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Examiners' Report
June 2022

GCSE Biology 1BI0 1H

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June 2022

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Introduction

The Pearson Edexcel GCSE (9-1) Paper 1 Biology (Higher tier) paper is the first of two papers taken as part of the GCSE (9-1) Biology qualification. This is the fifth assessment of the GCSE (9-1) but the first time it had been examined in the summer since 2019. The autumn sittings in 2020 and 2021 had much lower entries. To compensate for lost learning as a result of the covid pandemic and in line with the other awarding organisations, candidates had access to an advanced information document for this paper which detailed some of the content that would be included in the exam and some that was not included. It also identified key core practicals. It was only the specification points that were given and not the questions.

The Biology specification and the qualification follows a linear assessment model whereby candidates must complete the two papers in the same single year of certification. Paper 1: Biology (Higher tier) is awarded a total of 100 marks and it is assessed by a variety of question types, including multiple-choice questions, short-answer questions, calculations and extended open-response questions. Candidates should answer all questions in a time period of 1 hour and 45 minutes. The extended open-response questions are identified by an asterisk (*) in the question paper to indicate that marks are also awarded for the ability to structure a response logically. There are two such questions in this paper. In addition, the GCSE (9-1) Biology qualification assesses practical knowledge and maths skills; the requirements of which are given in the specification. Furthermore, there are 8 mandatory core practicals which candidates must complete prior to the examination, as aspects of working scientifically are also assessed in questions throughout the paper.

Paper 1: Biology (Higher tier) contains questions assessing the content from Topics 1 to 5, as identified in the specification. In this examination series, candidates were required to respond to questions that tested their knowledge and understanding of the work of Mendel and inheritance, DNA structure and extraction, STIs transmission and prevention, the eye and brain, evolution of antibiotic resistance and the development of new drugs, mitosis and cancer, the work of Charles Darwin and Alfred Wallace, the pentadactyl limb, genetic engineering and stem cells and the lytic cycle of a virus. Questions designed to assess practical work included writing a plan to test the effectiveness of antiseptics, which included the identification of variables and a control as well as aseptic techniques, the preparation of a microscope slide to view cells going through mitosis and the action of the enzyme lipase on fat which included some theoretical application of enzyme function. The maths skills assessment in this paper related to questions requiring ratio calculations, percentage probability, calculations of infection numbers per 1000 of a population, nerve transmission time and mitotic index where the equation was given in the questions.

The publication of an advanced notice gave candidates a focus of topics to revise ahead of the examination and this included the relevant core practicals. There was evidence that, particularly candidates of a high ability, had a high level of understanding of the topics assessed on this paper, reflecting that they were able to target their revision.

Most candidates were able to access both extended writing responses. For genetic engineering, candidates of all abilities were able to name the enzyme's involved although the accuracy of their use varied. For the practical method most candidates recognised safety or aseptic precautions that were needed with many identifying a control for the investigation and some controlled variables. The detail of the methods varied across the range of abilities sitting the paper with inaccuracies reducing the level awarded to some candidates.

Most candidates were able to demonstrate a good level of knowledge in the early questions, including the work of Mendel and genetic inheritance, DNA structure and extraction, STI transmission and prevention and the eye and brain. Some items across the paper were high scoring for candidates from a range of different abilities including drug development, the outcomes of mitosis and the use of human stem cells. The evolution of antibiotic resistance challenged some candidates who were able to give some details of the process but not a complete explanation. Only high ability candidates were able to completely describe the role of the pentadactyl limb as evidence for evolution and similarly the lytic cycle of a virus was accessed by most candidates but full details were only given by those of higher ability.

Across the paper candidates showed they could extract data and recognise trends from graphs and use data given in tables to complete calculations. There was clear confusion on the value of one million by some candidates. The responses to the questions assessing aspects of practical work showed a good level of understanding, possibly a reflection of the inclusion of core practicals on the advanced information. It is also likely this is a reflection of teachers understanding of this aspect of the specification improving as it was new to this specification when first assessed in 2018. Candidates of all abilities were able to answer questions using their practical skills knowledge on the preparation of a microscope slide and the use of aseptic techniques. The enzyme practical challenged more candidates, as it was based on the enzyme lipase and the effect of substrate concentration and temperature rather than the effect of pH on amylase activity and so required candidates to apply their practical skills knowledge. Candidates who could not recall that lipase digests fats to fatty acids were most impacted on these questions. The effect of boiling was higher scoring suggesting that the effect of high temperatures on the active site is something that candidates can easily understand.

Question 1 (b)(i)

This question required the number of offspring to be converted into a ratio in its simplest form. The correct answer was 3:1.

Question 1 (b)(ii)

When candidates identified the correct genotype for the parents, they were able to complete the Punnett square and the majority correctly identified 25% as the probability for the homozygous recessive offspring. Some candidates stated the probability from a correct Punnett square was 50%, possibly identifying the probability for a heterozygous genotype or the homozygous dominant and recessive combined. Where the incorrect parental gametes were given, an error carried forward was applied for completion of the Punnett square and also for the identification of the probability of homozygous recessive offspring from an incorrect Punnett square. Punnett squares using letters other than A/a were accepted but those who tried to complete the Punnett square as though there was sex-linkage did not score marks.

(ii) Complete the Punnett square to show the outcome of a cross where both parent pea plants are heterozygous. diff Aa same

Show the percentage probability of homozygous recessive offspring in your answer. aa aa

(3)

	A	a
a	Aa	aa
a	Aa	aa

percentage probability of homozygous recessive offspring 50 %

ResultsPlus
Examiner Comments

This response scores two marks. The parental gametes are incorrect as they have one being homozygous recessive but the Punnett square is correct for their gametes so gains the mark through an error carried forward. The percentage is also correct for their Punnett square.

(ii) Complete the Punnett square to show the outcome of a cross where both parent pea plants are heterozygous.

Show the percentage probability of homozygous recessive offspring in your answer.

(3)

	A	a
A	AA	Aa
a	Aa	aa

percentage probability of homozygous recessive offspring 25 %

ResultsPlus
Examiner Comments

This response scores full marks for correct parental gametes, correct Punnett square and percentage.

ResultsPlus
Examiner Tip

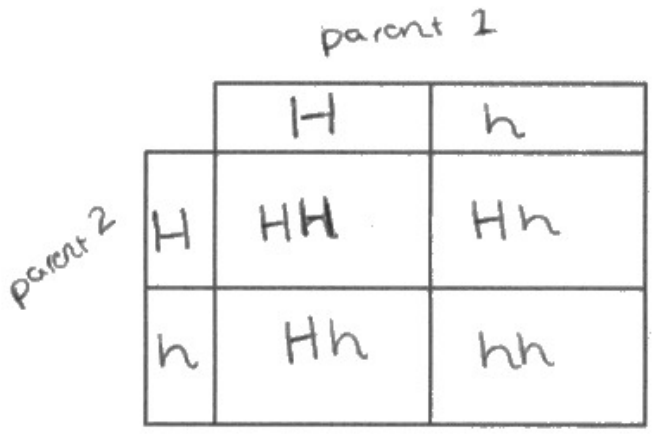
Underlining or highlighting key words in the question is a useful exam technique.

Try to use the letters given in the question but if you chose different letters make sure the lower case and capitals are clearly distinct.

(ii) **Complete the Punnett square to show the outcome of a cross where both parent pea plants are heterozygous.**

Show the percentage probability of homozygous recessive offspring in your answer.

(3)



percentage probability of homozygous recessive offspring 75 **%**

ResultsPlus
Examiner Comments

This gained two marks. The percentage is incorrect.

ResultsPlus
Examiner Tip

Learn the genetic terms used for genotypes and phenotypes.

Question 1 (c)(i)

The most common response for this question was based around the idea of genetic variation or allowing adaptation to a change in the environment. Many candidates obtained the mark for this. Incorrect responses included the idea that it was a quicker process or that identical offspring were produced.

(c) (i) Some plants reproduce sexually.

Give **one** advantage of this type of reproduction.

(1)

Variation in the offspring means that they are more likely to be adapted to the environment and survive selection pressure.

ResultsPlus
Examiner Comments

This has two advantages both of which are correct. It allows for variation and enables organisms to survive a selection pressure.

(c) (i) Some plants reproduce sexually.

Give **one** advantage of this type of reproduction.

(1)

a quick process

ResultsPlus
Examiner Comments

This is not correct for sexual reproduction.

(c) (i) Some plants reproduce sexually.

Give **one** advantage of this type of reproduction.

(1)

[redacted] 2 plants are needed for this as the plant requires a partner for fertilisation to occur.

ResultsPlus
Examiner Comments

This response describes the process of sexual reproduction rather than an advantage.

ResultsPlus
Examiner Tip

Read the question carefully.

Question 1 (c)(ii)

Meiosis is the process for forming gametes.

Knowing the spelling of key words such as meiosis is important especially where terms such as mitosis are similar.

Question 2 (a)

This question was answered to a high level by most candidates who gave weak hydrogen bonds as the mechanism for bonding base pairs together. Many also gave the pairings of A-T and C-G and the idea that there were complementary base pairs. Some detailed responses gave the number of bonds between the base pairs which exceeds the demand of the specification.

2 (a) DNA molecules contain base pairs.

Describe how the base pairs are bonded together in a DNA molecule.

(2)

A-T and C-G always link together. A base is always joined to a sugar and form a double helix

ResultsPlus
Examiner Comments

This scores one mark for the A-T/C-G mark. Responses only needed to have one combination of the pairs but if they gave both they must be correct. The details of the sugar is not relevant.

2 (a) DNA molecules contain base pairs.

Describe how the base pairs are bonded together in a DNA molecule.

(2)

They bond together forming a double helix and a nucleotide which has phosphate and sugars.

ResultsPlus
Examiner Comments

This does not answer the question, which is on the bonding of the base pairs but describes details of the DNA shape and structure.

2 (a) DNA molecules contain base pairs.

Describe how the base pairs are bonded together in a DNA molecule.

(2)

They are bonded together with weak hydrogen bonds. Adenine and thymine always pair with 2 bonds and Cytosine and Guanine always pair with 3 bonds.

ResultsPlus
Examiner Comments

This response has the content to be awarded the mark for weak, hydrogen bonds and the complementary bases. Names of the bases were accepted but not needed, letters are fine.

Question 2 (b)(i)

Most candidates gave the correct sequence for the complementary strand for the DNA molecule. Incorrect responses included those that gave the transcribed mRNA sequence and those that repeated the DNA sequence. Candidates must take care when forming letters that a C and a G can be distinguished.

(b) Figure 1 shows part of a DNA molecule.

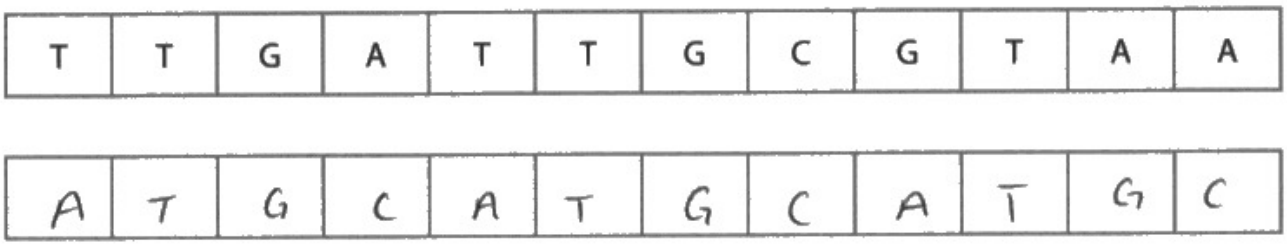


Figure 1

(i) Write the code for the complementary DNA strand in Figure 1.

(2)

ResultsPlus
Examiner Comments

This response scored zero as the complementary bases are not given.

ResultsPlus
Examiner Tip

Consider tricks like straight sided letters pair together and curved letters pair together to help with remembering key information.

(b) Figure 1 shows part of a DNA molecule.

T	T	G	A	T	T	G	C	G	T	A	A
A	A	C	T	A	A	C	G	C	A	T	T

Figure 1

(i) Write the code for the complementary DNA strand in Figure 1.

(2)

ResultsPlus
Examiner Comments

This shows that candidates need to be careful when forming letters that they are distinct.

This was awarded both marks.

ResultsPlus
Examiner Tip

Take care when forming letters and numbers that they are clear.

Question 2 (c)(i)

This question was more challenging with many candidates recognising that proteases digests proteins but linked this to the idea that it allowed the DNA to be extracted which forms part of the introduction to the question. Where the explanation was linked it was most frequently to the idea of breaking down the membrane of the cell or the nucleus. Responses were credited where they clearly referred to breaking down the proteins associated with the DNA as well as breaking down enzymes which could degrade the DNA. Knowledge on histones is not required at this stage.

(c) A student wanted to extract the DNA from fresh peas.

The student crushed the peas and added washing up liquid and water.

The enzyme protease was then added to this mixture.

(i) Explain why the enzyme protease was added to the mixture.

(2)

The protease enzyme will digest any of the protein that the peas may contain and give a clearer sample of DNA.

ResultsPlus
Examiner Comments

One mark for the protease digesting protein. A clearer sample is not enough to meet the explanation aspect to the question.

(c) A student wanted to extract the DNA from fresh peas.

The student crushed the peas and added washing up liquid and water.

The enzyme protease was then added to this mixture.

(i) Explain why the enzyme protease was added to the mixture.

(2)

to breake down the cell membraune, so the DNA can get out, it is soluble so it makes it easier for you to take the stranels of DNA out as its a precipitate.

ResultsPlus
Examiner Comments

This response has part of the explanation but it is not linked to why the protease will break down the cell membrane.

ResultsPlus
Examiner Tip

When answering 'explain' questions look to see if they are asking about explaining how or explaining why so that you can include sufficient detail in your answer.

(c) A student wanted to extract the DNA from fresh peas.

The student crushed the peas and added washing up liquid and water.

The enzyme protease was then added to this mixture.

(i) Explain why the enzyme protease was added to the mixture.

(2)

protease breaks down the proteins in the cell membrane and the nuclear membrane to allow the DNA to be exposed. this means we can access the DNA to extract and observe it.

ResultsPlus
Examiner Comments

This response makes the link between the role of the protease and why it was added to the mixture.

Question 2 (c)(ii)

The majority of candidates knew that ice cold ethanol is used to precipitate the DNA or to make it visible. To extract the DNA was not credited as it was given in the question. Other incorrect ideas that were seen included the idea of cooling the mixture or denaturing enzymes which is not why the ethanol is added to the filtrate.

Question 3 (a)(i)

Candidates had to identify that gonorrhoea was the median value from the data. Some candidates wrote the values in order so they could easily select the correct one.

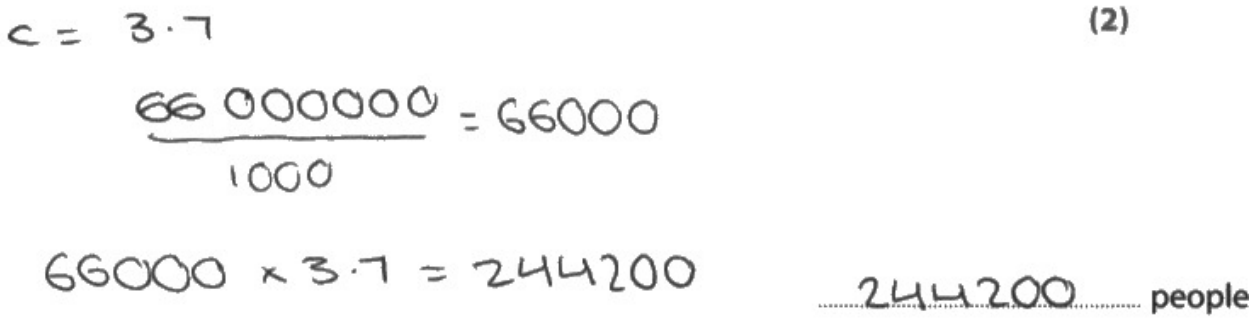
Question 3 (a)(ii)

Errors were made on this calculation when candidates did not know the value of a million. This meant that they could not determine that 66000 should be multiplied by 3.7. One mark was awarded for the answer being given to the incorrect order of magnitude to acknowledge that only one error had been made in the calculation. Alternative methods to obtain the answer were credited and full marks were awarded for correct answers without workings.

(ii) The population of the UK in 2017 was 66 million people.

Calculate the total number of people diagnosed with chlamydia in the UK in 2017.

(2)



ResultsPlus Examiner Comments

This response clearly shows the method used to obtain the correct answer of 244200. They wrote 66 million out correctly in digits.

ResultsPlus Examiner Tip

Always show your workings for calculations.

(ii) The population of the UK in 2017 was 66 million people.

Calculate the total number of people diagnosed with chlamydia in the UK in 2017.

(2)

66,000,000 / 1000 = 66,000

66,000 × 0.8 = 52,800

52,800 people

ResultsPlus
Examiner Comments

The incorrect rate of infection was used for this calculation. This was a common error seen, most likely for candidates who had identified gonorrhoea as the correct answer to the previous question.

(ii) The population of the UK in 2017 was 66 million people. 6600000

Calculate the total number of people diagnosed with chlamydia in the UK in 2017.

$\frac{6600000}{1000} \times 3.7 = 24\,420$ **(2)**

24 420 people

ResultsPlus
Examiner Comments

This answer is given to the incorrect magnitude but was awarded one mark as the only error is the value of a million.

ResultsPlus
Examiner Tip

Know the value of a million as well as the values for pico, nano, micro, milli, kilo.

Question 3 (a)(iii)

This question was answered well by most candidates who recognised that communicable disease can be passed from person to person. Candidates were also credited when they applied the term to chlamydia and stated that it could be passed on through body fluids or by sexual contact. Some candidates recognised that communicable diseases are caused by pathogens. Responses that just stated that communicable diseases could be passed on were not credited

(iii) State why chlamydia can be described as a communicable disease.

(1)

it can be transmitted through bodily fluids from an infected person ~~to other~~

ResultsPlus
Examiner Comments

This says why chlamydia is communicable and how it is spread from person to person, so it was credited with the mark.

(iii) State why chlamydia can be described as a communicable disease.

(1)

It can spread from person to person

ResultsPlus
Examiner Comments

This defines the idea behind communicable diseases and was awarded the mark.

Question 3 (a)(iv)

(iv) Give **one** way the transmission of chlamydia can be prevented.

(1)

wearing a condom while having sex

ResultsPlus
Examiner Comments

This gained the mark for wearing a condom.

ResultsPlus
Examiner Tip

Be specific in responses – this identifies a condom as the way transmission can be prevented. Avoid vague responses such as protection without being specific.

(iv) Give **one** way the transmission of chlamydia can be prevented.

(1)

By using barrier-method contraception.

ResultsPlus
Examiner Comments

Although not all barrier methods would prevent transmission, the most common barrier contraception method is the condom which does prevent spread so this was credited.

(iv) Give **one** way the transmission of chlamydia can be prevented.

(1)

Abstinence from sexual intercourse.

ResultsPlus
Examiner Comments

This would prevent transmission of chlamydia as an alternative correct answer.

(iv) Give **one** way the transmission of chlamydia can be prevented.

(1)

~~Contraception~~ Contraception

ResultsPlus
Examiner Comments

This is not specific enough to answer the question.

Question 3 (a)(v)

This question requires candidates to recall that chlamydia is caused by a bacteria and that antibiotics inhibit cell processes in bacteria, they were also credited for antibiotics killing bacteria. Where candidates scored one mark this was often because they repeated the stem of the question, stating that chlamydia was caused by a bacteria so it could be treated with antibiotics which lacks the linked explanation.

(v) Explain why chlamydia can be treated with antibiotics.

(2)

Chlamydia is a virus and a communicable disease, it can be treated with antibiotics as antibiotics can kill the virus and also virus is not antibiotic resistant.

ResultsPlus
Examiner Comments

This response scored zero. Chlamydia is a virus is incorrect. Antibiotics can kill the virus is also incorrect science.

(v) Explain why chlamydia can be treated with antibiotics.

(2)

Chlamydia is a bacterial infection and antibiotics inhibit processes in the bacterial cell, not the host organism. Antibiotics can be used to treat bacterial infections.

ResultsPlus
Examiner Comments

This correctly makes the link between chlamydia being caused by a bacteria and why antibiotics can be used to treat it which completes the explanation for two marks.

Question 3 (b)

Most candidates had a good idea of the effect of HIV on the immune system or that it destroys white blood cells, combining these two points in a linked explanation enabled both marks to be awarded. Some candidates stated that you can catch AIDS suggesting that the link between HIV infection and the development of AIDS is not fully understood.

(b) HIV is another sexually transmitted infection.

Explain how HIV can lead to the onset of AIDS.

(2)

Human ImmunoVirus is a viral infection that targets th
whit blood cells & reproduce in it, ~~es th~~ this process kills th
whit blood cells overtim, leading to Acquired Immuno Defiency
Syndrome as your immun system is weakend & seseptibl to other
infections.

(Total for Question 3 = 9 marks)

ResultsPlus
Examiner Comments

This detailed response shows a good understanding of the link between HIV infection and the development of AIDS.

(b) HIV is another sexually transmitted infection.

Explain how HIV can lead to the onset of AIDS.

(2)

HIV destroys white blood cells and weakens the immune system to make people susceptible to catching disease such as AIDS.

ResultsPlus
Examiner Comments

This was two marks for white blood cells being destroyed and a weakened immune system. Although AIDS cannot be caught this does not affect the score.

ResultsPlus
Examiner Tip

Be clear on how HIV leads to the development of AIDS and recognise that AIDS is not something that can be caught.

Question 4 (a)(ii)

The organelles which release energy are mitochondria or the singular of mitochondrion. Most candidates were able to identify this for the mark. The most common incorrect response seen was ribosomes.

Question 4 (a)(iii)

The nucleus of the light receptor cells is the labelled structure. As both of labelled nuclei was accepted, this mark was obtained by most candidates.

Question 4 (a)(iv)

The light receptor which responds to dim light is the rod cell. The shape of the cell within the diagram could also be used to help candidates to answer the question.

Question 4 (a)(v)

This question follows on from part (a)(iv) which states that cell A responds to dim light and asks how the role of cell B is different. Marks were awarded for identifying it as a cone cell, which detects colour and responds to different wavelengths of light. The idea of responding to bright light was also credited. Most candidates recognised its role in colour vision with many able to identify it as a cone cell.

(v) **Describe how the role of light receptor cell B is different from the role of light receptor cell A.**

(2)

whilst light receptor A responds to dim light, light receptor B responds to bright light and is responsible for colour vision as it detects colour → it is a cone cell.

ResultsPlus
Examiner Comments

There are two marks here for identifying B as the cone cells and that it is responsible for colour vision, this mark would also have been given for responding to bright light.

ResultsPlus
Examiner Tip

When a question refers to a structure always make sure that you identify what the structure is within your answer.

(v) Describe how the role of light receptor cell B is different from the role of light receptor cell A.

(2)

Light receptor A is responsible for seeing in dim light whereas Light receptor B is responsible for processing the colours being seen.

ResultsPlus
Examiner Comments

This response repeats information given on the question paper for light receptor A. One mark is given for processing colours.

ResultsPlus
Examiner Tip

Don't repeat information given on the question paper. It won't be worth marks and can give you the impression that you have included sufficient information.

Question 4 (b)(i)

Candidates needed to re-arrange the equation to enable them to calculate the time taken for an impulse to travel the length of the optic nerve. They also need to convert one of the measurements so that they are the same. Different methods were credited and the answer could be given to different decimal places. A number of candidates lost a mark for not rounding correctly.

(b) The optic nerve carries information from the back of the eye to the brain.

The optic nerve is 47 mm in length.

Nerve impulses travel at 75 metres per second.

(i) Calculate the time an impulse takes to travel the length of the optic nerve.

Use the equation: $\text{speed (m/s)} = \frac{\text{distance}}{\text{time}}$

(3)

$75 = \frac{47mm}{x}$

47mm =

0.000627 seconds

4.7cm =

10mm : 1cm

47mm : 4.7cm

100cm : 1m

4.7cm : 0.047m

$75 = \frac{0.047}{x}$

$75x = 0.047$

$x =$

ResultsPlus
Examiner Comments

This scores full marks for the correct answer rounded correctly. The candidate has carefully converted the measurement of length into metres.

ResultsPlus
Examiner Tip

Make sure you convert measurements so that they are the same unit when using them in calculations.

(b) The optic nerve carries information from the back of the eye to the brain.

The optic nerve is 47 mm in length.

Nerve impulses travel at 75 metres per second.

(i) Calculate the time an impulse takes to travel the length of the optic nerve.

Use the equation: $\text{speed} = \frac{\text{distance}}{\text{time}}$

(3)

$\frac{0.00047}{75}$

0.00000626 seconds

ResultsPlus
Examiner Comments

This response has converted the unit for distance incorrectly. They have correctly divided a distance by speed so are awarded the mark for changing the subject of the equation. The answer they obtain is correct for their calculation with the use of a recurring number, so they score two marks.

(b) The optic nerve carries information from the back of the eye to the brain.

The optic nerve is 47 mm in length.

Nerve impulses travel at 75 metres per second.

(i) Calculate the time an impulse takes to travel the length of the optic nerve.

Use the equation: $\text{speed} = \frac{\text{distance}}{\text{time}}$

(3)

75 metres : 75,000 mm

47 ÷ 75,000 : 0.000626

: 6.26×10^{-4}

6.26×10^{-4} seconds

ResultsPlus
Examiner Comments

Answers in standard form were acceptable. This response is worth two marks as the final substitution stage is rounded incorrectly. The recurring sign is not shown on the number given on the answer line.

(b) The optic nerve carries information from the back of the eye to the brain.

The optic nerve is 47 mm in length.

Nerve impulses travel at 75 metres per second.

(i) Calculate the time an impulse takes to travel the length of the optic nerve.

Use the equation: speed = $\frac{\text{distance}}{\text{time}}$

×1000

m mm

(3)

$\frac{75000}{47} = 6.266 \times 10^{-4}$

6.27×10^{-4} seconds

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Examiner Comments

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

Question 4 (b)(iii)

Candidates needed to assimilate the information in the question which stated that the optic nerve connects to the occipital lobe of the brain to identify that the sense that would be affected if the lobe was damaged would be sight. Incorrect responses included hearing and also balance.

(iii) State the sense most likely to be affected if the occipital lobe is damaged.

(1)

Hearing

ResultsPlus
Examiner Comments

This scored zero as it is the wrong sense. To obtain the answer to this question, candidates needed to have read the information in the question.

(iii) State the sense most likely to be affected if the occipital lobe is damaged.

(1)

Sight

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Examiner Comments

This is correct for the mark.

Question 5 (a)(i)

A linked explanation of how *Klebsiella* bacteria develop resistance to antibiotics was required for this item. Marks were awarded for evolution or natural selection, which relies on mutation or variation in the population. This leads to some bacteria surviving treatment with antibiotics, allowing them to reproduce with offspring inheriting the resistance trait. Some candidates gave the idea that bacteria could become immune to antibiotics which is not creditworthy or that the human body can become immune. The idea that bacteria are strong or weak was not credited, responses needed to refer to bacteria which are resistant to antibiotics surviving treatment with antibiotics.

5 (a) In 2017, a new strain of *Klebsiella pneumoniae* bacteria was discovered that was resistant to 26 different antibiotics.

(i) Explain how *Klebsiella pneumoniae* bacteria developed resistance to antibiotics.

(4)

Bacteria develop resistance to antibiotics by the process of natural selection. Within the large population of bacteria, one will have a genetic mutation, leading to a resistance to the antibiotic. Due to the selection pressure / change of environment (antibiotics) that bacteria will survive and the majority of the rest will die. Due to the process of survival of the fittest that bacteria will then reproduce and eventually build a population of bacteria, resistant to the antibiotic — as the bacteria's resistant gene is inherited by the offspring.

ResultsPlus
Examiner Comments

This response shows a high level of detail and use of scientific terms to fully explain how antibiotic resistance develops in bacteria.

5 (a) In 2017, a new strain of *Klebsiella pneumoniae* bacteria was discovered that was resistant to 26 different antibiotics.

(i) Explain how *Klebsiella pneumoniae* bacteria developed resistance to antibiotics.

(4)

Resistant bacteria develop when infected people don't finish their whole course of antibiotics. Normally they start to feel better so stop taking medication. This is because the weak ~~antibodies~~ bacteria have been killed of leaving a small amount of most strong resistant ~~bodies~~ bacteria. They are ~~now~~ resistant as they have already been exposed to the antibiotics. These ~~ant~~ bacteria then reproduce and make the person ill again. It is harder to treat as antibiotics don't work so the communicable disease spreads infecting more people with resistant bacteria.

ResultsPlus
Examiner Comments

This response scored two marks. Weak bacteria would have been insufficient but this response does link stopping course of antibiotics and small amount of resistant bacteria being left behind (survival) and that these bacteria then reproduce. It does not elaborate further on the process.

ResultsPlus
Examiner Tip

Do not refer to the organisms that survive in evolution as strong, use the specific adaptation they have acquired eg resistance, increased height.

5 (a) In 2017, a new strain of *Klebsiella pneumoniae* bacteria was discovered that was resistant to 26 different antibiotics.

(i) Explain how *Klebsiella pneumoniae* bacteria developed resistance to antibiotics.

(4)

Klebsiella pneumoniae bacteria was exposed to low levels of antibiotics. This allows the bacteria to gain a degree of immunity to similar antibodies.

ResultsPlus
Examiner Comments

References to bacteria developing immunity to antibiotics is incorrect, candidates should refer to the development of resistance.

Question 5 (a)(ii)

This question asked how the use of antibiotics contributed to the development of resistance in bacteria. The mark was awarded for the idea of over-use, not finishing a course, or their incorrect use for non-bacterial illness. Examples such as use in agriculture were also credited. Some incorrect responses described the mechanism of evolution rather than answering how the use of antibiotics made a contribution.

(ii) State how the use of antibiotics could contribute to *Klebsiella pneumoniae* bacteria developing resistance to antibiotics.

(1)

The bacteria will continue to evolve and adapt due to natural selection

ResultsPlus
Examiner Comments

This is not how the use of the antibiotics contributes to the development of resistance and did not score a mark.

(ii) State how the use of antibiotics could contribute to *Klebsiella pneumoniae* bacteria developing resistance to antibiotics. NATURAL SELECTION?

(1)

If you don't finish a course of antibiotics, the bacteria become resistant to it.

ResultsPlus
Examiner Comments

Not finishing a course of antibiotics contributes to the development of antibiotic resistance and was a commonly seen answer.

(ii) State how the use of antibiotics could contribute to *Klebsiella pneumoniae* bacteria developing resistance to antibiotics.

(1)

using antibiotics when they are not necessary

ResultsPlus
Examiner Comments

This is a misuse of antibiotics and was awarded the mark.

Question 5 (b)

Most candidates gained at least two marks on this item with many getting full marks. Responses that used the terms pre-clinical and/or clinical testing were more likely to give the details of testing on cells, animals and humans and gain all three marks. Some detailed responses referred to double blind trials or described the use of a placebo. Blind trials was not credited but single blind was sufficient.

(b) New antibiotics are being developed to treat the disease caused by *Klebsiella pneumoniae*.

Describe the stages of antibiotic development that would occur after the discovery of a new antibiotic.

(3)

The antibiotic would be trialed on a group of people from different age groups who have klebsiella pneumoniae. They would for example have 10 people 50-60. Then half get the new antibiotic, half get a placebo. This would then test if the antibiotic actually works.

ResultsPlus
Examiner Comments

This scored two marks for trialling on people and a description of double-blind trials by referring to the use of the placebo and the drug.

(b) New antibiotics are being developed to treat the disease caused by *Klebsiella pneumoniae*.

Describe the stages of antibiotic development that would occur after the discovery of a new antibiotic.

(3)

Test the antibiotic on animals in order to see if there are any unknown sideeffects that could harm humans. Test it on people who are healthy and do not have the disease (volunteers) to test what would happen when used on humans. Then give it to people with the disease to see if the antibiotic works.

ResultsPlus
Examiner Comments

This response scored two marks but could have increased the mark by including the idea of pre-clinical or clinical trials which are listed in the specification.

ResultsPlus
Examiner Tip

Try to use specific terms referred to in the specification.

(b) New antibiotics are being developed to treat the disease caused by *Klebsiella pneumoniae*.

Describe the stages of antibiotic development that would occur after the discovery of a new antibiotic.

(3)

The scientists would pick out a useful molecule and test it in pre-clinical trials. It is tested on human cells in the lab and on mice to test for side effects and work out dosage. This also tests if it is effective on infected cells. It's then tested in clinical trials on people with the disease.

(Total for Question 5 = 9 marks)

ResultsPlus
Examiner Comments

This scored full marks as it refers to pre-clinical trials, testing on human cells as well as a named animal (mice), clinical trials and testing on healthy volunteers.

(b) New antibiotics are being developed to treat the disease caused by *Klebsiella pneumoniae*.

Describe the stages of antibiotic development that would occur after the discovery of a new antibiotic.

(3)

Firstly it would go through pre-clinical trials, where scientists do computer modelling and test the antibiotic on cells, tissues & animals. then, it would invalve a clinical trial on healthy volunteers to find out side effects & dosage. After, there would be a double blind placebo test with unhealthy volunteers in hospital to determine effectiveness.

(Total for Question 5 = 9 marks)

Lastly, it would need to wait to be licensed by government and mass produced.

ResultsPlus
Examiner Comments

This response referred to the process of development of the drug as well as its use in trials. Full marks were awarded.

Question 6 (a)

This question introduced a practical which required application of knowledge as it was not the core practical. Candidates who do not read the introductory information carefully for questions like this one will score lower. Responses to this question either gave the reason that the milk B drop rose to the surface was due to the fat content or related to the idea of being less dense than water. Some incorrect answers referred to it being lighter.

6 A student investigated the fat content of two types of milk: milk A and milk B.

Before starting the investigation, the student added a drop of oil from a pipette into a test tube of water as shown in Figure 5.

The drop of oil rose to the surface of the water.

(Source: © Nana_studio/Shutterstock)

Figure 5

(a) The student then placed a drop of milk A into one test tube of water and a drop of milk B into a different test tube of water.

The drop of milk A sank to the bottom and the drop of milk B rose to the surface.

Give **one** reason for the drop of milk B rising to the surface.

(1)

Milk B had fat content made it.

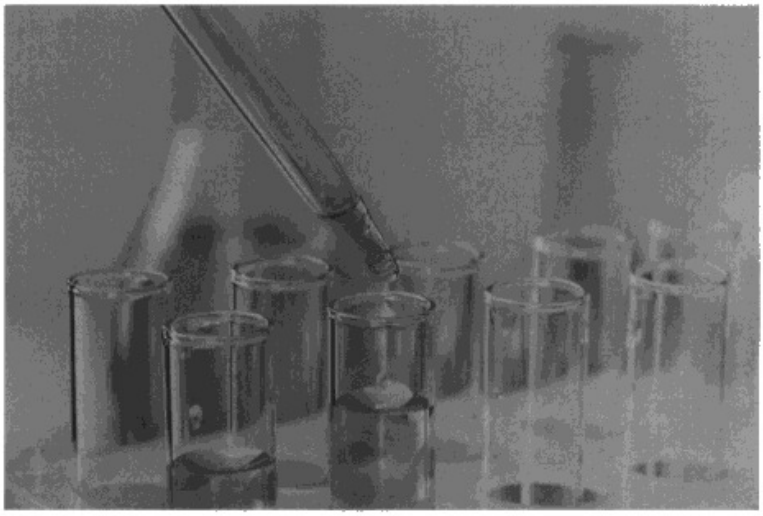
ResultsPlus
Examiner Comments

Fat content would cause the droplet to rise in the tube and this response gained the mark.

6 A student investigated the fat content of two types of milk: milk A and milk B.

Before starting the investigation, the student added a drop of oil from a pipette into a test tube of water as shown in Figure 5.

The drop of oil rose to the surface of the water.



(Source: © Nana_studio/Shutterstock)

Figure 5

(a) The student then placed a drop of milk A into one test tube of water and a drop of milk B into a different test tube of water.

The drop of milk A sank to the bottom and the drop of milk B rose to the surface.

Give **one** reason for the drop of milk B rising to the surface.

(1)

A had lower density than water due to its high fat content.

ResultsPlus
Examiner Comments

In this response 'it' must be milk B. So this gains the mark for lower density as well as high fat content.

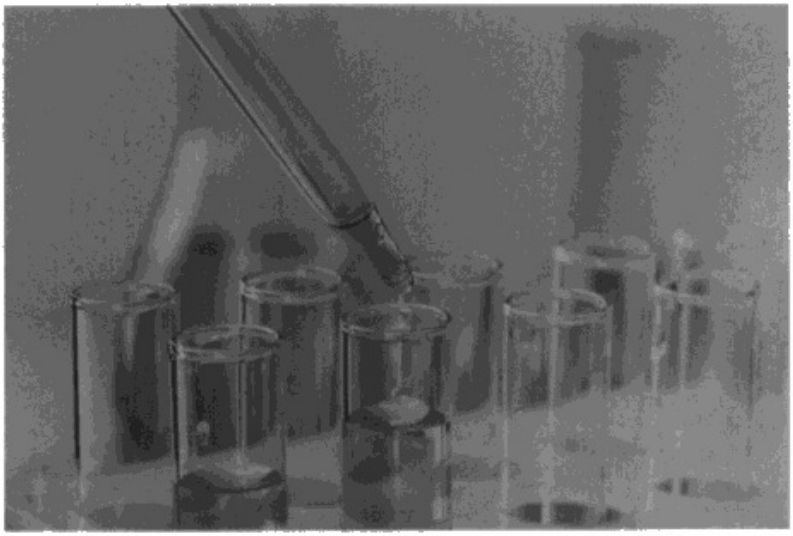
ResultsPlus
Examiner Tip

Be careful using terms such as 'it', as it can be ambiguous as to what is being referred to as 'it'.

6 A student investigated the fat content of two types of milk: milk A and milk B.

Before starting the investigation, the student added a drop of oil from a pipette into a test tube of water as shown in Figure 5.

The drop of oil rose to the surface of the water.



(Source: © Nana_studio/Shutterstock)

Figure 5

(a) The student then placed a drop of milk A into one test tube of water and a drop of milk B into a different test tube of water.

The drop of milk A sank to the bottom and the drop of milk B rose to the surface.

Give **one** reason for the drop of milk B rising to the surface.

(1)

Beause it is lighter than water.

ResultsPlus
Examiner Comments

This shows a misconception, as milk is heavier than water.

Question 6 (b)(i)

Lipase digests fats into fatty acid and glycerol which will reduce the pH of a mixture or make it more acidic. This is what was required to explain the change from pH 7 to pH 5. Most candidates obtained the mark for recognising that the pH has reduced or become more acidic with many also recognising that fat is the substrate for lipase. Some candidates suggested that the product of fat digestion was amino acids or lactic acid.

(b) 5 cm^3 of milk B and 1 cm^3 of lipase were added to a different test tube.

The pH of this mixture was pH 7.

This test tube was placed in a water bath for 10 minutes.

The pH of the mixture changed from pH 7 to pH 5.

(i) Explain what caused this change in pH.

(3)

The Lipase broke down the fat in the milk causing it to become more acidic as well as there was no PH Buffer keeping it the same for the whole experiment.

ResultsPlus
Examiner Comments

This scores two marks for fats being broken down and the mixture becoming more acidic. It does not fully explain the drop in pH as fatty acids are not given in the answer.

(b) 5 cm^3 of milk B and 1 cm^3 of lipase were added to a different test tube.

The pH of this mixture was pH 7.

lipids → lipase → fatty acid

This test tube was placed in a water bath for 10 minutes.

The pH of the mixture changed from pH 7 to pH 5.

(i) Explain what caused this change in pH.

(3)

The lipase is an enzyme that breaks down lipids. The test tube was placed in a water bath, which ensured optimum temperature for the enzymes. The enzymes changed the lipids into fatty acids. Therefore, the pH got more acidic due to the enzyme activity.

ResultsPlus
Examiner Comments

This is a full explanation of the change in pH and gained full marks.

(b) 5 cm^3 of milk B and 1 cm^3 of lipase were added to a different test tube.

The pH of this mixture was pH 7.

This test tube was placed in a water bath for 10 minutes.

The pH of the mixture changed from pH 7 to pH 5.

(i) Explain what caused this change in pH.

(3)

The enzyme lipase breaks down lipids + fats. The pH change was caused by the fats and lipids being broken down. The test tube was placed in the water bath so that it was the optimum temperature for the ~~ease~~ active sites of the enzyme lipase to bind to the substrate of the fats + lipids.

ResultsPlus
Examiner Comments

This answer repeats the same aspect three times rather than expanding on the why the breakdown of fat would change the pH. They also give the idea that the pH changed from the question but did not state how it changed.

Question 6 (b)(ii)

Candidates needed to recall that milk B did not rise in water indicating that it did not contain fat or contained less. Therefore, the pH did not change as fatty acids were not produced. Some candidates recognised that there was no substrate for the lipase or that there was no fat and those with a good knowledge of enzymes recognised that a lack of fatty acid production meant the pH didn't change. Some candidates incorrectly linked this to the previous question suggesting that the enzyme had already reacted.

(ii) This procedure was repeated with milk A.

There was no change in the pH of this mixture after 10 minutes.

Explain why there was no change in the pH of the mixture containing milk A.

(2)

There was no lipids in the mixture for the fg lipase to react with. So no acid was formed.

ResultsPlus
Examiner Comments

This scored one mark for no lipids. The acid specifically needed to be fatty acids.

(ii) This procedure was repeated with milk A.

There was no change in the pH of this mixture after 10 minutes.

Explain why there was no change in the pH of the mixture containing milk A.

(2)

Milk A contained no fat, therefore there was nothing for the lipase ~~ens~~ to breakdown. So nothing was broken down ~~aa~~ and this caused the pH to stay the same because no glycerol or fatty acids were produced.

ResultsPlus
Examiner Comments

This is a complete explanation for there being no fat so fatty acids were not produced.

Question 6 (b)(iii)

This question was generally answered well with most candidates recognising that the enzyme has been denatured so the active site had changed shape which allowed them to obtain at least two marks. Some candidates extended this to include the idea that the substrate could not bind or that fatty acids were not produced. Some candidates gave incorrect responses suggesting that the cooling had reduced the temperature below the optimum and so the enzyme would not react.

(iii) The student repeated this procedure with lipase that had been boiled and left to cool.

This was added to another sample of milk B.

Describe why the pH did not change in this mixture.

(3)

The pH did not change as the lipase enzymes were boiled. The boiling of the lipase enzymes caused the enzymes to denature meaning the shape of the active site changed due to the high temperature. Because the enzymes were denatured, the substrate could not fit into the active site (the lock and key model was no longer available), this meant the lipids could not be broken down into ~~fatty~~ acidic fatty acids so the pH did not change.

ResultsPlus
Examiner Comments

This gained full marks. The lipase enzyme was boiled repeats the stem of the question but they made the link to the temperature being high later in the response. They have denaturing and changing the shape of the active site as well as the substrate not fitting into the active site and this would have also got the marking point for no fatty acids produced.

(iii) The student repeated this procedure with lipase that had been boiled and left to cool.

This was added to another sample of milk B.

Describe why the pH did not change in this mixture.

(3)

The enzyme lipase was boiled, denaturing the enzyme's active site, making it change shape. This meant the pH did not change in the mixture this time because the fatty acid in milk B was not broken down. Therefore the pH did not change in the mixture. Milk B pH was neutral so the pH stayed at 7.

ResultsPlus
Examiner Comments

This gained two marks for denaturing the active site. The context of fatty acids is incorrect.

ResultsPlus
Examiner Tip

Read responses carefully if you have time at the end to ensure you have not made any errors.

(iii) The student repeated this procedure with lipase that had been boiled and left to cool.

This was added to another sample of milk B.

Describe why the pH did not change in this mixture.

(3)

Because this time the lipase has been boiled, heating the fat and causing it to disolve So then Milk B was like Milk A and did not change PH

ResultsPlus
Examiner Comments

This response repeats boiled from the question and links the heat to dissolving the fat. No marks were awarded.

Question 7 (a)

This 4 mark question combined practical skills knowledge with subject knowledge on mitosis. Most candidates gave the practical details on how to prepare a microscope slide but few applied the question to knowledge on mitosis, that the meristem or the tip of the root was needed. Most candidates recognised the need for a stain and a coverslip. Many stated that it needed to be a thin slice. Many candidates gave details on using the microscope, which was not credited as it doesn't answer the question.

7 (a) A student was investigating mitosis in the roots of a garlic plant.

Describe how the student could prepare a microscope slide to show mitosis in the growing roots of a garlic plant.

(4)

The student would achieve a very thin layer of the tip (where the meristem are growing and cell division occurs,) garlic plant root, and place it on a clean slide. Then a drop of iodine would be placed on the cells ~~then~~ layer so the cells are more visible through the microscope. Then place another clean slide diagonally ontop ~~and~~ to ensure there are no air bubbles and the sample is secured. Place the slide on the microscope stage.

ResultsPlus
Examiner Comments

This was awarded full marks for a thin layer, from the tip of the root, adding iodine (MP4) and the idea of putting a second slide on top was accepted as a description of a coverslip as it was recognised that some centres may have done this when they did the core practical.

7 (a) A student was investigating mitosis in the roots of a garlic plant.

Describe how the student could prepare a microscope slide to show mitosis in the growing roots of a garlic plant.

(4)

Cut thin slice of garlic plant so light can see through. use pipette to drop water on center of slide and tweezer the garlic plant specimen on. Add drop of iodine to react with specimen starch to give colour. Clip slide under lowest powered objective lens. Move coarse adjustment knob until nearly in focus then fine adjustment knob until clear. Need a light microscope to investigate living cells mitosis. Could repeat with varying parts of the garlic plant besides roots also shoots.

ResultsPlus
Examiner Comments

This response scored three marks. A thin slice of garlic, a drop of water being added to the slide and iodine is a named stain.

7 (a) A student was investigating mitosis in the roots of a garlic plant.

Describe how the student could prepare a microscope slide to show mitosis in the growing roots of a garlic plant.

(4)

place the garlic root on the glass slide ~~ad~~and add some blue dye to garlic to be able to see it clearer. The ~~A~~clip the slide on use the coarse adjustment knob to change the position of the slide from left to right and use the fine adjustment knob to lower or higher it up of down.

ResultsPlus
Examiner Comments

This scores one mark for dye being acceptable for stain. The response doesn't refer to the tip of the root or a thin section being needed and no marks are available for details on using the microscope.

ResultsPlus
Examiner Tip

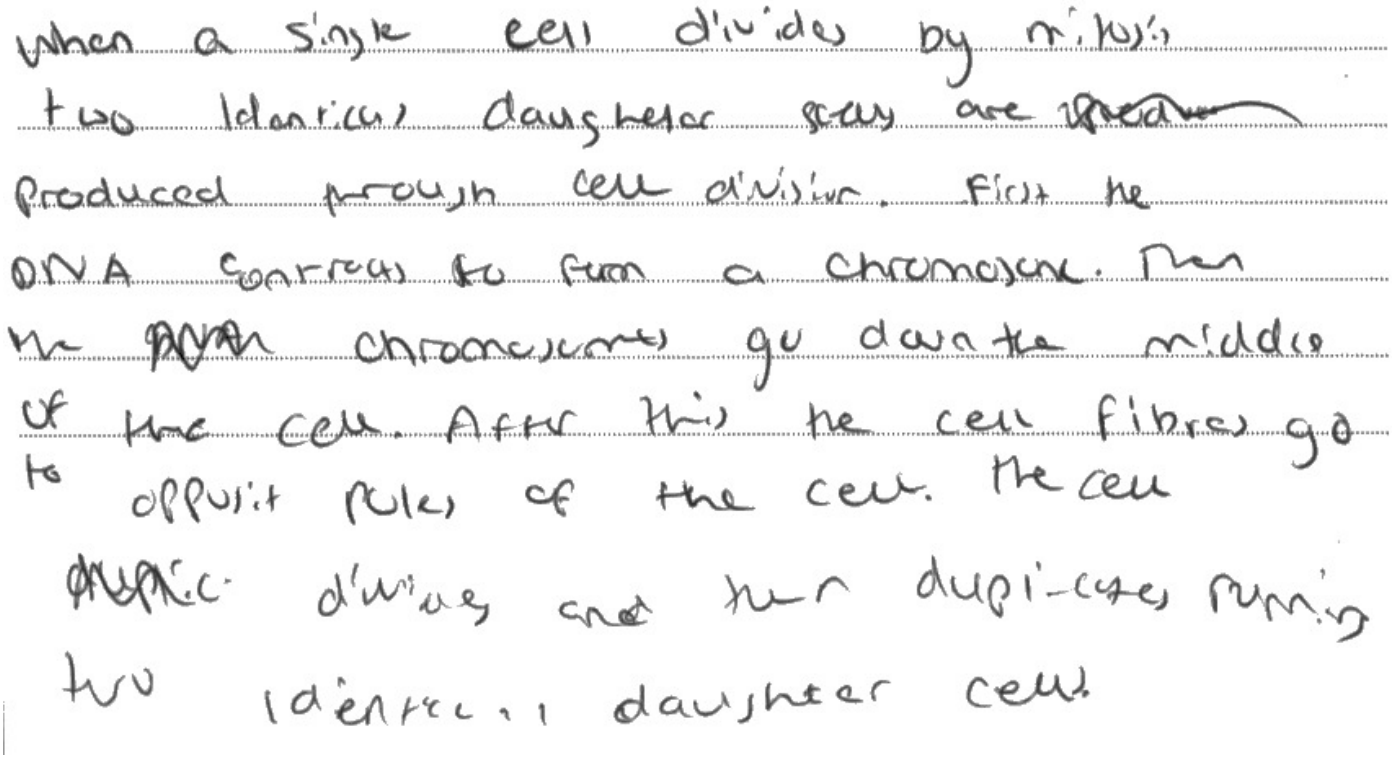
Make sure you focus on the area of the practical being assessed in the question.

Question 7 (b)

Marks were awarded for two cells being produced, that they were genetically identical and diploid. Some candidates have details of 23 pairs of chromosomes or 46 chromosomes which was credited although the question is not specifically about human cells. Some candidates confused diploid and haploid and some just gave the idea that the cells were identical without reference to the genetic material which was insufficient. Comparisons with meiosis were also seen which was a question on a previous paper and not required here.

(b) Describe what is produced when a single cell divides by mitosis.

(3)



ResultsPlus
Examiner Comments

This was only one mark for two cells in this response. Identical is insufficient as it has to be linked to genetically or the idea of the same DNA. There are no marks for the steps of mitosis as the question asks what is produced by mitosis and not how a single cell divides by mitosis.

(b) Describe what is produced when a single cell divides by mitosis.

(3)

When a single cell divides by mitosis two genetically identical, diploid daughter cells are produced and they are used for growth and repair.

ResultsPlus
Examiner Comments

This is full marks for two / genetically identical / diploid cells. It is clear the cells produced are for growth and repair which would also be worthy of a mark had full marks not already been awarded.

(b) Describe what is produced when a single cell divides by mitosis.

(3)

Mitosis produces two genetically identical daughter cells. All features/defects on the parent cell will be passed down to the offspring. These cells will then divide more and more, and will all be identical to each other.

ResultsPlus
Examiner Comments

This response is limited to two marks for genetically identical and two cells produced.

Question 7 (c)

The equation for calculating mitotic index was provided but candidates needed to recognise that interphase is not part of mitosis. The first mark was for totaling the stages of mitosis, the second was for the calculation and then the final mark was for the answer being given to three significant figures. An error carried forward was applied when the number of cells was incorrectly calculated allowing the maths skills marks to be obtained. The most frequent errors seen was the selection of one or two phases of mitosis but not all four or using interphase.

(c) The student observed 89 cells on the microscope slide.

Figure 6 shows the number of cells at each stage of the cell cycle.

stage of cell cycle	number of cells
Interphase	44
Prophase	12
Metaphase	6
Anaphase	18
Telophase	9

Figure 6

Use this equation to calculate the mitotic index for this slide.

$$\text{mitotic index} = \frac{\text{number of cells in mitosis}}{\text{total number of cells}} \times 100$$

Give your answer to three significant figures.

(3)

12 + 18 + 6 + 9 = 45

$\frac{45}{89} \times 100 = 50.56$

Mitotic index 50.6

ResultsPlus
Examiner Comments

This scores full marks. The steps of the working are also clear.

(c) The student observed 89 cells on the microscope slide.

Figure 6 shows the number of cells at each stage of the cell cycle.

stage of cell cycle	number of cells
Interphase	44
Prophase	12
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Give your answer to three significant figures.

(3)

12 + 6 + 18 + 9 = 45

$\frac{45}{89} \times 100 = 50.56$

Mitotic index 50.56

ResultsPlus
Examiner Comments

This gains two marks as it is not given to 3 significant figures.

ResultsPlus
Examiner Tip

Read the question carefully so that you know how an answer to a maths question should be given. This should have been to three significant figures.

(c) The student observed 89 cells on the microscope slide.

Figure 6 shows the number of cells at each stage of the cell cycle.

stage of cell cycle	number of cells
Interphase	44
Prophase	12
Metaphase	6
Anaphase	18
Telophase	9

Figure 6

Use this equation to calculate the mitotic index for this slide.

$$\text{mitotic index} = \frac{\text{number of cells in mitosis}}{\text{total number of cells}} \times 100$$

Give your answer to three significant figures.

(3)

$\frac{9}{89} \times 100$

$= 10.123...$

$= 10.1$

Mitotic index 10.1

This was awarded two marks. They have only used the number of cells in telophase showing an error in the understanding of the biology. However, the maths calculation has then been completed correctly and given to three significant figures.

Question 7 (d)

Cancer causes cells to divide uncontrollably and most candidates obtained this mark by stating this or giving the idea of rapid cell division. References to mutation or tumour were ignored as they do not answer the question.

(d) The mitotic index is often used in the diagnosis of cancer.

State the effect of cancer on cell division.

(1)

Cancer causes uncontrollable rapid cell division

ResultsPlus
Examiner Comments

This is worthy of the mark as it is clear that the cell division is uncontrolled / rapid.

(d) The mitotic index is often used in the diagnosis of cancer.

State the effect of cancer on cell division.

(1)

It increases it rapidly

ResultsPlus
Examiner Comments

Avoid using 'it'. This was awarded the mark as it must refer to the cell division and therefore it being rapid. In other contexts 'it' could be ambiguous as to what is being referred to.

(d) The mitotic index is often used in the diagnosis of cancer.

State the effect of cancer on cell division.

(1)

never stops growing cancerous cells.

ResultsPlus
Examiner Comments

This answer is not about the cell division and was not given a mark.

Question 8 (a)

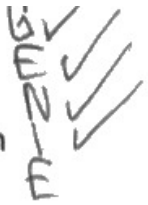
This question required an outline of the theory of evolution by natural selection. Unlike previous questions that have examined this specification point, it was not channeled to a specific example and required the principles of over-production, variations, struggle for existence, survival of the fittest, inheritance and repetition. Most candidates gave detailed responses and many obtained full marks.

8 Alfred Russel Wallace travelled around Malaysia during the 1800s and wrote to Charles Darwin about the animal species he studied.

His main conclusions were very similar to those of Charles Darwin and they both contributed to the current understanding of evolution.

(a) Describe the theory of evolution by natural selection.

(3)



Genetic variation means that there would have been variation in a species. An environmental change would occur and some of the species will have been able to survive and some wouldn't depending on their characteristics. Natural selection would then occur between the remaining species and their offspring would inherit these characteristics. This characteristic will continue to be inherited and the species

ResultsPlus
Examiner Comments

This scored full marks with the idea of variation, a change in the environment, survival of the fittest and inheritance by the offspring.

ResultsPlus
Examiner Tip

The use of acronyms to help remember processes is a good revision strategy.

8 Alfred Russel Wallace travelled around Malaysia during the 1800s and wrote to Charles Darwin about the animal species he studied.

His main conclusions were very similar to those of Charles Darwin and they both contributed to the current understanding of evolution.

(a) Describe the theory of evolution by natural selection.

(3)

They proposed the idea of 'Survival of the fittest' Thought

Showed that traits can be passed from parent to offspring.

Studied a variety of organisms around the world.

Brain size got bigger. Arms got shorter.

ResultsPlus
Examiner Comments

This scored two marks for the idea of survival of the fittest and the inheritance by offspring.

8 Alfred Russel Wallace travelled around Malaysia during the 1800s and wrote to Charles Darwin about the animal species he studied.

His main conclusions were very similar to those of Charles Darwin and they both contributed to the current understanding of evolution.

(a) Describe the theory of evolution by natural selection.

(3)

the weak ones will die meaning that gene will end before they can reproduce whereas the strong ones in the species will reproduce and pass on their strong genes to their offspring.

ResultsPlus
Examiner Comments

This was awarded one mark. The candidate did not get the mark for weaker die / stronger reproduce but they were not penalised twice and were given the mark for offspring inheriting genes.

ResultsPlus
Examiner Tip

Avoid the terms weak genes and strong genes as it is not scientifically correct.

Question 8 (b)(i)

The context of this question centres around differences in opinion between Darwin and Wallace resulting in an explanation as to why female birds have less brightly coloured feathers and how that helps survival. The marks were awarded for the idea that it made them harder to be seen which could be linked to the idea that they would be camouflaged, less likely to be hunted or killed by a predator or that they could hunt more effectively as their prey would not see them. Most candidates gave good answers to this question.

(b) Wallace and Darwin did not always agree.

Darwin believed that male birds have feathers that are brightly coloured to make them more attractive to female birds.

Wallace thought that female birds have feathers that are less brightly coloured so they are more likely to survive.

(i) Explain why having feathers that are less brightly coloured increases the survival rate of females.

(2)

When female birds a sitting on eggs, they'll need darker feathers so they're camoflaged from predators that could eat them or the eggs.

ResultsPlus
Examiner Comments

This scored full marks for the female being camouflaged from predators. It also refers to the idea of being less obvious in the nest.

(b) Wallace and Darwin did not always agree.

Darwin believed that male birds have feathers that are brightly coloured to make them more attractive to female birds.

Wallace thought that female birds have feathers that are less brightly coloured so they are more likely to survive.

(i) Explain why having feathers that are less brightly coloured increases the survival rate of females.

(2)

because they don't become a threat to other species

ResultsPlus
Examiner Comments

This response does not score. The candidate has confused the idea that colourful markings are often used as a threat. In this case the female is not colourful, so they have not answered the question.

(b) Wallace and Darwin did not always agree.

Darwin believed that male birds have feathers that are brightly coloured to make them more attractive to female birds.

Wallace thought that female birds have feathers that are less brightly coloured so they are more likely to survive.

(i) Explain why having feathers that are less brightly coloured increases the survival rate of females.

(2)

This is because depending on there environment but if their feathers are less brightly coloured this means that they can blend into their surroundings allowing them to camaflage making them not as noticeable to predators than the male bird

ResultsPlus
Examiner Comments

This scored two marks for blending in and camouflage making them less noticeable to predators.

Question 8 (b)(ii)

This question asked candidates to apply their knowledge to the context to recognise that the female of the species produce offspring so their survival is more important and this was combined with the idea that males can reproduce with more than one female. Some responses did not gain credit if they stated that only the females reproduce or that males do not reproduce. Whilst it is likely the candidate knew that the females produce the offspring, they did not say this and gave incorrect science. This emphasises the importance of checking answers in exams.

(ii) Suggest why it is more important for the survival of the species that the survival rate is higher in female birds than in male birds.

(2)

female birds carry and lay the eggs. one male bird can mate with many female birds, so less males are needed.

ResultsPlus
Examiner Comments

This scores full marks for the idea of the female producing the eggs and that the male birds can mate with more than one female.

(ii) Suggest why it is more important for the survival of the species that the survival rate is higher in female birds than in male birds.

(2)

Female Birds Sexually reproduce so if there is a shortage of them ~~they may~~ the whole population of Birds become extinct. However, if there is a shortage of Male Birds they can still breed with many female Birds at the same time.

ResultsPlus
Examiner Comments

This scored one mark with the male birds mating with many female birds.

The idea of females reproducing sexually did not get the mark as males are involved in sexual reproduction.

(ii) Suggest why it is more important for the survival of the species that the survival rate is higher in female birds than in male birds.

(2)

femal birds reproduce they are needed to give birth and too keep the species from going extinct they are needed.

ResultsPlus
Examiner Comments

This was given one mark as it is clear that the females are producing the offspring.

Question 8 (c)

This question focused on how the limbs shown in the figure provided evidence for evolution. The marks could be obtained for recognising them as pentadactyl limbs or describing that they have the same bone structure. This indicates that they evolved from a common ancestor, which would also have had a pentadactyl limb. A mark was also available for details on the differences in the limb and how they linked to function. Many candidates recognised it as a pentadactyl limb with some citing that this shows evolution from a common ancestor. Most candidates did not link this to the common ancestor having a pentadactyl limb.

(c) Figure 7 shows the limbs of five animals.

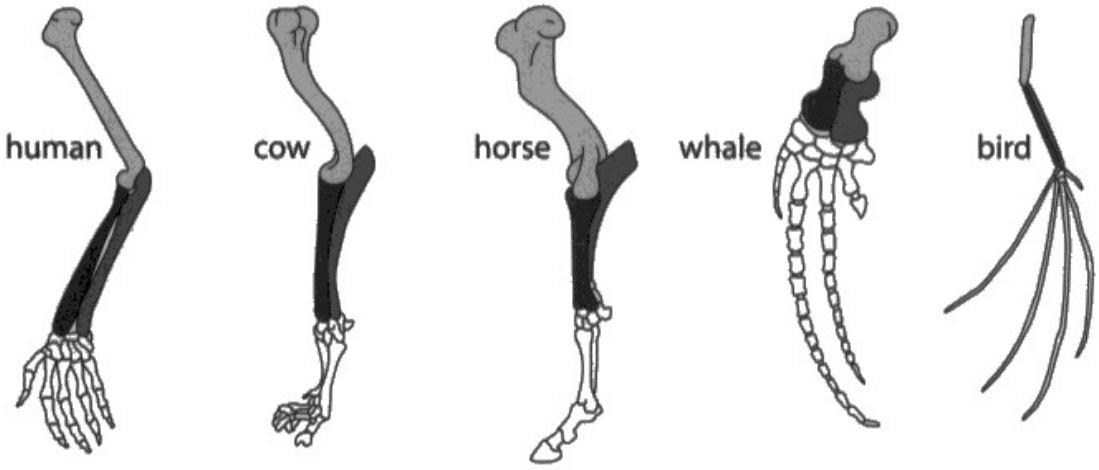


Figure 7

Describe how the structure of these limbs provides scientists with evidence for evolution.

(3)

A pentadactyl limb is any limb with 5 digits present in animals, reptiles, amphibians, etc. From this, we can infer that any species that possesses this limb decends from a common ancestor.

ResultsPlus
Examiner Comments

This gained two marks for the pentadactyl limb and descended from a common ancestor. They could have improved the response by indicating that the common ancestor also had a pentadactyl limb.

(c) Figure 7 shows the limbs of five animals.

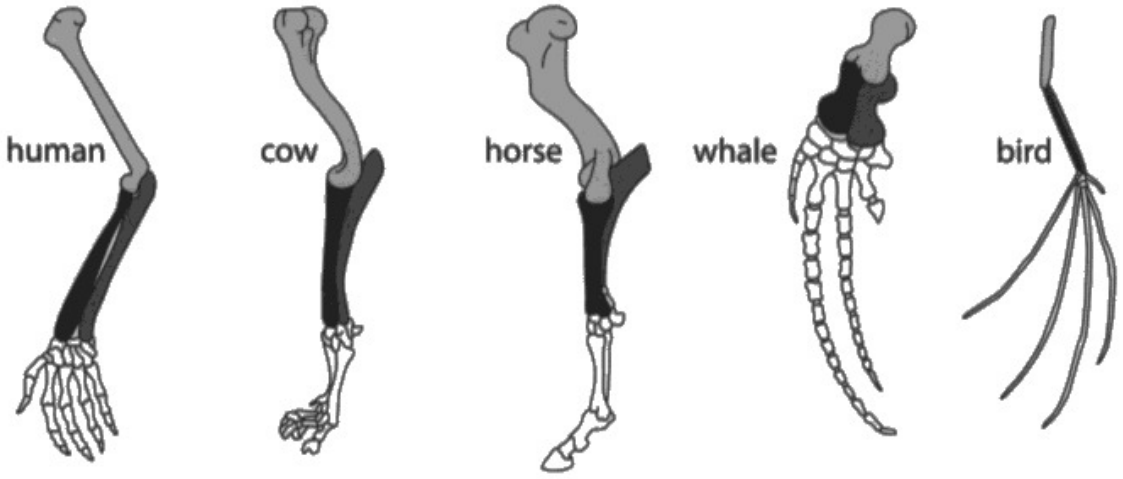


Figure 7

Describe how the structure of these limbs provides scientists with evidence for evolution.

(3)

Birds have long thin bones. It gives the bird a large surface area for their wings to fly whilst also being lightweight as they are thin, which also helps them fly.

ResultsPlus
Examiner Comments

This response has a description of the differences of the bird limb and how it relates to its function for one mark. It does not give any further information on how the limbs are evidence for evolution.

(c) Figure 7 shows the limbs of five animals.

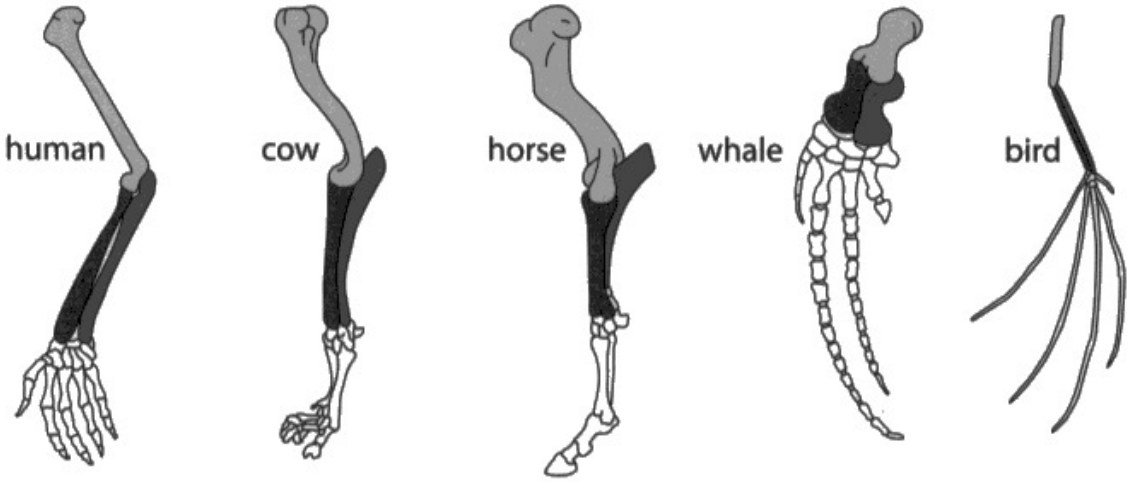


Figure 7

Describe how the structure of these limbs provides scientists with evidence for evolution.

(3)

All of these animals have a pentydactal limb, which suggests that they all derived from a common ancestor who also had a pentydactal limb. This is evidence because it is unlikely that the evolution of a pentydactal limb would have occured more than once, showing that they all evolved from one common ancestor. These animals all have a pentydactal limb, which shows some sort of similar bone structure.

ResultsPlus
Examiner Comments

This detailed response scores full marks. They have made the link between the limbs and the common ancestor having a pentadactyl limb.

Question 9 (a)(i)

This question required careful reading of the introductory information as well as the question. The pig is engineered not to produce pig's kidneys as they cannot be used in humans, would be rejected or ideas around them interfering with the growth of the human kidneys. It was not so they could grow human kidneys which is achieved by implanting stem cells.

9 There is a shortage of kidneys for organ transplants.

Scientists are investigating how to grow kidneys using genetically modified pig embryos.

Figure 8 shows this process.

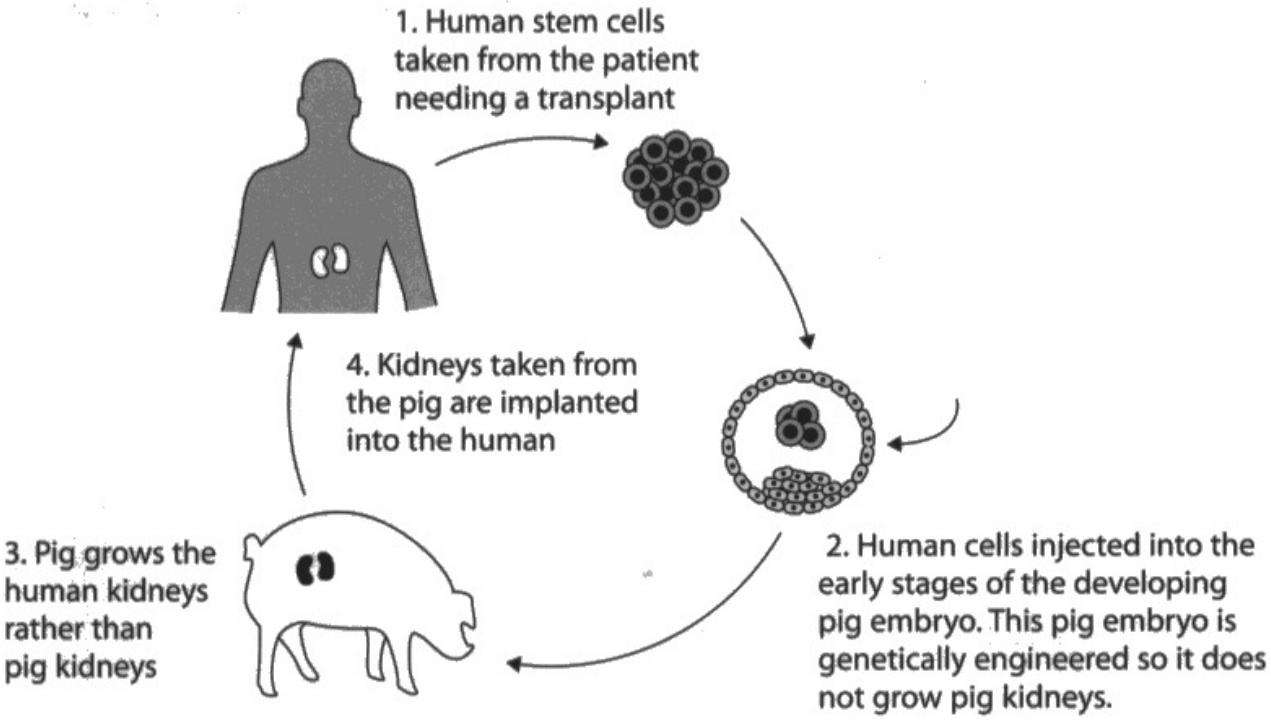


Figure 8

(a) (i) State why the embryo of the pig must be engineered so it does not grow pig kidneys.

(1)

So that pig grows human kidneys that can be transplanted

ResultsPlus
Examiner Comments

This was not worth the mark as it doesn't answer why they don't grow pigs kidneys They grow human kidneys not pig kidneys is given in the diagram.

9 There is a shortage of kidneys for organ transplants.

Scientists are investigating how to grow kidneys using genetically modified pig embryos.

Figure 8 shows this process.

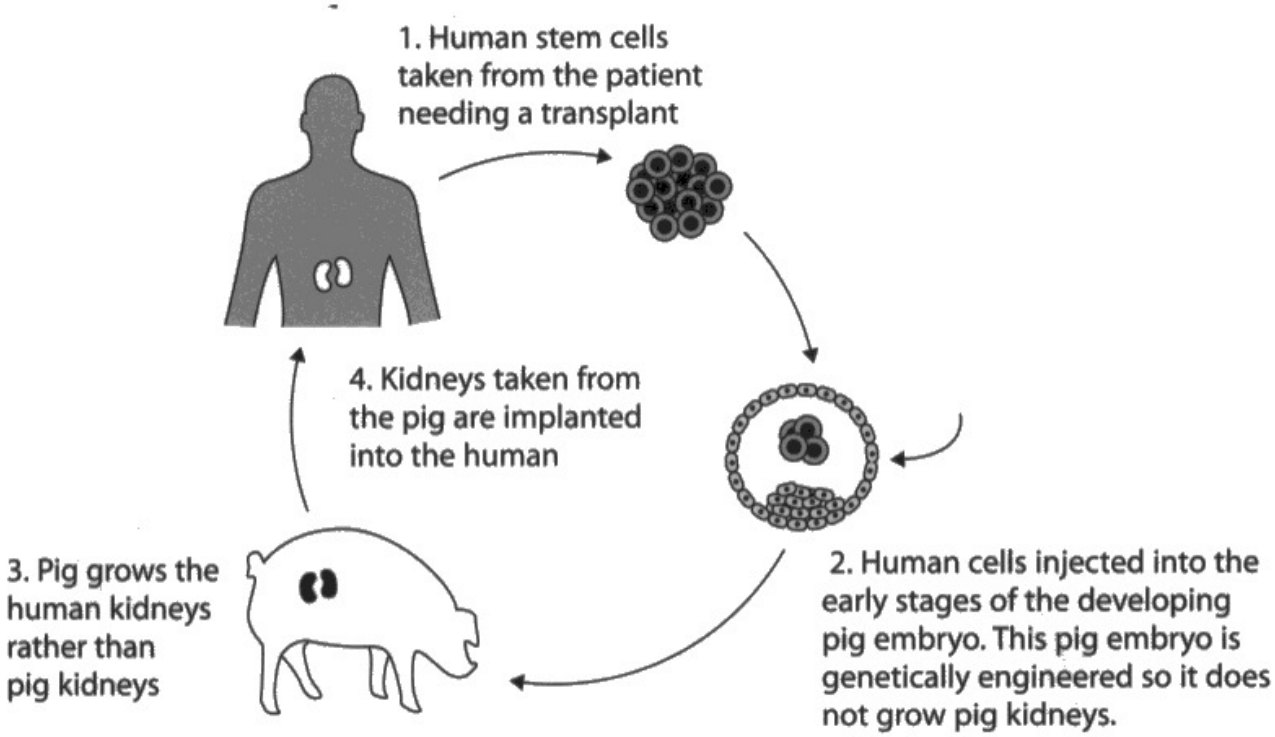


Figure 8

(a) (i) State why the embryo of the pig must be engineered so it does not grow pig kidneys.

(1)

because the human can't have pig kidneys

ResultsPlus
Examiner Comments

This was given the mark as it shows that the pig cannot develop pig kidneys because they could not be used by a human.

Question 9 (a)(ii)

Human stem cells were used because stem cells are undifferentiated cells and can become specialised so they would be able to form human kidney cells or human kidneys, and if transplanted there is less chance of rejection. Most candidates answered this question well, applying the knowledge they had learnt to a specific context.

(ii) Explain why human stem cells are used for this process.

(2)

human stem cells are used for this process to ensure that the kidneys don't grow to large in the pigs, and so when implanted into the human body, it doesn't reject them.

ResultsPlus
Examiner Comments

This scores one mark. It does not give the role of the stem cells but has got the idea that the kidneys would be less likely to be rejected by the human body.

(ii) Explain why human stem cells are used for this process.

(2)

human stem cells are used so the kidney has a lower chance of being rejected by the patient. these stem cells can specialise into kidney cells and are not foreign to the patient.

ResultsPlus
Examiner Comments

This response was worth full marks. It has a lower chance of rejection, stem cells can specialise and that they can form kidney cells.

(ii) Explain why human stem cells are used for this process.

(2)

Human Stem cells are used for this process. This is because they are cells which can become specialised cells for anything.

ResultsPlus
Examiner Comments

This only obtains one mark for stem cells becoming specialised.

Question 9 (b)(i)

Extracting information from graphs and data tables is a key scientific skill. Candidates need to ensure they provide an answer that fits with the command word, in this case 'compare'. There are several comparisons that can be made between the number of donors available and the number of transplants needed. The number of donors only increases by a small amount. The number of transplants needed increases rapidly until a peak in 2014/2015 and then decreases. Candidates were told to use information from the graph and a mark was available for comparative data, to get this mark they had to compare data at the same point between number of donors available and number of organ transplants.

(b) Figure 9 shows the number of organ transplants needed and the number of donors available in the USA from 1991 to 2018.

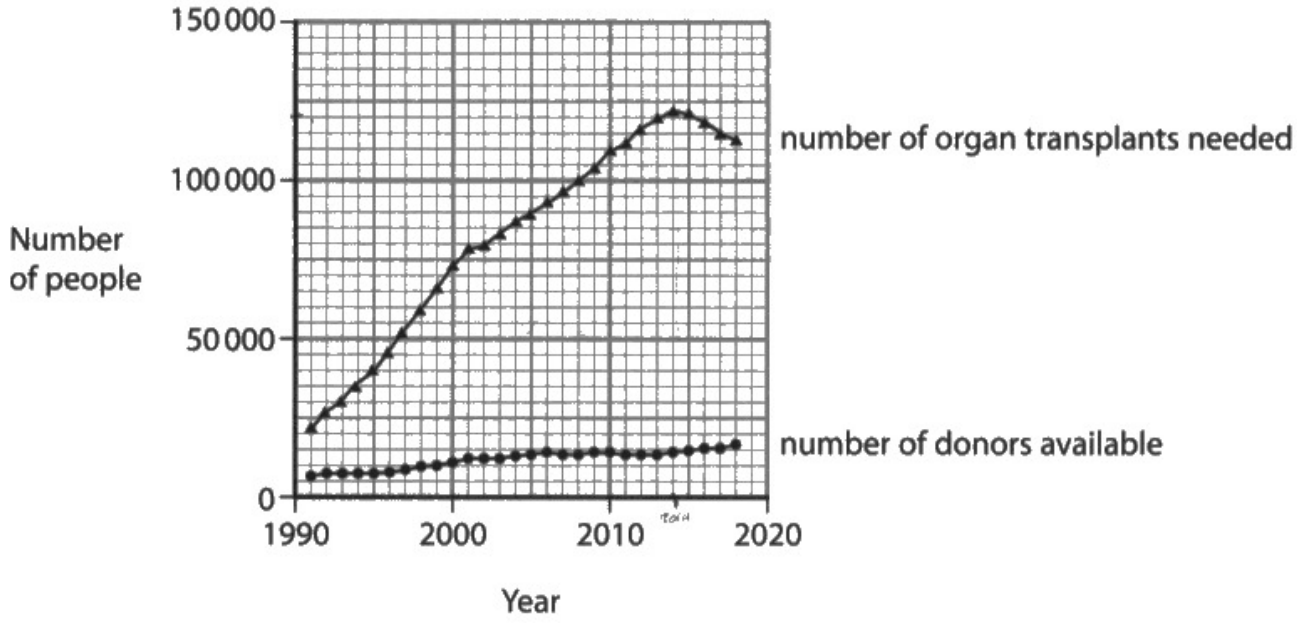


Figure 9

(i) Compare the number of donors available with the number of organ transplants needed from 1991 to 2018.

Use information from the graph to support your answer.

(3)

The number of organ transplants needed rapidly increase until 2014 with 120,000 people until it begins to decrease. However, number of donors available slightly increases but in the amount it's almost constant constant from 1991 to 2018.

ResultsPlus
Examiner Comments

This scores two marks. It makes a comparative comment between the trend for the number of organs needed and number of donors available. It also recognised that the trend in the number of organs transplanted decreases from 2014.

(b) Figure 9 shows the number of organ transplants needed and the number of donors available in the USA from 1991 to 2018.

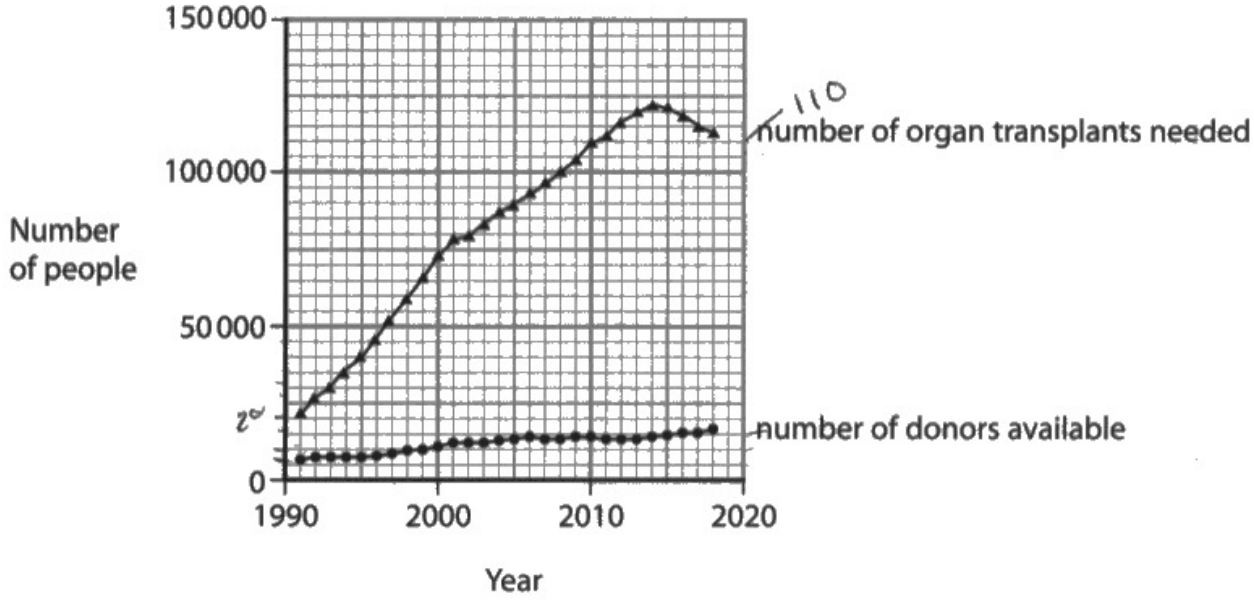


Figure 9

(i) Compare the number of donors available with the number of organ transplants needed from 1991 to 2018.

Use information from the graph to support your answer.

(3)

There are only ~~20,000~~ 5000 donors available in 1991 with ~~only~~ ~~110,000~~ 20,000 transplants needed.

In 2018, there are only 15000 donors available with 110,000 transplants needed. This could be due to a population increase so more people need more of that thing

ResultsPlus
Examiner Comments

This only scored one mark. It has used comparative data at two different points but it makes no comparison between the trends.

(b) Figure 9 shows the number of organ transplants needed and the number of donors available in the USA from 1991 to 2018.

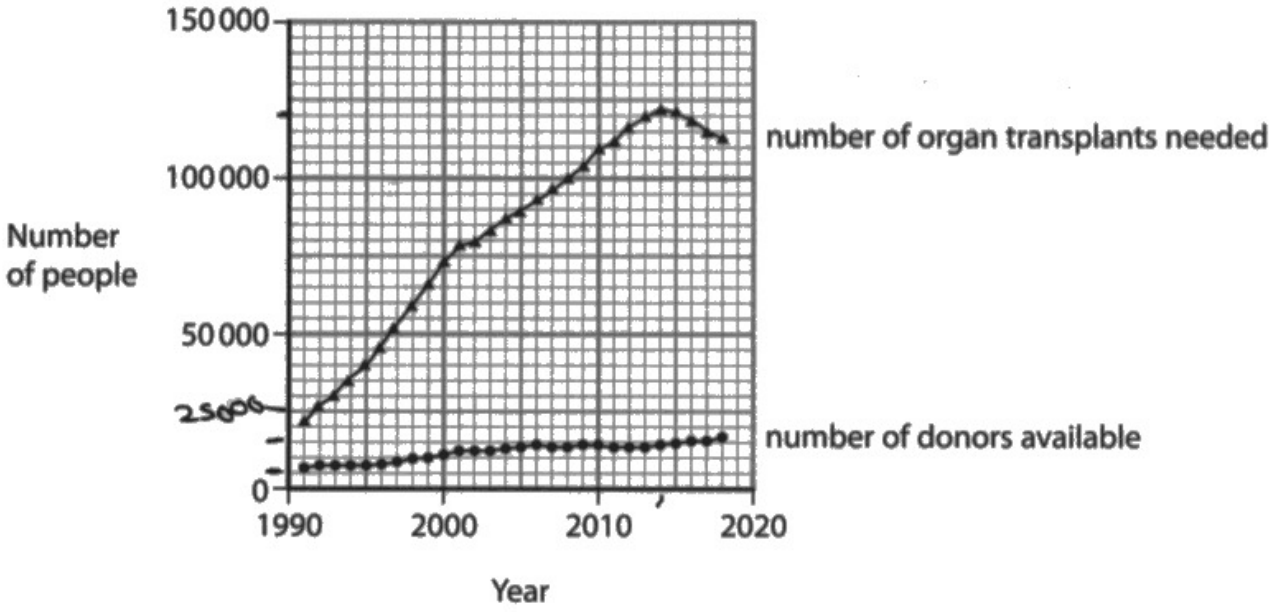


Figure 9

(i) Compare the number of donors available with the number of organ transplants needed from 1991 to 2018.

Use information from the graph to support your answer.

(3)

there is a lot less donors available compared to the amount of transplants needed. the ~~transplants~~ donors available stays around 5,000-15,000 wheras the transplants needed positively increases until 2014 when it then starts to drop. in 2014 the amount of transplants needed was at a peak of 120,000.

ResultsPlus
Examiner Comments

This was worth three marks. Less donors available compared to transplants needed, donors staying around 5000-15000 whereas transplants increases, then that the number of donors decreases from 2014.

Question 9 (b)(ii)

The reason that scientists are genetically engineering animals for organ transplants is that there is a shortage of donors. Most candidates were able to obtain this mark.

(ii) State why scientists are genetically engineering animals for organ transplants.

(1)

~~this is preferable/better~~ There are not enough human donors available to accomodate the number of organ transplants needed

ResultsPlus
Examiner Comments

This scored the mark for the idea of there not being enough donors.

(ii) State why scientists are genetically engineering animals for organ transplants.

(1)

~~there are not~~ animals already have similar organs to humans

ResultsPlus
Examiner Comments

This is not why animals are being engineered for organ transplants.

(ii) State why scientists are genetically engineering animals for organ transplants.

(1)

So more people can have organs transplanted that need it.

ResultsPlus
Examiner Comments

This is the idea of meeting the demand for organs and gained the mark.

Question 9 (c)

The first extended open response question on this paper was on the production of a genetically engineered bacterial cell which can produce human insulin. The indicative content included the details on the enzymes involved in the process as well as sticky ends, these are listed in the specification for this content. Most candidates demonstrated some knowledge on the process including the role of some enzymes. Confusion occurred when the response indicated that the human was being genetically engineered and there were some responses where the recombinant plasmid was constructed but not inserted into the bacteria, which limited the level which could be awarded.

***(c) Bacteria have been genetically engineered to produce human insulin since 1978.**

Explain how bacteria can be genetically engineered to produce human insulin.

(6)

The gene for insulin is extracted from a human and when it is taken out the gene has sticky ends. This gene is taken to a bacterial cell where it is inserted into the genome of the bacteria. Once it is inserted into the bacteria when the bacteria divides it produces new bacteriums ~~with~~ which produce Insulin. This insulin ~~can~~ can be extracted and used for humans.

ResultsPlus
Examiner Comments

This response was level 2, worth three marks. It had the removal of the human insulin gene and insertion into the bacterial DNA. It does not refer to an enzyme so does not get 4 marks. It could not be awarded level 3 as it does not use a plasmid or vector DNA.

*(c) Bacteria have been genetically engineered to produce human insulin since 1978.

Explain how bacteria can be genetically engineered to produce human insulin.

(6)

- Restriction enzymes are used to cut up the DNA.
- The gene is then took from the DNA and stuck in a plasmid. (The In the bacteria)
- The plasmid then contains the ~~human~~ gene that contains the insulin.
- The ~~a~~ bacteria then divides ~~a~~ and it contains the human insulin so it starts to be made.
- The gene from the DNA has to fit in the plasmid.
- The complimentary sticky ends hold the ~~com~~ bases together. Like the A to the T and the G to the C.

ResultsPlus
Examiner Comments

This was a level 2 response worth 4 marks. The level is determined by the detail of the process of genetic engineering. They have a brief understanding of the removal of the gene and the use of a plasmid. It is not detailed enough for level 3 as it does not give an indication of the insertion of the plasmid back into the bacteria. Once the level 2 was awarded then the use of one correct enzyme meant that 4 marks could be given.

*(c) Bacteria have been genetically engineered to produce human insulin since 1978.

Explain how bacteria can be genetically engineered to produce human insulin.

(6)

• the preferred gene is cut out from it's host using restriction enzymes and inserted into a new host. in this case the gene from the cell of an insulin - producing body is inserted into a new ~~other~~ sequences. sticky ends are restitched with the use of ligase.

ResultsPlus
Examiner Comments

This has isolated knowledge and does not combine sufficient information to be awarded more than level 1. They have the idea that restriction enzymes are used to remove genes and that sticky ends can be re-attached with ligase, so they have made some links to enable them to be awarded two marks.

*(c) Bacteria have been genetically engineered to produce human insulin since 1978.

Explain how bacteria can be genetically engineered to produce human insulin.

(6)

A restriction enzyme recognises the sequence of bases which codes for insulin and cuts it out of the DNA, leaving sticky ends. A plasmid is taken from a bacterium and it is cut at the same sequence of bases. The gene for insulin is joined to the plasmid by DNA ligase to form a recombinant plasmid. The recombinant plasmid is inserted back into the bacterium. The bacterium then reproduces to make more bacteria which produce insulin.

ResultsPlus
Examiner Comments

This is a concise, accurate response which was given 6 marks. It has all the detail required for level 3 with removal of the gene, insertion into the plasmid and the plasmid inserted into the bacteria with one enzyme correct enabling level 3 to be given. They referred to sticky ends, restriction enzymes and ligase so are awarded the top of the level.

Question 10 (a)(i)

The introduction to this question outlined some aseptic techniques which can be used when culturing microorganisms. It first asked why the agar and the loop were sterilised before use. The mark was for the idea of preventing contamination or killing unwanted micro-organisms. The mark was not given for sterilised as this was given in the introduction. Some candidates stated that these were aseptic techniques which is correct but does not answer why they were used. Some candidate suggested that warming the equipment up increased the rate of reaction.

10 (a) Figure 10 shows part of a method used to produce a bacterial culture on a Petri dish.

Step 1. Sterilise Petri dish and agar before use
Step 2. Pass inoculating loop through a flame
Step 3. Allow inoculating loop to cool
Step 4. Use inoculating loop to collect bacterial sample
Step 5. Use inoculating loop to spread bacteria onto agar

Figure 10

(i) State why step 1 and step 2 are necessary.

(1)

This is aseptic technique to remove unwanted microorganisms and prevent contamination of ~~agar~~ the culture.

ResultsPlus
Examiner Comments

This gained the mark for either removing unwanted microorganisms or for preventing contamination.

10 (a) Figure 10 shows part of a method used to produce a bacterial culture on a Petri dish.

Step 1. Sterilise Petri dish and agar before use
Step 2. Pass inoculating loop through a flame
Step 3. Allow inoculating loop to cool
Step 4. Use inoculating loop to collect bacterial sample
Step 5. Use inoculating loop to spread bacteria onto agar

Figure 10

(i) State why step 1 and step 2 are necessary.

(1)

they are aseptic techniques that allow this experiment to be safe and controlled.

ResultsPlus
Examiner Comments

Aseptic techniques is not sufficient, the question is looking for why they are used. Safe and controlled was too vague.

10 (a) Figure 10 shows part of a method used to produce a bacterial culture on a Petri dish.

Step 1. Sterilise Petri dish and agar before use
Step 2. Pass inoculating loop through a flame
Step 3. Allow inoculating loop to cool
Step 4. Use inoculating loop to collect bacterial sample
Step 5. Use inoculating loop to spread bacteria onto agar

Figure 10

(i) State why step 1 and step 2 are necessary.

(1)

The petri dish, agar and inoculating loop need to be sterilised so that no other bacteria is involved in the experiment

ResultsPlus
Examiner Comments

Sterilised is given in the stem of the question which on its own would not be sufficient. The mark was awarded for no other bacteria being involved in the experiment.

Question 10 (a)(ii)

The second aspect of this part of the question was why the loop was cooled. Many candidates recognised that this prevented the bacteria in the culture being killed. Some gave the idea that it would melt the agar which was not credited.

(ii) Give **one** reason why step 3 is included.

(1)

The inoculating loop needs to cool because it is hot, and that heat could kill the bacteria in the sample.

ResultsPlus
Examiner Comments

This accurately answers why the loop needed to be cooled.

(ii) Give **one** reason why step 3 is included.

(1)

This is to keep temperature of the bacteria consistant, control variable.

ResultsPlus
Examiner Comments

This did not gain the mark as it is not about maintaining the temperature of the loop or controlling variables.

(ii) Give **one** reason why step 3 is included.

(1)

to ensure the heat doesn't affect the bacterial sample.

ResultsPlus
Examiner Comments

This was not sufficient for the mark, 'the heat not affecting the bacterial culture' does not give the idea of the heat being detrimental to the bacteria.

Question 10 (a)(iii)

This extended open response question directly examined the core practical on microbial growth. It asked for the inclusion of controlled variables and a control. The levels were awarded based on the level of detail in the plan to utilise the equipment necessary, the identification of controlled variables and a description of the control. Most candidates recognised the need to divide the plate up so that the different antiseptics could be tested. The use of a control with either an unsoaked filter disc or a filter disc soaked in water was commonly seen. Candidates recognised that the plate needed to be incubated to obtain the results and some gave the detail of how to measure a zone of inhibition. Some responses were limited to level 1 as they spread the antiseptics directly onto the agar which would not allow results to be obtained. The answers were generally separated into levels 2 and 3 based on the detail of controlled variables and practical techniques including safety and aseptic working. Some candidates gave the idea the filter discs should be the same size, soaked for the same time or inoculated with the same volume. Higher level responses included times and/or temperatures for incubation.

*(iii) A student wanted to investigate how effective three different antiseptics were at killing bacteria.

The student was provided with:

- an inoculated Petri dish prepared using the method in Figure 10
- three different antiseptics
- filter paper discs
- sticky tape.

Devise a plan for the student to complete this investigation.

Include a control and any variables that the student would need to consider.

(6)

1. After using the method shown in figure 10, the student should add each of the antiseptics to a different filter paper disc.
   - they would need to control the amount of antiseptic added and the size of the filter paper disc.
2. Then, the student should put the lid on the petri dish and add to small pieces of tape to either side (enough to let some oxygen in).
3. place the petri dish into an incubator for a set period of time to let the bacteria grow and the antiseptic try to stop it.
4. once removed from the incubator, the student should measure the zone of inhabition around the antiseptic (using πr^2)
5. the larger the zone of inhabition, the more effective the antiseptic is.

NOTE: during steps 1 and 2 it is recommended to have a burning bunsen on the desk to kill unwanted bacteria (e.g. from the air).

ResultsPlus
Examiner Comments

This is a level 3 response. It is a plan that would allow results to be obtained which includes controlled variables and safe working. There is no reference to the control so 5 marks were awarded.

ResultsPlus
Examiner Tip

Make sure you address all aspects of the question.

*(iii) A student wanted to investigate how effective three different antiseptics were at killing bacteria.

The student was provided with:

- an inoculated Petri dish prepared using the method in Figure 10
- three different antiseptics
- filter paper discs
- sticky tape.

Devise a plan for the student to complete this investigation.

Include a control and any variables that the student would need to consider.

(6)

Spread the antiseptic on the agar sample with bacteria. Place the filter paper disc on top of the sample. Use sticky tape to cover the petridish so that there is no unwanted microorganisms contaminating the experiment. Repeat this process for each antiseptics. The control that needs to be considered is the amount of antiseptics added as it has to be the same for each. The filter paper disc must be the same size. These control variables would make the results more comparable.

ResultsPlus
Examiner Comments

This was worth level 1. Spreading the antiseptic on the agar sample is not correct. They do not cover any aspects of a plan. They have referred to some safety aspects with taping the agar plate and the amount of antiseptic which would be acceptable for a variable.

*(iii) A student wanted to investigate how effective three different antiseptics were at killing bacteria.

The student was provided with:

- an inoculated Petri dish prepared using the method in Figure 10
- three different antiseptics
- filter paper discs
- sticky tape.

Devise a plan for the student to complete this investigation.

Include a control and any variables that the student would need to consider.

(6)

The student should first light a bunsen to provide an updraft and then soak each sterile paper disc in each aseptic and using a clean pair of sterilised tweezers remove the lid slightly and place each disk an even amount from each other in the dish and then close the lid and tape it down with the tape. After a certain amount of time the student should work out each antiseptics zone of inhibition by finding the area of the circle and compare ~~each~~ size with the largest area being the most effective.

ResultsPlus
Examiner Comments

This was a level 2 response. The plan is good and would obtain results. It has content from aseptic/safety working but does not have a controlled variable, so cannot get level 3. The 'certain time' is insufficient as the time is not stated. It is worth 4 marks as the plan includes multiple aseptic and safety points.

*(iii) A student wanted to investigate how effective three different antiseptics were at killing bacteria.

The student was provided with:

- an inoculated Petri dish prepared using the method in Figure 10
- three different antiseptics
- filter paper discs
- sticky tape.

Devise a plan for the student to complete this investigation.

Include a control and any variables that the student would need to consider.

(6)

method;
coat fully 3 filter paper discs in the 3 different antiseptics (and leave one dry), keeping them seperate. In your mind, split the agar in the petri dish into equal ~~thirds~~ quarters and (one at a time, lifting the petri dish as little as possible and for as short as possible) put ~~one~~ filter paper disk in each ~~third~~ quarter, remembering, or marking, which is which. Then stick two pieces of sticky tape on each side, not covering the whole thing to allow oxygen in. Flip it upside down. Controls; one filter paper disk is dry to prove that the antiseptic is killing the bacteria (control), ~~soak~~ coat the 3 disks in the same volume of antiseptic, the filter paper disks must be the same area.
independent variable; antiseptic. dependant; bacteria killed by each antiseptic.

ResultsPlus
Examiner Comments

This scored level 3 with 6 marks. They have a workable error free plan which includes safety/aseptic working (taping, lifting the lid slightly) and a variable (volume of antiseptic). They are awarded the top of the level as the plan uses a dry filter disc as a control.

Question 10 (b)

The final question examined a topic which candidates find challenging with the lytic cycle of a virus. There were some very good and detailed responses provided. Some responses confused the lytic and lysogenic cycles. Most candidates included the idea of cell lysis being involved and some good descriptions of taking over the cell to produce viral genetic material and proteins were seen.

(b) Viruses can cause disease.

Describe how the lytic pathway is involved in the reproduction of viruses.

(4)

Viruses place their genetic material into a host cell. The ~~bacteria~~ virus then reproduces itself inside its host. Eventually the ~~but~~ virus lyses and bursts the cell spreading the virus through the blood stream into ~~other cells~~ other cells.

ResultsPlus
Examiner Comments

This pathway has limited detail, scoring two marks for placing genetic material into the host cell and then lysis of the cell.

(b) Viruses can cause disease.

Describe how the lytic pathway is involved in the reproduction of viruses.

(4)

The lytic pathway begins when a virus locks on to a cell in a human body. It will then inject its genetic material into the host cell. Then the virus will use the protein and enzymes of the host cell to produce parts of the virus. Then the parts of the virus is assembled to form new viruses. The host cells will then burst, releasing the viruses ~~and cells~~ which makes them infect other cells by repeating these steps.

ResultsPlus
Examiner Comments

This is an accurate and detailed description of the lytic pathway of a virus which gained 4 marks for injecting the genetic material into a cell, using the proteins and enzymes of the host cell to produce viral parts which assemble and then the cell bursts.

(b) Viruses can cause disease.

Describe how the lytic pathway is involved in the reproduction of viruses.

(4)

In the lytic pathway, the virus will insert it's DNA into a hosts DNA like bacteria. There viral components will assemble using resources from the bacteria. After some time the viral components will assemble leading to the cell membrane being overloaded and bursting. The virus' in the host will be released and bind on to other hosts and repeating the lytic pathway.

ResultsPlus
Examiner Comments

This was three marks. The DNA insertion is the lysogenic cycle, so this statement was ignored, this mark was not given if the response inferred it is inserted into the host DNA. The viral components will assemble is one mark, using the resources from the bacteria (host cell) is another mark and the cell bursting is the third mark.

Paper Summary

Based on their performance on this paper, candidates should:

- ensure they answer the actual question in the paper. Written responses to a number of questions indicated that candidates used past papers as part of their revision process which is commendable but care must be taken to ensure that candidates answer the actual question in the paper, as although the knowledge may be similar the question is rarely identical.
- recognise that the word 'explain' means additional scientific information is needed that is linked to the answer given. They should also understand that the command word 'compare' requires the answer to make comparisons between two sets of data or two concepts. Language used in responses should be comparative – 'greater', 'faster', 'quicker' etc.
- read the information given in the introduction to the question but avoid repeating it in the answer as it will not gain credit. Candidates should also read mathematical questions carefully to note whether an answer is required in standard form or to a specified number of significant figures. They should ensure they consistently apply rules for rounding up numerical answers and understand recurring numbers.
- ensure that methods for core practicals are understood, including the differences between controls and control variables. Be prepared to apply your knowledge of practical activities to unfamiliar practical investigations.
- make sure that genetic terms from the specification, such as heterozygous, homozygous dominant and homozygous recessive are understood. When explaining evolution, avoid using terms like stronger or weaker organisms survive/die and link answers to the specific adaptation the question is based upon. Be clear on the differences between the lytic and the lysogenic cycle of a virus.
- always show the mathematical workings when doing calculations as a mark can be awarded for errors carried forward. Check the number of marks given for the question and ensure that they have included enough facts to match the marks awarded.
- consider the context of the question to ensure they apply their scientific knowledge to the situation they are being asked about.

Grade boundaries

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