accept 4 and 6 (mm) accept 4 and 6 (mm) accept 5 ÷ 250 = 0.02 (2) 4 ÷ 250 = 0.016 (2) 6 ÷ 250 = 0.024 (2) accept numbers in standard form award full marks for 20 000 without working	**(3)**

Q24.

S.S. number	Answer	Additional Guidance	Mark
	division 0.0062 ÷ 2 / 6.2 ÷ 2 (1) **OR** unit conversion 0.0031 x 1000 / 0.0062 x 1000 (1) 3.1 (picograms)	award full marks for correct answer with no working accept 6.2/ 0.0031 for 1 mark with no working	**(2)** AO2(1)

Q25.

Question number	Answer	Additional Guidance	Mark
	division 0.0062 ÷ 2 / 6.2 ÷ 2 (1) **OR** unit conversion 0.0031 x 1000 / 0.0062 x 1000 (1) 3.1 (picograms)	award full marks for correct answer with no working accept 6.2/ 0.0031 for 1 mark with no working	**(2)** AO2(1)

Q26.

Question number	Answer	Mark
(i)	6 / six	**(1)** AO2.1

Question number	Answer	Mark
(ii)	D cell wall, chloroplast, large vacuole. The only correct answer is **D** cell wall, chloroplast, large vacuole A is incorrect because both the cell membrane and nucleus are also found in animal cells B is incorrect because the cell membrane and cytoplasm are also found in animal cells C is incorrect because the nucleus is also found in animal cells	**(1)** AO1.1

Q27.

Question number	Answer		Mark
(i)	6 / six		**(1)** **AO1.2**

Question number	Answer	Mark
(ii)	D cell wall, chloroplast, large vacuole. The only correct answer is **D** cell wall, chloroplast, large vacuole A is incorrect because both the cell membrane and nucleus are also found in animal cells B is incorrect because the cell membrane and cytoplasm are also found in animal cells C is incorrect because the nucleus is also found in animal cells	**(1)** **AO1.1**

Q28.

Question Number	Answer	Additional guidance	Mark
	• 5:15 (1) • 1:3	allow full marks for correct final answer with no working	**(2)** AO 2 1

Q29.

Question number	Answer	Mark
(i)	2:1	**(1)**

Question number	Answer	Mark
(ii)	0.05	**(1)**

Question number	Answer	Mark
(iii)	(as the size of the cube increases) the rate of diffusion remains the same / the size of the cubes does not affect diffusion rate	**(1)**

Question number	Answer	Mark
(iv)	An explanation that combines identification – amplification of knowledge (2 mark): • from an area where it is high concentration to an area of low concentration / down a concentration gradient (1) • because the jelly/agar/cube is **permeable** (1)	**(2)**

Q30.

Question Number	Answer	Additional guidance	Mark
(i)	(2 x 5.0 x 2.0) + (2 x 5.0 x 2.0) + (2 x 2.0 x 2.0) or 20 + 20 + 8 (1) 48.0	Allow full marks for correct final answer accept 48	**(2)** AO 1 1

Question Number	Answer	Additional guidance	Mark
(ii)	• chip B has greater surface area (1) • therefore **more** water {absorbed / moved into the potato chip} (1)	accept chip B is bigger / has more cells	**(2)** AO 3 2a AO 3 2b

Question Number	Answer	Additional guidance	Mark
(iii)	An explanation that links the following: • (cells) lose water / become plasmolysed (1) followed by • (water moves out) by osmosis (1) • from a high concentration of water molecules (in the potato) to a low concentration of water molecules (in the solution) / through the partially permeable membrane (to the salt solution) (1)	accept get smaller/shrink/lose mass accept from low solute concentration to a high solute concentration accept from high to low water potential	**(3)** AO 1 1

Q31.

Question Number	Answer	Additional guidance	Mark
(i)	(2 x 5.0 x 2.0) + (2 x 5.0 x 2.0) + (2 x 2.0 x 2.0) or 20 + 20 + 8 (1) 48.0	allow full marks for correct final answer accept 48	**(2)** AO 1 1

Question Number	Answer	Additional guidance	Mark
(ii)	• chip B has greater surface area (1) • therefore **more** water {absorbed / moved into the potato chip} (1)	accept chip B is bigger / has more cells	**(2)** AO 3 2a AO 3 2b

Question Number	Answer	Additional guidance	Mark
(iii)	An explanation that links the following: • (cells) lose water / become plasmolysed (1) followed by • (water moves out) by osmosis (1) • from a high concentration of water molecules (in the potato) to a low concentration of water molecules (in the solution) / through the partially permeable membrane (to the salt solution) (1)	accept get smaller/shrink/lose mass accept from low solute concentration to a high solute concentration accept from high to low water potential	(3) AO 1 1

Q32.

Question number	Answer	Additional guidance	Mark
	• 42 (1) • X 85 % = 35.7 (g)	Award full marks for correct numerical answer without working Allow 36 for full marks	(2)

Q33.

Question number	Answer	Mark
(i)	Substitution 1.84 – 2.15 = -0.31 (1) change in mass Evaluation -0.31 ÷ 2.15 = -0.144 (1) Correct decimal places -0.144 x 100 = -14.41 (%) (correct to 2 dec place)	(3)

Question number	Answer	Additional guidance	Mark
(ii)	An explanation that combines application of knowledge (1 marks) and reasoning/justification – application of understanding: (2 mark) • chip 2 has gained mass but chip 5 has lost mass (1) • because chip 2 was immersed in a solution where the sucrose concentration outside the chip was lower than the sucrose concentration inside the chip (1) • so water osmosed into the chip causing it to become turgid / so chip water osmosed out of chip 5 and it became plasmolysed (1)	Accept reverse argument for chip 5	(3)

Q34.

	Answer	Acceptable answers	Mark
(a)(i)	Any **two** of the following points: (yeast cell) • has a nucleus (1) • does not have a flagellum (1) • does not have a plasmid (1) (bacterial cell) • has chromosomal DNA / circular DNA (1) • has a capsule (1) • has a slime coat (1) • does not have mitochondria (1)	Accept: has a vacuole accept: named bacterial feature e.g pilli, small ribosome, if not labelled in yeast cell	**(2)**
(a)(ii)	does not have chloroplasts/chlorophyll	cannot photosynthesise	**(1)**
(b)(i)	7×10^9 (-) 5×10^{10} **(1)** =(-)4.3×10^{10} or (-)43×10^9	two marks for correct bald answer accept 43 000 000 000 allow one mark for correct subtraction from wrongly selected numbers	**(2)**

		only accept the numbers in the table with a correct minus calculation	
(b)(ii)	A description including any **two** of the following points: • involved in defence against disease / part of immune system (1) • phagocytosis (1) • antibody / antitoxin production (1)	accept: (fight pathogen / harmful microorganism / named microorganism) accept: engulf / ingest / surround /digest cells reject: make antigens ignore: refs to role of red blood cells or platelets	**(2)**
(b)(iii)	tired / lack of energy / lethargy / short of breath	anaemia /fainting / less oxygen / increased anaerobic respiration reject: references to asthman	**(1)**

Q35.

	Answer	Acceptable answers	Mark
(a)(i)	Any **two** of the following points: (yeast cell) • has a nucleus (1) • does not have a flagellum (1) • does not have a plasmid (1) (bacterial cell) • has chromosomal DNA / circular DNA (1) • has a capsule (1) • has a slime coat (1) • does not have mitochondria (1)	Accept: has a vacuole accept: named bacterial feature e.g pilli, small ribosome, if not labelled in yeast cell	**(2)**
(a)(ii)	does not have chloroplasts/chlorophyll	cannot photosynthesise	**(1)**
(b)(i)	7×10^9 (-) 5×10^{10} **(1)** =(-)4.3×10^{10} or (-)43×10^9	two marks for correct bald answer accept 43 000 000 000 allow one mark for correct subtraction from wrongly selected numbers only accept the numbers in the table with a correct minus calculation	**(2)**

(b)(ii)	A description including any **two** of the following points: • involved in defence against disease / part of immune system (1) • phagocytosis (1) • antibody / antitoxin production (1)	accept: (fight pathogen / harmful microorganism / named microorganism) accept: engulf / ingest / surround /digest cells reject: make antigens ignore: refs to role of red blood cells or platelets	**(2)**
(b)(iii)	tired / lack of energy / lethargy / short of breath	anaemia /fainting / less oxygen / increased anaerobic respiration reject: references to asthman	**(1)**

Q36.

Question Number	Answer	Acceptable answers	Mark
(a)(i)	nucleus (1)		**(1)**

Question Number	Answer	Acceptable answers	Mark
(a)(ii)	**C** In DNA, the bases A - T are complementary		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)	A definition including two of the following: • a sperm fuses with egg / penetrates the egg (1) • nuclei/genetic information fuses /combines (1) • reference to haploid gametes /gametes have 23 chromosomes (1) • reference to cell made being diploid / has 23 pairs of chromosomes / zygote formed (1)	Ignore sperm meets egg	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(i)	A description that includes the following: • (aerobic) respiration / using glucose / using oxygen (1) • energy released (for movement / swimming / metabolism)(1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(ii)	An explanation including **two** of the following: • a change in a base/base sequence/order of bases / a change in mRNA (1) • named change e.g. addition/deletion (1) • reference to change in an amino acid / order of amino acids (1)	Accept codon, triplet, genetic code for base. substitution/deletion/other named gene mutation.	**(2)**

Q37.

Question Number	Answer	Acceptable answers	Mark
(a)(i)	nucleus (1)		**(1)**

Question Number	Answer	Acceptable answers	Mark
(a)(ii)	**C** In DNA, the bases A - T are complementary		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)	A definition including two of the following: • a sperm fuses with egg / penetrates the egg (1) • nuclei/genetic information fuses /combines (1) • reference to haploid gametes /gametes have 23 chromosomes (1) • reference to cell made being diploid / has 23 pairs of chromosomes / zygote formed (1)	Ignore sperm meets egg	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(i)	A description that includes the following: • (aerobic) respiration / using glucose / using oxygen (1) • energy released (for movement / swimming / metabolism)(1)		**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(ii)	An explanation including **two** of the following: • a change in a base/base sequence/order of bases / a change in mRNA (1) • named change e.g. addition/deletion (1) • reference to change in an amino acid / order of amino acids (1)	Accept codon, triplet, genetic code for base. substitution/deletion/other named gene mutation.	**(2)**

Q38.

Question number	Answer	Additional guidance	Mark
(i)	Any one from: • keep leaf peel flat (1) • keep leaf peel in place (1) • protect the (objective) lens (1) • protect the specimen (1)	ignore to prevent drying out	(1) AO 2 2

Question number	Answer	Additional guidance	Mark
(ii)	An explanation linking **two** of the following: • the leaf peel is thin / leaf is too thick (1) • as the leaf peel allows light to pass through it/the leaf would not allow light to shine through it (1) • to enable the {stomata / cells/ guard cells} to be identified (1)	accept leaf would be opaque accept to see stomata / cells	(2) AO 2 2

Q39.

Question Number	Answer	Additional guidance	Mark
	• **all** points plotted correctly to +/- ½ small square (1) • a line showing a steady increase that levels off at 30au/40g (1)	accept dot-to-dot line	(2) AO 2 2

Q40.

Question number	Answer	Mark
	smaller (1) diffusion (1) must be in correct order accept any reasonable spellings.	**(2)** AO 1 1 AO 2 1

Q41.

Question number	Answer	Mark
	B denatured **5b The only correct answer is B** ***A*** *is not correct because the enzyme is not specific when it changes shape* ***C*** *is not correct because the enzyme is not digested when it changes shape* ***D*** *is not correct because the enzyme is not dead when it changes shape*	**(1)** AO1 (1)

Q42.

Question number	Answer	Mark
	C	**(1)**

Q43.

Question number	Answer	Additional Guidance	Mark
(i)	pressure (1) thick (1)	must be in correct order	(2)

Question number	Answer	Additional Guidance	Mark
(ii)	26 ÷ 20 (1) 1.3 (mm)	two marks for correct answer	(2)

Question number	Answer	Mark
(iii)	**B** the aorta transports oxygenated blood away from the heart	(1)

Q44.

	Answer	Acceptable answers	Mark
	to supply / contain (a large amount of) nutrients / energy (for the zygote / embryo)	food /named nutrient Ignore references to foetus Reject baby	(1)

Q45.

	Answer	Acceptable answers	Mark
	to supply / contain (a large amount of) nutrients / energy (for the zygote / embryo)	food /named nutrient Ignore references to foetus Reject baby	(1)

Q46.

Question Number	Answer	Additional guidance	Mark
(i)	water (1) lid (1)	answers must be in the correct order	**(2)** **AO2 2**

Question Number	Answer	Additional guidance	Mark
(ii)	interpretation (85 – 21) = 64 (1) calculation (25 x 4.2 x 64) 6720 (J)	full marks for correct answer without any working award one mark for an answer correctly calculated from an incorrect temperature change	**(2)** **AO2 1**

Question Number	Answer	Additional guidance	Mark
(iii)	An explanation including **two** from: • the {temperature change / rise in temperature} was smaller (1) • this type of cheese contained less {energy / fat} / the piece of cheese had a smaller mass / a smaller mass of the cheese burned / the cheese was held further away from the container (1) • therefore less energy was transferred to the water (1)	accept other valid variables	**(2)** **AO3 2a 2b**

Q47.

Question number	Answer	additional guidance	Mark
	An answer linking: • mix the food in ethanol and pour into water (1) • white emulsion forms (1)	accept add water and ethanol and mix accept white precipitate / goes cloudy /emulsion test accept rub pea / food on filter paper (1) and look for a translucent mark (1)	**(2)** AO1 2

Q48.

Question number	Answer	additional guidance	Mark
	An answer linking: • mix the food in ethanol and pour into water (1) • white emulsion forms (1)	accept add water and ethanol and mix accept white precipitate / goes cloudy / emulsion test accept rub pea / food on filter paper (1) and look for a translucent mark (1)	**(2)** **AO1 2**

Q49.

Question number	Answer	Additional guidance	Mark
	A description including: • add Biuret {reagent / solution} / do the biuret test (1) • colour change (from blue) to purple protein is present (1)	 accept sodium hydroxide and copper sulfate accept mauve/violet for purple accept the use of an albustix (1) colour change for albustix (1)	**(2)** AO1 2

Q50.

Question Number	Answer	Additional Guidance	Mark
	Structure A • the mitochondria {**release energy** / for respiration} (1) **Structure B** • {acrosome / contains enzymes} to digest the egg cell membrane (1)	reject produces / creates energy	**(2)** **AO1 1**

Q51.

Question number	Answer	Additional Guidance	Mark
	An answer including: • measure the **start and end** temperature (of the water) (1) • burn the **food** (in the chamber) (1) • use the **increase** in the temperature of water to calculate the energy content (1)	 accept use the **thermometer** to measure the (water) temperature ignore heat the food accept use temperature **change** to calculate the energy content ignore the temperature rise is the energy content	**(3)** AO1 (2)

Q52.

Question Number	Answer	Additional Guidance	Mark
	An answer including: • use the x40 **objective** lens (1) and **one** from: • use the x10 **eye piece** lens (1) • use the focusing wheel (1)	 accept other combinations of x 400 lenses for two marks accept move the {stage / lens}	**(2)** **AO1 1**

Q53.

Question Number	Answer	Additional guidance	Mark
(i)	Any **one** from: • a single result could be anomalous (1) • to calculate a mean (1)	 accept to see if the results are the same / similar ignore references to increasing accuracy	**(1)** **AO1 2**

Question Number	Answer	Additional guidance	Mark
(ii)	Any **two** from: • measure the length / width of the carrot sticks (1) • cut sticks from the same carrot / same part of carrot (1) • use the same variety of carrot (1) • (surface) dry the carrot sticks before weighing (1)	 accept other valid ways of improving this method, e.g. using more than three carrot sticks (1)	**(2)** **AO3 3b**

Question Number	Answer	Additional guidance	Mark
(iii)	substitution (0.8 ÷ 4.2) x 100 (1) evaluation 19.048 (1) 2 significant figures 19 (%)	full marks for correct answer without any working accept 19.0476 / 19.05 (2) award one mark for rounding an incorrectly calculated answer to 2 significant figures	**(3)** **AO2 1**

Question Number	Answer	Mark
(iv)	An explanation linking any **two** from: • the carrot sticks gained mass (1) • because water moved into the carrot (cells) (1) • by **osmosis** / description of osmosis (1)	**(2)** **AO3 2a 2b**

Q54.

Question Number	Answer	Additional guidance	Mark
	A description including the following: • add Benedict's solution (to some dialysis fluid) (1) • {heat / boil / put in water bath} (1) • see if it turns {green / yellow / orange / red} (1)	 accept brown	**(3)** **AO2 2**

Q55.

Question Number	Answer	Additional guidance	Mark
	A description including: • add Benedict's solution (to some dialysis fluid) (1) • {heat / boil / put in water bath} (1) • see if it turns {green / yellow / orange / red} (1)	 accept brown	**(3)** **AO2 2**

Q56.

Question Number	Answer	Mark
	An answer including: • (add) iodine (solution) (1) • (iodine solution changes from brown to) blue-black / black (1)	**(2)** **AO1 2**

Q57.

Question Number	Answer	Additional guidance	Mark
	Any two from: • mass of product formed increases as enzyme concentration increases (1) • then (the mass of product formed) remains the same (1) • 30 au/40 g is point where mass of product remains the same (1)	accept then levels off (1)	**(2)** AO 3 1a AO 3 1b

Q58.

Question number	Answer	Additional guidance	Mark
(i)	Two from: • (meristem cells) are undifferentiated (1) • (meristem cells) divide / produce more cells (1) • by mitosis (1)	accept are stem cells accept (the cells produced) can differentiate /become specialised/elongate (1)	**(2)** AO1 1

Question number	Answer	Additional guidance	Mark
(ii)	An answer including • use a thin section of {cells/meristem} (1) • add a stain / named stain (1) • place a cover slip on top of the sample (1)	accept add a sample of the cells to the microscope slide accept a description of a coverslip	**(3)** AO1 2

Q59.

Question number	Answer	Additional guidance	Mark
(i)	Two from: • (meristem cells) are undifferentiated • (meristem cells) divide / produce more cells (1) • by mitosis (1)	accept are stem cells accept (the cells produced) can differentiate /become specialised/elongate (1)	(2) AO1 1

Question number	Answer	Additional guidance	Mark
(ii)	An answer including: • use a thin section of {cells/meristem} (1) • add a stain / named stain (1) • place a cover slip on top of the sample (1)	accept add a sample of the cells to the microscope slide accept a description of a coverslip	(3) AO1 2

Q60.

Question number	Answer	Additional guidance	Mark
	A description including: • add Biuret (reagent / solution) (1) • colour change (from blue) to mauve / purple (1)	accept sodium hydroxide and copper sulfate	(2) AO1.1